International Digital Organization for Scientific Research ISSN: 2579-079X
IDOSR JOURNAL OF SCIENCE AND TECHNOLOGY 2(3): 30-41, 2017.

The Efficacy of Locally Improvised Materials and Home Activities on Students Achievement and Retention in Chemistry

Mary-Ann .E. Udogu and Elizabeth Enukora

Department of Chemistry, Nwafor Orizu College of Education, Nsugbe, Nigeria.

ABSTRACT

The study investigated the efficacy of locally improvised materials and home activities on student achievement and retention in chemistry in Onitsha North Local Government Area of Anambra State. Quasi-experimental research design was used which was of the pre-test, post-test, non-equivalent, non-randomized control group design. The population for the study was four hundred and twenty (420) SSI senior secondary chemistry students drawn from six (6) public schools in the study area. Sample for the study is one hundred and twenty (120) SSII chemistry students drawn from two (2) randomly selected schools from the population. The two schools were randomly assigned to treatment groups (one taught chemistry using locally improvised materials and home activities who served as an experimental group while the other taught using standard materials and served as control group. Three research questions and three hypotheses were used to guide the study. The study revealed that there is no significant difference in academic achievement of student taught chemistry with locally improvised instructional materials and those taught chemistry with standard instructional materials. Also the study showed that there is no significant different in knowledge retention of students taught chemistry with locally improvised instructional material and those taught chemistry with standard instructional material. The work indicated through the findings that teachers of chemistry can get the optimum performance of students by the use of instructional materials and also improve students' manipulative skills. The study also revealed that instructional materials improve students' science skills. The implication is that in order to enhance students' science process skills, such innovative use of instructional techniques should be introduced into class works.

Keywords: Local, Improvised, materials, retention and chemistry

INTRODUCTION

Throughout the past couple of decades, the increase of global challenges has had to hinder the economic, political and social development of many nations including Nigeria. [1], posited that the problems in many third world countries especially in Africa emanate substantially from lack of concern over the scientific and technological development of their citizenry. He continued to say that in such countries, majority of their populace are scientifically illiterate and lack desired skills and competences. To achieve sustainability in development, there is a demand of new knowledge which science and technology must provide.

Science is the intellectual human effort to understand better the history of the natural world and how the natural world works with observable physical evidence as the basis of that understanding. It is done through observation of natural phenomena or through experimentation that tries to stimulate natural processes under controlled condition. This is the systematic study of nature and behavior of the material and physical universe based on observation, experiment and measurement and the formulation of laws to describe these facts in general terms.

Education as we all know is indispensable veritable tool for any national development. [2], posited that level of education of members of a society determines the level of development in that country. Education exposes one into new knowledge and experiences for growth and development [3].

[4], maintained that science education and its application to real life problem is the only most powerful instrument for enabling all members of the society to face world challenges and play roles as productive members of the society. [5], posited that it is scientific and technological advancement that will ensure that the human and material ' resources with which country is endowed are properly harnessed and exploited thereby creating wealth for the citizenry and bring upliftments in the standard of life.

Chemistry is one of the fundamental ingredients of science and technology. Chemistry according to [5], is a branch of natural science that deals with the study of the composition of matter, its property and the changes it undergoes, its reaction with other substance, its uses and synthesis. This is the most fundamental subject in the natural science and form the basis of technology in modern world. The power of chemistry according to [6], is what creates as a whole an enabling infra-structure that declines good medicine and materials that are hall-mark of modern life. Chemistry applies to our daily life and is referred to by [7] as Oracle of modern sciences. In other words, chemistry is a life subject and must be taught well.

Despite the importance and role of chemistry in nation building, many problems seem to beset chemistry education which resulted in consistent poor achievement in chemistry education in both internal and external examinations. The poor state of chemistry education in Nigeria has been a concern to chemistry educators, chemists and all those who care about the subject.

The student's achievement in this subject from year to year has never been rewarding according to West African examination council (WAEC) annual reports. This situation therefore calls for continued efforts in identifying solutions to the problems in order to achieve qualitative and functional Chemistry education. For qualitative Chemistry education is functional in nature and could empower the recipient to be useful members of the society through acquisition of certain basic skills, abilities and competence. [8], stated that, the quality of Science instruction in any given educational system determines the quality of education in all its ramification. The nation had been experiencing changes in every aspect of life in order to meet the rate of technological development and so the teaching and learning of chemistry cannot be left aside, since it has been a very vital subject for nation building.

Furthermore, if the students continue to record poor achievement in chemistry, the nation cannot boast of achieving qualitative and functional education for technological development. Many problems are often enumerated as being responsible for poor performance in student's achievement in chemistry. Some of such problems are large class population, lack of professionally qualified teachers, poor teaching method, lack of devotion to duty by teachers, lack of interest to study by students, abstract nature of chemistry, inadequate laboratory facilities and equipment and of teachers non-use of instructional materials in the teaching of chemistry concept [9]. The above mentioned problems are recognized as important contributor to student's poor achievements in chemistry.

Emphasis will be laid on inadequate laboratory facilities and materials with the addition that ever where the laboratory facilities are available, some science teachers do not expose their students to practical experience. Chemistry as a science need to be carefully taught through the use of student's active participation. This could be done through the use of activity-based oriented form of instruction for better understanding and improved result on the part of learners. Activity-based oriented form of instruction in teaching chemistry involves the use of scientific 'materials, but most of these materials are not readily available in schools [7]. Therefore there is the need for improvisation of non-available instructional materials by teachers using local malarial and resources to facilitate instruction whenever there is lack or shortage of specified

first hand teaching materials [10]. Many of the instructional materials needed for the teaching of chemistry concept in Nigerian schools are very expensive and hence, they are not readily available in schools. Therefore, there is the need to improvise these materials for effective, qualitative and functional chemistry education.

Not only thus, the abstract nature of chemistry subject can as well be completely removed if chemistry teachers bring into the classroom the students life local experience and linking them to students day to day activities and experiences outside the school for proper retention. In this way, the teacher is sure of his/her students active participation in the classroom.

Some of the topics or concept in chemistry to be taught with local materials or improvised materials includes;

1. Properties of acid

Some basic properties of acid include sour taste, irritating and corrosive properties. Instead of waiting to acquire factory made and imported acids in order to explain these properties to the students, the following ideas what students utilize everyday can be used. Unripe fruits such as grapes and lemons can be used in treating these properties

2. Acid- Base titration

Acid-Base titration is a neutralization reaction in which acid reacts with base to form salt and water only. Some of the local materials or improvised materials that can be used in acid-base titration are as follows;

Acids- using of unripe fruits like grape or lemon juice.

Base- local ash from burnt male or female inflorescence of oil palm tree (Ngu)

Indicator- leaves flower extracts.

Beaker- Jam jars, cream jars, tumblers and glass cups.

Funnels- plastic bottles opened at the base

Dropping pipette- Ear/eye drop.

Measuring cylinder-graduated bottles of some chemicals, feeding bottles

Reagents bottles- Malta bottles or bottle in which drugs are dispensed

Test tubes- the disposable syringe.

Round bottom flasks- dead electric bulbs

Burners- hurricane lamp using spirit, candle, kerosene, stove.

Other homes or local activities which teacher exposed students to are;

1. Application of cleansing properties or organic acid and base in removing stains as properties of acid and base.
2. The chemistry of fizzy drinks and substances for medication.
3. Application of unripe fruits in closed containers to hasten their ripening as etherification principle.
4. Application of turning brown of foods like egg, breadfruit, avarcado pear during preparation as oxidation process
5. Application of food decay as a fermentation process.
6. Application of caustic potash in the wood ash as for the local black soap making saponification principle.
7. Application of local gin from palm wine as fermentation and distillation process
8. Washing dirty clothes with soap and drying it under the sun titration and evaporation processes.
9. Application of turning of cooling breadfruit to green when solution of local potash prepared from palm front is added as a displacement reaction.
10. There is no way one can be exhaustive in the applications of local home chemistry during teaching and learning of chemistry, because everything we do in our homes has some chemistry implications and applications..

[11], gave various kinds of models used in educational instruction namely mental models, theoretical models, mathematical models, diagrams, concrete models etc. These types of models are special pedagogic significance in science and technology instruction due to the nature of knowledge and knowledge getting process in those disciplines.

STATEMENT OF THE PROBLEM

Chemistry is a real life science subject. By its nature, its practical oriented subject and its teaching and learning require use of huge resource materials. Experience over the years has shown that teachers have been depending on excessive use of words to express and convey chemistry ideas, facts and principles skills to students during teaching and learning exercise (Lecture method). This method of teaching has denied students of active participation in learning of chemistry which made some students according to [12], to understand chemistry as a white man "magic' yet it is something they experience in their everyday life.

Federal government has emphasized the involvement of students in practical exercise during science teaching using materials resources. But researchers like [7], have reported

that there are inadequate resources for teaching science subjects in schools. Based on the above assertion, there is need to try out the use of local instructional materials during teaching especially chemistry.

The problem of this work is to ascertain the efficacy to which the used of local available materials in the environment help to enhance students achievements and knowledge retention in chemistry.

PURPOSE OF STUDY

The purpose of the study therefore is to ascertain

- The efficiency of using locally improvised instructional materials in enhancing student's achievement in chemistry.
- The extent to which the use of locally improvised instructional materials enhanced knowledge retention in chemistry.
- To determine the influence of gender on the students' achievement for those taught using locally improvised instructional materials.

Finally, the society will benefit from the study because if students study chemistry and its allied courses, our dream in the use of science and technology for capacity building and sustainable development will be fully realized

RESEARCH QUESTIONS

The following research questions guided the study

1. What are the mean achievement scores of students taught chemistry using locally improvised instructional materials and those taught using standard instructional material.

2. What are the mean scores in retention test of students taught chemistry using locally improvised instructional materials and those taught with the standard instructional materials.

3. What are the mean achievement scores of male and female students taught chemistry using locally improvised instructional material.

RESEARCH HYPOTHESIS

The study was guided by the following null hypothesis at 0.05 levels of significance.

1. There is no significant difference on the mean achievement scores of student

taught chemistry using locally improvised instructional materials and those taught with the use of standard instructional materials.

2. There is no significant difference between the mean scores on retention ability of those taught chemistry with locally improvised materials and those taught with the use standard instructional materials.

3. There are no significance difference between the mean achievement scores of male and female /students taught chemistry using locally improvised instructional materials.

METHOD

Quasi-experimental research design was used which was of the pre-test, post-test, non-equivalent, non-randomized control group design. Intact classes were used in order not to disrupt the school setting. The study was carried out in Onitsha North Local Government Area of Anambra State. The population for the study was four hundred and twenty (420) SSI senior secondary chemistry students drawn from six (6) public schools in the study area. Sample for the study is one hundred and twenty (120) SSII chemistry students drawn from two (2) randomly selected schools from the population. The two schools were randomly assigned to treatment groups (one taught chemistry using locally improvised materials and home activities who served as an experimental group while the other taught using standard materials and served as control group.

Experimental group were taught using locally improvised materials. Example locally prepared base (using Nzu (Potash) was used to teach them titration with leaves extract as indicator. Other theories were taught them using some home activities like application of caustic potash from palm ash for local black soap making for saponification principle etc.

The control groups were taught using standard material from the laboratory.

Instrument for data collection was Chemistry Achievement Test (CAT) prepared by the researcher and is made up of fifty (50) questions and two (2) theory questions on practical works.

These were test I, II and III. These tests were gotten from re-arrangement and further rearrangement of test I

Test I served as Pre-test

Test II served as immediate post-test

Test III served as retention test. These tests were validated by experts in the field of chemistry and measurement and evaluation, while it reliability sought using test – re-test method with schools not under study and data analysed using Pearson product moment correlation which was obtained at 0.90 alph coefficient.

METHOD OF DATA COLLECTION

Finally all the groups who have been pre-tested before treatment to monitor equivalency were given post-test to measure the achievement. The two groups were tested again after four (4) weeks to monitor knowledge retention.

METHOD OF DATA ANALYSIS

Means and standard deviation were used to analyse research questions while null hypotheses analyzed using ANCOVA at 0.05 alpha level using pre-test as a covariate.

RESULTS

Table I: The data presented here are the mean scores and standard deviations of the experimental and control groups on pre-test, post-test and retention test.

	Test	No	Mean	SD	Difference
Experimental group	(Pre-test)	66	23.70	9.62	
Control group	Pre-test	54	22.10	8.70	
Experimental group	Post-test		81.27	7.10	1.37
Control group	Post-test		79.90	12.80	
Experimental group	Retention		51.80	1.93	1.30
Control group	Test		63.10	3.41	

Table I above showed that the mean score of experimental group is higher than that of the control group in the Pre-test and post-test while mean score of control group is higher than those of the experimental group in the retention test. This gave answers to research questions 1, 2 and 3.

Hypothesis I: There will be no significant difference in mean scores of students taught chemistry using locally improvised materials and activities in home and those taught using standard materials.

Table 2: ANCOVA summary of Post-test scores of (E & C) using pre-test scores as a Covariate.

N = 120	Between	Within	Total
Sum of squares Y	(151.11)	519.81	670.92
Sum of squares X	19.31	250.21	253.88
Sum of Products	-13.12	250.76	263.33
Degree of freedom	k-1=1	N-K-119	120
Adjusted sum of square Y	(18.79)	294.17	
Degree of freedom adjusted sum of sum of squares	1	N-K-1 = 118	119
Variance estimate	18.44	4.09	

$$F = \frac{28.10}{9.93} = 2.83$$

F – Calculated = 2.83

F – Critical = 3.07

Table 2 above showed that the experimental group did not perform significantly better than the control group, hence the observed F value (calculated) is less than the Critical value. Hence teaching chemistry using locally improvised materials and home activities proved the same efficacy as using standard materials.

Hypothesis 2: There will be no significant difference in the mean scores on knowledge retention test of students taught chemistry using locally improvised materials and home activities and those taught using standard materials.

Table 3: ANCOVA summary of knowledge retention test scores of Experimental and control groups using pre-test as a Covariate.

	Between	Within	Total
Sum of squares Y	(210.29)	499.81	210.10
Sum of squares X	22.69	219.63	242.32
Sum of Products	-15.43	217.49	222.92
Degree of freedom	k-1=1	N-K-119	120
Adjusted sum of square Y	(17.88)	275.17	
Degree of freedom adjusted sum of sum of squares	1	N-K-1 = 118	119
Variance estimate	18.78	3.84	

$$F = \frac{26.85}{8.97} = 3.00$$

F – Calculated = 3.00

F – Critical = 3.03

From the table 3 above one may conclude that the two methods have equal efficacy in the ability to retain knowledge gained by students. F-critical is greater than the F-calculated. The null hypothesis is therefore accepted.

DISCUSSIONS OF THE FINDING

The findings of this study as shown in research question 1, that was answered in table 1 above, it was observed that, there is no significant difference between the student taught with locally improvised instructional materials and students taught with standard instructional materials, using improvised instructional materials, assists the teacher economically and also allows students use their intellectual ability during learning and teaching processes.

This is in line with the findings of [4], that learning is an activity that takes place in a contact and not in a vacuum. He reiterated that student taught with teaching aids do not have a blank mind but a consolidated and developed library of knowledge.

In other words students acquire more information through many instructional materials so as to bring deeper understanding of the topics under consideration.

Earlier on, [8], ascertained that in a modem science curriculum programme, students need to be encouraged to learn not only through their eyes, or ears but should be able to use their hands to manipulate apparatus.

In research hypothesis two, the ANCOVA comparison of knowledge retention scores after four weeks of both experimental and control groups shows clearly that teaching with locally improvised instructional materials did not make for better knowledge retention than those taught with standard instructional materials. Since the difference observed in their mean scores are not significant at the probability level of 0.05. This means that locally improvised instructional materials equally encourages conceptual understanding which aid knowledge retention. This result agrees with the discoveries made by [4], who reported that expository approach to instruction encourages memorization of facts, concepts and principles with no meaningful understanding. Again, He retaliated that students only regurgitate facts during examination with the result that the retention of ideas, facts and principles learned in this way might not be achieved and transfer of a new knowledge gained impossible.

CONCLUSION

The study revealed that there is no significant difference in academic achievement of student taught chemistry with locally improvised instructional materials and those taught chemistry with standard instructional materials. Also the study showed that there is no significant different in knowledge retention of students taught chemistry with locally improvised instructional material and those taught chemistry with standard instructional material.

EDUCATIONAL IMPLICATIONS

The findings of the present study have obvious educational implications on students, teachers, curriculum developers and government.

The work indicated through the findings that teachers of chemistry can get the optimum performance of students by the use of instructional materials and also improve students' manipulative skills.

The study also revealed that instructional materials improve students' science skills. The implication is that in order to enhance students' science process skills, such innovative use of instructional techniques should be introduced into class works.

Most of our teachers seemed concerned with content knowledge acquisition rather than reflect on students' critical thinking. It is in the school that many people develop the traits,

values and habits they will use for the rest of their lives. Teaching and learning should be such that individuals can think critically. Hence, teaching using locally improvised instructional materials and standard instructional materials should be encouraged.

Finally, the use of locally improvised instructional material and standard instructional material is an active approach in which teacher-student interaction is enhanced and students problems clearly observed, so that adequate help can be provided.

RECOMMENDATIONS

The following recommendations were made in view of the foregoing implications of the findings;

1. The teacher should make use of different instructional materials as long as they are relevant to their lesson content as it helps to bridge the gap between abstract learning and concrete learning.

2. Policy makers in secondary schools should raise fund so as to procure materials necessary for improvisation of instructional materials in chemistry and text books that would facilitate the effective teaching of chemistry.
3. The need to update teachers' knowledge on materials for teaching of chemistry and acquaint them with new innovations is also to be enhanced. This could be made possible by frequently organizing seminars, workshops and in service training for chemistry teachers.
4. There is need for the teachers to be resourceful in materials selection and planning. This is to reduce the cost of production and maintenance of instructional materials (standard), local production and improvisation as improvisation have always been a positive step towards the realization of this suggestion.

5. Furthermore, teachers of chemistry should be periodically supervised and assessed in relation to their students' performances in the subject

REFERENCES

1. Uzoechi, (2007). Teachers' perception of the availability and usage capital territory (FCT), Abuja. *47 annual conference proceedings STAN.* 169-173

2. Onyeachi J.A.E. (2010). Re-appraising Entrepreneurship Education for function and Self-reliance: Issues and challenges. Benin-City. *Journal of qualitative Education,* 7(1).

3. Eya, P.E. (2010). Reappraising the current National policy on Education for functionality and self-Reliance: Issues on free Education- Benin-City. *Journal of qualitative Education.* 7(1).

4. Atume, F. 2011. Appraising science and Engineering education in Nigeria: The mind opener 19, (24-28)

5. Okoye, N (2001). Essentials of human learning. Alioka erudite publishers.

6. Ezeliora, B (2009). Nurturing young chemistry to STAN, chemistry and workshop proceedings, Kano: Abione Dynamic printers.

7. Ibole, (2009). Linking student day to day activities with selected topic in senior secondary school chemistry

8. Omotayo, et al (2008). Crude oil degradation by microorganisms in soil composts. Department of microbiology. University of Lagos, Nigeria.

9. Okeke and Okeke (2008). The relationship between academic achievement of students taught mathematics using low cost learning kits and those taught with conventional method. *Journal of science Education, school of sciences,* Nwafor Orizu college of Education, 8(1) 191-104.

10. Oyedimma (2010), using improvised materials to enhance the teaching of basic science in primary schools. Capacity building workshop Training manual for primary school teachers in Oyo state. 2 published by Odunahs press and publishers Oyo. pp (25-31).

11. Onasanya, S.A. (2004). Selection and utilization of instructional media for effective practice teaching institu. *J. stud. Educ. 2:* 127-133.

12. Uduchukwu, (2006). The use of project, discovery and scientific inquiry method in the teaching of electrolysis. A hand book for chemistry Teachers on effective methods of Teaching different concepts in chemistry. Chemistry panel series 2 P.93.