Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS) 3(3): 346-351
 (ISSN: 2141-6990)
jeteraps.scholarlinkresearch.org

Assessment of Resource Availability for Chemistry Instruction in the Secondary Schools in Rivers State

A. A. Arokoyu and Ugonwa Rosemary .C.

Department of Curriculum Studies and Educational Technology
Faculty of Education, University of Port Harcourt
Corresponding Author: Ugonwa Rosemary .C.

Abstract
This work is on assessment of material resource availability for chemistry instruction in secondary schools in Rivers State. Discussions were made on the significance of instructional resources on practical-based chemistry teaching as it affects science and technological advancement of Nigeria as a nation. The problem which is the deplorable state of chemistry laboratories in secondary schools is stated under statement of the problem with some effects of unavailability of resources for chemistry instructions. Selected schools from four Local Government Areas in Rivers State were used for this study. 60 chemistry teachers selected from 20 schools formed the sample. The purpose of the study is to investigate the extent of availability and utilization of the non-human resources for chemistry instruction in secondary schools in Rivers State. A rating scale was administered to respondents to answer the research questions. Data analysis was carried out using mean and standard deviation. The result obtained revealed that most secondary schools do not have adequate resources for chemistry instruction. Also the few available resources are not properly utilized for chemistry instructions in schools. Recommendations were also made for the way forward.

Keywords: assessment, resource availability, chemistry, instruction, secondary school

INTRODUCTION

Science and technology are imperative for a sustainable, responsible and global development. Through the application of science, man ensures the longevity of his existence in various discoveries, innovation and inventions that have improved the quality of lives of mankind. Developed nations of the world are so called because of their advancement and growth in science and technology. In other words, for Nigeria to be at par with the developed nations of the world there is the need to make science more interesting among citizenry and ensure effective teaching of sciences in our schools, (Obomanu 2010).

Chemistry is one of the fundamental ingredients of technology. It is a branch of science that deals with the practical and experimental understanding of natural phenomena. The study of chemistry follows from the simple to a more complex, hence chemistry is said to be more process than a product. A very important aspect in the delivery of chemistry is the methods and materials employed in transmitting knowledge. This implies that, like every other science subject, the teaching and learning of chemistry can only be effective by the use of instructional resources (instructional materials, teaching aids, audio – visuals). Instructional resources are aids employed by the teacher to enhance the effectiveness of instruction. They are information carries specifically designed to elicit desired behavioural change in the learners. Instructional resources include a wide variety of equipments and materials used for teaching and learning ranging from hardware to software. However, most of these resources are not adequately available in many Nigerian schools, where they may be available; they may be under used or not used at all by the teachers for teaching chemistry. According to Gbamanja (1991), learning is more effective and maximized if the environment has adequate resources. A bare and uninteresting room offers little or no stimulation for learning. Indeed, days have come when science teachers should be resourceful and must be able to improvise where necessary so as to make their teaching more meaningful and interesting. Nigeria shall not continue to operate an educational system where most of the chemistry classrooms and laboratories are empty and expect to be self reliant in the area of science and technology. Quality and effective teaching of chemistry depends largely on adequate provision and proper utilization of instructional resources. A practical-based approach to chemistry is the key to a breakthrough in science and technology advancement. It is therefore for these reasons that this study investigates the extent to which the instructional resources are made available for use in chemistry instructions in the secondary schools in Rivers state.

STATEMENT OF THE PROBLEM

Teaching and learning of chemistry demand lots of time, knowledge of other sciences and mathematics and a lot of hard work in the area of practical and experimentation. Reports from several researches reveal that student's performance in senior secondary certificate examination SSCE, like WAEC have persistently been poor (Aburime 2004 and Asiyai 2005). Commenting on students' achievement in chemistry, the WAEC chief examiners report on chemistry 1 May/June 2005, 2007 & 2009 noted that generally, candidates performance were poor as have been in previous years. Could these chronic poor performances be attributed to poor exposure of candidates to practical works? Could it be as a result of non availability of resources for teaching chemistry in the schools, or inefficiency in the use of the available material resources for instructions? The quality of chemistry instruction in secondary schools in Rivers State is really of great concern in this study. This is because; chemistry instruction requires specialized laboratory and use of resources which may not be adequately available or properly utilized for chemistry teaching in the schools. Unavailability of resources for use in chemistry instruction may result to several problems such as:

- Students low level of academic performance
- Insignificant achievement in understanding of the processes of science and technology (scientific method) as a tool for national development.
- Restrictions to access and equity in the implementation of modern science by the teachers and students.
- Decline in the promotion of scientific literacy in Nigeria.

These assumptions constitute the basis for this study, aimed at finding out the reasons behind students' poor academic achievement in chemistry Senior Secondary Certificate Examination.

LITERATURE REVIEW

Conceptual Definitions

Science is an enterprise that builds and organizes knowledge in the form of testable explanation and predictions about the natural word. Gbamanja (1991) defined science as knowledge acquired through a systematic organization of events and objects in the natural phenomena; it is a systematic process of acquiring knowledge and understanding about natural phenomena. Henry Margenau (in Arokoyu 2005) sees science as a process of constructing theories which are sets of abstractions that represent experiences of the sense. Science is distinguished from other fields of knowledge by its use of empirical methods for establishing its knowledge claims about the natural world. Chemistry as one of the major sciences is concerned with the composition, structure and properties of matter, as well as the changes it undergo during chemical reactions (wikipedia). Chemistry is the science of matter and the changes it undergoes under different conditions of temperature and pressure. The science of matter as is carried out in chemistry is more specialized, and as such classroom-based teaching has been found to be more efficient in delivery of a context-based chemistry, Lan (2006). A laboratory is simply defined as a work place for the conduct of scientific research or where science is practiced (online dictionary). According to McDonnel et al (2007), practical classes are designed to complement materials dealt with in lectures and give student's practical experiences which will be invaluable in their future careers as chemists. For chemistry, instructional resources include chemistry laboratory, consumables and non consumables such as chemicals/reagents, measuring cylinders, retort stands, beakers, Bunsen burners, charts, television, projectors, computers, electricity, etc. these instructional resources can be commercially produced, or produced by individual teachers or by resource centers (such as ICT centres, voluntary agencies).

Many theorists have made their contribution on how science can be better learnt and taught. Henry Margenau's philosophy for science teaching and learning include that science should not be presented as a set of dogma. Everyone has his/her mental construct which should be assisted to thrive. Hence science is to enable us explore nature, make discoveries and live a better life through his application named technology. The implication of Jean Piajet's cognitive theory on science teaching and learning as cited in Arokoyu (2005) is that modern science has moved from telling and dispensation of knowledge or what one might term 'absolute truth' to problem solving and rational inquiry into natural phenomena. The use of instructional resources in science teaching today is imperative and this is the crux of Piajet's theory.

Furthermore, Jerome Brunner in his theory centers on learning through discovery activities performed by the learner. He is of strong opinion that the learner should obtain knowledge by himself through the use of materials and the learners' mental process. In a major review on the role of laboratory teaching in science education, Hofstein and Luntta (2004, in Donnell 2007) detailed some of the factors that inhibit students learning. Among these are the use of recipe-style laboratory practical and classroom-based teaching of theories and concepts. These styles of teaching do not allow students to think about a larger purpose of their lesson concept. Anekwe (2010 in Dike 2010) observed that the nation's economy, science and technology are grossly underdeveloped because the country's levels of educational system are not equipping the beneficiaries with the needed skills necessary for economic, scientific and technological development. The national policy on education (FRN 2004) devoted section 11 of the policy on educational services which according to the document is meant to "facilitate the implementation of education policy…and make learning experiences more meaningful for the children". The policy goes on the specify measures in achieving the above objectives through the establishment of teachers resource centers, educational resource centers and science and mathematics centers and workshops. Moreso, modern science curricular stresses student's involvement in science activity and teachers use of pedagogy that moves away from teacher dominated to student-centered. Empirical studies within and outside Nigeria have established that student's achieve greater learning both in cognitive and psychomotor domain when resources are used for instructional purposes, (Ifeakor 2006). This conforms to a Chinese proverb that says; what I hear, I forget. What I do, I understand. Students cannot do when the facilities of doing are not provided. Instructions given in form of practical work improve the learners' level of understanding. Not only would the resources make chemistry to be activity oriented, it would also be student centered and self reliant. The indispensability of the resources to the teaching of chemistry cannot be over emphasized.

Agusiobi (1998) cited in Ifeakor (2006) explained that the poor capital investment in terms of provision of science resources contributes to students low level of academic performance. These resources therefore need to be adequately provided, and properly utilized by the teachers for effective chemistry instruction in the secondary schools.

OBJECTIVES OF THE STUDY

The purpose of the study is to

- Assess the extent to which resources are available for teaching chemistry in Rivers State secondary schools.
- Investigate the level of utilization of these resources by teachers and students during the teaching and learning of chemistry.

RESEARCH QUESTIONS

The following research questions were raised to guide this study:

- To what extent are resource materials available for chemistry instruction in Rivers State secondary schools?
- To what extent are the available resources utilized for chemistry instruction in the secondary schools?

METHODOLOGY

Research Design

This study is a descriptive research and the survey research design was adopted. Hence, survey design will be used to ascertain the availability and utilization of resource materials in teaching chemistry in secondary schools in Rivers State.

Population

All chemistry teachers in secondary schools in Rivers State constitute the population for this study.

Sample and Sampling Technique

Rivers State comprises of upland and riverine areas. Stratified random sampling was used to select twenty secondary schools from four local government areas of Rivers State. Five schools were selected in each of the four local governments in Rivers State. Two local government areas each were selected from the upland and riverine areas of the state. A total of 60 chemistry teachers were selected for the study, three teachers in each of the twenty sample secondary schools. The strata for sample selection of schools were based on school locations, with respect to geo-political zones and urbanization (i.e. districts).

Research Instrument

The research instrument used for this study is a 22-items rating scale. The items were rated as follows: highly available, moderately available, sparingly available and not available. The inventory is designed to measure the effects of variables of resource availability and utilization in teaching chemistry in secondary schools in Rivers State.

Validation of Instrument

Two experienced chemistry graduate teachers in secondary schools in Obio-Akpor local government area and two senior lecturers in the curriculum departed approved the face and content validities of the research instrument after careful reading and corrections.

Reliability of Instrument

The reliability of the instrument was established using split half method. By this method, the instrument was administered to a group of ten (10) chemistry teachers randomly selected to test the reliability of the instrument prior to data collection. The teachers were splited into two halves, and their rated scores were correlated using Pearson Product – moment correlation method to obtain a co-relation of half (+ 0.78) and finally, the split half formula was applied to obtain correlation co-efficient of + 0.88 which shows that the instrument is reliable.

Administration of the Instrument

The inventory was administered to a group of 60 chemistry teachers in Rivers State, after a brief explanation of the purpose of this study to the respondents in the sample schools.

Method of Data Analysis

Data will be analyzed using mean and standard deviation. A standard reference mean of 2.50 was adopted for the purpose of determining the degree of acceptable availability and utilization of resource materials in teaching chemistry in secondary schools in Rivers State.

Research Question 1:

To what extent are resource materials available for chemistry instruction in Rivers State secondary schools?

Table 1: Availability of resources for chemistry instruction

	Teachers Response							
S/N	**Items/Resources**	**Highly Available**	**Moderately Available**	**Sparingly Available**		**Mean**	**S.D**	**Total**
1.	Chemistry laboratory	-	-	45	15	1.75	0.43	60
2	Teachers preparatory office	2	8	35	15	1.95	0.72	60
3.	Library/ICT section (for journals, periodicals, archives)	-	-	56	04	1.94	0.24	60
4.	Electricity source	-	09	50	1	2.14	0.94	60
5.	Water supply	2	7	40	11	2.00	0.16	60
6.	Consumables							
	(a) Conc acids-HCl, $HS0_4$, $HN0_3$	6	38	16	-	2.83	0.58	60
	(b) Alkalis & Bases – NaoH, $CuS0_4$ NH_40H	32	20	8	-	3.4	0.71	60
	(c) Reagent bottles	-	14	42	14	2.17	0.52	60
	(d). Measuring cylinders, volume flask.	6	10	32	12	2.03	0.70	60
	(e). Burettes, pipettes, beakers, conical flask	6	38	16	-	2.83	0.52	60
	(f) Local materials (fruits, ashes, palm oil, shells)	2	8	42	8	2.05	0.6	60
7	Non Consumables							
	(a). Laboratory tables shelves and stools	2	8	15	35	1.95	0.72	60
	(b). Test tube and racks							
	(c). Chemical Balance	-	5	9	46	1.93	0.48	60
	(d). Bunsen burners	-	4	50	6	2.0	0.37	60
	(e) Tripod and retort stands	-	8	45	7	2.02	0.50	60
	(f). Spatular, crucible	-	14	42	14	2.17	0.52	60
8	Visuals and audio visuals aids							
	(a) Graphic materials (charts, maps and globes	-	19	38	3	2.27	0.94	60
	(b) Non-projected still pictures	-	-	4	56	1.94	0.24	60
	(c). Overhead projectors	-	-	-	60	1.0	0.00	60
	(d) Video and audio tapes	-	-	-	60	1.0	0.00	60
	(e) Computer and its peripherals	-	-	-	60	1.0	0.00	60

Standard reference mean X = 2.50

Table 1 shows that mean ratings of 1.75, 1.95, 1.94, 2.14, 2.00, 2.17, 2.03, 2.05, 1.93, 2.02, 2.27, 1.94 for chemistry and laboratory teachers preparatory office library/ICT electricity, water, reagent bottles, measuring cylinders, weighing balance, tripod and retort stands, graphic materials, visual and audio visual aids respectively which are less than the standard reference mean of 2.50 indicates that the chemistry teachers were of the view that the resources for chemistry instruction are not adequately available in the secondary schools in Rivers State. However a mean rating of 2.83 and 3.40 which is greater than 2.50 indicates that the teachers were of the view that only the acids and bases, burettes and pipettes including beakers and conical flasks are available in the secondary schools.

Research Question 2:

To what extent are the available resources utilized for chemistry instruction in the secondary schools?

Table 2: Utilization of resources for chemistry instruction (see appendix)

Table 2 shows that mean ratings of 1.75, 1,93, 2.27, 2.17, 1.95, 2.0, 2.14, 2.02, 1.0, for chemistry laboratory, teachers preparatory office, electricity, water supply, reagent bottles, measuring cylinders, local materials, laboratory tables and stools, tripod and retort stands, Bunsen burners and visual and audio visual aids respectively which are less than the standard reference mean of 2.50 indicates that the chemistry teachers were of the view that the resources for chemistry instruction are not utilized in secondary schools in Rivers State. Only the acids and bases, burettes and pipettes which rated 2.83 and 2.93 respectively are utilized in chemistry instruction.

DISCUSSION OF RESULTS

The results above reveal that most of the resources for chemistry instruction are inadequately available. Research question 1 indicated means of 1.75, 1.95, 2.03, 2.05, 1.95, 2.17 & 1.00 for the availability of chemistry laboratory, teacher preparatory office, measuring cylinders, local materials, laboratory tables & stools, chemical balance, spatula & audio-visuals respectively, only the acids & bases, burettes, pipettes, beakers & conical flasks are available. This is in conformity with the view of Danjuma (2006) who noted that there is poor supply of materials in chemistry laboratories in secondary schools.

Furthermore, research question 2 reveals that most of the available resources are not properly utilized or not used at all for chemistry instruction. Only the acids, bases, burettes, pipettes & test tubes indicated that they are occasionally used, since they rated above the reference mean of 2.50. This is in conformity with the view of Ifeakor (2006) who noted that some laboratories are opened only on WAEC and NECO examination days. This unavailability of resources and their non-utilization for teaching could be the reason for the continued inability of students to identify and state the uses of simple laboratory apparatus and the poor performance as observed by WAEC Chief Examiners Reports.

This finding is in conformity with the findings of Ifeakor (2006), Asiyai (2006), Danjuma (2006) for Anambra, Delta and Plateau States respectively.

With regards to visuals and audio-visuals, the results revealed that they are neither available nor used in chemistry teachings. This is an indication that chemistry teachers have not embraced the technological age of information and communication in their teaching, not withstanding the policy statement by the Nigerian government that "government shall provide appropriate information and communication technology, ICT, facilities…" (FRN 2004).

Students must be provided with these ICT materials and where they are available should be properly utilized. The availability of material resources like well equipped laboratories, with standard desks and laboratory stools, current textbooks and journals will not only enhance the teaching and learning of chemistry but help students acquire the required process skills in science.

In addition, use of teaching aids induces active participation in learning and helps students to learn with interest and understanding. This will inevitably better the performance of the students, thus help prepare them for useful and purposeful living within the wider society.

SUMMARY OF FINDINGS

Most secondary schools in Rivers state, as revealed in findings in the upland and riverine areas of the selected four Local Government Areas of Rivers State, have no resources for the study of chemistry. The few available one's are inadequate and are seldom used for chemistry instruction in these schools.

CONCLUSION AND RECOMMENDATIONS

For Nigeria as a nation to be developed in area of science and technology, the teaching of chemistry must be supported by adequate provision of material resources, required for effective instruction. This will no doubt boost the student's academic achievement in chemistry and other sciences.

Consequently, the following recommendations are made to the government, school heads and chemistry teachers.

- ❖ There should be a strict adherence to the implementation of the education policy concerning provision of material resources for science teaching.
- ❖ Government and all stake holders in education should assist in ensuring that adequate facilities for teaching and learning chemistry are provided in the secondary schools.
- ❖ Government should provide specialized laboratories for chemistry practical and refurbish dilapidated ones, employ enough laboratory custodians for proper use and management of the laboratories.
- ❖ Chemistry teachers should make requisitions of materials for chemistry teaching and ensure proper utilization of them. They should also relate chemistry teaching to our natural environment by improvisation for effectiveness in the teaching of chemistry.

REFERENCES

Aburime, E. F. (2004): Refocusing Research in Science, Technology and Mathematics Education: A case for Mathematics laboratory. Proceedings of the 45th Annual Conference of STAN. 183 – 187.

Anekwe J. U. (2010): E-learning in Tertiary Education. A necessity for self reliance in Nigeria. In H. I. Dike (Ed) Nigerian Journal of Curriculum Theorists Educational Technologies (NJOCTET). A Publication of CSET Department. UNIPORT. Vol.1 No.1 June 2010.

Arokoyu A. A. (2005); Investigation of SS3 students. Understanding of the atomic and mole concepts in Rivers State. Journal of vocational and technical education. Vol.2 No.2 2005.

Asiyai R. I (2006): An Appraisal of the Adequacy of the physical Resources available for Teaching Chemistry in Secondary Schools in Delta State. In Nzewi U. (Ed) Science Teachers Association of Nigeria. Resources for Science, Technology, and mathematics (STM) Education, proceedings of the 47th Annual Conferences 2006. Gold Press Ltd Ibadan.

Danjuma B. R. (2006): survey of the supply of equipment and materials in chemistry laboratories in Plateau State Senior Secondary Schools. In Nzewi U. (Ed) Science Teachers Association of Nigeria. Resources for Science, Technology, and mathematics (STM) Education, proceedings of the 47th Annual Conference 3006. Gold Press Ltd Ibadan.

Federal Republic of Nigeria (2004): National Policy on Education. Lagos: NERDC.

Gbamanja S.P.T (1991): Modern Methods in Science Education in Africa. Owerri. Totan Publishers Limited.

McDonnel C. (2007): O' Connor C. and Seery M.K. (2007) Developing Practical Chemistry Skills by means of student driven problem-based learning mini-Projects. Retrieved February 3, 2011 from www./mlb.com/name/nmo568111/

LAN D. (2006): Science Education in Schools. Issues, evidence and proposals. A commentary by the Teaching and Learning Research Programme (TLRP). London. www.trp.org.

West African Examinations Council (2005): The West African Senior School Certificate Examinations, May/June (2005) Chief Examiners reports (Nigeria). Lagos 157-196.

WAEC Chief Examiners reports (2007): The West African Senior School Certificate Examinations, May/June (2007) Chief Examiners Reports (Nigeria). Lagos 158-189.

WAEC Chief Examiners reports (2009): The West African Senior School Certificate Examinations, May/June (2009) Chief Examiners Reports (Nigeria). Lagos.

Wikipedia; free online Dictionary.

Table 2: Utilization of resources for chemistry instruction

	Teachers Response							
S/N	**Items/Resources**	**Always Used**	**Occasionally Used**	**Seldom Used**	**Never Used**	**Mean**	**S.D**	**Total**
1.	Chemistry laboratory	-	-	45	15	1.75	0.43	60
2	Teachers preparatory office	-	5	46	9	1.93	0.44	60
3.	Library/ICT section (for journals, periodicals, archives)	-	-	45	15	1.75	0.43	60
4.	Electricity source	-	19	38	3	2.27	0.94	60
5.	Water supply	-	14	42	14	2.17	0.52	60
6.	Consumables							
	(a) Conc acids-HCL, $HS0_4$, $HN0_3$	6	38	16	-	2.83	0.58	60
	(b) Alkalis & Bases – NaoH, $CuS0_4$ NH_40H	6	38	16	-	2.83	0.58	60
	(c) Reagent bottles	2	8	35	15	1.95	0.58	60
	(d). Measuring cylinders, volume flask.	2	7	40	11	2.0	0.72	60
	(e). Burettes, pipettes, beakers, conical flask	8	42	8	2	2.93	0.66	60
	(f) Local materials (fruits, ashes, palm oil, shells)	2	7	40	11	2.00	0.63	60
7	Non Consumables							
	(a). Laboratory tables shelves and stools	2	9	50	1	2.140	0.66	60
	(b). Test tube and racks	10	36	12	2	2.03	0.38	
	(c). Chemical Balance	-	14	42	14	2.17	0.71	60
	(d). Bunsen burners	-	8	45	7	2.02	0.52	60
	(e) Tripod and retort stands	2	7	40	11	2.0	0.50	60
	(f). Spatular, crucible	-	5	46	9	1.93	0.66	60
8	Visuals and audio visuals aids							
	(a) Graphic materials (charts, maps and globes	-	1	50	9	2.14	0.44	60
	(b) Non-projected still pictures	-	-	4	56	1.94	0.38	60
	(c). Overhead projectors	-	-	-	60	1.00	0.24	60
	(d) Video and audio tapes	-	-	-	60	1.00	0.00	60
	(e) Computer and its peripherals	-	-	-	60	1.00	0.00	60

Standard reference mean X = 2.50