

AFRREV STECH
An International Journal of Science and Technology
Bahir Dar, Ethiopia

Vol.1 (1) January-March, 2012:131-143

ISSN: 2225-8612

**Resources for Chemistry Teaching in Secondary Schools in
Akwa Ibom State, Nigeria**

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Abstract

This study investigated the status of human and material resources for effective implementation of the new chemistry curriculum for secondary schools in Nigeria in Akwa Ibom state. To achieve the objectives of the study, two research questions were raised. Ex-post-facto design was used. The

sample consisted of 105 chemistry teachers from all the 31 local government areas of the state using criterion sampling technique. A researcher-developed questionnaire, *Resources for Chemistry Teaching Questionnaire (RCTQ)*, with a reliability index of 0.83 determined using Cronbach's alpha reliability formula, was used in collecting relevant data. The results of data analyses using percentage rating showed that available human resources are not equitably distributed; the basic facilities are either lacking or are grossly inadequate; and the basic chemicals and equipment for students' activities are either lacking or are grossly inadequate. Consequently, it was been recommended that the state government should urgent steps to ensure successful implementation of the new curriculum in the state.

Introduction

The goals of science education in Nigeria include among others, cultivating knowing, inquiring, and rational mind for the conduct of good life and democracy; producing scientists for national development; and providing understanding of the complexity of the physical world, the forms and the conduct of life (FRN, 2004:29). For education in Chemistry at the senior secondary school level, the objectives include developing interest in the subject; acquiring interest in science technology and mathematics; acquiring basic STM knowledge and skills; developing reasonable level of competence in ICT applications that will engender entrepreneurial skills; applying skills to meet societal needs of creating employment and wealth; being positioned to take advantage of the numerous career opportunities offered by chemistry; and being adequately prepared to further studies in chemistry (FRN, 2009). These goals and objectives are in line with the guidelines of the Nigerian National Policy on Science and Technology (FRN, 1999) that:

- Science and technology should form the basis for national development as well as a tool for influencing the thinking and working process of Nigerians.
- The policies for science and technology shall take due cognizance of the economic situation and the cultural milieu in the country.
- Provision shall be made for adequate scientific and technological manpower so as to ensure the development of the national capability in science and technology along with providing the basis for efficient utilization of Nigeria's abundant natural resources.

- The socio-political system within the country shall reflect the prime position of science and technology with regard to national development.

To underscore the importance of Chemistry Education in Nigeria, students' admission into science, and technology courses in Nigerian tertiary institutions is dependent upon their having acquired a credit pass in Chemistry at the senior secondary school level (JAMB, 2009). Ironically, despite the importance of Chemistry Education in national development and everyday life, research reports show declining students' performance in the subject (Omole, 2002; Osokoya, 2003).

Highlighting the trend of candidates' performance in West African Senior School Certificate Examinations (WASSCE) between 1996 and 2001 in his study on, 'Pattern of career aspiration among secondary school chemistry students', Osokoya (2003) showed that 33.46% of all the candidates who registered and sat for the exams in 1996 had credit pass; 23.58% in 1997; 31.09% in 1998; 21.39% in 1999; 31.88% in 2000; and 32.90% in 2001. Omole (2002) asserted that, in all the years the poorest performances in WASSCE are usually recorded in chemistry and mathematics; and Olayiwola (2004) observed that the situation persists. This ugly situation is not in the best interest of Nigeria as a nation in a hurry to catch up with the developed nations by the year 2020.

Studies on possible causes of candidates' persistent poor performances in Chemistry indict poor investment in science and technology education in terms of resources and infrastructures (Eshiet, 1996; Dike & Arokoyu, 2009) leading to the teaching of the subject as a body of abstract, only to be memorized and regurgitated during examinations. According to Akpan (2008:25), the Nigerian Educational Sector Analysis (ESA) report of 2003, showed that Nigerian primary schools, in general, do not have laboratories, although, some teaching equipment is kept within the classrooms or in stores; that the Nigerian secondary schools which are expected to have four laboratories – Biology, Chemistry, Physics and Integrated Science – in practice, have three – Biology, Chemistry and Physics, with some schools having none at all. The report further showed that,

1. The mean number of laboratories per school for all Nigeria is 0.5 for each of Biology, Chemistry and Physics. That is, one laboratory for every two schools in each subject.

2. On average, Chemistry and Biology laboratories meet the minimum standard of 128m² of floor space.
3. There is a shortage of preparation rooms (three preparation rooms to five laboratories).
4. There are about four chemical and apparatus stores to five laboratories.
5. The provision of water taps in most states is adequate.
6. On the average, the number of electrical points is 5.7 in Physics, 4.9 in Chemistry, and 4.1 in Biology.
7. A high proportion of available equipment in the schools is in bad condition – the incidence of damage being highest in Physics and Chemistry.
8. Certain items of equipment are oversupplied, while several others are undersupplied.
9. Biology laboratories are the least adequately equipped, while Physics are the best.

The picture painted by this report shows a sordid state of science teaching in Nigerian primary and secondary schools. The report, however, is in general terms. In Akwa Ibom state, the policy thrust of the government on education has been towards revolutionizing the teaching of science and technology at both the primary and secondary school levels. Consequently, the state government, in quick response to the need for sound science and technology education, adopted the following guiding principles to science and technology policy development following the education stake-holder's workshop on science and technology of March 26-27, 2002 at Uyo (Government of Akwa Ibom state, 2004; Akpan, 2008):

1. Science and technology shall be the major determinant of economic growth and quality of life development.
2. Education and training in Science, Mathematics, Statistics, and Technology (SMST), are crucial to the future of Akwa Ibom State.
3. Human capacity development in science and technology is essential for future development, and gender equity must be emphasized in the process.

4. The Akwa Ibom State investment in science and technology shall support both basic and applied research.
5. Akwa Ibom State science and technology environment will be enabled through infrastructure development that includes all tiers of education, industry, government, and commerce.
6. Akwa Ibom State shall engage in and foster the practice of culture – sensitive science and technology that will utilize local natural resources maximally.

With these lofty principles, it should be expected that the primary and secondary schools in Akwa Ibom state are well equipped by now for effective science and technology teaching and learning, more so that the new 9-year basic education curriculum for Nigerian schools is in its ninth year of implementation. It therefore became necessary to ask: What is the status of resources for Chemistry teaching in secondary schools in Akwa Ibom State? How prepared is the state for effective implementation of the new Chemistry curriculum come 2011?

Objectives of the study

The objectives were:

1. To assess the status (quality and distribution) of human resources (teaching and supporting staff) for Chemistry teaching in secondary schools in Akwa Ibom State.
2. To assess the status of chemistry laboratories in secondary schools in Akwa Ibom State.

Research questions

The research questions were:

1. What is the status of human resources (teaching and supporting staff) for Chemistry teaching in secondary schools in Akwa Ibom State?
2. What is the status of Chemistry laboratories in secondary schools in Akwa Ibom State?

Methodology

Ex-post-facto design was used for the study. The study area comprised the entire Akwa Ibom State. The choice of the entire state as the study area was

informed by the need to assess the situation on ground considering that the new revised national curriculum for chemistry takes effect from September 2011.

The population of the study consisted of all the 412 Chemistry teachers (245males; 167 females) in all the 229 government-owned secondary schools in Akwa Ibom State during the 2010/2011 academic session (State Secondary School Board, SSSB, Uyo). The sample consisted of 105 Chemistry teachers from 62 government-owned secondary schools in the state who represented the 31 local government areas in the state at the 2011 NNPC/EXONMOBIL Science Quiz competition facilitated by the Science Teachers Association of Nigeria (STAN) Akwa Ibom State branch in Uyo, from Monday, July 14 – Tuesday July 22, 2011. Purposive sampling technique was used for sampling and the criterion was attendance at the competition. The 62 schools were those who qualified for the state levels of the competition.

A researcher-developed questionnaire – Resources for Chemistry Teaching Questionnaire (RCTQ) – was used in collecting relevant data. This was a 2 part - 20 item questionnaire designed to solicit for responses on the status of human and material resources available for chemistry teaching in the state secondary schools. Part 1 was on the status of human resources and Part 2 was on the status of material resources. The instrument had a reliability index of 0.83 determined using Cronbach's alpha reliability formula. The instrument was administered on the respondents by the researchers at the 2011 NNPC/EXONMOBIL Science Quiz competition venue. The administration lasted for the 8 days the competition lasted. Data generated were analyzed using frequency count and percentage.

Results and discussion

Research questions 1: What is the status of human resources (teaching and supporting staff) for Chemistry teaching in secondary schools in Akwa Ibom State?

Table 1 (Appendix) presents the frequency and percent distribution of teaching and supporting staff for Chemistry in secondary schools in Akwa Ibom State by school location.

It should be noted that the 105 respondents reported with respect to the situation in their respective schools, hence, the disparity between the number of respondents and the number of Chemistry teachers in Table 1. Considering the percentage distribution of Chemistry teachers in secondary schools in

Akwa Ibom State the results in Table 1 show that, by qualification, only 4.20% are Ph. D. holders in Chemistry education, 16.78% are M.Sc. holders in Chemistry education, 63.64% are holders of B.Sc in Chemistry education, 9.09% are holders of NCE in Chemistry education, while 6.29% are holders of B.Sc in Chemistry related disciplines, such as Biochemistry and Microbiology. This observation shows that 84.62% of the Chemistry teachers in the state are graduates in Chemistry education with B.Sc and above degree in Chemistry education. This is quite encouraging.

However, with respect to distribution by school location, Table 1 shows that 60.84% of the available Chemistry teachers are in the urban schools, while only 39.16% are in the rural schools. This observation indicates a high concentration of available Chemistry teachers in the urban schools with relatively lower number of schools.

With respect to support staff, the results in Table 1 show that 74.04% of support staffs in our secondary schools are Senior Secondary School Certificate Examination (SSCE) certificate holders while only 25.96% are holders of National Diploma (ND). This observation indicates that almost all the support staffs in our schools have little or no knowledge about school science laboratory management. The distribution by location shows that 61.54% of them are in urban schools leaving only 38.46% for the rural schools.

Research Question 2: What is the status of Chemistry laboratories in secondary schools in Akwa Ibom State?

Table 2 (Appendix) presents the status of chemistry laboratories in secondary schools in Akwa Ibom State.

In Table 2, the results show that 98.1% of the schools in Akwa Ibom State have at least a laboratory for science teaching. However, 83.5% of these schools have one specifically meant for Chemistry teaching. That is, 16.50% of the schools in the state are still without any laboratory for Chemistry teaching.

On the state of power supply to the laboratories, Table 2 shows that only 57.30% of the laboratories are connected to the national grid and only 48.50% of the schools have standby generators. As regards water and gas supply, Table 2 shows that 47.6% of the laboratories are equipped with pipe borne water while only 43.7% of them enjoy regular water supply; and 53.7% of the laboratories are equipped with gas facilities for heating.

On ventilation and security situation of the laboratories, Table 2 shows that 78.60% of the respondents said the laboratories in their schools are well ventilated; 47.60% said they have fume cupboard; while 59.20% said their laboratories are equipped with fire extinguishers or other fire-fighting equipment. As regard lighting and seating situation of the laboratories the results in Table 2 show that lighting situation is good in 54.40% of the schools; while seating situation could only be said to be good or adequate in only 48.50% of the laboratories.

The situation with regard to storage facilities and ancillary rooms in the existing laboratories as displayed in Table 2 is shown as being grossly inadequate. Only 44.70% of the respondents say that their laboratories are equipped with adequate storage facilities and ancillary rooms. On adequacy of the floor space, the situation as presented in Table 2 is awful. Only 22.30% of the 105 respondents said that their laboratories are spacious enough for effective students' activities.

As regard availability of chemicals and equipments for effective students' hands-on, minds-on and hearts-on activities Table 2 shows that only 40.80% of the schools in the state can say they have enough chemicals and equipments for students' activities. This is a very unfortunate situation as students in the other 59.20% schools would only have to wait until examination season before they can be introduced to laboratory activities.

In summary, the results in Tables 1 and 2 yield the following findings:

1. 84.62% of the Chemistry teachers in the state are highly qualified professional graduates in Chemistry education; however, 64.18% of these professional teachers are in the urban schools.
2. Almost all the support staffs in school laboratories in Akwa Ibom are unqualified and 61.54% of them are in the urban schools.
3. 98.10% of the schools in the state have at least a laboratory for science teaching; however, only 83.5% of them have one specifically meant for Chemistry teaching.
4. On power supply, 57.30% of the laboratories are connected to the national grid and only 48.50% of the schools have standby generators.
5. Only 43.7% of the school laboratories enjoy regular water supply; while only 53.7% of the laboratories are equipped with gas facilities for heating.

6. Lighting, seating and security situations of the laboratories are relatively poor.
7. Storage facilities and ancillary rooms in the existing laboratories are grossly inadequate.
8. The floor spaces of the laboratories are grossly inadequate.
9. Chemicals and equipments for effective students' hands-on, minds-on and hearts-on activities are grossly inadequate.

Discussion of findings

The purpose of this study was to assess the status of human and material resources for effective implementation of the new chemistry curriculum for secondary schools in Nigeria in Akwa Ibom State come September, 2011. The findings summarized above show that all is not well. Considering the first research question - What is the status of human resources (teaching and supporting staffs) for Chemistry teaching in secondary schools in Akwa Ibom State? – the findings in Table 1 indicated that, the teachers on ground, excepting just a few, are highly qualified professionals, but the support staffs are almost all unqualified; and that available human resources are concentrated in the urban schools. This implies that the schools in the rural areas of the state may not have enough manpower for effective implementation of the scheme if something is not done urgently about it.

Considering the second research question, the findings in Table 2 indicated that, though about 84.00% of the secondary schools in the state have a separate laboratory for chemistry, these laboratories in most schools are poorly equipped; lack basic facilities as electricity, pipe-borne water, gas facilities for heating, and safety facilities; and are grossly inadequate, in terms of space, for effective students' hands-on, minds-on and hearts-on activities. There is therefore urgent need for the government to step up facilities in the schools laboratories for effective take off of the programme considering the population explosion in secondary schools in the state occasioned by the free education policy of the state government.

Conclusion

Consequent upon the observations made, it is hereby concluded that all is not well with the state of resources for Chemistry teaching in the secondary schools in Akwa Ibom State. The available human resources are not equitably distributed; the basic facilities are either lacking or are grossly

inadequate; and the basic chemicals and equipment for students' activities are either lacking or are grossly inadequate. It is therefore, recommended that the state government takes urgent steps to ensure successful implementation of the new curriculum in the state starting September, 2011.

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APPENDIX

Table 1: Distribution of teaching and supporting staff for chemistry in secondary schools in Akwa Ibom State by school location

S/N	Qualification	No of Teachers		Total	%
		Urban	Rural		
1.	Teaching Staff				
	PhD Chem. Ed.	2	4	6	4.20
	M. Sc. Chem. Ed.	22	2	24	16.78
	B. Sc. Chem. Ed.	56	35	91	63.64
	N.C.E. with Chem.	6	7	13	9.09
	Others (Specify)	1	8	9	6.29
	Total	87	56	143	100.00
	%	60.84	39.16	100.00	-
2.	Support Staff				
	WASSCE or Equivalent	41	36	77	74.04
	National Diploma (ND)	23	4	27	25.96
	Higher National Diploma (HND)	0	0	0	0.00
	Others (Specify)	0	0	0	0.00
	Total	64	40	104	100.00
	%	61.54	38.46	100.00	-

Table 2: The status of chemistry laboratories in secondary schools in Akwa Ibom State

S/N	Items	Yes			No		
		Urban	Rural	Total (%)	Urban	Rural	Total (%)
1.	Do you have any laboratory for science or teaching in your school?	64	39	103(98.1)	1	1	2(1.9)
2.	If the answer to 5 is yes, is there any one specifically meant for chemistry teaching?	53	33	86(83.5)	11	6	17(16.5)
3.	Is the lab powered by PHCN?	46	13	59(57.3)	18	26	44(42.7)
4.	Is there any standby generator for the laboratory?	38	12	50(48.5)	26	27	53(51.5)
5.	Is the laboratory equipped with pipe borne water?	37	12	49(47.6)	27	27	54(52.4)
6.	Does the laboratory enjoy regular water supply?	36	9	45(43.7)	28	30	58(56.3)
7.	Is the laboratory equipped with gas facilities for heating?	44	15	59(57.3)	20	24	44(42.7)
8.	Is the laboratory well ventilated?	52	29	81(78.6)	12	10	22(21.4)
9.	Is there a fume cupboard in the laboratory?	42	7	49(47.6)	22	3	25(24.4)

10.	Is the laboratory equipped with fire extinguisher or other fire-fighting equipment?	44	17	61(59.2)	20	22	42(40.8)
11.	Is the lighting situation in the laboratory good?	43	13	56(54.4)	21	26	47(45.6)
12.	Are the seating facilities adequate?	42	8	50(48.5)	22	31	53(51.5)
13.	Is the laboratory equipped with adequate storage facilities/rooms?	38	8	46(44.7)	26	31	57(55.3)
14.	Is the laboratory spacious enough for effective students' activities?	16	7	23(22.3)	48	32	80(77.7)
15.	Are chemicals and equipments for students' hands-on, minds-on and hearts-on activities available?	37	5	42(40.8)	27	34	61(59.2)
