THE STATUS OF HUMAN AND MATERIAL RESOURCES FOR TEACHING SCIENCE IN SECONDARY SCHOOLS: ISSUES IN EDUCATION

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Abstract

This study is a descriptive survey on the examination of human and material resources for teaching science in Kontagora metropolis, Niger state. The sample for this study comprised fifty three (53) government and private secondary school teachers purposively selected from 18 Secondary Schools. Out of the 53 teachers, 18 were Biology teachers, 17 chemistry teachers and 18 physics teachers. The instrument used to collect data was a Ten (10) item questionnaire designated Status of Human Resources Questionnaire-(SHRQ) and a checklist on the status of material resources for teaching science. Frequencies and percentages were used to analyze data collected. The findings revealed availability of more materials and teaching staff in government schools, a higher teacher students' ratio in private schools and insufficient basic materials and equipments in most schools. Based on these findings, employment of more teaching and non teaching staff, procurement of more materials and equipment among others were recommended.

The importance of science and technology in national development cannot be over-emphasized. The development of a nation depends solely on the amount of science and technology at the disposal of such nation. In other words, a virile nation is a nation with adequate technology to make its people comfortable. The teaching of science is one of the most important parts of education. Consequently, more students are needed to become competent in the key science subjects of physics, chemistry, and biology.

The 4th Edition of the Nigerian Policy on Education (NPE) (2004) claims that education is an instrument for national development, it fosters the worth and development of the individual and the general development of the society. It also believes that there is need for functional education for the promotion of a progressive and united Nigeria. Therefore, the School programmes need to be relevant, practical and comprehensive.

For education to be functional, it has to be geared towards self-realization, individual and national efficiency, effective citizenry, national consciousnesses, and cultural, economic, political, scientific and technological progress among others. In order for these objectives to be successfully actualized, there are some fundamental needs that must be adequately provided. These basic needs include the resources of both human and materials. Human Resources include the academic and non-academic staff in its right quantity and quality needed for the effective impartation of knowledge to students in science, while the Material Resources are adequate infrastructural and instructional materials, equipment or facilities needed for the teaching and learning of chemistry, Physics, and Biology.

Science education has been strongly influenced by constructivist thinking. Constructivism theory emphasizes the active role of the learner, and the significance of current knowledge and understanding in mediating learning, and the importance of teaching that provides an optimal level of guidance to learners (Taber, 2011). In addition, the process of science, include such elements as the scientific method and critical thinking than on direct instruction of facts. Some researchers suggest that it is more effective as a model for teaching science. This is because students learn better when they are actively involved in the teaching and learning process using the appropriate teaching materials.

Findings from researches conducted at both secondary and colleges revealed that science subjects are perceived by both students and teachers to be abstract, misconceived and difficult to comprehend (Jimoh, 2000; Agommouh & Nzewi, 2003; Musa, 2010; Onijamowo, 2010; and Obomanu & Onuoha, 2012). Consequently, this calls for adequate human and material resources for effective teaching of science in secondary schools so as to increase students enrollment, performance and erase students' phobia towards science.

The fields of science, technology and education hold a paramount place in the modern world in combating the widespread scientific ignorance, to standardize teaching in schools, and to raise the number of secondary school graduates who choose scientific and technical majors in tertiary institutions. An emphasis in teaching the scientific process so that students have a better understanding of the methods of science, and can critically evaluate scientific evidence. Adewuyi (1999) posited that the objectives of any educational process should determine methods and materials needed for achieving such objectives. The materials used for enhancing instructional effectiveness include both human and material resources employed for achieving the instructional objectives.

Statement of the Problem

To achieve the stated Education goals and objectives of science education in the secondary school curriculum, the standard calls for more than 'science as process,' in which students learn such skills as observing, inferring, and experimenting. Inquiry is central to science learning. Therefore, certain standards with regards to resources need to be met. There are several studies indicating that the status of human and material resources is responsible for the declining students' performance in science (Olorundare, 2006). The author is therefore seeking to ascertain:

i. The status of human and material resources for teaching science in Kontagora metropolis Niger state.
ii. If there is any difference in the status of resources in private schools and Government owned schools in Kontagora metropolis.

Research Questions

The study was guided by the following research questions:

1. What is the status of human resources for teaching science in Kontagora metropolis?
2. What is the status of material resources for teaching science in Kontagora LGA?
3. Does the Federal government provide more resources to Government owned schools than the private owners of schools?

Methodology

The study is a survey research which involves all secondary schools in Kontagora Metropolis, Niger state.

Sampling and Sampling Techniques

The sample for this study comprised fifty three (53) secondary school teachers purposively selected from 18 secondary schools in Kontagora metropolis. Out of the 53 teachers, 18 were Biology teachers, 17 chemistry teachers and 18 physics teachers. The 18 secondary schools consist of ten (10) government owned schools and seven (7) private schools.

Instrument/ Instrument Administration

The instrument used to collect data from the teachers was a Ten (10) item questionnaire on the Status of Human Resources Questionnaire-(SHRQ) and a checklist on the status of material resources for teaching chemistry, Biology and Physics. The instrument was designed by the researcher. The questionnaire and checklist were designed in such a way that the subject teachers can respond to the items by ticking the appropriate column indicating number or status. Each item available was assigned I point and 0 point when not available.

Item Available (IA)-1 point

Item Not Available (INA)-zero point

The questionnaire and checklist were validated by two experts in science Education. The instrument was personally administered directly by the researcher on the teachers. The researcher duly sought for permission from the school principals.

Data Analysis

The method chosen in the analysis of data was based on the descriptive nature of the study. Therefore, simple frequencies and percentages were used to answer the research questions.

Results

Results of analyzed data are presented below according to the questions.

Research Question 1: What is the status of human resources for teaching science in Kontagora metropolis?

Table (1) Shows the Status of Human Resources which include Academic Staff, Laboratory Attendant, Laboratory Technician, Students' Population and Teacher-Student Ratio.

Table 1:

Secondary Schools	Human Resources	CHEMISTRY	PHYSICS	BIOLOGY	TOTAL
Government owned schools (G.O.S)	Academic Staff	21	24	31	76
Private Schools (P.S)		12	14	6	36
G.O.S	Laboratory Attendant	11	14	11	32
P.S		6	4	4	14

G.O.S	Laboratory Technologists	4	14	8	26
P.S		4	2	3	9
G.O.S	Student Population	707	516	1613	2836
P.S		416	686	918	2020
G.O.S	Teacher Student Ratio	1:34	1:22	1:52	1:37
P.S		1:35	1:49	1:153	1:63
NCCE Minimum Standard		1:30	1:30	1;30	1:30

Research Question 2: What is the status of material resources for teaching science in Kontagora LGA?

Answer to this research question is on tables 2, 3, and 4 which show the resource materials available and functional for teaching Chemistry, Physics and Biology in both government and private schools.

Table 2:
Availability of Basic Equipment Required for Teaching Chemistry in Secondary Schools

S/No	Equipment & Consumables	Number available	Number Functional
1.	Gas Cylinder	17	10
2.	Bunsen burner	207	200
3.	Test Tube	1372	1307
4.	Test tube rack	151	134
5.	Meter Balance	106	39
6.	First Aid Box	14	13
7.	Burette	400	323
8.	Pipette	454	390
9.	Beakers	761	699
10.	Fume Cupboard	10	7
11.	Conical Flask	423	414
12.	Desiccators	163	162
13.	Kipp's Apparatus	8	8
14.	Buchner Flask	33	30
15.	Gas Jar	109	84
16.	Retort Stand and Clamp	395	258
17.	Tripod Stand and Gauze	115	108
18.	PH Meter	91	6
19.	Water Distiller	15	10
20.	Test Tube Holder	322	286

21.	Centrifuge	01	88
22.	Pipe- clay Triangle	33	28
23.	Crucible and Lid	68	59
24.	Evaporating Basins	90	83
25.	Filter Funnel and Stand	259	248
26.	Glass Rod	284	121
27.	Test Tube Brush	166	115
28.	Tongs	204	184
29.	Wash Bottle	221	177
30.	Wash Glass	138	122
31.	Spatula	274	262
32.	Heating Mantle	113	107
33.	Test Tube Rack	360	259
34.	Nichrome wire, cobalt glass	12	11
35.	Teat – Pipette	75	54
36.	Boiling Tube	518	516
37.	Heating Block	34	27
38.	Measuring Cylinder	274	266
39.	Volumetric Flask	147	129
40.	Condenser – Liebig	21	17
41.	Separating Funnel	101	85
42.	Thistle Funnel	130	126
43.	Pneumatic Trough	17	12
44.	Round Bottom Flask	201	147
45.	Measuring Cylinder	274	266
46.	Distillation Column	31	19
47	Delivery tubes	211	152
48.	Thermometer	236	188

Table 3:
Availability of Basic Equipments Required for the Teaching of Physics in Secondary Schools

S/No	**Equipment & Consumables**	**Number available**	**Number Functional**
1.	Meter Balance	266	231
2.	Top Loading Balance	152	110
3.	Thermostat	119	84
4.	Conductivity Meter	97	87
5.	Retort stand and clamp	507	393
6.	Tripod stand	386	357
7.	Concave mirror	419	379
8.	Convex mirrors	392	331
9.	Calorimeter	252	174
10.	Meter ruler	787	624
11.	Stop Watch	395	344
12.	Stop clock	163	143
13.	Ray Boxes	257	209
14.	Resistor	382	343
15.	Optical board	328	282

16.	Ammeter	313	261
17.	Knife edge	354	313
16	Plane (or flat) Mirror	510	328
19.	Measuring Cylinder	299	251
20.	Concave Lens	385	350
21.	Convex Lens	497	360
22.	Sonometer	168	145
23.	Vernier Caliper	184	165
24.	Micrometer Screw Gauge	147	105
25.	Rectangular Glass Block	328	252
26.	Thermometer	334	289
27.	Meter Bridge	184	138
28.	Pendulum Bobs	421	382
29.	Spiral springs	283	249
30.	Turning Fork	153	125
31.	Volt Meter	240	211
32.	Galvanometer	271	230
33.	Bursen Burners	206	176
34.	Test Tube	4590	4512
35.	Droppers Bottles	711	678
36.	Jockeys	281	243
37	Rheostat	308	280
38.	Standard Weight	570	280
39.	Standard Resistors Boxes	185	165
40.	Glass Prism	375	313
41.	Density Bottle	122	113
42.	Beakers	752	690
43.	Lens Holder	365	266
44	Potentiometer	50	46
45	Optical Pins	65	60
46	Optical Pins	104	66
47	Meter Bridge	68	63
49.	Cell: Lead acid accumulatros/ dry cells	332	311

Table 4:
Availability of Basic Equipment Required for the Teaching of Biology in Secondary Schools

S/No	Equipment & Consumables	Number available	Number Functional
1.	Hand Lenses	474	425
2.	Microscope	219	205
3.	Incubator/ Sterilizer	60	40
4.	Balance	175	123
5.	Refrigerator	57	40
6.	Water Filter	110	79
7.	Dry Oven ($30^0$0C – 120^0C)	62	30
8.	Centrifuge	114	61
9.	Herbarium Cabinet	81	54

10.	Photometer	101	51
11.	Dissecting Microscope	155	105
12.	Insect Light Traps	77	50
13.	Slide Projector	103	80
14.	Overhead projector	43	27
15.	Tissue Grinder	28	17
16.	Water Bath	113	96
17.	Soil Auger	46	29
18.	Measuring Tape	184	164
19.	Dissecting Sets	121	103
20.	Dissecting Boards/Plate Trays	338	230
21.	Bunsen Burners	242	226
22.	Gas Cylinder	52	43
23.	Prepared Plate and Animal Specimens	330	294
24.	Quadrate	142	94
25.	Whirling Hygrometer	55	30
26.	Wind Vans	64	45
27.	Beaker	711	562
28.	Vain Gauge	62	45
29.	Soil Testing Kits	65	43
30.	Thermometer	225	188
31.	Maximum and Minimum Thermometer	115	84
32.	Wet and dry bulb Thermometer	98	89
33.	Bell Jars	65	55
34.	Pestle & Mortar	43	33
35.	Hygrometer	120	99
36.	Tripod Stands	204	185
37.	Permanent Slides	554	513
38.	Test Tube	4901	4857

Research Question 3: Does the Federal government provide more resources than the private owners?

Table 3 presents the summary of the resources for teaching the basic science subjects in government and private schools; equipment available, functional equipment, non functional equipment, equipment not available, and total glassware.

Table 5:

MATERIAL / SUBJECT	GOVERNMENT OWNED SCHOOL			PRIVATE SCHOOLS		
	CHEMISTRY	PHYSICS	BIOLOGY	CHEMISTRY	PHYSICS	BIOLOGY
Total Items of Equipment Found	5979 (63.53%)	14262 (74.83%)	7848 (82.46%)	3433 (36.47%)	4795 (25.16%)	1669 (17.53%)
Total Number of Functional Equipment	5578 (93.29%)	12399 (86.94%)	7175 (91.42%)	3128 (91.11%)	4543 (94.74%)	1255 (75.19%)
Total number of Non Functional Equipment	401 (6.71%)	1863 (13.06%)	673 (8.58%)	305 (8.89%)	252 (5.25%)	414 (24.81%)
Total Number of Equipment not available	135	88	138	210	66	71
Total number of Glassware	14610 (52.01%)			3602 (36.39%)		

Discussion

From the data on table 1 it was discovered that government owned schools had average of two teachers for the basic science, while private schools had average of one teacher for each subject. This implies that there is need for employment of more science teachers in both government and private schools because the student teacher ratio is higher than stipulated in the curriculum and the NCCE minimum standard ratio of 1:25. This especially was found to be worst for Biology with 1:153 teacher student ratio in private schools. In addition, both schools had average of 1-2 laboratory attendants, while some schools have 1 laboratory technician and most schools had none.

In the area of material resources, tables 2, 3, and 4 show that most schools had some of the basic materials for teaching science subjects. However there were some schools that lack most of the important equipment like pneumatic trough, ph meter, centrifuge, thermometers, kips apparatus, optical board, and thermostat among others. In most of the government and private schools some of the materials like glassware, retort stand, wash bottle, spatula, meter balance, glass prism, dissecting board/ trays, permanent slides were found in large number.

The result in table 5 revealed that government provides more human and material resources for the teaching of science in secondary schools. This finding is in line with an earlier finding of Nkwocha and Tanko (1998) that the federal Government provides more materials than the state governments or private owners.

Conclusion

The study has revealed the status of human and material resources for teaching science in secondary schools in Kontagora metropolis. The study found that the government schools had more materials than the private schools for teaching science.

Recommendations

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

1. The federal government should ensure that the numbers of supporting staff needed in science departments are employed.
2. There should be employment of more academic staff by both government and private owners to reduce the student teacher ratios to conform to the recommended standard.

References

Adewuyi, J. O. (1999). *Principles and practice of Educational Technology*: International publishers Ltd. Ibadan.

Agommuoh, P. C. & Nzewi, U. M.(2003). Effects of videotape instruction on secondary school students Achievements in physics. *JSTAN*, (1&2),88-92.

Federal Republic of Nigeria (FRN) (2004). *National Policy on Education*. Revised Edition. Lagos: National Educational Research Development Council Press.

Jimoh, A.T. (2000). *Conceptions of selected physical chemistry concepts held by chemistry students in Nigerian Colleges of Education.* An unpublished Ph.D thesis University of Ilorin, Nigeria.

Musa, O. D. (2010). *Misconceptions and alternative conception of organic chemistry concepts held by students' Nigeria colleges of education.* An unpublished Ph.D thesis. University of Ilorin, Nigeria.

Nkwocha, L. & Tanko, S. (1998).The state of communicating Science, Technology and Mathematics (STM) in secondary schools in Niger State. *Proceedings of 39th Annual Conference of STAN.65-69.*

Obomanu, B. J. & Onuoha, C. O. (2012). Students Conceptual Difficulties in Electrochemistry in Senior Secondary Schools. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS)* 3(1):99-102 (ISSN: 2141-6990).

Olorundare, A. S. (2006). Constructivism and learning in science*. Ilorin Journal of Education.* 20; 38-49.

Onijamowo, O. T. (2010*). Senior School Chemistry student misconceptions and alternative conceptions of selected chemistry concepts in Kogi State Nigeria.* An M.ED unpublished Dissertation. University of Ilorin, Nigeria.

Taber, K. S. (2009). *Progressing Science Education: Constructing the Scientific Research Programme into the Contingent Nature of Learning Science*. Springer. ISBN 978-90-481-2431-2.

Taber, K. S. (2011). Constructivism as educational theory: Contingency in learning and optimally guided instruction. In J. Hassaskhah. *Educational Theory*. Nova.

Wikipedia (2013). *Science Education.* http://en.wikipedia.org/w/index.php?title=Scienceeducation&oldid=566161108. Retrieved 19th August, 2013.