A Comparative Investigation into the Prospects and Problems of Secondary School Science Delivery in Niger State and the Federal Capital Territory (F.C.T) Abuja

[1]Aworonye L.N and [2]Babagana, M.

[1]Department of Science and Environmental Education, University of Abuja.
A Former Research Officer at the N.E.R.D.C Abuja.

[2]Department of Science Education, Federal University of Technology, Minna, Niger State.

Abstract

A survey of the prospects and problems of secondary school science delivery in Niger State and the Federal Capital Territory was conducted involving 100 science teachers (51 from FCT and 49 from Niger State). Using a questionnaire containing a-prospects and problems in Science teaching (PAPIST) scale comprising five (5) sub-scales. A comparative analysis of each sub-scale as well as that of the entire PAPIST scale using means, standard deviations and coefficient of variation was made. Tests of significant on the sub-scales and PAPIST scale were also computed using the t-statistic. Results shows that F.C.T. schools are a bit better placed in terms of infrastructure, equipment and materials than Niger State schools. Both FCT and Niger State schools showed a positive performance with means greater than the 2.5 mean divide line.The same trend was observed in the student readiness and participation sub-scale. However, in the assessment and evaluation sub-scale, Niger State schools showed a better performance than FCT schools, with both making it above the average. On the policy provision/instruction sub-scale as well as the personnel preparedness and utilization sub-scale, both groups performed below the average. Despite these variations, there were no significant differences in their performances on the t-test scores on the various sub-scales and the overall PAPIST scale. Implication for science teaching, curriculum implementation and review were highlighted and recommendations made.

Introduction

One of the indices for measuring effective implementation of science education programmers in any country is uniformity. This becomes more desirable in a federated unit such as Nigeria where constitutionally, education belongs to the exclusive, concurrent and residual lists; meaning that the federal, state and local governments are by law empowered to pursue the enterprise of education albeit to specified limits. To ensure the uniformity of standard, the National Policy on Education NPE, (2004)-the document which spells out guidelines for the running of education in Nigeria-stipulates in paragraph 115 that: government shall establish efficient inspectorate services as federal, state and local government levels for monitoring and maintaining minimum standards at all levels of education below the tertiary level. (p59) in article 118 the policy posits that

> "The goals of the inspectorate service shall be to: -
> obtain information on problems and difficulties of teachers and institutions and offer practical solutions to them; and encourage dissemination of information on innovation and progressive educational principles and practices in the school system through publications, workshops meetings, seminars, conferences e.t.c." (p60).

From the foregoing, the onus lies on science educators to continually ascertain what goes on in the class room either by standardized observational instruments or through interaction with teachers, students or both with a view to obtaining information necessary for charting a glorious course for science teaching and learning.

Background to the study

Given that at the on set of the implementation of the present 6-3-3-4 system of education which is presently undergoing

some transformation, it was Anambra State that first blazed the trail in its implementation before other states followed suit, this shows that the implementation may differ from one state to another in one or other of its ramifications. Given the fact that Niger state and the FCT are contiguous, political and social entities sharing many interesting things in common and having an interflow of personnel and materials, there is need to compare what goes on in the classroom of the two entities. Considering the fact that in the planning and organization of any meaningful science education programme, teacher preparedness and motivation (Ukoli: 1995), student readiness and participation Fakunle, (1995) as well as availability of infrastructure, equipment and materials Odumosu, (1997) are indispensable parameters, the study cannot but derive its focus from these interrelated variables.

More importantly it is fact that a comparative study serves as a mirror through which stakeholders in science education delivery reflect the state of the art in one another's domain and hence address any shortfalls where need be. Above all is the need to provide the information for curriculum review in science technology and mathematics (S.T.M) education which is akin to the theme of the 49th annual conference of the Science Teachers Association of Nigeria (S.T.A.N).

Statement of the problem

The study set out to ascertain the prospects and problems of secondary science delivery in Niger state and the federal capital territory (FCT), Abuja and to compare findings.

Objectives of the Study

The objectives of the study are to: -

i. Develop an instrument for use in determining secondary science education delivery;
ii. Determine science teachers' opinion on the delivery system;
iii. Compare the responses of Niger state and FCT teachers to the instrument; and
iv. Provide relevant information for policy makers, school administrators and research scholars.

Research questions

1) What parameters can be used to measure the prospects and problems in science teaching (PAPIST) at the secondary level?
2). How do the Niger state and FCT teachers respond to the PAPIST scale and sub-scales?
3). How can teachers respond be analyzed to show trend and or variations?

Hypotheses

HO_1: There will be no significant difference in the mean scores of niger state and FCT teachers on each of the five subscales of the PAPIST scale.

HO_2: There will be no significant difference in the mean scores of both groups of teachers using the PAPIST scale.

Procedure

The investigation took form of a survey using a questionnaire designed by the researchers and validated by a group of experienced science teachers in both the FCT and Niger state.

Sample

A total number of 100 teachers (51 from the F.C.T and 49 from Niger state) who were randomly selected stratified to reflect male and female representatives from 3 area councils of the federal capital territory (F.C.T), Abuja and 4 local government areas of Niger state formed the sample of this study.

Instrument

The instrument for this study is a questionnaire divided into two sections:

Section A sought information on respondents' background, respondents' educational qualifications, teaching experience, work load and years of experience in present school.

Section B constituted the 25-item-prospects and problem in science teaching (PAPIST) scale divided into five subscales namely, infrastructure, equipment and materials (5 items), policy provisions/instruction (6 items), personnel preparedness and utilization (5 items), student readiness and participation (5 items), and assessment and evaluation strategies (4 items). Response to the items required a tick on the preferred rating on a four point likert scale of strongly agree (SA), Agree (A), Disagree (D) and strongly Disagree (SD) for each of the 25 items.

Data Collection

In order to ensure quick collection of data, each of the researchers with area were the questionnaire aspect collected on the spot covered one area. The Niger state and F.C.T secondary education boards, the principals and heads of science department of the various schools acted as research assistants in the administration and collections of data.

Data Analysis

Frequency counts and percentages were used to analyze the background information/characteristics of respondents while scoring of items on the PAPIST scale was done by assigning numerical values of 4,3,2 and 1 to the strongly Agree, Disagree and strongly disagree ratings respectively. A mean score of 25 was used to decide on agreement or disagreement. A mean score greater than 2.5 indicated a positive deposition to the item while that less than 2.5 indicated the otherwise. However, in an attempt to ascertain the degree of variability of one item from the other, standard deviations of score were equally computed, and in order to compare the distributions, co-efficient of variation were also computed so much that a higher coefficient of variation showed a greater relative variation and by implication a less agreement in opinion. This was done in the sub-scales. The summary mean score and standard deviation of items in each sub-scale provided data for tests of significance on the sub-scale while the summary mean score and standard deviation of the five subscales provided data for the test of significance on the PAPIST scale.

Results and Discussions

The results of the study followed the order of characteristics of respondents, research questions and tests of hypothesis, while discussions were done by each sub-heading.

Table 1: Characteristics of Respondents

Attribute	FCT N= 51				NIGER STATE N=49				
	Category	Frequency	%	Total	Attribute	Category	Frequency	%	Total
Gender	Male Female	40 11	78:4 21:57	51 (100%)	Gender	Male Female	33 16	67.3532.65	49(100%
Qualifications of teachers		1 2 42 6	1.96 3.92 82.35 11.76	51 (100%)	NCE/OND HND BSC/B.ED M.SC/M.ED		12 2 21 14	24.49 4.08 42.86 28.57	49 (100%)
Years of teaching experience	0-4 5-9 10-14 15-19 20 and above	8 15 10 13 5	15..96 29.41 19.61 25.49 9.80	51 (100%)	Year of teaching experience	0-4 5-9 10-14 15-19 20 and above	8 13 12 10 6	16.33 26.33 24.49 20.41 12.24	49 (100%)

From the table it can be seen that while FCT has a male to female science teacher ratio of 72:22, Niger state has 67:33 ratio. This portends a serious implication on

human resources development and utilization, for according to U.N.D.P's (2002) report; male-female representation in all work situations should reflect at least a 70:30 ratio so as to encourage women involvement in nation building. That Niger state has not only met with this international standard but has also beaten the F.C.T in this regard is a welcome development. For as Ozigbo (2002) observed in the 1990s, "in the core north, early withdrawal of girls for marriage and apathy for western education accounted for the incidence of high drop-out in secondary education. There is an improvement in this regard.

On educational qualifications, the distributions shows that both FCT and Niger state have more than 70% of their teachers having qualifications of a first degree and above. This will certainly augur well for science delivery. For, as the great African statesmen, Nyerere (1968) once remarked---teachers can make or ruin a society---they have a power which is second to none---not a power of a man with gun" on years of teaching experience the distribution shows that a majority of science teachers of both groups (FCT, 54%--and Niger state 67%) have 10 years and above teaching experience. This speaks volumes on competency.

Research Question 1: What parameters can be used to measure prospects and problems in science teaching?

Table 2 Shows Breakdown Analysis of the PAPIST Scale

Sub-scale	Item	Item description
Infrastructure, equipment and materials	1	Enough classrooms for the teaching and learning of the science subject thought
	2	Spacious classroom for teaching and learning science.
	3	Specific laboratory for the teaching of each science subject.
	4	Enough equipment and materials for the teaching of science
	5	Regular replacement of laboratory consumables
Policy provisions/instruction	6	Teacher-pupil ratio is about 1:35
	7	The textual materials used reflect the provision of the curriculum
	8	Availability of student's workbook derived from textual materials
	9	Availability of teachers' guide
	10	Adequacy of audio-visual materials for teaching science
	11	Sufficiency of time allocated for science for teaching
Personnel preparedness and utilization	12	Provision on in-service training vacation courses for science teachers
	13	Provision of opportunities to attend workshops/seminars
	14	Number of periods allows for effective science teaching
	15	Regular payment of science teaching allowance
	16	Availability of qualified laboratory attendants
Student readiness and participation	17	Adequate mathematical competences of students for science learning
	18	Students' responses encourage teaching and learning of science
	19	Effective participation in JETS and other relevant competitions
	20	Enough students' excursions to industrial, scientific and technological sites.
	21	Encouraging students' performance in terminal examinations on science
Assessment and evaluation	22	Continuous assessment tests are constructed by the teacher
	23	Preparation of end-of term examination by education resources centers proficiency courses for teachers in continuous assessment (C.A) test item development
	24	Use of school results by WAEC/NEC

The PAPIST scale was developed by taking recourse to the provisions of the National Policy on Education (N.P.E, 1977, 1981) the national curriculum for junior and senior secondary schools (1985) and by a consideration of the contributions of some science educators that included Nwana (1985), Bajah (1986), Ikeobi (1986), Jegede and Okebukola (1986), Obioma (1986), Orji (2007).

It also reflects the programme evaluation models of stake of antecedents, transactions and outcomes (A.T.O) and stufflebean context input, process and product (C.I.P.P

Research question 2: How do both groups of teachers respond to items on the PAPIST scale sub-scales? Table 3-7 show the results of responses

Table 3: Distribution of Mean (□x) Standard Deviation (S.D) and Coefficient of Variati (C.O.V) of Infrastructure, Equipment and Material Sub-Scale.

		F.C.T teachers N= 51			Niger State Teachers N=49		
S/N	Item description	□x	SD	Coefficient of variation	□x□	SD	Coefficient of variation
1	Enough classrooms for the teaching of the science subject I teach.	3.4	0.75	22.1	3.2	1.0	31.3
2	Spacious classrooms for teaching and learning of science.	3.3	0.83	22.1	3.2	1.0	31.3
3	Specific laboratory for the teaching of each science subject.	3.3	0.83	26.7	2.7	0.90	33.3
4	Enough equipment and materials for the teaching of science.	2.7	0.83	30.7	2.6	1.10	42.3
5	Regular replacement of laboratory consumables.	2.4	0.80	33.3	1.8	0.90	50.0
Summary	Sub-scale summary	3.02	0.40	13.2	2.68	0.49	18.3

The results show that with an average mean of 3.02 as against 2.68 FCT schools are more favorably disposed to having adequate infrastructure, equipment and materials than Niger state schools. This could be attributed to a greater number of schools in Niger st than in the FCT somewhat captured by t enrolment in basic subjects in 1995 sho below culled from Ingawa (2002).

Table 3.1 Enrolment in Basic Subjects at SSCE 1995

Category	English	Mathematics	Physics
Niger	6651	6596	1334
FCT	4293	4293	876

Source: towards the improvement of education in the northern states of Nigeria (2002) Area Hou A.B.U Kaduna P. 62

It is noteworthy however that of the 5 items that made up this subscale only "regular replacement of laboratory consumables" on both sides that did not make the 2.5 mean divide line. This is an indication th practical work would not be given the priori it rightly deserves and calls for immedia intervention by school administrato

Table 4: Distribution of Mean Standard Deviation and Coefficient of Variation of the Policy Provisions/ Instruction Subscale.

		F.C.T teachers N=51			Niger State Teachers N=49		
S/N	Item description	X	SD	Coefficient of Variation	X	SD	Coefficient of Variation
6	Teacher-pupil ratio is about 1:35	2.5	0.97	38.80	1.8	0.97	53.9
7	The textual materials used reflect the provision of the curriculum.	2.9	0.60	20.7	2.8	0.70	25.0
8	Availability of student's workbook derived from textual materials.	2.3	0.85	37.0	2.2	0.90	40.9
9	Availability of teachers guide.	2.1	0.89	42.4	2.4	0.80	33.3
10	Adequacy of audio-visual materials for teaching science.	2.2	0.75	34.1	1.6	0.80	50.0
11	Sufficiency of time allocated for science teaching.	2.6	0.79	30.4	2.8	0.80	28.6
Summary	Sub-scale summary.	2.43	0.27	11.1	2.27	0.46	22.0

The results show that use of appropriate textual materials and sufficient time allocated to science teaching are the only two items out of the six items favorably disposed to science teaching. The subscale summary of findings with a mean of 2.43 and 2.27 for FCT and Niger state respectively shows that secondary school science education implementation deviates from policy and curriculum provisions. Teacher pupil ratio should be looked into for effective teaching /learning situations while workbooks/teacher guides should form criteria for recommending textual materials.

Table 5: Distribution of Mean Standard Deviation) and Coefficient of Variation of the Personnel Preparedness and Utilization Sub-Scale.

		F.C.T teachers N=51			Niger State teachers N=49		
S/N	Item description	X	SD	Coefficient of Variation	X	SD	Coefficient of Variation
12	Provision of in-service training/vacation courses for science teachers	2.3	0.75	32.6	2.0	1.10	55.0
13	Provision of opportunities to attend workshops/seminars	2.4	0.92	12.1	1.9	1.00	52.6
14	Number of periods allows for effective science teaching	2.8	0.86	30.7	3.2	0.50	15.6
15	Regular payment of science teaching allowance	1.8	0.90	50.0	1.5	0.80	53.3
16	Availability of qualified laboratory attendants	2.1	0.91	43.3	2.0	1.00	50.0
Summary	Sub-scale summary	2.28	0.33	14.5	2.12	0.57	26.9

The results continue to show a similarity in trend. Only the item on work load and effective science teaching attracted a favorable response, although learned in favor of Niger state teachers. The rest fall short of expectation with a dismal performance on the part of regular payment of science teaching allowance. In time past STAN was enjoined to look into regular payment of science teaching allowance (1986). That clarion call

done more than two decades ago is as relevant today as it was then. The federal government in conjunction with other stakeholders in the field of education should be re-introduced the vacation courses of the 1980s so as to equip teacher with novel ideas and practices necessary for effective science delivery.

Table 6: Distribution of Mean Standard Deviation and Coefficient of Variation of the Student Readiness and Participation Sub-scale.

		F.C.T teachers N=51			Niger State teachers N=49		
S/N	Item description	X	SD	Coefficient of Variation	X	SD	Coefficient of Variation
17	Adequate mathematical competences of students for science learning	2.3	0.67	29.1	2.6	1.00	38.5
18	Students responses encourage teaching and learning of science	2.8	0.67	23.9	3.3	0.60	18.2
19	Effective participation in J.E.T.S and other relevant competitions	2.1	0.73	23.5	2.2	1.20	54.5
20	Enough students excursions to industrial, scientific and technology sites	2.1	0.71	33.8	2.3	0.90	39.1
21	Students' performance in terminal examinations on science are encouraging	3.0	0.71	23.7	2.8	0.60	21.4
Sum mary	Sub-scale summary.	2.66	0.39	14.7	2.64	0.39	14.8

From the table there is slight alteration in trend. While Niger state students are favorably disposed to mathematical competency (x =2.6) their FCT counterparts are not (x =2.3) on the other hand FCT students are better disposed to J.E.T.S and other competitions (x =3.1) than their Niger state counterparts (x – 2.2.)

On the whole however the sub-scale summary shows the closest similarity in trend among the various sub-scales, science teachers are being enjoyed to ensure that student participations is science teaching and learning is encouraged by providing classroom and, out of classroom activities as the need arises.

Table 7: Distribution of Mean Standard Deviation and Coefficient of Variation of Assessment and Evaluation Sub-scale.

		F.C.T teachers N=51			Niger State teachers N=49		
S/N	Item description	X	SD	Coefficient of Variation	X	SD	Coefficient of Variation
22	Continuous assessment tests are constructed by the teacher	3.4	0.77	22.6	3.5	0.50	14.3
23	Preparation of end-of-term examination by education resources centers	2.6	1.14	43.8	2.8	1.10	39.3
24	Proficiency courses for teachers in continuous assessment (C.A) test item development	2.2	0.89	40.5	2.5	0.90	36.0
25	Use of school result by WAEC/NECO	2.6	0.90	34.6	3.0	0.50	16.7
Summ ary	Sub-scale summary.	2.70	0.44	16.3	2.95	0.36	12.2

From the table there is agreement that teachers construct continuous assessment test items yet they are not favorably disposed to attending proficiency courses for C.A test-item development. It may not be surprising if Ipaye's observation (1987) of more than two decades ago still becomes the order of the day. He wrote that "one of the major problems in schools today is that many teachers are still very much deficient in test construction. Some do not know at all what is called "test items". Even the normal teacher-made tests are not properly set and used".

Table 8: Distribution of Mean Standard Deviation and Coefficient of Variation of Prospects and Problems in Science Teaching (PAPIST) Scale.

Sub-scale	F.C.T teachers N=51			Niger State teachers N=49		
	X	SD	Coefficient of Variation	X	SD	Coefficient of Variation
Infrastructure/materials	3.02	0.40	13.2	2.68	0.49	18.3
Policy provision/instruction	2.43	0.27	11.1	2.27	0.46	22.0
Personnel preparedness and utilization	2.28	0.33	14.5	2.12	0.57	26.9
Students readiness and participation	2.66	0.39	14.7	2.64	0.39	14.8
Assessment and evaluation	2.70	0.49	16.3	2.95	0.36	12.2
PAPIST scale summary.	2.62	0.06	2.2	2.53	0.09	3.6

From table 8, only three of the five sub-scales namely, infrastructure/materials, student readiness/participation and assessment evaluation are favorably disposed to science teaching while the other two are not. This shows that the prospects of secondary school science delivery in F.C.T and Niger state outweigh the problems; with F.C.T better disposed than Niger state.

Since education resource centers develop end-of-term continuous assessment item and teachers are invariably involved in these exercises, test-item, development workshops should be organized from time to time to allow virtually all teacher get equipped in test construction, validity and reliability skills. This will enhance the reliance of public examining bodies on such results in the computation of terminal grades.

Table 9: Test of Significance on the Infrastructure, Equipment and Materials Sub-Scale

Group	X	SD	No	Df	Problem level	Calculated value	Critical value	Decision
F.C.T teachers	3.02	0.40	5	8	0.05	1.07	-2.31 to 2.31	Accept
Niger State teachers	2.68	0.49	5					

The result shows that despite the fact that this FCT showed a relatively better disposition to provision of infrastructure, equipment and materials for secondary school science delivery there is no significant difference in this regard between the two contiguous political entities.

Table 10: Test of Significance on Policy Provisions/ Instruction Sub-scale

Group	X	SD	No	Df	Problem level	Calculated value	Critical value	Decision
F.C.T teachers	2.43	0.27	6	10	0.05	0.61	-2.00 -0.23to2.23	Accept
Niger State teachers	0,27	0.46	6					

On the policy provisions/instruction sub-scale, that there is no significant difference in the performance of both delivery systems.

Table 11: Test of Significance on Personnel Preparedness and Utilization Sub-Scale

Group	X	SD	No	Df	Problem level	Calculated value	Critical value	Decision
F.C.T teachers	2.28	0.33	5	8	0.05	0.49	-2.31 to 42.31	Accept
Niger State teachers	2.12	0.57	5					

The result show that there is no significant difference in the mean performances of personnel preparedness and utilization sub-scale.

Table 12: Test of Significance on Student Readiness and Participation Sub-Scale

Group	X	SD	No	Df	Problem level	Calculated value	Critical value	Decision
F.C.T teachers	2.66	0.39	5	8	0.05	0.07	-2.31 to 2.31	Accept
Niger State teachers	2.64	0.39	5					

With almost the same mean and standard deviation of the items of both groups in this sub-scale. It is wonder that there is no significant difference in their performances.

Table 13: Test of Significance on Assessment and Evaluation Sub-Scale

Group	X	SD	No	Df	Problem level	Calculated value	Critical value	Decision
F.C.T teachers	2.70	0.44	4	6	0.05	-0.85	-2.45 to 2.31	Accept
Niger State teachers	2.95	0.36	4					

The result equally shows that there is no significant difference in the mean sores of the items of both groups of schools in the sub-scale.

Table 14: Test of Significance on the Overall (PAPIST Scale Performance).

Group	X	SD	No	Df	Problem level	Calculated value	Critical value	Decision
F.C.T teachers	2.62	0.06	5	8	0.05	1.66	-2.00 to 2.00	Accept
Niger State teachers	2.53	0.09	5					

The result is a reflection of the results of the various sub-scales. There is no significant difference in the mode of science delivery at the secondary level between the FCT and Niger state.

Summary and Conclusion

Science education delivery at the secondary level in the FCT and Niger state leaves much to be desired. Government alone cannot meet the demands of sound science education delivery. Other stakeholders should be implored to contribute meaningfully. The paper recognizes the contributions of some multinationals and oil companies in some S.T.M related endeavors but wishes to request STAN to play an Oliver Twist if our science education delivery train must reach the Promised Land.

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