

Evaluating Secondary Mathematics Education in Nigeria

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Abstract

The study was designed to evaluate mathematics education in Nigeria. Specifically eight (8) secondary schools were randomly sampled in Cross River State. The result of the evaluation showed that one hundred percent (100%) of the respondents expressed the view that there was inadequacy of mathematics teaching materials in all the secondary schools. The result also revealed that 69% of total teachers teaching mathematics were not mathematics but borrowed from other science and technical subjects to teach mathematics. It was also discovered that from 2000 to 2003 about 6,282 students of eight sampled secondary schools sat SSCE however 84.45% (5,309) failed. The result of the data analysis from the chi-square (X^2) statistic revealed that students' performances were independent of years of examination. Suggestions were made on how to rectify problems of acute scarcity of teaching materials, teaching personnel as well as to reduce students failure in public examination.

Keywords: *Evaluation, Secondary, Mathematics, Education, Nigeria*

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Background to the Study

Evaluation as a process involves the assessment of different components of a system and judging the outcome. The judgment could be based on the comparison of outcome and established criteria or standard, or it could be based on the magnitude of calculated or observed statistical results. Historically, most of the judgments of the results of evaluations in Mathematics education in Nigeria were based on observed statistical result. For example, the judgment of traditional Mathematics and modern Mathematics were based on the observed high rates of student's failures in the two curricula.

However, in this study both established standard and magnitude of calculated statistical results would be used in judging Mathematics education from 2010-2014 in Cross River State. The achievement of desired goal and objective of secondary Mathematics education rests on proper curriculum plan, development and implementation. This encompasses careful selection of useful contents and pilot testing and evaluating them before implementation. It also involves the procurement of enough qualified teaching personnel, relevant materials and conducive environments.

However, history has revealed that not all of these important strategies were employed in Mathematics curriculum plan, development and implementation in Nigeria. For example, both traditional and modern Mathematics contents were purely relevant Nigerian culture and experience. In addition, the hasty nature of implementation of modern Mathematics curriculum in 1964 without pilot testing and evaluating it before real implementation was another serious problem that negatively affected students' performance in the subject. Infact, negligence in procuring enough qualified Mathematics teachers and teaching materials during the implementation and, of course, after the implementation of the two curricular (Modern and General Mathematics) was another setback in the teaching and learning of Mathematics.

Related Literature

Mathematics education in Nigeria passed through three developmental stages viz: Traditional Mathematics, Modern Mathematics and General Mathematics. The first Mathematics curriculum (Traditional Mathematics) which was taught in Nigerian secondary schools from the colonial period to 1964 mainly comprised more of arithmetic processes taught purely as an abstract subject through memorization, use of formulae and lots of drills which encouraged rote learning (Fajemidagba, 2001, Adetula, 2005). The ultimate aim was just to coach students to pass examinations without any regards for the acquisition of real mathematical knowledge. Even the text books used were prepared for British children, hence based on different culture and environment.

According to Lassa (2004) the above mentioned poor method of teaching and the foreign nature of teaching materials led to mass failure in public examinations which attracted the attention of the general public. To buttress this observation, (Fajemidagba, 2001) says: "The concern of the public for poor performance of students on the West African Examination Council (WAEC) and other public examinations led to the reappraisal of the syllabi and other curricular for school Mathematics in Nigeria."

For these and other reasons such as the inability of the syllabus to contain scientific and practical orientation for technological advancement, and heavy computation that lacked applicability to everyday life led to abolition of Traditional Mathematics in 1964. However, it

should be noted that there were two arithmetic curriculums that ran concurrently with Traditional Mathematics. These were commercial and technical arithmetic meant for vocational training centres and technical schools respectively.

After the abolishing of traditional Mathematics, a more scientifically and practically oriented Mathematics curriculum was introduced. This was 'Modern Mathematics.' According to Fajemidagba (2001), Modern Mathematics too was partially foreign based and introduced in Nigerian secondary schools in 1964 without proper and adequate preparation. According to Shirley (2008) the effects of this unpreparedness were: acute scarcity of qualified Mathematics teachers, low standard and poor quality of the few existing Mathematics teachers, absence of teaching materials and lack of motivation of Mathematics teachers. In addition, Nigerian Educational Research Council (NERC) (2007) pointed out that even the teachers' Colleges and Universities were not able to produce enough qualified mathematics teachers for the programme.

Like Traditional Mathematics, Modern Mathematics too failed to meet the expectations of the Nigerian public. There are mass failures in examinations which are criticisms of the entire Modern Mathematics curriculum (NERC, 2007). Considering all the problems which contributed to the failure of two previous Mathematics curricula, NERC (2009) reviewed Modern Mathematics syllabus and developed a new syllabus for secondary schools. According to NERC (2009), all the necessary materials which had no connection with the day-to-day life of Nigerian children were taken away from the Modern Mathematics syllabus. In their place, relevant materials which reflect the environment and the background of the children were placed. In addition, some relevant topics from the Old Traditional Mathematics syllabus were also incorporated into the new syllabus. This combination of the new ideas and old ideas from both Traditional and Modern Mathematics syllabi gave birth to new Mathematics curriculum called General Mathematics.

General Mathematics curriculum, according to NERC (2009) was implemented in secondary schools in 2009. However, it should be noted that the curriculum was reviewed in 2009 and implemented in the same year. Impliedly there was no room for pilot testing the new curriculum. For this, the problems experienced in the last two Mathematics curricula are still manifesting in the present General Mathematics curriculum which calls for evaluation.

Statement of the problem

Despite all previous governments' efforts to minimize the rate of poor performance in secondary school Mathematics, still this ugly trend of poor performance (mass failures) is manifesting in the present General Mathematics. Therefore, this study is aimed at finding answer to the following question: How effective is the teaching and learning of Mathematics in secondary schools in Nigeria?

Objective of the study

The study aimed at evaluating the present Mathematics education at secondary school level in the areas of content, teaching personnel, teaching materials and students' performances. It intended to compare the results of the evaluation with aims and objectives of Mathematics education as contained in National Policy on Education (NPE).

Research questions

This study is aimed at finding answers to the following questions:

1. What are the perceptions of Mathematics teachers on the relevance of the present General Mathematics content to Nigeria secondary school children's experience and culture?
2. What content areas of the subject are not relevant to Nigeria secondary children's experience and culture?
3. Are there enough qualified Mathematics teachers at secondary school level?
4. Are there enough Mathematics teaching materials in secondary schools?
5. Does the student-teacher ratio conform with the standard recommended in the National Policy on Education?
6. What are the performances of students in Senior Secondary School Certificate Examination from 2010-2014

Hypothesis

In addition to research questions, the study is also based on the following null hypothesis (Ho): There is no significant difference between number of passes/failures and year of examination.

Significance of the Study

The result of data analysis of this study and suggestions will guide the education policy makers to review (if necessary) the present secondary school Mathematics education. The study will also provide useful data to future researchers in the same area.

Scope of the Study

The study concerned all the senior secondary schools in Cross River State. The students' results in Senior Secondary Certificate Examination (S.S.C.E) for the period 2010-2014

Population

The study constituted two types of population viz:

- i. All the one hundred and eighteen (118) senior secondary school Mathematics teachers in Cross River State and
- ii. All the twenty one thousand (21,000) graduated students (at S.S.C.E level) from 2010-2014 in Cross River State.

Sample

The samples for the study were drawn from cluster sampling techniques. Out of twenty nine (29) senior secondary schools in the state, the researcher randomly selected eight (8). The thirty nine (39) Mathematics teachers of the eight (8) senior secondary schools selected constituted sample for the Mathematics teachers, while six thousand two hundred and eighty two (6,282) students of the same schools constituted sample for the students who sat S.S.C.E from 2010-2014.

Methodology and Procedures

The study involved the use of three (3) types of questionnaires: Mathematics Teachers' Questionnaire. The Mathematics Teachers' Questionnaire comprised two items seeking for information about the relevance of present General Mathematics content to Nigeria secondary schools children's experience and culture and the content areas the irrelevant to

their experience and culture (see section A of the appendix). Mathematics Heads of Department Questionnaires comprised four items aimed at collecting information about the adequacy or inadequacy of the Mathematics teaching materials, the number of students in each school (see section B of the appendix).

The school Examination Officers' Questionnaire was mainly a table requesting for information about the total number of students that sat for S.S.C.E in each school from 2014. The table also sought information on the number of students under the following categories of grades: Pass 7-8, Credit 1-6 and Fail 9 (see section C of the appendix). The researcher administered all the questionnaires by himself.

Results of Data Analysis

The following tables show the results of data analysis:

Table 1: Responses of 39 Mathematics teachers in respect to Relevance of Mathematics contents

Opinion	V.Rev.	Rev.	F. Rev.	F. Irrev.	Irrev.	V. Irrev.	Total
No. of teachers	10	21	8	0	0	0	39
Percentage	25.64%	53.85%	20.51%	0.00%	0.00%	0.00%	100%

Table 2: Responses of 8 Mathematics Heads of Department in respect to Adequacy of Teaching Materials

Opinion	V. Adeq.	Adeq.	F. Adeq.	F. Inadeq.	V. Inadeq.	V. Inadeq.	Total
No. of teachers	10	21	8	0	0	0	39
Percentage	0.00%	0.00%	0.00%	12.50%	50.00%	37.50%	100%

Table 3: Number of Mathematics Teachers (with qualifications) and Teacher-student ratio (T-SR) of 8 Schools

Schools	NCE (Maths)	B.ED (Maths)	B.Sc. (Maths)	DIP (Maths)	Others No. (Maths)	Total	Students	No. of T-SR
SPC Ikot Nsa Calabar	1	2			4	7	3,000.00	1:428
GSS Ikom	1			1	2	4	1,480.00	1:370
GSDA Akamkpa					5	5	2,700.00	1:540
GSS Akamkpa					3	4	2,300.00	1:575
MKC Ogoja				1	4	5	2,452.00	1:490
GGSS Ogep Osokon			1		3	4	1,322.00	1:330
BSS Okundi	1			2	2	5	1,967.00	1:393
FGS Ikom		1			4	5	2,135.00	1:427
TOTAL	4	3	1	4	27	39	17,356.00	1:445

Table 4: S.S.C.E Results of 8 Senior Secondary Schools

Year	Total Sat.	No. of Passes (P7-8)	No. of Credits (C1-6)	No. of fails (F9)
2010	1213	239 (19.70%)	15 (1.24%)	959 (79.06%)
2011	1175	198 (16.85%)	11 (0.94%)	966 (82.21%)
2012	1248	124 (9.94%)	13 (1.04%)	1111 (89.02%)
2013	1243	195 (15.68%)	15 (1.21%)	1033 (83.11%)
2014	1403	145 (10.35%)	18 (1.283%)	1240 (88.382%)
Total	6282	901 (14.34%)	72 (1.15%)	5309 (84.51%)

Table 5 shows the 5x2 contingency of passes/failures at S.S.C.E level and year of examination of eight (8) senior secondary schools. Passes in this sense include ordinary passes (P7-8) and credits (C1-6) as shown in table 4:

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Year	Passes	Failures	Total
2010	*187.9 254	*1025.1 959	1213
2011	*182.0 209	*993.0 966	1175
2012	*193.3 137	*1054.7 1111	1248
2013	*192 210	*1050.5 1033	1243
2014	*217.3 163	*1185.7 1240	1403
Total	973	5309	6282

The figures without a strike are the observed frequencies while those with astrike are expected frequencies.

Table 5: X2-Results of 5x2 Contingency table of passes and Failures:

X ²	Df	LS	CV of X ²	Remark
69.6	4	0.05	9.488	H rejected

- CV = Critical Value
- Df = Degree of freedom
- LS = Level of Significance

Discussion of Findings

Table 1 revealed the result of data analysis from thirty nine (39) questionnaires administered to thirty nine (39) Mathematics teachers in eight (8) sampled schools. 25.64% indicated that the present Mathematics contents are very relevant to Nigeria secondary school children's experience and culture. 53.85% are of the opinion that the contents are relevant, while 20.51% have the belief that contents are fairly relevant to children's experience and culture.

Table 2 presented the result of data analysis from eight (8) questionnaires administered to eight (8) Mathematics Heads of Department in eight (8) sampled schools. 12.50% have shown that

Mathematics teaching materials are fairly inadequate. Fifty percent (50%) expressed the feeling the teaching materials are inadequate, while 37.50% are of the view that materials are very adequate.

Table 3 portrayed the characteristics of Mathematics teachers available in the eight (8) sample schools. Out of thirty nine (39) teachers, seven (7) have read Mathematics with Education (N.C.E and B.Ed.), five (5) read Mathematics without Education (Diploma and B.Sc.) while twenty seven (27) read other courses which are not Mathematics. Impliedly this means that 69% (27) of the total thirty nine (39) teachers are not Mathematics teachers but borrowed from other science and technical subjects to teach Mathematics as a result of severe shortage of real Mathematics teachers.

The table also revealed the average teacher-student ratio of 1:445. Though the National Policy on Education (2004) is silent on the maximum number of students per teacher at secondary school level, it is still teaching opinion of the researcher that this ratio is very high. It is indicating that there acute shortage of Mathematics teachers in the sampled schools.

Table 4 showed the S.S.C.E results of six thousand, two hundred and eighty two (6,282) students of eight (8) sampled schools over the period of five years. 14.34% (901) passed at the ordinary level (P7-8), 1:15% (72) passed at credit level (C1-6), and 84.5.1% (5309) failed (F9). Considering this five year-year result, the researcher is of the opinion that the students' performance in the subject is very poor. The researcher equally believed that the poor performance could be connected to absence of teaching materials and severe shortage of qualified and trained Mathematics teachers.

Table 5 revealed the result of data analysis from computation of X^2 . The result showed that the calculated value of X^2 (69.60) is greater than critical value of X^2 (9.488) at 0.05 level of significance. Hence, the null hypothesis (H_0) is rejected, impliedly, there is significant independence between passes/failures and years of examination. In other words it means that student's performances were independent of years of examination. The implication of this finding to the student's performances in Mathematics is that there was no particular year that students perform better. Therefore it could be concluded that students' poor performances in Mathematics were as a result of constraining factors discussed above which were not addressed throughout the years.

It is the view of the researcher that these findings can be extended to all secondary schools in Nigeria since they operate the same syllabus. It is equally believed by the researcher that present poor students' performances in Mathematics could hinder the rapid scientific and technological progress as against the aim of education in National Policy on Education (1989:7).

Summary of Findings

1. All the General Mathematics contents are relevant to Nigeria secondary school children's experience and culture.
2. There is severe scarcity of Mathematics teaching materials in all the secondary schools in Cross River State.
3. There is acute shortage of qualified and trained Mathematics teachers in all the secondary schools.

4. Students perform poorly in Mathematics examinations.
5. Students' performances are independent of years of examination.

Conclusion

Evaluation of Mathematics Education is supposed to be a continuous process at fixed time intervals. This will enable Mathematics educators and administrators at any time to identify problem areas that need remedial attention. The problems could emerge from teaching personnel, methods of teaching, curriculum, teaching materials and environment. For example, the result of this evaluation has shown the following problems: Acute shortage of qualified and trained Mathematics teachers, severe scarcity of teaching materials and massive failure of students in Senior Secondary School Certificate Examinations. This will enable the educational management to take appropriate action as per the suggestions made by the researcher.

Recommendations

As part of remedial measures against the problems of Mathematics in Nigeria secondary schools, the following suggestions are made:

1. As part of radical approach, the government should immediately establish reasonable number of Colleges of Mathematics Education throughout the country and National Commission for Colleges of Mathematics Education (NCCME). The government should fully finance the Colleges of Mathematics Education through NCCME. The aim is to produce enough and well-qualified secondary school Mathematics teachers.
2. The NCCME should pay high allowances to students in College of Mathematics Education and students studying Mathematics Education in other Colleges of Education and universities in order to attract more students to study Mathematics Education.
3. The government should encourage and support financially universities, Colleges of Education and all existing educational units at Federal and State level to explore the production of Mathematics textbooks and other teaching materials that can be sold at subsidized prices to parents and students.
4. There should be intensive and continuous training workshops for existing Mathematics teachers, especially for the untrained ones.
5. Special salary structure and allowances should be worked out for Mathematics teachers at secondary school level. This will encourage more people to read Mathematics Education and join teaching.

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Appendix

SECTION A: (MATHEMATICS TEACHER'S QUESTIONNAIRE)

1. Tick the appropriate response in respect to the relevance of the present General Mathematics content in Nigeria secondary school children's experience and culture:
 - A. Very Relevant
 - B. Relevant
 - C. Fairly Relevant
 - D. Fairly Irrelevant
 - E. Irrelevant
 - F. Very Irrelevant
2. For the responses from D to F (1) above, indicate here the content areas that are irrelevant to Nigeria secondary school children's experience and culture:

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SECTION B: (MATHEMATICS HEADS OF DEPARTMENT QUESTIONNAIRE)

1. Tick the appropriate response in respect to the adequacy of Mathematics teaching materials in your school.

- A. Very Adequate
- B. Adequate
- C. Fairly Adequate
- D. Fairly inadequate
- E. Inadequate
- F. Very inadequate

2. For the responses from D to F of (1) above, indicate here the inadequate teaching materials:

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3. Indicate the number of teachers teaching Mathematics in your school against the following qualifications:

- N.C.E (Maths):
- B.Ed./B.Sc. Ed. (Maths):
- B.Sc. (Maths):
- Diploma (Maths):
- Others (No. of Maths):

4. Indicate the total number of students in your school:

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SECTION C: (EXAMINATION OFFICERS' QUESTIONNAIRE)

Fill in the following table by indicating the total number of students who sat for S.S.C.E. in each year (from 2010-2014), number of passes (P7-8), number of credits (C1-6) and number of fails (F9).

Year	Total Sat.	No. of Passes (P7-8)	No. of Credits (C1-6)	No. of Fails (F9)
2010				
2011				
2012				
2013				
2014				
Total				