

EVALUATION OF SECONDARY MATHEMATICS EDUCATION FOR NATIONAL DEVELOPMENT IN NIGERIA IN THE 21ST CENTURY

ADIGUN Olatunde Thomas, *Ph.D.*

Department of General Studies Education,
The College of Education, Lanlate,
Oyo State, Nigeria.

thomasadigun@yahoo.com

Abstract

Evaluation of secondary school Mathematics education is the assessment of all the components involved in the teaching and learning of Mathematics. Specifically, the study was limited to eight (8) public secondary schools which were randomly selected; one secondary school each from the eight (8) education zones in Oyo State, Nigeria. Five (5) research questions and two (2) hypotheses were raised to guide the study. The target population was two hundred and twenty-five thousand, six hundred and forty-five (225,645) graduated students at SSCE level and two hundred and one (201) Mathematics teachers. Three (3) research instruments were used to collect data. Frequency and percentages were used to answer the research questions while Chi-square statistics was used to test the hypotheses formulated. The results revealed that; the present General Mathematics contents are relevant to students' experience and culture; there is serious shortage of Mathematics teachers in the sampled schools; teacher to student ratio was 1:430; and 72.54% of students had F9 grades in Mathematics. The result of data analysis of the chi-square statistics revealed that calculated value of X^2 (77.00) is greater than critical value of X^2 (9.49) at 0.05 level of significance. It means that students' performances in the years 2012 – 2016 in WAEC May/June Mathematics examinations were not dependent of years of examination. Conclusions were made that General Mathematics contents evaluation should be done from time to time and insufficient qualified Mathematics teachers and Mathematics teaching materials should be given immediate attention to improve students' performance in the subject.

Keywords: Evaluation, Mathematics Education, Students' Performance, Mathematics Teachers.

Background to the Study

Evaluation involves assessment of all components of a system and judging the outcome. The outcome could be judged based on careful comparison of the available outcome and the accepted fact or standard already set. The judgment could also be based on the magnitude of observed statistical results. Majority of the judgments of the results of evaluations in Mathematics education in Nigeria were based on observed statistical result. For instance, based on the high rate of students' failure in Traditional Mathematics and Modern Mathematics the two curricula were judged (Bessong & Felix, 2018).

To achieve the desired goals and objectives of secondary Mathematics, there should be proper planning, development and implementation of the curriculum. This should include careful selection of useful topics, pilot testing and evaluating the curriculum before implementation. Other things to be put into consideration are employment of enough qualified teaching personnel and provision of relevant materials and favourable environments. Due to the introduction of Universal Primary Education (U.P.E) in 1976, it was made compulsory for all children of school age to go to school. This led to increase in student enrolment without the attendant increase in teachers and infrastructure. This affected the teaching and learning of Mathematics negatively and led to the introduction of "Traditional" and "Modern" Mathematics. Both the traditional and modern mathematics contents were very relevant to Nigerian culture and experience. But because of poor implementation, without pilot testing and not evaluating it before the implementation, students' performances were very poor.

There was Additional Mathematics meant for a few talented ones who may continue studies in Mathematics, Science and Engineering in institutions of higher learning. All the problems which contributed to the failure of the two previous Mathematics curricula were reviewed by Nigerian Educational Research Council (NERC) in modern mathematics syllabus and developed a new syllabus for secondary schools. According to NERC (2009), all necessary materials which had no connection with the day-to-day life of Nigerian children were taken away from the modern Mathematics syllabus. Relevant materials which reflect the environment and the background of the children were placed. Furthermore, some relevant topics from the old Traditional Mathematics syllabus were also incorporated into the new syllabus. Fusion of the old ideas and the new ideas from both Traditional and Modern Mathematics syllabi gave birth to new Mathematics curriculum called General Mathematics.

According to NERC, General Mathematics curriculum was implemented in secondary schools in the year 2009. The curriculum was reviewed the same year but there was no room for pilot testing of the new curriculum. Hence, mass failure that was experienced in the last two Mathematics curricula is still manifesting in the present General Mathematics curriculum. Therefore, failure on the side of government to provide enough qualified Mathematics teachers and teaching materials as well as infrastructure during and after implementation of the Modern and Traditional Mathematics curricula was a great setback in the teaching-learning of Mathematics in Nigeria. In this study, both the standard set and the observed statistical results would be used in judging Mathematics education for five consecutive years 2012 to 2016 in Oyo State, Nigeria.

During the pre-colonial period, Mathematics that was taught in Nigerian secondary schools was divided into Arithmetic, Algebra, Trigonometry and Geometry. The subjects were examined that way at School Certificate level. Mathematics curriculum then was mainly comprised of arithmetic processes which were taught as an abstract subject through memorization, use of formulae and drills. The curriculum then encouraged rote learning (Fajemidagba, 2001). The results of West African Examination Council (WAEC) and, other examination bodies throughout the period of the 1960s revealed poor performances in Mathematics. Three prime reasons for the poor performances include: text books were written by foreign authors, unavailability of Mathematics graduate teachers and foreign examination syndicate (Olayanju, 2004). Another independent effort dealing with the problems of the school Mathematics curricula was organized by the Comparative Education Study and Adaptation Centre (CESAC) at University of Lagos, Nigeria, aimed at developing a new syllabus for secondary level Mathematics and organizing a carefully planned timetable of text writing, trial testing of the material and teacher training; as early as August 1976.

The Nigeria Oil Boom between 1961-1969 introduced some major Mathematics curriculum innovations. Entebbe Mathematics Experiment and the School Mathematics Project (SMP) were the prominent two of them. The schools were allowed to choose the curriculum they preferred and the examining body WAEC examined both projects. Introduction of these projects made worst the already bad state of teaching and learning of Mathematics. Each of the projects included elements of the so called “Traditional” and “Modern” Mathematics. This crisis between the two Mathematics projects made both students and parents more confused about the subject. The crisis came to a stop in April 1977 when the then Federal Minister of Education Col. Dr. A.A. Ali abolished the controversial modern Mathematics in all Nigerian Secondary Schools. In the year 1978, the National Critique Workshop set up by the Federal Government of Nigeria released a new Mathematics Curriculum for the Secondary School in April 1978 in Benin (Odili, 2006).

In consideration of innovations which Mathematics curriculum had passed through from pre-colonial period, in which Mathematics was taught in compartmental form to the period of Oil boom of Traditional and Modern Mathematics. Later, we had the Entebbe Mathematics Experiment and the School Mathematics Project (SMP) period. In addition to the period of the fusion of the old ideas and the new ideas from both Traditional and Modern Mathematics syllabi, there came the new Mathematics curriculum called General Mathematics in the year 2009 in all Nigerian secondary schools. It was observed that throughout these periods there was no proper and adequate preparation for the programme.

Shirley (2008) pointed out some of the effects of bad preparation as: acute scarcity of qualified Mathematics teachers, lack of motivation of Mathematics teachers, low standard and poor quality of the few existing Mathematics teachers, and absence of teaching materials. Nigeria Educational Research Council (NERC) (2007) also revealed that the teachers’ colleges and universities were unable to produce enough qualified Mathematics teachers for the programme. Bessong and Felix (2018) carried out a study on evaluating secondary Mathematics education in Cross River State. Findings of the study include: severe scarcity of Mathematics teaching materials in all the secondary schools in Cross River State, acute shortage of qualified and trained Mathematics teachers, poor performance of students in Mathematics examinations and that students’ performances are independent of years of examination, among others. However, the problem of poor performance in Mathematics at

secondary level from the period of pre-colonial, through Traditional and Modern Mathematics is still manifesting in the present period of General Mathematics curriculum. For national development in the 21st century, General Mathematics curriculum calls for urgent evaluation for better performance in Mathematics.

Statement of the Problem

As a result of poor performance experienced in Mathematics throughout the three developmental stages which Mathematics education passed through in Nigeria, and despite the various efforts made by the government to minimize poor performance in Mathematics, this study aims at evaluating the effectiveness of the teaching and learning of the subject at secondary school level in Oyo State, Nigeria.

Purpose of the Study

The main purpose of this study is to evaluate the present Mathematics education at senior secondary school level. The study compares the results of evaluation with the aims and objectives of Mathematics education as contained in the National Policy on Education (NPE). The study specifically:

1. determine the relevance of the present General Mathematics content to Nigeria secondary school students' experience and culture;
2. examines the number of qualified personnel (Mathematics teachers) at secondary school level;
3. considers the performances of students in senior secondary school certificate examination for five (5) years;
4. demonstrates whether there are enough Mathematics teaching resources or not in secondary schools; and
5. examines whether the student to teacher ratio conforms to the standard recommended in the national policy on education.

Research Questions

The following research questions were raised to guide the study:

1. What is the difference in the number of Mathematics teachers holding relevance/irrelevance perceptions of the General Mathematics content to Nigeria secondary school students' experience and culture?
2. Is Mathematics teaching resources in senior secondary schools in Oyo State adequate?
3. Are the qualified personnel (Mathematics teachers) at senior secondary school level in Oyo State enough?
4. Does the student to teacher ratio conform to the standard recommended in the national policy on education?
5. What were the performances of students in senior secondary school certificate examination from the year 2012 to 2016 in Oyo State?

Research Hypotheses

In addition to the research questions raised, the following research hypotheses were tested;

HO₁: There is no significant difference between the number of Mathematics teachers holding relevance and irrelevance perceptions of the General Mathematics content to Nigeria secondary school students' experience and culture.

HO₂: There is no significant difference between the number of students that passed and those that failed Mathematics in WASSCE from the years 2012 to 2016 in Oyo State.

Scope of the Study

The study was restricted to senior secondary students in Oyo State, Nigeria. May/June (WAEC) students' results in General Mathematics in Senior School Certificate Examination (SSCE) for the period 2012- 2016 were used for the study. The study was limited to eight (8) public senior secondary schools.

Significance of the Study

The study is of great significance because it is hoped that the results of this research are expected to improve and uplift the standard of teaching and learning of Mathematics. Suggestions made will guide curriculum planners and curriculum developers as well as education policy makers to review the present secondary school Mathematics education if the need arises.

Population, Sample and Sampling Techniques

The target population for this study was two hundred and twenty five thousand, six hundred and forty five (225,645) graduated students at SSCE level and all the two hundred and one (201) Mathematics teachers in public secondary schools in Oyo State. From the eight (8) education zones in Oyo State: Ibadan city, Ibadan less city, Kajola, Ibarapa, Saki, Oyo, Ogbomoso and Irepo, the researcher randomly selected one secondary school each from each education zones to serve as sample schools out of three hundred and thirty-seven (337). The twenty seven (27) Mathematics teachers in the eight (8) randomly selected secondary schools formed sample for the Mathematics teachers. Sample for the students were nine thousand, five hundred and eighteen (9,518) students of the selected eight (8) schools that sat for SSCE May/June (WAEC) examinations from 2012 – 2016.

Research Instrument

Three (3) research instruments were used to collect data for this study: Mathematics Teachers' Questionnaire (MTQ), Mathematics Heads of Department Questionnaire (MHDQ) and School Examination Results (SER). SER sought information on the number and grades of students that sat for SSCE (WAEC) examinations from year 2012 – 2016 based on year, total sat, number passed (D7-E8), number of credits (A1-C6) and number failed (F9). MHDQ was designed to collect information about the adequacy and inadequacy of the Mathematics teaching resources based on (A) Very Adequate, (B) Adequate, (C) Fairly

Adequate, (D) Fairly Inadequate, (E) Inadequate, and (F) Very Inadequate. The second aspect of MHDQ asked the respondents to indicate the Inadequate Mathematics teaching materials and the third aspect was used to ask the respondents to indicate the number of teachers teaching Mathematics in their school with qualifications, while the fourth aspect requested the respondents to indicate the students' populace in each school. MTQ sought information about the relevance of present General Mathematics curriculum content to Nigeria secondary school students' experience and culture as well as the content that are considered not relevant. MTQ asked the Mathematics teachers to tick the appropriate response based on (A) Very Relevant, (B) Relevant, (C) Fairly Relevant, (D) Fairly Irrelevant, (E) Irrelevant, and (F) Very Irrelevant. Then, second aspect of MTQ asked the respondents to indicate Mathematics content areas that are irrelevant to Nigerian students' experience and culture.

Validation of Research Instrument

For the purpose of face and content validity of the instruments (MTQ and MHDQ), they were given to experts in measurement and evaluation and two experts in Mathematics education as well as two experienced secondary school Mathematics teachers in Oyo State. After all the corrections had been effected, the two instruments (MTQ and MHDQ) were administered to the respondents.

Procedure for Data Collection

The consent and co-operation of the principals of selected schools were sought. With the co-operation of research assistants (Mathematics teachers) from selected schools, the two questionnaires (MTQ and MHDQ) were personally administered to enhance their prompt responses. Then, SSCE May/June (WAEC) examinations results from year 2012 to 2016 were collected from the eight (8) school principals selected for this study. All the questionnaires were administered by the researcher within two weeks and they were 100% returned.

Data Analysis Techniques

Data collected were subjected to statistical analysis and interpretations to obtain the results using descriptive and inferential statistics. Frequency and percentages were used to answer the research questions while Chi-square statistics was used to test the two hypotheses formulated for this study. The two hypotheses were tested at 0.05 level of significance.

Data Analysis and Results

Answering Research Questions

Research Question 1

What is the difference in the number of Mathematics teachers holding relevance/irrelevance perceptions of the General Mathematics content to Nigeria secondary school students' experience and culture?

Table 1: Relevance/Irrelevance of General Mathematics content to students' experience and culture

Opinion	V. Rel.	Rel.	F. Rel.	F. Irrel.	Irrel.	V. Irrel.	Total
No of teachers	09	16	02	0	0	0	27
Percentage (%)	33.33	59.26	7.41	0.00	0.00	0.00	100

Table 1 revealed the opinion of twenty-seven (27) Mathematics teachers in respect of relevance /irrelevance of General Mathematics to students' experience and culture in eight (8) sampled schools. 33.33%, 59.26% and 7.41% pointed out that General Mathematics contents are very relevant, relevant and fairly relevant to students' experience and culture respectively. None (0.00%) of the twenty-seven teachers (27) pointed out that the present General Mathematics contents are not relevant to students' experience and culture.

Research Question 2

Are Mathematics teaching resources in senior secondary schools in Oyo State adequate?

Table 2: Responses on Adequacy/Inadequacy of Mathematics teaching materials

Opinion	V. Adeq.	Adeq.	F. Adeq.	F.Inadeq.	Inadeq.	V. Inadeq	Total
No of teachers	0	0	01	02	04	01	08
Percentage (%)	0.00	0.00	12.50	25.00	50.00	12.5	100

Table 2 revealed the opinion of eight (8) Heads of Mathematics Department in eight (8) sampled schools concerning adequacy/inadequacy of Mathematics teaching materials in secondary schools in Oyo State eight (8) education zones. 12.50%, 25.00%, 50.00% and 12.50% pointed out that Mathematics teaching materials are fairly adequate, fairly inadequate, inadequate and very inadequate respectively.

Research Questions 3 and 4

3. Are there qualified personnel (Mathematics teachers) at senior secondary school level in Oyo State enough?

4. Does the student to teacher ratio conform to the standard recommended in the national policy on education?

Table 3: Number of Mathematics Teachers with Highest Qualifications and Teacher to Student ratio

School	NCE (Math)	B.Ed. (Math)	B. Sc. (Ed.) (Math)	Dip. (Math)	Others (Math)	Total No of Math Teachers	Total No of Students	Teacher to Student Ratio
Ib city	1				4	5	1,030	1:206
Ib less city	1		1		1	3	1,025	1:342
Kajola		1			2	3	1,500	1:500
Ibarapa		1			3	4	1,350	1:338
Saki	1				2	3	1,930	1:643
Oyo				1	2	3	1,680	1:560
Ogbomoso	1		1		2	4	1,322	1:331
Irepo				1	1	2	1,769	1:885
Total	4	2	2	2	17	27	11,606	1:430

Table 3 reveals the number of Mathematics teachers and their qualifications in the eight (8) sampled secondary schools in Oyo State. The table pointed out that eight (8) which is 29.63 percent out of twenty-seven (27) Mathematics teachers read Mathematics and have teaching qualification. Two (2) teachers, which is 7.41% read Mathematics without teaching qualification (Diploma certificates) and seventeen (17) which is 62.96 percent are not Mathematics teachers but borrowed from other subjects like Physics, Chemistry, Biology and Technical subjects to teach Mathematics. The last column of table 3 also revealed teacher to student ratio, on the average it was calculated to be 1:430 in the eight (8) sampled schools. Despite the fact that National Policy on Education (2009) does not stipulate the maximum number of students to a teacher at secondary school level, ratio 1:430 is extremely high, which shows that there is serious shortage of Mathematics teachers in the sampled schools.

Research Question 5

What are the performances of students in senior secondary school certificate examination from the year 2012 to 2016, in Oyo State?

Table 4: WAEC SSCE Results of Eight (8) Senior Secondary Schools for Five (5) Years

School	Total Cand. (5yrs)	A1-C6	D7-E8	F9
Ib city	1312	167 (12.72%)	234 (17.84%)	911 (69.44%)
Ib less city	1241	145 (11.68%)	209 (16.84%)	887 (71.47%)
Kajola	1048	097 (9.26%)	151 (14.41%)	800 (76.33%)
Ibarapa	1213	101 (8.32%)	220 (18.14%)	892 (73.54%)
Saki	1340	112 (8.36%)	282 (21.04%)	946 (70.60%)
Oyo	1008	130 (12.90%)	134 (13.29%)	744 (73.81%)
Ogbomoso	1124	158 (14.06%)	152 (13.52%)	814 (72.42%)
Irepo	1232	102 (8.28%)	220 (17.86%)	910 (73.86%)
TOTAL	9,518	1,012 (10.63%)	1,602 (16.83%)	6,904 (72.54%)

Table 4 shows the results of nine thousand, five hundred and eighteen (9,518) students that sat for WAEC SSCE for the period of five (5) years. The table revealed that one thousand and twelve (1,012) which is 10.63 % students had between A1- C6, one thousand six hundred and two (1,602) which is 16.83% students had D7–E8 grades and six thousand nine hundred and four (6,904) which is 72.54% students had F9 grades in Mathematics. Researcher observed that the results were very poor and the poor performance may be due to insufficient number of Mathematics teachers and Mathematics teaching materials.

Testing Research Hypotheses

Research Hypothesis 1

HO₁: There is no significant difference between the number of Mathematics teachers holding relevance and irrelevance perceptions of the General Mathematics content to Nigeria secondary school students' experience and culture.

All the twenty-seven (27) teachers pointed out that the present General Mathematics contents are relevant to students' experience and culture. This shows that all the contents of General Mathematics are relevant to Nigeria secondary school children's experience and culture.

Research Hypothesis 2

HO₂: There is no significant difference between the number of students that passed and those that failed Mathematics in WASSCE and the years 2012 to 2016 in Oyo State.

Table 5: Chi-Square Contingency Test for Evaluation of secondary Mathematics

Year	Passed		Failed		Total
	Observed freq.	Expected freq.	Observed freq.	Expected freq.	
2012	960	923.7	892	928.3	1852
2013	922	907.7	898	912.3	1820
2014	1097	970.5	867	984.5	1964
2015	832	980.5	1134	985.5	1966
2016	936	936.6	980	960.4	1916
TOTAL	4747		4771		9518

Table 6: Chi-Square Statistics on Evaluation of Passed and Failed of Secondary Mathematics examinations

Group	df	Level of Sign.	X ² -cal.	X ² -tab.	Remark
Passed	4	0.05	77.00	9.49	HO ₂ Rejected
Failed					

Table 6 shows the result of data analysis that calculated value of X² (77.00) is greater than critical value of X² (9.49) at 0.05 level of significance. Therefore, HO₂ is rejected. This implies that there is significant independence between the numbers of passed/failed students and the years 2012 – 2016 WAEC May/June Mathematics examinations in Oyo State. It

means that students' performances in the years 2012 – 2016 in WAEC May/June Mathematics examinations were not dependent of years of examination. Their performances were poor, there was no a single year they performed better throughout the period under consideration. The researcher observed that students' poor performances in Mathematics examinations were due to insufficient qualified Mathematics teachers and Mathematics teaching materials which were not addressed in secondary schools in Oyo State.

Summary of Major Findings

The outcomes of the major findings are as follows:

1. The present General Mathematics contents are relevant to students' experience and culture.
2. Teacher to student ratio, on the average was calculated to be 1:430 in the eight (8) sampled schools.
3. There is serious shortage of qualified Mathematics teachers in the sampled schools.
4. The students' results were very poor for the periods under consideration.
5. The students' performances were not dependent of the years of examination.

Discussion of Results

It was found from this study that calculated value of X^2 (77.00) is greater than critical value of X^2 (9.49) at 0.05 level of significance. Therefore, H_0 is rejected. It means that students' performances in Mathematics examinations were not dependent on years of examination. This is in line with the study of Bessong and Felix (2018) who evaluated secondary Mathematics education in Cross River State, Nigeria. This shows that students' performances were not dependent of the year of examination.

Conclusion

Based on the findings of this study, it is concluded that the present General Mathematics contents are relevant to students' experience and culture, teacher to student ratio was 1:430, there is shortage of qualified Mathematics teachers and very poor students' results and students' performances were not dependent of the years of examination. Therefore, general Mathematics contents evaluation should be done from time to time. This will enable the stakeholders to find out problem areas in the teaching and learning of Mathematics that need to be corrected. Also, insufficient qualified Mathematics teachers and Mathematics teaching materials which were not addressed in secondary schools in Oyo State should be given immediate attention.

Recommendations

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

1. The government should enforce the colleges of education and faculties of education in the universities to produce enough and qualified Mathematics teachers. This can be done by giving scholarship to students that study Mathematics Education in the Colleges and Universities.
2. Enough and qualified Mathematics teachers should be employed by the Oyo State Government so as to improve students' performance in Mathematics.
3. Issue of insufficient Mathematics teaching materials should be given immediate attention.
4. Employed Mathematics teachers should be encouraged by sponsoring them for further study and pay their salaries as and when due.

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