EVALUATION OF THE IMPLEMENTATION OF SECONDARY SCHOOL MATHEMATICS CURRICULUM IN ENUGU EDUCATION ZONE

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Abstract: The main purpose of this study was to evaluate the implementation of senior secondary school mathematics curriculum in Enugu education zone. Literature related to the study was reviewed. Evaluative research design was adopted in order to appraise all efforts of the Government in the implementation and realization of the curriculum's objectives. Scriven goal free evaluation model guided inquiries that would yield data to warranted value judgment. The population of this study consist of all the 10,478 students and 142 teachers in the 31 public senior secondary schools in Enugu Education Zone. Simple random sample and disproportionate stratified sampling technique were used to select105 students and 96 teachers for the study. A checklist and questionnaire were developed and validated for the purpose of data collection. Data were arranged and analyzed according to research questions. Among others, the major findings of the study were that: most facilities for implementing the senior secondary Mathematics curriculum in Enugu Education zone are adequate, but the classes are over populated; quality of teachers used in implementing the senior secondary school mathematics curriculum in Enugu education zone is grossly inadequate. Hence, the major educational implication of the findings of the study is that there is still need for improvement in the senior secondary school Mathematics curriculum delivery to meet the demands of quality Mathematics education in the study area. The main recommendation is that the Government should re-strategize and reinforce efforts to staff schools with qualified Mathematics teachers and equip schools with basic educational service and facilities to mitigate the effect of large class size.

Keywords: Secondary School, Mathematics Curriculum, physical facilities, qualification of teachers

Background of the Study

Education is a cornerstone of development, and within the realm of education, secondary schooling occupies a pivotal position in shaping the future of students. In Nigeria, secondary education serves as the bridge between primary and tertiary education, offering students the platform to acquire essential skills and knowledge (Ige, 2013). It is during this phase that students are expected to develop into critical thinkers who are not only self-reliant but also capable of contributing to the growth of their nation. The quality of secondary education has far-reaching implications for the nation's development, particularly in a rapidly changing and evolving global landscape.

The National Policy on Education (Federal Republic Nigeria, 2004) articulates clear objectives for secondary education in Nigeria. Among these objectives are the diversification of the curriculum to cater to the different talents, opportunities, and future roles of students, the provision of trained manpower in applied science, technology, and commerce at sub-professional levels, and the impartation of technical knowledge and vocational skills necessary for agricultural, industrial, commercial, and economic development. These objectives underscore the importance of secondary education in preparing students for the challenges and opportunities they will encounter in their lives.

One of the core subjects taught in secondary schools across Nigeria is mathematics. Mathematics is not just a subject; it is a fundamental discipline that underpins scientific and technological development. Its importance in everyday life cannot be overstated. Mathematics equips students with essential skills such as logical reasoning and quantitative calculation. Moreover, it fosters abstract thinking, problem-solving abilities, and creative development. In a knowledge-driven economy, mathematics plays a crucial role in nurturing individuals who can meet the demands of the modern world.

The success of secondary education, particularly in subjects like mathematics, hinges on the effectiveness of curriculum planning, development, and implementation. In Nigeria, as in many other countries, curriculum is the cornerstone of education. It defines what students are expected to learn, how they should learn it, and the intended outcomes of their education (Nnamani, 2017). Therefore, the curriculum is not merely a document; it is a blueprint for the educational journey of students.

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In 2011, Nigeria introduced a new senior secondary mathematics curriculum. This curriculum aimed to not only teach the core principles of mathematics but also emphasize the practical application of mathematics to real-life situations. The curriculum was designed to enhance students' technological and entrepreneurial skills, aligning education with the demands of the modern world. It sought to equip students with the competencies needed to thrive in a dynamic and competitive global environment (Olateru-Olagbegi, 2015).

However, the success of any curriculum depends on its effective implementation. Curriculum implementation involves translating the goals and objectives outlined in the curriculum document into tangible learning experiences for students. It is a complex and multifaceted process that requires the collaboration and commitment of various stakeholders, including teachers, school administrators, policymakers, and educational institutions (Nigerian Educational Research and Development Council, 2012)

One notable feature of the new mathematics curriculum is its alignment with the constructivist learning approach. This approach places the learner at the center of the educational process, emphasizing active engagement, critical thinking, and problem-solving (Zanzali, 2003). To fully realize the potential of this learner-centered curriculum, all stakeholders, particularly teachers and school administrators, must be actively involved in its implementation. Despite the government's intentions to use the new curriculum as a tool for providing trained manpower in applied science, technology, and commerce, there have been systemic shortcomings that have manifested in poor student

performance in mathematics. This performance gap raises questions about the extent to which mathematics teachers have taken measures to implement the new curriculum effectively.

The existing literature has shown that the challenges in curriculum implementation in Nigeria are multifaceted. They encompass administrative constraints, inadequate instructional facilities, a lack of qualified teachers, unrealistic goals, and poor supervision, among others. These challenges can undermine the potential of even the well-designed curriculum. Moreover, there is a significant gap in the literature regarding the evaluation of the state of mathematics education, particularly in Enugu education zone. This gap hinders our understanding of the level of commitment in implementing the new mathematics curriculum and the factors that may impede its successful execution.

To address these issues and provide a comprehensive evaluation of the implementation of secondary school mathematics curriculum in Enugu Education Zone. By shedding light on the challenges and opportunities in curriculum implementation, this research aims to contribute to the enhancement of mathematics education in Nigeria and, by extension, the nation's scientific and technological development.

Purpose of the Study

The main purpose of this study was to evaluate the implementation of secondary school mathematics curriculum in Enugu education zone. Specifically, the study:

1.   Ascertained the adequacy of physical facilities for implementing senior secondary school mathematics curriculum in Enugu education zone;

2.   Assessed the qualification of teachers used in implementing the senior secondary school mathematics curriculum in Enugu education zone;

3.   Identified the methods adopted in teaching senior secondary school mathematics;

Research Questions

In line with the purposes, this study was premised on the following research questions:

1.   To what extent are physical facilities adequate for implementing senior secondary school mathematics curriculum in Enugu education zone?

2.   What is the minimum qualification of teachers used in implementing the senior secondary school mathematics curriculum in Enugu education zone?

3.   What methods are adopted in teaching senior secondary school mathematics?

Review of Literature

Concept of Secondary Education:

Secondary education in Nigeria has evolved over time, initially introduced alongside primary education by Christian missionaries in 1842 (Nnamani, 2017). It gained more attention from the government when primary school graduates needed to further their education. Secondary education targets a specific age group and aims to develop students intellectually, offering more comprehensive literacy, numeracy, and communication skills compared to primary education. It is divided into Junior and Senior Secondary Schools, with the latter preparing students for higher education and the workforce. The curriculum is designed to be diverse, catering to different talents and opportunities, with objectives ranging from providing trained manpower to fostering national unity and inspiring self-improvement (Federal Republic of Nigeria [FRN], 2004).

Concept of Mathematics:

Mathematics is a fundamental discipline that has evolved from the study of geometric figures and numerical computations (Brown, 2004). It is the science of numbers, space, measurement, quantity, magnitude, and abstract structures. Mathematics seeks patterns, formulates conjectures, and uses logical deduction to prove or disprove them (Clarke, Goos, & Morony, 2007). It plays a vital role in various fields, including science, technology, and everyday life, contributing to problem-solving, logical reasoning, and creative thinking. Mathematics education is crucial for preparing individuals to thrive in a technologically driven world (Peter-Koop, 2005).

Concept of Curriculum:

The concept of curriculum encompasses the entire educational plan, including what is taught, why it is taught, how it is taught, and to whom it is taught (Moronkola, 2000). Curriculum is not limited to syllabi, lesson plans, or schemes of work; it represents a comprehensive framework for education. Curriculum development involves reconstructing knowledge and experiences to facilitate effective learning (Nnamani, 2017). It is a dynamic process that reflects societal needs and aims to achieve educational objectives. A functional curriculum considers aims and objectives, content, teaching methods, and the societal context in which learners will function (United Nations Educational, Scientific and Cultural Organization, 2006). Curriculum changes are necessary when a curriculum is deemed ineffective in meeting the needs of society (Nnamani, 2017). Curriculum design should focus on inspiring and motivating learners, providing clear and relevant content, effective implementation, teacher competence, quality teaching, the availability of instructional materials, and appropriate assessment methods (Olateru-Olagbegi, 2015).

THEORITICAL FRAMEWORK

Scriven Goal-Free Evaluation Model

This approach developed by Scriven in 1974 focuses on the actual outcomes rather than the intended outcomes of a programme. In practice with this approach, the evaluator has minimal contact with the programme managers and staff and is less concern with the programme's stated goals and objectives. According to Alkin (2004), the major question addressed in this kind of evaluation is, "What are all the effects of the programme, including any side effects? This approach developed by Scriven compensates for inherent weaknesses in a goal-orientated approach by providing an unbiased perspective of on-going programme. The evaluator here remains purposely uninformed about the programme's predetermined goals and looks for all the effects of a programme regardless of its developer's intended objectives. If a programme is meeting its intended purpose, the evaluation should confirm this. The evaluator will also be more likely in this model to find unanticipated effects that goal-based evaluation might miss because of the specificity of their search. Stufflebeam and Shinkfield (2007) believe that goal-free evaluation provides important supplementary information, expands the sources of evaluative information, is effective for finding unexpected information, is cost-efficient, and is welcomed by clients. Scriven also emphasized the importance of not only evaluating to test if goals have been met but also to see if the goals themselves are worthy. Brown (1989) however came to realise that whilst evaluating to test if goals and objectives are met the evaluation procedures could also be used to facilitate curriculum change and improvement and so began a paradigm shift in programme evaluation research from product to process-oriented approaches. In critics, Stake (1975) observed that there is rarely a formal plan drawn up in advance but rather patterns in the data are looked for as the evaluation progresses and hence proposed the Responsive/Client-Centered Evaluation model. This will also help in proper implementation of a planned programmes/polices, such as teaching of mathematics in senior secondary education according to curriculum layout.

Empirical Review

Adegoke and Mefun (2016) conducted a study to assess the adequacy and availability of human and material resources for implementing the new Mathematics Curriculum in Nigeria. The research revealed a shortage of qualified mathematics teachers and instructional materials, with recommendations suggesting that teachers join professional bodies and undergo professional education courses.

Akudolu and Umeny (2016) aimed to determine the extent to which Peace Education curriculum was being implemented by surveying junior secondary school teachers in Enugu State, Nigeria. The findings indicated that many teachers were not utilizing peace-prone instructional strategies, leading to recommendations for revising teacher education programs to better equip educators for peace education.

Alabi (2014) examined the implementation of the senior secondary school curriculum for entrepreneurship education in Ondo State, finding disparities between public and private schools. The study suggested incorporating entrepreneurship education into secondary school programs and improving school funding.

Ityokyaa and Adejoh (2014) evaluated the implementation of the biology program in secondary schools in Benue State, Nigeria, revealing issues such as unqualified biology teachers and ineffective teaching methods. Recommendations included recruiting more qualified biology teachers and providing in-service training.

Igwe (2015) explored challenges in the implementation of secondary education chemistry curriculum in Nigeria. The study highlighted issues like inadequate instructional materials and the need for teacher involvement in curriculum planning, recommending teacher empowerment and the employment of more qualified chemistry teachers.

Oris (2014) conducted a pilot study evaluating the implementation of the English language curriculum of the Nigeria Certificate in Education, revealing deficiencies in infrastructure and teacher attitudes. The study recommended improvements in teacher training and the availability of instructional materials.

Research Method

Design of the Study: The study utilizes an evaluative research design, which aims to make informed judgments about the worth of something based on descriptive information and criteria. This design is suitable for assessing the state and level of implementation of the mathematics curriculum in the study area.

Area of the Study: The research was conducted in Enugu Education Zone, Enugu State, Nigeria. This zone consists of three Local Government Areas (LGAs) and was chosen due to its commitment to quality education and recent teacher recruitment efforts.

Population of the Study: The population includes all 10,478 students and 142 teachers in 31 senior secondary schools within the Enugu Education Zone.

Sample and Sampling Technique: The study's sample consists of 201 respondents, comprising 105 students and 96 teachers. Disproportionate stratified sampling was employed to select 5 schools from each of the 3 LGAs, and 7 students from each sampled school. All mathematics teachers in the selected schools were included.

Instruments for Data Collection: The primary instrument used for data collection is the Mathematics Curriculum Implementation Instrument (MCII), which includes demographic questions and five clusters addressing research questions related to physical facilities, teacher qualifications, teaching methods, evaluation methods, and challenges in implementing the mathematics curriculum.

Validation of the Instrument: To ensure instrument validity, three specialists in mathematics education and measurement and evaluation examined the MCII. Their feedback and suggestions were incorporated to improve the instrument's alignment with the study's objectives.

Reliability of the Instrument: The reliability of the MCII was established through trial-testing in four schools outside the study area. Cronbach's Alpha method was used, resulting in reliability indices ranging from .784 to .811, with an overall index of .794, indicating the instrument's reliability.

Methods of Data Collection: The researcher and four trained research assistants visited the sampled senior secondary schools, where they conducted direct observations of school facilities and instructional procedures. Proforma was used to gather teacher qualifications, while questionnaires were administered to both students and teachers on-site to ensure the collection of all completed questionnaires.

Method of Data Analysis: Data collected were analyzed using descriptive statistical tools with SPSS version 20.0. Mean and standard deviation were calculated for questionnaire items. A mean score of 2.5 or higher indicated that an item was implemented. For the checklist, a benchmark of 100% availability of physical facilities was considered significant. The minimum qualification for mathematics teachers was set as a B.Sc. (Ed.) in Mathematics Education, following the National Policy on Education (NPE) 2004.

Result Presentation

Research Question One: To what extent are physical facilities adequate for implementing senior secondary school mathematics curriculum in Enugu education zone?

S/N	Basic input facilities for Mathematics education include:	Minimum Standard (MST)	% Available	Decision
1	Class room	1:45	80	**Adequate**
2	Mathematics lab	1	0	**Inadequate**
3	Textbook on mathematics	At least 1 per 5 stds	67	**Adequate**
4	Graph board	At least 1 per 20 stds	33	**Inadequate**
5	Office stores	1 per School	20	**Inadequate**
6	Teacher/student ratio	1.45	7	**Inadequate**
7	Chairs and desk in the class room.	1 per student	93	**Adequate**
8	Class room windows	At least 4 per class	100	**Adequate**
9	Geoboard	At least 1 per 20 stds	80	**Adequate**
10	Weighing balance	At least 1 per 20 stds	60	**Adequate**
11	Geometrical shapes	At least 1 per 20 stds	93	**Adequate**
12	Library facilities/benches and stools	1 per sch	60	**Adequate**
13	Templates	At least 1 per 20 stds	67	**Adequate**
14	Black board/white board	2 per class room	100	**Adequate**
15	General course staff room	At least 1 per sch.	100	**Adequate**

Table 1: *Checklist showing the status of basic input facilities for implementing Mathematics curriculum in Enugu education zone*

With regard to research question one, Table 1 shows the status of basic input facilities for implementing senior secondary school mathematics curriculum in Enugu education zone as against the minimum standard. The data obtained through the use of checklist show that most facility status are adequate with respect to their available.

Research Question Two: What is the ratio of minimum qualification of teachers used in implementing the senior secondary school mathematics curriculum in Enugu education zone?

Table 2: *Checklist showing the adequacy of teachers for implementing senior secondary school mathematics curriculum*

LGA	NCE	B.ED	B.SC	M.ED	Total	% Qualified	% Not qualified	Teacher/Student Ratio
Enugu North	10	29	15	7	61	59	41	1:50
Enugu East	9	12	3	4	28	57	43	1:144
Isi-Uzo	2	4	1	0	7	57	43	1:231
Total	**21**	**45**	**19**	**11**	**96**	**58**	**42**	**1:142**

Table 2 shows the quality of available teachers used in implementing senior secondary school mathematics curriculum in Enugu education zone. This indicated that the percentage of qualified teachers in the school is 58% (ie) that is those that has the basic educational requirement, B. Ed and M.Ed. while the teacher student ratio is 1:142, this was achieved based on the qualified teachers to student's populations.

Research Question Three: What methods are adopted in teaching senior secondary school mathematics curriculum using UNICEF standard as bench mark?

Table 3: The mean ratings and standard deviation on the extent UNICEF designated CFSs in Enugu State

S/N	Method of instruction	X	SD	D
1	Students participate in classwork	2.96	.84	Adopted
2	Assignment and exercise are given at the end of the lesson	2.79	.78	Adopted
3	Students are encouraged to ask questions	3.39	.81	Adopted
4	Students are encouraged to answer questions	3.32	.83	Adopted
5	Simple experiments are demonstrate	2.57	.91	Adopted
6	Instructional materials are used to reduce abstract conception	2.40	1.02	Not Adopted
7	Projects methods are used	2.94	1.01	Adopted
8	Formative evaluation are used to guide lesson progress	2.77	.94	Adopted

9	Practical activities are organized for students	2.23	1.00	Not Adopted
10	Lessons are mostly not teacher centered	2.54	1.09	Adopted
	Cluster mean	2.79	.50	Adopted

Table 3 indicates how often various instructional strategies are utilized in implementing senior secondary mathematics curriculum. The result shows the item by item Mean Scores (X) and Standard Deviation (SD) of students and teachers. On the whole, the cluster mean score is 2.8 which shows that teachers often utilize the above listed instructional strategies in implementing the senior secondary mathematics curriculum.

Discussion of Findings

Adequacy of physical facilities for implementing senior secondary school mathematics curriculum in Enugu education zone

The data collected with reference to research question one ascertained the physical facilities used in implementing senior secondary school Mathematics curriculum in the study area. Findings indicated that vital facilities such as class room, textbook on mathematics, chairs and desk in the class room, class room windows, geoboard and weighing balance were available and adequate at the schools. Other facilities found to be adequate for implementing the senior secondary school curriculum include geometrical shapes, library facilities/benches and stools, templates, black board/white board and general course staff room. These input resources are vital in addressing students' needs and supports implementation of the curriculum. These findings are in contrast to those found by Oribabor (2014) which evaluated the new English Language Curriculum in Nigerian Secondary Schools. Oribor found out that there is non-availability of recommended instructional materials for implementing the new English Language Curriculum. Aibieyi and Oghoator (2015) also found lack of these physical facilities wanting when they studied factors militating against effective implementation of the 6-3-3-4 education policy in Nigeria. It is anticipated that utilized physical facilities as provided for implementation of the senor secondary school Mathematics curriculum in Enugu education zone is capable to support the development of the competencies and skills that students will acquire to meet standards established by the school and prepare them to meet the challenges of life, work and career.

Regrettably, availability of vital education resources such as Mathematics lab, graph board, and office stores were found to be inadequate at the schools. These facilities enable learners to be open to new ideas and becoming eager to explore. This finding is consistent with those found by Puyate (2008) in a study to identify the constraints to the effective implementation of vocational education program in Port Harcourt Local Government Area of Rivers State. Puyate found these infrastructure and instructional materials inadequate. This present study also highlighted the gross inadequacy in the teacher student ratio. This is similar to those found by Adegoke and Mefun (2016) which examined the level of adequacy and availability of human and material resources for the implementation of the Nigeria newly introduced Mathematics Curriculum. Results of Adegoke and Mefun show that there are not enough of qualified mathematics teachers in the schools. A sizeable numbers of the teachers sampled did not read mathematics and some of those who read mathematics did not have requisite teaching qualification. This is

regrettable because successful implementation of the curriculum depends on availability and adequacy of human and material resources. This is because if well qualified mathematics teachers and instructional materials are not available, no matter how well structured and intentioned the new mathematics curriculum may be, its successful implementation may not be achieved.

Qualification of teachers used in implementing the senior secondary mathematics curriculum in Enugu education zone

Findings of this study indicated that only 58% Mathematics teachers are qualified to teach Mathematics at the senior secondary. More still, there is a paltry teacher student ratio of 1:142. These indicate that on average, the senior secondary schools in Enugu education zone do not maintain the Bachelor in Education as a minimum qualification for teaching. With respect to ratio of teacher to student it could be inferred that Mathematics teachers are insufficient at the senior secondary schools in the study area. This is similar to the findings of Adegoke and Mefun (2016) that there are not enough of qualified mathematics teachers in the schools. A sizeable number of the teachers sampled did not read mathematics and some of those who read mathematics did not have requisite teaching qualification.

In another study Ityokyaa and Adejoh (2014) revealed among others, that majority (60%) of the biology teachers were not qualified to teach biology hence teaching methods often used by teachers were not the same as those recommended for teaching the subject. This could also be the situation in Mathematics classroom as an implication to the huge percentage of unqualified teachers found in the schools. This could constitute a major constraint to the effective implementation of Mathematics curriculum in Enugu education zone.

Methods adopted in teaching senior secondary school Mathematics

With respect to the instructional methods adopted in the teaching and learning of Mathematics at the study area, findings of this present study revealed that students participate in classwork, assignment and exercise given at the end of the lesson, students are encouraged to ask and answer questions, simple experiments are demonstrated, projects methods are used formative evaluation are used to guide lesson progress while lessons are mostly not teacher centered. These are similar to the findings of Idowu (2015) conducted to appraise the effective implementation of the school civic curriculum at the basic and senior secondary levels in Lagos and Ogun states, in the south-western geo-political zone of Nigeria. Idowu study showed eclectic pedagogical classroom practices whereby teachers mixed active (learner-based) pedagogies with didactic (teacher-based) teaching style to implement classroom civic education. In a similar finding that evaluated the implementation of the English language curriculum of the Nigeria Certificate in Education at a College of Education in Ogun State, Nigeria, Oris (2014) revealed that lecturers employed mostly a combination of teaching modes in classrooms. This also echoes the findings of Oleabhiele and Oleabhiele (2015) which focused on the extent of implementation of post-economics curriculum in senior secondary schools in Edo state. Oleabhiele and Oleabhiele (2015) discovered that the instructional strategies employed by economics teachers to implement the curriculum content are appropriate as specified by the curriculum.

Conclusions

This study evaluated the implementation of senior secondary school Mathematics curriculum in Enugu education zone. The following conclusions are made on the basis of the findings of the study: The facilitates for implementing the senior secondary school Mathematics in Enugu Education zone are adequate, but the classes

are overpopulated. The quality of teachers used in implementing the senior secondary school mathematics curriculum in Enugu education zone is grossly inadequate and the lessons are student centred.

Achievement in Mathematics in senior secondary schools in Enugu education zone are mostly measured by continuous assessment and there are inherent challenges in effective implementations of the senior secondary school Mathematics in Enugu education zone.

Educational Implications of the findings of the Study

Physical facilities for implementing the curriculum are adequate, hence, the objectives of mathematics education would likely be met in Enugu education zone. There is dearth of qualified Mathematics teachers in schools, this implies that effective implementation of Mathematics curriculum may not be feasible. Student centred pedagogies are adopted in teaching senior secondary Mathematics; hence, teaching and learning would be responsive to the objectives the curriculum.

Findings show that students achievement are often done through many evaluation strategies, this implies that the students are evaluated on cognitive domain, effective and psychomotor domains. Inherent challenges in effective implementations of the senior secondary school Mathematics in Enugu education zone are most likely to sabotage the efforts of stakeholders

Recommendations of the findings of the Study

Bearing in mind the findings of this study, the following recommendations are made towards improving the implementation of senior secondary Mathematics curriculum

1. Infrastructure should be prioritized in schools so that they are properly equipped for functional teaching and learning of Mathematics education. Hence, provision of instructional materials should continue to be a central feature of Government efforts for effective implementation of senior secondary school Mathematics curriculum

2. Government should declare a state of emergency in recruitment of qualified teachers and encourage service teachers to upgrade their qualification through in-service training to attend seminars, workshops in order to improve their teaching skills

3. Proper funding of education and provision of school physical facilities as a panacea to eminent collapse of secondary education should be sustained

4. Governments should allocate adequate funds to the education sector, to take care of over populated class size and reduce the inappropriate teacher student ratio

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