



Evaluation of The Implementation of Senior Secondary School Chemistry Curriculum in Enugu West Senatorial District of Enugu State, Nigeria

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Abstract

The study investigated the evaluation of the implementation of the Senior Secondary School Chemistry Curriculum in Enugu West Senatorial District of Enugu State, Nigeria, guided by two research questions related to the Context (C) Evaluation phase of the CIPP model. Employing an Evaluation Research Design, it involved 110 SSS3 Chemistry teachers from 109-government Public Schools, with a sample of 44 teachers selected through multistage sampling procedure. Data collection utilized the Chemistry Curriculum Evaluation Questionnaire (CCEQ), validated by three experts and tested for reliability using Cronbach's alpha ($\alpha = 0.87$ for cluster 1, 0.95 for cluster 2). Analysis involved frequency, percentage, mean, and standard deviation. Results indicated insufficiency of curriculum in achieving its objectives, with the supplied Chemistry syllabus aligning with the national curriculum. Recommendations emphasize collaborative efforts between the state government and stakeholders to address implementation issues. The study acknowledges limitations and suggests further research.

Key-words: chemistry, chemistry education, curriculum, evaluation, implementation

Introduction

Chemistry occupies a strategic place in the educational system of most countries of the world including Nigeria. Currently, Nigeria needs a functional science education to meet the needs of the local industries, citizens as well as satisfy the practical needs of the society. Ojokuku (2012) viewed Chemistry as one of the branches of pure science that deals with the study of matter, its structure, composition, properties and the changes it undergoes. Chemistry is a branch of science which deals with the study of matter, the interaction between matter and the study of the interactions (Njelita, Egolum and Ezeokeke, 2014). Achimugu (2016) further pointed out that Chemistry is concerned with identifying common materials around us and then turning them into more useful products, and hence Chemistry plays an important role in influencing the rate of economic and technological development. Operationally, Chemistry is the science subject that primarily focuses on identifying matter in terms of its physical and chemical properties and its valuability for economic and technological advancement. Perhaps, from these assertions, it is inferable that Chemistry can exert a dominant and decisive influence on the life of individuals in the areas of industry, agriculture, infrastructure as well as in the developmental effort of a nation. The progress of any nation depends on the achievement in the field of Chemistry. By nurturing a well-educated populace in Chemistry, a continuous

pipeline of innovative minds capable of addressing global challenges, contributing to scientific discoveries, and propelling societal progress is ensured. Chemistry education thus becomes not only a gateway to understanding the intricacies of the natural world but also a key driver for fostering a scientifically literate and empowered society.

Chemistry education has been identified to be one of the major bedrocks for the transformation of a nation's economy. Igboegwu and Okonkwo (2012) viewed Chemistry education as a necessary ingredient for becoming self-reliant, earning a living and contributing towards building sustainable national development. Samantha (2017) observes that Chemistry education is a pivot through which many individuals could be transformed into entrepreneurship discoveries whose profound impacts could be noticed if carefully utilized for proper everyday learning, being one of the targets of national development. To the researcher, Chemistry education is the study of the teaching and learning of Chemistry in all academic institutions such as schools, colleges and universities. Chemistry Education is considered as a key agent of development, either as a way of developing human capacity, increasing the skilled workforce for modernization, or as a matter of personal freedom, developing capability and empowerment. The National Policy on Education (NPE) in the National

Curriculum for Senior Secondary Schools Science stated specific objectives to be achieved by each subject curriculum. For Chemistry, the specific objectives to be achieved in the curriculum include: facilitating a transition to the use of scientific concepts and techniques acquired in Integrated Science with Chemistry, providing the students with basic knowledge of chemical concepts and principles through efficient selection of content and sequencing, show Chemistry in its interrelationship with other subjects, show Chemistry and its link with industry, everyday life, benefits and hazards and provide a course which is complete for pupils not proceeding to higher education while it is at the same time a reasonably adequate foundation for a postsecondary Chemistry course (National Policy on Education, 2014). Therefore, Chemistry education is of paramount importance to the development of any country, especially in the context of Nigeria as a developing nation. It serves as a catalyst for economic growth by contributing to various industries such as pharmaceuticals, agriculture, and manufacturing. A strong foundation in Chemistry enhances agricultural practices, promotes healthcare advancements, and addresses environmental challenges. Moreover, it facilitates resource management, technological innovations, and global collaboration. By fostering a culture of innovation and research, Chemistry education empowers individuals to contribute to scientific progress, ultimately laying the groundwork for a more prosperous, sustainable, and interconnected future.

There is a need to revisit Chemistry education in terms of adequacy of curriculum content and proportion of syllabus coverage of the curriculum designed for achieving objectives, teaching and practice, integrating Chemistry education into everyday living, nature and society, directing it to achieve a functional Chemistry education for the good of the individual and the society at large. In spite of the roles of Chemistry education in national development, evidence in literature (Adewumi and Monisola 2013; Ezechukwu & Ukozor 2016) shows there is a consistent poor achievement in Chemistry in public examinations conducted by West African Examinations Council (WAEC). Evidence from the West African Examinations Council (WAEC) has consistently reflected poor achievement in Chemistry (WAEC chief examiner's report for 2016, 2017, 2018, 2019, 2020, 2021 and 2022 (Source: www.waeconline.com). The poor achievement in Chemistry in the SSCE has been attributed to so many factors, among which may be due to the fact that most Chemistry teachers do not follow the content of the curriculum adequately, which could be as a result of

too much workload, administrative duties and other engagements outside the school. Lawrence (2016), stated that an overloaded curriculum, and lack of adequate time to cover the curriculum is a factor that impedes objectives or affects the effective implementation of the science curriculum. Thus, some teachers do not go in-depth because they are only interested in covering the scheme of work, without ensuring that effective teaching and learning takes place. Poor achievement could also be attributed to a lack of diagnosing whether the state syllabus supplied to schools is in line with the National Curriculum in terms of content coverage. Wotring, Chen, and Fraser (2021) posited that comprehensive syllabus coverage enhances the likelihood of students achieving the intended learning outcomes specified in the curriculum and ensures that students are exposed to essential knowledge and skills. Evaluating the adequacy of the national Chemistry curriculum in achieving its objectives and the alignment of topics covered in the curriculum with the Enugu State-supplied syllabus, play a crucial role in shaping the implementation of Chemistry education. The investigations address curriculum effectiveness, local relevance, resource allocation, educator preparedness, and student achievement. By scrutinizing the coherence between the national curriculum and the syllabus at the state level, the assessment offers insights for continuous improvement, ensuring that the education system remains dynamic and responsive. Furthermore, the findings can inform policy development, facilitating adjustments to enhance the overall quality of Chemistry education, foster student learning, and meet the evolving needs of both national and regional or state contexts. The effectiveness of Chemistry education depends on the curriculum, highlighting areas for improvement and adaptation. To achieve the quest for educational excellence, the intersection of Chemistry education and the curriculum emerges as a powerful nexus, shaping the future generation's scientific understanding and contributing to the progress of our nation.

Curriculum refers to a blueprint guiding educational experiences, comprising a comprehensive plan that delineates what, how, and when students will learn within a specific educational setting. It is a structured plan outlining what is to be taught in an educational program. It encompasses the goals, content, materials, methods, and assessments used to guide learning experiences in schools, colleges, or other educational settings. Curriculum, according to Okorie (2010), is a statutory and public document that expresses the desires and aspiration of people of a given period and articulates the desirable

experiences, which the people intend for themselves, and their younger generation; the sequence and method of achieving such experiences usually spelt out as goals and objectives to be reached in a school process. Mulenga (2018) defined curriculum as a concept that involves all types of activities that occur inside or outside of the classroom for the purpose of providing quality education and experiences to students. Beyond a mere collection of subjects, the curriculum embodies a dynamic process, evolving to meet the needs of diverse learners, societal changes, and advancements in knowledge. It is a roadmap for educators, serving as a foundation to design, implement, and evaluate educational programs while striving to achieve specific learning outcomes and prepare students for the complexities of the modern world. Another dimension to curriculum is that the learning contents may not result in achieving the objectives if both contents and objectives are not closely related. The achievement of the objectives is partly determined in terms of how well the curriculum is implemented. Since Chemistry as a subject is highly needed for improvement of life skills, science and technology, then it becomes necessary that effective implementation of Chemistry curriculum should be ensured by the stakeholders especially the teachers.

Implementation refers to the process of putting a plan, idea, design, or system into action or practice. It's the stage where concepts are translated into tangible, real-world results by executing the necessary steps outlined in a strategy or blueprint. Implementation often involves deploying resources, managing tasks, and executing plans to achieve specific goals or objectives. Onyeachu (2008) defined curriculum implementation as the process of putting all that has been planned as a curriculum document into practice in the classroom through the combined effort of the teacher, learners, school administrators, parents, as well as interaction with the physical facilities, instructional materials, and psychological- and social environment. Onyeachu notes that even if a curriculum is planned correctly and documented, the critical test for it lies with implementation. Onyeachu identifies implementation as a problematic aspect of the curriculum and is the key to successful innovation. Mkpa and Izuagba (2009) as cited in Obilo and Saugoleye (2015) also maintained that curriculum implementation is the actual engagement of the learner with planned learning opportunities; this planning includes the instructional materials that will be used for its implementation at the appropriate stages. Whether it's in education, business, technology, project management, or any other field, implementation is crucial for turning intentions into

reality. Successful implementation of a Chemistry curriculum relies on collaboration among educators, administrators, and stakeholders to ensure that the curriculum's goals are met, students are engaged, and learning outcomes are achieved. While implementing a Chemistry curriculum involves translating the educational framework, goals, and objectives outlined in the curriculum into practical teaching and learning activities within the classroom or educational setting, evaluation assesses the effectiveness of these practices in achieving educational goals. Evaluation serves as a diagnostic tool, identifying areas for improvement and informing adjustments in implementation to meet the evolving needs of students and society.

Evaluation is one of the most important tools for determining the quality of any educational program, which can lead to reformation, revision, or termination of programs. Evaluation is the process of determining the extent to which objectives are attained. American Evaluation Association (2014) opined that Evaluation is a systematic process to determine merit, worth, value or significance. Chen (2015) was of the view that Evaluation is the process of systematically gathering empirical data and contextual information about an intervention program—specifically answers to what, who, how, whether, and why questions that will assist in assessing a program's planning, implementation, and/or effectiveness. Evaluation is the process of collecting data on a programme to determine its value or worth with the aim of deciding whether to adopt, reject, or revise the programme. There are two ways of doing evaluation: formative and summative evaluation. Formative evaluation emphasizes ongoing feedback and assessment during the learning process to facilitate improvements and guide instruction. It aims to monitor progress, identify areas of difficulty, and provide timely interventions to enhance learning outcomes. According to Stufflebeam and Shinkfield (2020), formative evaluation is “used to improve the development and implementation of programs by providing feedback and making ongoing adjustments”. Summative evaluation, on the other hand, is typically conducted at the end of a learning period or project to assess the overall effectiveness and outcomes. It focuses on measuring the achievement of predetermined objectives and providing judgments or grades based on the performance of individuals, programs, or institutions. According to Scriven (2018), summative evaluation is “judgement of merit or worth made at the end of a learning period or project”.

Curriculum evaluation is an empirical, field-based attempt to find out how the use of particular

curriculum content meets the objectives of implementing it in schools. The importance of curriculum evaluation is to determine the value of the curriculum itself with respect to the following: Are the contents of the national Chemistry curriculum for secondary schools adequate for achieving the objectives of the curriculum? Are the topics in the national Chemistry curriculum adequately covered by the Chemistry syllabus supplied to schools by the State Ministry of Education? Curriculum evaluation needs to be carried out at different stages of implementation if the desired results are to be obtained. Curriculum can be evaluated in a number of ways using the different evaluation models such as Tyler's model, Stake's model, Taba's model, Scriven's Goal-Free model, Kirkpatrick's model, Roger's model and CIPP model. These evaluation designs and models have been used for evaluating the projects, programs or working of institutes.

The Stufflebeam's Context, Input, Process and Product (CIPP) model of evaluation was used in this research. The CIPP framework was developed as a means of linking evaluation with programme decision-making. It aims to provide an analytic and rational basis to programme decision making, based on a cycle of planning, structuring, implementing, reviewing and revision decisions to detect the presence of any defects or weaknesses in the context, input, process and product of the programme or curriculum. Kirkpatrick & Stufflebeam (2013) defined the CIPP model as a comprehensive and systematic approach to evaluation, providing a framework to assess and improve educational programs. It emphasizes the importance of considering the context, inputs, processes, and products to make informed decisions and improve program effectiveness. Any weaknesses discovered through evaluation activities will lead to remedial or adjustment measures to improve the programme. The CIPP model is an attempt to make evaluation directly relevant to the needs of decision-makers during the phases of implementation activities of a programme. The Stufflebeam's CIPP evaluation model is recommended as a framework to systematically guide the conception, design, implementation, and assessment of programmes/projects implementation in order to provide feedback and judgement of the project's effectiveness for continuous improvement. It is unique as an evaluation model as it allows evaluators to assess the program at different stages, namely: before the program commences by helping evaluators to assess the need, and at the end of the program to assess whether or not the program has achieved its objectives.

However, this study targeted only the "Context" component of the CIPP evaluation model, because it tends to comprehensively understand the curriculum context or background in which the Chemistry education operates, including the socio-economic, cultural, and institutional factors, needs or problems that gave rise to the curriculum contents and objectives. This study is a pre-implementation assessment to identify potential challenges and opportunities, establish baseline data, or inform policy and program design. Currently, there seems to be cases of crisis in the Nigerian educational system, and so, the need for a context-focused evaluation response to ascertain the feasibility of program implementation, becomes a crucial first step.

Context refers to the need and opportunities that define the goals and objectives on the basis of which the outcomes are measured. Context includes the background, History, goals and objectives of the school. Context evaluation helps to assess the needs and opportunities within a defined context or environment (Stufflebeam & Shinkfield, 2007). The objectives of context evaluation are to define, identify and address the needs of the target population, identify the problems and assess if the goals are responsive to the desired needs or not (Stufflebeam, 2007). The importance of context evaluation in this study was to determine the value of the curriculum in terms of its adequacy in meeting the set objectives and its alignment with the syllabus supplied to schools. Martha (2015) revealed that when the objectives of the components were adequate, but the underlying assumptions or principles taught were defective, that the objectives or needs of the students would only be partially met. Wotring, Chen, and Fraser (2021) were of the view that comprehensive syllabus coverage enhances the likelihood of students achieving the intended learning outcomes specified in the curriculum and ensures that students are exposed to essential knowledge and skills. A well-covered syllabus prepares students for further education, ensuring they have a solid foundation in the subject.

Statement of the Problem

One of the major goals of science education in Nigeria is to produce scientists for national development. Despite the importance of Chemistry in Nigeria's quest for technological development, there seems to be problems in the implementation of the laudable objectives of the senior secondary education Chemistry curriculum in Nigeria. How to sensitize Chemistry teachers on the need to effectively implement the senior secondary school Chemistry curriculum and make the government seriously involved in providing necessary environment for

curriculum implementation remain daunting. However, evaluation is a continuous and comprehensive process which involves judgments that cover all aspects of quality assurance in education. With the increase in educational institutions, there is a need to focus on evaluation of the quality of education being given to learners because education is responsible for shaping the future of individuals and society. In spite of the Nigerian government's desire to promote science education programmes in the country, the standard of science education in Nigeria has fallen beyond reasonable doubt (Dahiru 2010). In the particular case of Chemistry, one observes that despite the importance of Chemistry as a science subject, evidence has shown that students are not doing well in this subject at West African Secondary School Certificate Examination (WASSCE). It is against this background that the researcher deemed it necessary to empirically evaluate the implementation of the curriculum for secondary school Chemistry. Therefore, the problem of this study put in a question form is: To what extent has the implementation of the Chemistry curriculum succeeded in achieving the set objectives of Chemistry education, with regards to achieving aims and objectives of the curriculum and content coverage of the syllabus.

Besides, based on the researcher's knowledge, this kind of study has not been carried out in the area. This study covered some gaps or investigated some key aspects that makes it unique from previous research endeavours. To be precise, this study assesses the alignment between curriculum contents and curriculum goals/objectives. It also addresses resource or material (syllabus) deficiencies impacting curriculum coverage, and evaluates the relevance of curriculum content to local contexts.

Research Questions

The following research questions were designed to guide the study:

1. To what extent are the contents of the national Chemistry curriculum for secondary schools adequate for achieving the objectives of the curriculum?
2. What proportion of topics in the national Chemistry curriculum is covered in the Chemistry syllabus supplied to secondary schools by the Enugu State Ministry of Education?

Methods

The study adopted Evaluation Research Design. The population of this study was 110 senior secondary school 3 (SSS3) Chemistry teachers in the

109-government Public Schools in the five Local Government Areas of Enugu-west Senatorial district. SSS3 Chemistry teachers were chosen as the primary subjects of this investigation because of their comprehensive understanding of the Chemistry curriculum, with an emphasis on their experience in teaching for more than two years and preparation of students for the Senior School Certificate Examination. A sample of 44 Chemistry teachers drawn from the entire population were used for the study selected through a multistage sampling procedure. Multistage Sampling Procedure according to Bhandari (2023) is a procedure that requires drawing a sample from a population using smaller and smaller groups (units) at each stage. Firstly, a simple random sampling technique (labeled strips of paper are folded, mixed, and randomly chosen from a container) was used to select one out of the two educational zones in the Enugu-west district. Awgu educational zone emerged. This technique was used to ensure that each education zone has an equal and fair chance of being selected. In the second stage, a simple random sampling technique (balloting without replacement) was used to draw 2 out of the 3 local government areas in the zone that emerged. Aninri and Awgu local government areas emerged and have 17-government owned public schools with 17 Chemistry teachers and 27-government owned public schools with 27 Chemistry teachers respectively. All the SSS3 Chemistry teachers of all the schools in Aninri and Awgu LGAs were used as the sample size for the investigation.

The instrument for data collection was Chemistry Curriculum Evaluation Questionnaire (CCEQ) for secondary school Chemistry teachers. The CCEQ consisted of two sections; A and B. Section A was on the demographic variables of the respondents while section B consisted of two clusters. The first cluster which had 5 items elicited information on the extent to which the content of the national Chemistry curriculum for secondary school adequate in achieving the objectives of the curriculum. The second cluster which had 34 items elicited information on the proportion of topics in the national Chemistry curriculum covered by Chemistry Syllabus. Face validation of the instruments for data collection were done by three specialists; two from the Chemistry Education unit and one from Measurement and Evaluation unit, all in the Department of Science Education, University of Nigeria, Nsukka. The Cronbach's alpha reliability estimate was used to determine the internal consistency of the Chemistry Programme Evaluation Questionnaire (CCEQ) because the data are not dichotomously scored. Reliability index or reliability

coefficients of 0.87, and 0.95 were obtained for cluster 1 comprising 5 items and cluster 2 comprising 34 items respectively. This shows that the instruments were very reliable. The researcher got a letter of introduction from the Head of Department (HOD), Science Education Department, University of Nigeria, Nsukka. The researcher with the help of the six research assistants took copies of the letter to the sampled schools, sought and obtained permission from the school administration to collect data from Chemistry teachers using the questionnaires. Through the assistants, the researcher established relationships with the Chemistry teachers in the schools. The researcher administered the CCEQ for teachers with the help of six research assistants. The research

assistants were briefed on the modalities for administering the instruments. The copies of the questionnaires were administered and collected through direct delivery and recovery methods to ensure high return rate. Data collected were analyzed using frequency, percentage, mean and standard deviation. Since the instrument was a four-point-Likert scale, the benchmark for taking decisions was the mean, which was based on real limit of numbers, where a mean of 3.50-4.00 implies Very High Extent (VHE), 2.50- 3.49 implies High Extent (HE), 1.50-2.49 implies Low Extent (LE) and 1.00-1.49 implies Very Low Extent (VLE). While C = Covered and NC = Not Covered. 50% and above implies Covered, while 49% and below implies Not Covered.

Results

Table 1: Mean and Standard Deviation on the extent to which the contents of the National Chemistry Curriculum for Secondary Schools are adequate for achieving the objectives of the Curriculum

S/N	ITEM STATEMENT	X	SD	Dec.
1	The content of the national Chemistry curriculum develops students' interest.	2.78	0.50	HE
2	The national Chemistry curriculum ensures that students acquire basic theoretical, practical knowledge and skills.	2.29	0.46	LE
3	The national Chemistry curriculum enables students to develop interest in Science and Technology.	2.61	0.56	HE
4	The national Chemistry curriculum is adequate towards acquiring basic science, technology, engineering and mathematics (STEM) knowledge and skills.	2.32	0.54	LE
5	The national Chemistry curriculum is adequate in meeting societal needs of creating employment and wealth.	2.19	0.75	LE
Cluster Mean		2.41	0.42	LE

KEY: X = Mean, SD = Standard Deviation, Dec = Decision, HE= High Extent. Interpretation is based on real limit of numbers, where a mean of 3.50-4.50 implies Very High Extent (VHE), 2.50- 3.49 implies High Extent (HE), 1.50-2.49 implies Low Extent (LE) and 09.50-1.49 implies Very Low Extent (VLE).

The analysis of the result in Table 1 shows the mean and standard deviation on the extent to which the content of the National Chemistry Curriculum for secondary schools is adequate for achieving the objectives of the curriculum. The result shows that items 1 and 3 had a mean higher than 2.5 set as benchmark. This implies that the content of the national Chemistry curriculum develops students' interest and also the national Chemistry curriculum enables students to develop interest in Science and Technology. On the other hand, items 2, 4 and 5 had a mean lesser than 2.5 set as benchmark. This implies that the national Chemistry Curriculum ensures that students acquire basic theoretical, practical knowledge and skills; is adequate towards acquiring basic STEM knowledge and skills and adequate in meeting societal needs of creating employment and wealth to a low extent. However, the cluster mean of 2.41 with standard deviation of 0.42 is less than 2.5 set as benchmark. This implies

that the content of the National Chemistry Curriculum for Secondary Schools are not adequate for achieving the objectives of the curriculum.



Table 2: Frequency and Percentage on the proportion of topics in the National Chemistry Curriculum covered in the Chemistry syllabus supplied to schools by the Enugu State Ministry of Education

S/N	ITEM STATEMENT	Covered F (%)	Not Covered F (%)	Remarks
1	Chemical Industries	13 (29.5)	31 (70.5)	NC
2	Introduction to Chemistry	33(75.0)	11 (25.0)	C
3	Particulate Nature of Matter	32 (92.7)	12 (27.3)	C
4	Symbols, Formula and Equation	40 (90.9)	4 (9.1)	C
5	Chemical Combination	43 (97.7)	1 (2.3)	C
6	Gas Laws	43 (97.7)	1 (2.3)	C
7	Standard Separation Techniques	43 (97.7)	1 (2.3)	C
8	Acids, Bases and Salts	43 (97.7)	1 (2.3)	C
9	Water	32 (72.2)	12 (27.3)	C
10	Carbon and its Compound	40 (90.9)	4 (9.1)	C
11	Periodic Table	43 (97.7)	1 (2.3)	C
12	Chemical Reactions	43 (97.7)	1 (2.3)	C
13	Mass, Volume Relationship	43 (97.7)	1 (2.3)	C
14	Acid Base Reaction	40 (90.9)	4 (9.1)	C
15	Water	40 (90.9)	4 (9.1)	C
16	Air	31 (70.5)	13(29.5)	C
17	Hydrogen	36 (81.8)	8 (18.2)	C
18	Oxygen	42 (95.5)	2 (4.5)	C
19	Halogen	35 (79.5)	9 (20.5)	C
20	Nitrogen	33 (75.5)	11(25.0)	C
21	Sulphur	43 (97.7)	1 (2.3)	C
22	Oxidation Reduction Reaction	40 (90.9)	4 (9.1)	C
23	Ionic Theory	40 (90.9)	4 (9.1)	C
24	Electrolysis	30 (68.2)	14 (31.8)	C
25	Hydrocarbons	35 (79.5)	9 (20.5)	C
26	Alkanol	42 (95.5)	2 (4.5)	C
27	Quantitative and Qualitative Analysis	33 (75.5)	11(25.0)	C
28	Petroleum	33 (75.5)	11(25.0)	C
29	Metals and their Compound	43 (97.7)	1 (2.3)	C
30	Iron	34 (77.3)	10 (22.7)	C
31	Ethical Issues and Social	24 (54.5)	20 (45.5)	C
32	Fats and Oils	38 (86.4)	6 (13.6)	C
33	Soap and Detergents	28 (63.6)	16 (38.7)	C
34	Giant Molecules	21 (47.7)	23 (52.3)	C

Key: C = Covered and NC = Not Covered. 50% and above implies Covered, while 49% and below implies Not Covered.

In table 2, the proportion of topics in the National Chemistry Curriculum covered in the Chemistry syllabus supplied to schools by the Enugu State Ministry of Education was analysed. Item 1 was not covered while items 2, 3, 4, till 34 were covered. This implies that 97 percent of topics in the National Chemistry curriculum are covered in the Chemistry syllabus supplied to schools by the Enugu State Ministry of Education.

Discussions

The study's findings revealed that the national Chemistry curriculum for secondary schools falls short in adequately achieving its objectives. It could be attributed to various factors including design flaws, outdated content, lack of real-world relevance, inadequate coverage of key topics, an overloaded curriculum, resource constraints, and limited utilization of effective teaching methods and local resources by teachers as well as lack of proper



training and support for teachers, and the disconnect between theoretical knowledge and its practical application in everyday life. These findings aligned with earlier observations by Lawrence (2016) regarding curriculum overload and insufficient time for effective teaching, as well as the impact of inadequate laboratory facilities on practical learning experiences, as noted by Tolessa and Mohammed (2016). Additionally, Hassan (2019) emphasizes the importance of curriculum content in achieving educational objectives and highlights the significance of teacher capacity in curriculum implementation. Martha (2015) further underscores the importance of aligning curriculum components with students' needs for effective learning outcomes. The study calls for a revision of the Chemistry curriculum to ensure its functionality, relevance, and alignment with societal demands, aiming to cultivate students' interest in the subject, foster practical skills, and support scientific and technological development in the area of the study and the entire country.

The study findings indicate that the Chemistry syllabus provided to schools by the Enugu State Ministry of Education adequately covers the topics outlined in the national Chemistry curriculum. This alignment may be because over the years, there have been curriculum reviews and the concerted efforts of schools and States to synchronize their syllabi with the national curriculum. This ensures that students are adequately prepared for external examinations such as the Basic Common Entrance Examination, National Examination Council (NECO), and West African Examination Council (WAEC). The findings of this study agreed with the views of Wotring, Chen, and Fraser (2021) that comprehensive syllabus coverage enhances the likelihood of students achieving the intended learning outcomes specified in the curriculum and ensures that students are exposed to essential knowledge and skills. A well-covered syllabus prepares students for further education, ensuring they have a solid foundation in the subject. It supports their preparedness for higher education or entry into specific career paths related to the subject. Shikuku (2012) found that syllabus coverage influences the relevance of education to real-life applications. He added that comprehensive coverage ensures that students understand how the subject relates to practical scenarios, industries, or societal challenges. Beyond theoretical knowledge, syllabus coverage impacts the development of practical skills including laboratory work, experiments, or hands-on experiences essential for skill acquisition.

Conclusion

Based on the findings of the study, the following conclusions were drawn; The National Chemistry Curriculum for Secondary Schools is not adequate for achieving the objectives of the Curriculum, and the Chemistry syllabus supplied to schools by the Enugu State Ministry of Education covers the national Chemistry curriculum.

Recommendations

Based on the findings of the study, the following recommendations were made;

1. Government, curriculum planners and stakeholders should set up a committee that will constantly review the Chemistry curriculum, taking note of the changing nature of the society, country and subject itself.
2. The syllabus should be revisited and reviewed at intervals to ensure it is in line with the national Chemistry curriculum.
3. Adequate time allocation should be allocated to Chemistry teaching and learning exercises to enable the teachers to cover their syllabus.

References

- Achimugu, L. (2016). Principals' instructional leadership qualities that enhance efficient teaching and learning of chemistry senior secondary schools from perspectives of students and teachers. *International Journal of Science and Research*, 5(7), 2229 – 2237.
- Adewumi, A. F. & Monisola, K. A. (2013). Continuous assessment, mock results and gender as predictors of academic performance of chemistry students in WASSCE and NECO examinations in Ekiti state. *International Education Studies*, 6(7) 1 – 8.
- American Evaluation Association. (2014). What is evaluation <https://www.eval.org/p/bl/et/blogaid=4>.
- Bhandari, P. (2023). Multistage Sampling | Introductory Guide & Examples. Scribbr. Retrieved April 12, 2024, from <https://www.scribbr.com/methodology/multi-stage-sampling/>
- Chen, H. T. (2015). Practical program evaluation: Theory-driven evaluation and the integrated evaluation perspective (2nd ed.). Thousand Oaks, CA: Sage.
- Dahiru, S.Y. (2010). Falling standard of science education in Nigeria: A road map to re-engineering science education for employment and self productivity in Nigeria. *Journal of Academic Excellence*, (2), 2-4.
- Ezechukwu, I. R. & Ukozor, F. I. (2016). *Impact of Youth Education and Participation on Agricultural Productivity and Self Employment in Anambra*

- State. Onitsha: Global Academic Group publishers ltd
- Hassan, B. G. (2019). Extent of implementation of biology curriculum in public senior secondary schools in Maiduguri metropolis, Borno State, Nigeria. *Journal of Arts, Science & Commerce, Malegaon*, 10(1), 60-66.
- Igboegwu, E. N., & Okonkwo, I. G. A. (2012). *Influence of gender and location of school on students' achievement in chemistry. Journal of Research in Education*, 1(1), 1 – 14.
- Kirkpatrick, D. L., & Stufflebeam, D. L. (2013). *Evaluating training programs: The four levels* (3rd ed.). Berrett-Koehler Publishers.
- Lawrence, A. (2016). Factors Affecting the effective implementation of senior secondary education chemistry curriculum in Kogi state, Nigeria. *International Journal of Scientific and Research Publications*, 6(5), 240-253
- Martha, O. O. (2015). An Evaluation of the English Component of the General Studies Curriculum for Nigerian Polytechnics. *English Language and Literature Studies*, 5(2). ISSN 1925-4768 E-ISSN 1925-4776. Published by Canadian Center of Science and Education.
- Mkpa, M.A. & Izuagba, A.C. (2009). Curriculum studies and innovation. Owerri: divine Mercy
- Mulenga, I. (2018). Conceptualization and Definition of a Curriculum. *Journal of Lexicography and Terminology*, Volume 2, Issue 2, 1-23.
- National Policy on Education (NPE) (2014) Federal Republic of Nigeria, Abuja.
- Njelita, C.B., Egolum, E.O., & Ezeokeke, K.N.C. (2014). Identification of production skills possessed by the chemistry teachers and those acquired by students for wealth creation. *International Refereed Journal of Engineering and Science*, 3(3), 15–19.
- Obilo P.I & Sangoleye S.A (2015). Curriculum implementation and the teacher: Challenges and Way forward.
- Ojokuku, G.O. (2012). *Understanding chemistry for schools and colleges*. Lagos: Press on Chem resources.
- Okorie, E. U. (2010). Secondary schools' chemistry curriculum reforms in the 21st Century: Implication for Nigeria Educational System. *Curriculum and Media Technology Research, Journal of CUDIMAC*, 2(2), 108 – 119.
- Onyeachu, E. (2008). Teachers characteristics and school curriculum implementation in Nigeria Secondary Schools: A theoretical review in *Journal of the Nigerian Academy of Education*. Nigeria Jonahed, 1, 118–120.
- Samantha, M. L. (2017). Teaching chemistry through real-world applications. Academic paper, Department of science education, Montana State University, Bozeman, Montana. Retrieved from <http://www.scholarworks.montana.edu>.
- Scriven, M. (2018). Summative evaluation. In *Encyclopedia of Educational Philosophy and Theory* (pp. 1-4). Springer.
- Shikuku, B. N. (2012). Effect of syllabus coverage on secondary school students' performance in mathematics in Kenya. *International Journal of Educational Sciences*, 4(1), 31-34.
- Stufflebeam, D. L. (1971). The CIPP Model for Evaluation. In R. W. Tyler, R. M. Gagné, & M. Scriven (Eds.), *Perspectives of Curriculum Evaluation* (pp. 25-38). American Educational Research Association.
- Stufflebeam, D. L. (2007). The CIPP model for evaluation. *Evaluation*, 13(2), 156-163.
- Stufflebeam, D. L. & Shinkfield, A. J. (2007). *Evaluation theory, models, and applications*. San Francisco: Jossey-Bass.
- Stufflebeam, D. L., & Shinkfield, A. J. (2020). Formative evaluation. In *Encyclopedia of Educational Philosophy and Theory* (pp. 1-5). Springer.
- Tolessa, M. & Mohammed, S. (2016). Factors affecting implementation of practical activities in science education in some selected secondary and preparatory schools of afar region. *African Journal of Chemical Education*, 6(2). 125 – 138
- West African Examination Council (2016). *Chief Examiner's Report on Students' Performance in Senior Secondary Certificate Examination*. Sectional Report.
- West African Examination Council WAEC (2017). *Chief Examiner's Report on Students' Performance in Senior Secondary School Certificate Chemistry Examination*. Lagos: WAEC Sectional Report.
- West African Examination Council WAEC (2018). *Chief Examiner's Report on Students' Performance in Senior Secondary School Certificate Chemistry Examination*. Lagos: WAEC Sectional Report.
- West African Examination Council WAEC (2019). *Chief Examiner's Report on Students' Performance in Senior Secondary School Certificate Chemistry Examination*. Lagos: WAEC Sectional Report.
- West African Examination Council WAEC (2020). *Chief Examiner's Report on Students' Performance in Senior Secondary School Certificate Chemistry Examination*. Lagos: WAEC Sectional Report.
- West African Examination Council WAEC (2021). *Chief Examiner's Report on Students' Performance in Senior Secondary School Certificate Chemistry Examination*. Lagos: WAEC Sectional Report.
- Wotring, A., Chen, H., & Fraser, M. (2021). Exploring curriculum alignment through syllabus document analysis: From national language policy to local ELT practice. *Iranian Journal of Language Teaching Research*, 9(2), 57-72.