AJEMATES
African Journal of Educational Management, Teaching and Entrepreneurship Studies
VOL.9 (2), May-September, 2023 https://ajemates.org

TOWARDS EFFECTIVE IMPLEMENTATION OF SECONDARY SCHOOL CHEMISTRY CURRICULUM: FOCUS ON HINDRANCES ANDTHE WAY FORWARD FOR QUALITATIVE CHEMISTRY EDUCATION

Dr. Evelyn Obianuju Egolum & Onuigwe Blessing Ukamaka
eo.egolum@unizik.edu.ng; bu.onuigwe@unizik.edu.ng

Department of Science Education, Nnamdi Azikiwe University, Awka

ABSTRACT

The study investigated the extent chemistry teachers in secondary schools effectively implement the chemistry curriculum, the hindrances and the way forward for effective implementation of the chemistry curriculum. Four research questions and one hypothesis guided the study. A descriptive research design was used. The sample consisted of eighty six (86) chemistry teachers who were randomly selected from chemistry teachers in sixty two (62) secondary schools in Awka and Nnewi Education Zones of Anambra state. A validated structured questionnaire which had a reliability coefficient of 0.83 using Cronbach Alpha technique was used to collect data used for the study. The data collected were analyzed using means, standard deviation and t- test statistics. The result showed that some contents of the chemistry curriculum were not effectively implemented by chemistry teachers in secondary schools especially the non- graduate teachers. Also shortage of experienced and enough manpower, overloaded curriculum, lack of well-equipped laboratories among others were the hindrances to effective implementation of the chemistry curriculum. Almost all the teachers agreed that provision of enough qualified teachers, enough finance for adequate laboratory facilities, use of innovative techniques in teaching chemistry among others werethe way forward for effective implementation of chemistry curriculum to instill skills and knowledge in the students for qualitative chemistry education. Conclusion and recommendations were also made.

Keywords: Chemistry Education, Implementation, Curriculum, Hindrance, WayForward

Introduction

Chemistry is the bedrock required for any nation to attain technological development and scientific breakthrough (Jegede, 2003). Chemistry education occupies a pivotal position in Science, Technology and Mathematics (STEM) education. The application of chemistry has found great impact in food processing, solar and nuclear energy, industrialization, health etc. According to Njoku (2004), the enviable position which chemistry occupies in the educational system of most countries of the world including Nigeria is perhaps, justifiable in the sense that chemistry can exert a dominant if not a decisive influence on the life of individualsin the areas of industry, agriculture, education, infrastructure as well as in the developmental effort of a nation. Due to all these importance of chemistry, what should be taught in it and how it will be taught in schools therefore becomes the concern of groups, individuals,

communities, governments and even nations. According to Iji (2008), the quality of education in any system and at any level is dependent on the quality of the curriculum that is being used for teaching and learning.

Curriculum according to karma and Bello (2017) is a course of learning activities set out for the leaner to perform and make him achieve certain goals presented by the educational system. Ajeka (2008), saw curriculum as an aggregateof what an education system tries to do in order to achieve pre-determined objectives. It is concerned with what the students will be able to do, or learn as a direct consequence of what they gain from instructional experiences or the expectations from learning outcomes. According to Stotsky (2012), curriculum is a plan of action that is aimed at achieving desired goals and objectives. It is a set of learning activities meant to make the learner attain goals as prescribed by the educational system. It includes the subjects and activities that a given school system is responsible for.

Curriculum is a standard - based sequence of planned experiences where students practice and achieve proficiency in content and applied learning skills. It is the central guide for all educators as to what is essential for teaching and learning so that every student has access to rigorous academic experiences (Ride, 2022). Kelly (2009) defines curriculum as the learning which is planned and guided by the school whether it is carried on in groups or individually, inside or outside of school. Also Wiles (2008) sees curriculum as the totality of student experiences that occur in the educational process. It is a planned sequence of instruction or view of the student experiences in terms of the educators or schools instructional goals. The process of developing curriculum involves three sets or levels of decisions which includes scope, selection and simplification (Taber, 2019). Curriculum serves as a pivot on which challenges such as economic, political, social and educational development of a nation hinge. The chemistry curriculum for senior secondary schools has been organized in such a way that if it is well implemented in various schools of the federation, it would yield excellent result of the stipulated objectives and of course meet the national goals for science education and more.

Curriculum implementation entails putting into practice the officially presented courses of study, syllabuses and subjects (Gautam, 2015). Curriculum implementation refers to how the planned or officially designed course of study is translated by the teacher into syllabuses, scheme of work or lessons to be deliveredto students. The implementation as an essential part of curriculum development brings into existence the anticipated changes (Bediako, 2019). Ivowi (2004) sees curriculum implementation as the translation of ‘‘theory into practice’’, or ‘‘proposal into actions’’. Okebukola (2004) defined curriculum implementation as the translation of the objectives of the curriculum from paper to practice. Curriculum implementation is important because

- It makes the teacher to be systematic in delivery
- It helps to make the curriculum relevant to the needs of the learner and the society as a whole.

Curriculum implementation process involves helping the learner acquire knowledge or

experience. It is important to note that curriculum implementation cannot take place without the learner. The learner is therefore the central figure in the curriculum implementation process (Bediako, 2019). Although research materials and facilities also influences curriculum implementation, the teacher, thelearner, the school environment, culture and ideology, instructional supervision and assessment are the major factors that influences curriculum implementation.

The teacher is the important person in curriculum implementation process. Teachers with their knowledge and competences are central to curriculum development efforts. Better teachers support better learning because they are most knowledgeable about the practice of teaching and are responsible for introducing the curriculum in the classroom. The curriculum developers therefore has to consider the teachers as part of the factors that affects curriculum

Chemistry curriculum implementation is the activities of putting the plans, content and objectives of chemistry curriculum into action through the process of teaching and practice so that students can learn and exhibit physical application of the course (Ihuarulam, 2008). The successful implementation of the chemistry curriculum anchors on the teacher (Enaibe and Imonwerha, 2008), backed – up by other human and non- human resources in the school system. For qualitative chemistry education, it is the teacher that applies directly the contents, objectives and activities in the curriculum to the students in the classroom. Therefore the researchers want to find out whether the secondary school chemistry curriculum is effectively implemented. It will also find out the hindrances to effective implementation of the chemistry curriculum and the way forward for qualitative chemistry education.

Research questions

The study was guided by the following research questions:

1. To what extent do chemistry teachers in secondary schools effectivelyimplement the chemistry curriculum?
2. To what extent do graduates and non-graduate chemistry teacherseffectively implement the chemistry curriculum?
3. What are the hindrances to effective implementation of the secondary school chemistry curriculum?
4. What are the ways forward for effective implementation of the secondaryschool chemistry curriculum?

Hypothesis

There is no significant difference between the mean scores of graduate and non- graduate chemistry teachers in effective implementation of the chemistry curriculum.

Research method

A descriptive survey research design was adopted for the study. The population of the study consisted of all the chemistry teachers in the ninety seven governments owned secondary schools in Awka and Nnewi Education Zones of Anambra state. Thirty four (34) secondary schools were selected from Akwa education zone which has a total number of fifty three (53) secondary schools and twenty eight (28) secondary schools were selected from Nnewi education zone which has a total of forty four (44) secondary schools. All the schools were

selected through purposive sampling techniques. The sample for the study comprised of eighty sixty (86) chemistry teachers randomly selected from sixty two (62) secondary schools from the two zones. The instrument used to collect data for the study was a structured questionnaire which elicited information on the hindrances to effective implementation of the secondary schools chemistry curriculum and the way forward for qualitative chemistry education. The structured questionnaire designed by the researchers had two sections A and B. Section A of the questionnaire sought information on the personal data of the respondents which includes qualifications, years of experience, school, local government area and so on. Section B had 4 parts, Sections BI, BII, BIII and BIV. BI and BII had items built on a four point rating scales of very High Extent (VHE) – 4 points, Moderate Extent (ME) – 3 points, low Extent (LE) – 2 points and Very low Extent (VLE) – 1 point. Sections B111 and B1V had items built on a 4 point type scale of Strongly Agree (SA) – 4 points, Agree (A) – 3 points, Disagree (D) – 2 points and strongly Disagree (SD) –1 point.

Twenty chemistry teachers from ten secondary schools in Onitsha Education Zone which was outside the sampled schools for the study were used fortrial testing. The internal consistency of the instrument was established using Cronbach Alpha technique and it was found to be 0.83. The research questions were answered using means and standard deviations. A mean of 2.50 and above indicated that the respondents agreed with the items and mean of 2.49 and below indicated non–agreement. The t- test statistics at $p < 0.05$ level of significance was used to test the hypothesis.

Presentation of Results

Research Question 1: To what extent do chemistry teachers in secondary schools effectivelyimplement the chemistry curriculum?

Table 1: Means and standard deviations of chemistry teachers responses on theextent they effectively implement the secondary school chemistry curriculum.

S/N	Topics in the Chemistry Curriculum	Mean	Decision
1.	Concept of matter, elements, compounds and mixtures	3.11	EI
2.	Particulate nature of matter. Concept of atoms, molecules, atomic structure	2.94	EI
3.	Separation techniques	3.12	EI
4.	Daltons atomic theory, atomic and mass number	2.65	EI
5.	Chemistry symbols, empirical & molecular formula, chemical equations	2.63	EI
6.	The periodic table, periodic law and trends in periodic Properties	3.00	EI
7.	Laws of chemical combinations	2.58	EI
8.	Chemical bonding	2.90	EI
9.	Kinetic theory of matter, diffusion, osmosis	1.82	NEI
10.	Gas laws- Boyle's, Charles' & Avogadro's laws	3.31	EI
11.	Grahams law & Dalton's law of partial pressure	2.24	NEI
12.	The mole and molar volume of gases	1.90	NEI

13.	Acids, bases and salts	2.82	EI
14.	Water–types, methods of softening hard water, treatment of water pollution	2.97	EI
15.	Solutions- types of solutions (saturated, unsaturated & super saturated)	1.94	NEI
16.	Solubility and its calculations	2.35	NEI
17.	Carbon and its compounds, allotropes of carbon	3.11	EI
18.	Hydrocarbons, classes of hydrocarbons	2.80	EI
19.	Petroleum, fractions of petroleum	2.67	EI
20.	Octane number, reformation and cracking	2.40	NEI
21.	Industrial chemistry ; chemical industries, raw materials and sources, fine and heavy chemicals	2.74	EI
22.	Chemical reactions and their uses in determining the stoichiometry of reactions	1.83	NEI
23.	Electrolysis, electrolysis of some compounds, Calculations	2.71	EI
24.	Electrochemical cells, redox reactions	1.92	NEI
25.	Rates of chemical reactions	2.17	NEI
26.	Energy and reaction rates, energy profile, exothermic and endothermic reactions	2.60	EI
27.	Energy changes; heat combustion, solution, neutralization etc.	1-75	NEI
28.	Energy for chemical reactions; entropy, enthalpy, Gibbs free energy etc	1.89	NEI
29.	Equilibrium in chemical reactions	2.12	NEI
30.	Non- metals and their compounds; hydrogen; its preparation, properties and uses	2.83	EI
31.	Oxygen: preparation, properties and uses, oxides; air pollution- causes, effects & control	2.92	EI
32.	Halogens: position in the periodic table, laboratory properties and reactions of chlorine	1.53	NEI
33.	Sulphur: preparation, properties, allotropes and oxides	0.84	NEI
34.	Nitrogen: laboratory and industrial preparation, properties, oxides and uses	1.95	NEI
35.	Organic chemistry: classification and nomenclature	3.03	EI
36.	Homologues series: alkanes, alkenes and alkynes, alkanols, alkanoic acids and alkanoates	2.18	NEI
37.	Soapless and soapy detergent, aromatic hydrocarbons, amino acids	1.13	NEI
38.	Polymers and giant molecules	2.54	EI
39.	Carbohydrates: classification, properties and uses	1.47	NEI
40.	Electronic structure of atoms, orbital's and origin, shapes of s, p, d and f orbital's	3.25	EI
41.	Quantum numbers, rules and principles of filling electrons, treatment of wave nature of light	2.78	EI
42.	Radioactivity: radiation, types and nature of radioactive Decay	3.20	EI
43.	Quantitative analysis: acid- base titrations	2.07	NEI

44.	Qualitative analysis: Identification of cations and anions	2.48	NEI
45.	Preparation of standard solutions	1.35	NEI

Table 1 above showed that items 1,2,3,4,5,6,7,8,10,13, 14,19, 26 etc were effectively implemented by the respondents while items 9, 11, 15, 16, 20, 22, 24,25 etc were not effectively by the chemistry teachers in secondary schools.

Research Question 2: To what extent do graduates and non-graduate chemistry teachers effectively implement the chemistry curriculum?

Table 2: Mean and standard deviation of graduates and non- graduate teachers ineffective implementation of the chemistry curriculum

Group	Number of Subjects	Mean	Standard deviation
Graduate teachers [BSC(ED) and above]	62	3.10	0.92
Non-graduate teachers (TC11, NCE and below)	24	2.28	1.01

Table 2, revealed that the mean and standard deviation of graduate teachers on their extent of implementation of the chemistry curriculum effectively was 3.10 and 0.92 respectively while the mean and standard deviation for non-graduate teachers was 2.28 and 1.01. The result showed that the graduate teachers have higher mean than the non-graduate teachers indicating that they implement the chemistry curriculum more effectively.

Research question 3: What are the hindrances to effective implementation of the secondary schoolchemistry curriculum?

Table 3; chemistry teachers mean responses on the secondary school chemistryCurriculum.

S/N	Items	SA	A	D	SD	X	Decision
1.	Overloaded curriculum	23	42	18	3	2.99	Agreed
2.	shortage of manpower	20	48	12	6	2.60	Agreed
3.	Overcrowded classes	17	50	14	5	2.92	Agreed
4.	Examination malpractice	17	38	17	14	2.67	Agreed
5.	Inadequate periods in the Timetable	26	45	13	2	3.10	Agreed
6.	Lack of well-equipped chemistry Laboratory	42	22	13	9	3.13	Agreed
7.	Problem of examination Procedure	16	51	14	5	2.91	Agreed
8.	Variation of chemistry students and teachers expectations	21	32	20	13	2.71	Agreed
9.	Teachers use convectional methods in teaching	52	28	5	1	3.52	Agreed
10.	Inadequate learning environment	37	18	18	13	2.93	Agreed

11.	Lack of chemistry teachers professional development	10	45	27	14	2.84	Agreed
12.	Some contents of the curriculum are abstract and difficult to teach	44	17	20	5	3.16	Agreed
13.	Poor preparation of chemistry teachers by colleges and Universities	49	24	8	5	3.36	Agreed
	Grand mean					2.99	Agreed

In table 3, mean ratings of all were above the criterion mean of 2.50. This showed that all the chemistry teachers used for the study agreed that all the items were hindrances to effective implementation of the secondary school chemistry curriculum

Research Question 4: What are the ways forward for effective implementation of the secondary school chemistry curriculum?

Table 4; Chemistry teachers mean responses on the way forward for effective implementation of the secondary school chemistry curriculum.

S/N	Items (Way forward)	SA	A	D	SD	X	Decision
1.	Provision of enough and qualified chemistry teachers	47	25	8	6	3.31	Agreed
2.	Updating the knowledge of chemistry Teachers	29	51	4	2	3,24	Agreed
3.	Maintaining adequate monitoring by inspectors of education to ensure effective implementation	22	31	20	15	2.74	Agreed
4.	Provision of finance for instructional materials and facilities for chemistry Teaching	26	40	17	3	3.05	Agreed
5.	Creation of awareness among chemistry teachers on the critical aspects of the curriculum	32	34	18	2	3.12	Agreed
6.	Provision of conducive learning environment	27	30	26	3	2.96	Agreed
7.	Provision of ICT gadgets for teaching	12	37	14	23	2.43	Disagree
8.	Improvement of chemistry teachers pedagogical skills through seminars and conferences	27	40	16	3	3.06	Agreed
9.	Motivate chemistry teachers by paying them envious salaries as at when due	28	50	6	2	3.21	Agreed

10.	Encourage teachers to use innovative and practical oriented method in teaching	39	21	16	10	3.04	Agreed
11.	Each stage of implementation process should be evaluated	19	24	27	16	2.08	Disagreed
12.	Incorporation of research findings in chemistry teaching	29	38	13	6	3.07	Agreed
	Grand Mean					2.73	Agreed

In table 4, mean ratings of items 1,2,3,4,5,6,8,9,10 and 12 were above the criterion mean of 2.50 showing that the chemistry teachers used for the study agreed that the mentioned way forward in those items can help teachers implement chemistry curriculum effectively. However items 7 and 11 had mean ratings below 2.50 indicating the teachers used indicated disagreement with those items

Hypothesis: There is no significant difference between the mean scores of graduate and non-graduate chemistry teachers in effective implementation of the chemistrycurriculum.

Table 5: t-test comparism of mean scores of graduates and non-graduates chemistry teachers in effective implementation of the chemistry curriculum

Group	X	SD	N	Df	tcal	Tcrit	P<0.05
Graduate teachers	3.10	0.92	62	84	2.321	2.00	Significant
Non-graduate teachers	2.28	1.02	24				

Findings in table 5 revealed that t-crit is 2.001 less than t-cal of 2.321 hence there is a significant difference between the graduates and non-graduate teachers in their effective implementation of secondary school chemistry curriculum. Hence the null hypothesis was rejected.

Discussion of Findings

The findings of the study indicated that some contents of the secondary school chemistry curriculum especially the introductory parts were effectively implemented by the chemistry teachers but other parts of it especially the abstract topics and practically oriented ones were not effectively implemented. This might be due to the abstract nature of some of the topics in the chemistry curriculum. For example topics like kinetic theory of matter (diffusion, osmosis), the mole concept,stoichiometry of reactions, electrochemical cells and redox reactions, rates of chemical reactions, energy changes (heat of reaction, combustion, solution, neutralization), preparation of standard solutions and so on were not effectively implemented as designated by chemistry teachers used for the study. This might bedue to lots of calculations in these topics. This study is in agreement with the studyof Offiah

and Egolum (2007), which opined that prior knowledge of some relevant mathematical concepts by teachers and students are necessary for the study of some concepts such as stoichiometry, mass-volume relations, solubility, titrations etc in chemistry. Also Ugwoke (2018) posited that the extent to which secondary school chemistry teachers implement organic chemistry content is very low.

The results of these study showed that graduates and experienced chemistry teachers implement the chemistry curriculum more effectively than the non-graduates and inexperienced teachers. The result of the t-test also revealed thatthere is a significant difference between graduates and non-graduates chemistry teachers in the effective implementation of the secondary school chemistry curriculum in favour of experienced teachers. This is in agreement with the findings of Enaibe and Imonivwerhu (2006) who stated that successful implementation of chemistry curriculum anchors on experienced teachers because they can apply the potentials that will promote learning and adhere strictly to the standard and objectives asserted in the national curriculum

Result in table 3 showed that overloaded curriculum, shortage of manpower, lack of well-equipped laboratory and facilities, abstract nature of some content in the curriculum, teachers use of conventional methods in teaching and so on were among the factors that hinders effective implementation of secondary school chemistry curriculum. This is in agreement with the study of Achimugu (2016) andIgwe (2015), who both opined that low level implementation of science curriculumis traceable to some factors such as unqualified and inadequate chemistry teachers, inadequate provision of classrooms and laboratory facilities, voluminous curriculum content, shallow knowledge of chemistry teachers etc.

The findings of the study in table 4 also revealed that provision of enough qualified chemistry teachers, provision of finance for instructional materials and laboratory facilities for chemistry teaching among others are the way forward for effective implementation of the secondary school chemistry curriculum. This is in agreement with the study of Newbury (2002), who opined that adequate provision of finance for material resources will help teachers in carrying out experiments and practical's in sciences so that they do not teach only the theory aspect and neglect the practical aspect of sciences. This is because the use of laboratory equipment in teaching chemistry helps to implement the curriculum more effectively since it encourages hands-on-activities and will help sustain student's interest

Conclusion

The whole outcome of the study centered on poor implementation practices by the teacher constrained by other materials and non-material resources not available in the school for effective implementation of the secondary school chemistry curriculum. The content of the chemistry curriculum should be reduced to address the time issue and teach in depth to allow students develop a thorough understanding of essential concepts that will provide the building blocks for future learning thereby making the teaching of chemistry exciting and relevant to real life situations and this will pave way for qualitative chemistry education.

Recommendations

The following recommendations were made based on the findings of the study

1. Government should recruit enough and qualified chemistry teachers in secondary schools
2. The chemistry curriculum should be reviewed periodically to meet the needsof the learner and that of the society
3. Chemistry classrooms should be made to be student-centered and the contents of the curriculum should be reduced to allow teachers teach the topics in depth
4. Chemistry laboratories should be equipped adequately with equipments and chemicals for enough practical activities for students to develop skills

References

Achimugu, L. (2016). Factors affecting the effective implementation of secondary education chemistry curriculum in Kogi State, Nigeria. International Journal of Scientific Research Publications, 6 (5)

Ajeka, P.D. (2008). The problems of change in the teacher education curriculum development and implementation programme. A challenge for the 21st century. Multidisciplinary Journal of Research Development 10 (4), 136-141.

Bediakor, S. (2019). Models and concepts of curriculum implementation, some definitions and influence of implementation. Conference curriculum change & evaluation projects: Curriculum Researchers

Enaibe, P.U. & Imonivwerhu, P.A. (2008). Problems of implementation of Nigeria education programme: Challenge of U.B.E. Multidisciplinary Journal of Research Development, 10 (4) 121-124.

Gautam, K.C. (2015). Factors influencing curriculum implementation for students. International Journal of Applied Research, 1 (12), 984-986

Igwe, I.O. (2015). Secondary education chemistry curriculum implementationin Nigeria: Contending issues and innovative approach for the future. IJSAR Journal of Life Sciences, 3 (1) 24-33.

Iji, C.O. (2008). Refocusing school mathematics curriculum in line with global challenges. Proceedings of 49th Annual Conference of STAN, 226-230.

Ivowi, U.M.O. (2004). The critical role of educational resources on curriculum implementation in Noah, A.O.K., Shonbare, D.O., Ojo, A.A. & Olujuwon, J. (eds). Curriculum development of professionalizing teaching in Nigeria. Lagos: Central Education Service.

Jegede, P.O. (2003). Why we do not excel. Science Teachers Association of Nigeria Newsletter, 3 (3)

Kamar, Y.M. & Bello, S. (2017). Senior secondary biology curriculum and society: The need for adequate laboratory equipment and supporting staff. 60th Anniversary Conference Proceedings of STAN.197-202.

Kelly, A.V.(2009). The curriculum theory and practice. Newbury Park, C.A:Sage, 1-55

Newbury, N F. (2002). Teaching chemistry in tropic schools. London:Oxford University Press

Njoku, Z.C. (2004). Fostering the application of science education research findings in Nigerian classroom. Strategies and needs for teacher's professional development, 45th Annual Conference Proceedings of STAN, 217-222

Offiah, F.C. & Egolum, E.O. (2007). Effect of prior knowledge of some relevant mathematical concepts on student's academic achievement in stoichiometry in chemistry. Journal of Science, Engineering andTechnology 14 (3) 7676-7685.

Okebukola, P.A. (2004). Curriculum implementation in Nigeria: Strategies for the 21st century in Noah, A.O.K.,Shambara, D.O., Ojo, A.A & Olujuwon, T. (eds) Curriculum implementation and professional teaching in Nigeria. Lagos: A publication of Central Education Service

Ride, I. (2022). Curriculum definition. @ https://www.ride.n.gov.curriculum. Retrieved on 9/4/2022

Stotsky, S. (2012). Curriculum definition. Bartleby Research. https://www. Bartleby.com/essay. Retrieved on 8/4/2022.

Taber, K.S. (2019). The nature of the chemical concepts: Constructing chemical Knowledge in teaching and learning. Cambridge: Royal Society of Chemistry

Ugwoke, J. (2018). "An assessment of teacher's level of implementation of Chemistry curriculum in senior secondary schools in Nsukka L.G.A of Enugu State. Enugu: Afribay

Wiles, J.W. (2008). Leading curriculum development. Sage Publications. Retrieved from https://m.bannesandnoble.com>lead on 8/4/2022 (1)1-92