



Extent of Implementation of the Senior Secondary School Chemistry Curriculum Content in Urban and Rural Areas: The Role of Online Teaching

Ogbuabor, T. Tochukwu ^a, Onah, A. Ebere ^a, Nwafor, S. Chinedu ^b, Okechukwu, P. Onyinyechi ^a

^aDepartment of Science Education, University of Nigeria, Nsukka, Enugu State, Nigeria

^bDepartment of Science Education, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

Corresponding Author: sc.nwafor@unizik.edu.ng

Abstract

The study investigated the extent Chemistry curriculum is implemented in urban and rural areas: The role of online teaching. Descriptive survey research design was adopted with a population of 3,575 Chemistry students in Nsukka Local Government Area, Enugu State. Three hundred Chemistry students from six schools were randomly sampled. A 200-item questionnaire was used for data collection. Mean, standard deviation and t-test were used for data analysis. The results of the findings revealed that the extent of implementation of Chemistry curriculum in urban area were to a high extent in SS1 and SS3 but to a low extent in SS2 whereas in the rural area it was implemented to a low extent in SS I, SS II and SS III. Based on the findings, the researchers among others recommended the use of online teaching in addition to the physical classrooms to ensure the successful implementation of Chemistry curriculum.

Keywords: Chemistry, Chemistry curriculum, implementation, urban and rural areas, online teaching.

Introduction

Chemistry curriculum when effectively implemented serves as an organized fulcrum that ensures the attainment of the necessary knowledge, attitude and skills for solving both personal and community problems. Therefore, it helps in the realization of the aims of education towards dealing with life challenges. Chemistry is one of the science subjects upon which technological break-through is built and is the pivot on which the wheel of science rotates (Gongden, Gongden & Lohdip, 2011). It involves the study of matter: its, properties, behaviours and changes. Chemistry according to Okorie (2018), is a branch of pure science that deals with the structure and composition of matter that constitute living things and their environment, the mechanisms by which these changes occur, the products formed and the energy changes encountered. Hence, there is no aspect of human endeavor on natural phenomena that Chemistry does not feature.

Chemistry as a discipline plays a significant role in sustaining our manufacturing and chemical industries. This is because according to Igboanugo (2015), Chemistry helps to ensure continuous availability of students in expected number who take important profession such as medicine, pharmacy, dentistry, nursing, medical science laboratory, food science, agriculture, engineering, science education, environmental education etc.

The above points are indicators that chemistry plays an important role in the economy and national development of any nation and as such should be

considered essential. In Nigeria, Chemistry has been recognized as a central science subject in secondary schools and is taught in the last three years of secondary education usually called the Senior Secondary School (SSS) as stipulated by Nigerian National Policy on Education (FRN, 2014). In spite of the number of years Chemistry has been taught in our secondary schools, students' achievement in the subject as reported by the West African Examination Council Chief Examiner (2016-2021) has been poor and fluctuating. The poor achievement of students in Chemistry has been of great concern to both the chemistry educators, stakeholders in education and the examination bodies. A number of problems, which constitute a significant factor besetting education in chemistry in Nigerian secondary schools, are well documented in literature. The problems according to Okorie and Akubilo (2013) in Okorie and Ugwuanyi (2019) include dearth of well- trained Chemistry teachers, inadequate supply of Chemistry laboratory resources (including laboratory technologists and inappropriate pedagogical approach adopted by teachers. According to Aminu in Abdu (2010), evidence from findings, abounds that many students or candidates (during standardized examination) do not answer half of the questions, not because of time factors, but inability to confidently and independently attempt the questions. This could be that these students were not taught some of the topics as stipulated in the chemistry curriculum. In same vein, Nnachi (2011) asserted that the students' low achievement in chemistry as well as their negative attitude and loss of



interest in the subject could result from teachers' inability to implement the curriculum effectively. Also, according to Abdu (2010) ineffective implementations of curriculum contents could make students incapable to cope appropriately with the academic challenges. Hence, there is therefore need to carry out research on the extent of implementation of the senior secondary school Chemistry curriculum contents.

Curriculum is a learning outcome formulated for the students in order to attain their educational goals. Stearns (2021) defined curriculum as academic contents, topics and concepts that are taught to students in planned classes. Also, Chapel (2021) averred that curriculum is that lessons and academic contents taught in a school or in a specific course or program. Curriculum covers every element in the learning environment which includes the subject matter to be learned, the students, the teachers and the physical environment. Hence, the need for effective curriculum implementation. Implementation is said to take place when the teacher-constructed syllabus, the teacher personality, the teaching materials and the teaching environment interact with the learner. Curriculum implementation is aimed at actualizing the planned curriculum. It refers to "how the planned or officially designed course of study is translated by the teacher into syllabuses, schemes of work and lessons to be delivered to students", that will bring into existence the anticipated changes (Bediako, 2019). According to Nevenglosky, Cale, and Aguilar (2018) curriculum implementation refers to how teachers deliver instruction and assessment through the use of specified resources provided in a curriculum. It is the stage when in the midst of learning activities, teachers and learners are involved in negotiations aimed at promoting learning. Implementation further takes place as the learner acquires the planned or intended experiences, skills, knowledge, ideas and attitudes that are aimed at enabling the same learner to function effectively in the society. In Nigeria secondary schools, every subject has its own curriculum. Therefore, Chemistry as a subject has its own curriculum.

The senior secondary school chemistry curriculum is a document where the total experience to which all learners must be exposed, the contents, performance objectives, activities for both teachers and learners, teaching and learning materials and evaluation guide are provided. The curriculum ensures continuity and flow of themes, topics and experiences

from Senior Secondary one (SS 1) to Senior Secondary three (SS 3) levels (FRN, 2009). The Chemistry curriculum contents are taught in senior secondary schools in order to achieve the objectives of the senior secondary school programme. However, the secondary schools Chemistry curriculum objectives can only be realised if the students of Chemistry achieve better in the subject (Ezeudu, 2013). Therefore, students' academic achievement in any subject is an important index for measuring the effectiveness of teaching/learning and the extent to which the intended objectives of the subjects are being achieved. The students can achieve better in Chemistry only when the Chemistry curriculum contents are being effectively implemented or covered by the teachers, (Nnachi, 2011). Empirical studies such as Ezeudu (2009), Abdu (2010) and Hassan (2019) have reported the extent of implementation of different subject's curriculum like Chemistry, Mathematics and Biology respectively in different State in Nigeria and found out that the subjects curriculum were not fully implemented. However, none has been done on chemistry curriculum implementation with respect to school location (urban and rural areas), hence, the gap in knowledge which makes this present study necessary. Also, Ifeobu (2014) asserted that the achievement of the curriculum objectives is partly determined in terms of how well the curriculum is implemented. According to Abdu (2010), Poor implementation or coverage of curriculum contents could result in multiple problems. One of the problems is students' poor academic achievement in examinations, especially standardized one, since examination bodies such as the West African Secondary School Examination (WASCE), National Examination Councils (NECO), Joint Admissions and Matriculation Board (JAMB) etc; set examination questions (Standardized test) based on the curriculum contents. Another seeming problem is that which involves students' future performance or learning in tertiary institutions, since courses and topics at that level are continuation of what students learnt at the senior secondary school level, as such poor implementation of curriculum content makes students incapable to cope appropriately with the academic challenges at the post senior secondary schools level. Hence, the need to find alternative towards the successful implementation of the Chemistry curriculum both in and outside the classrooms. This can be achieved through the use of different online teaching.

Online teaching involves the presentation of a subject curriculum through the use of computer technology. According to Teachmint (2022) online teaching is the process of educating others on virtual platforms. It involves live classes, video conferencing, webinars, and other online tools. Similarly, Law (2022) opined that “online teaching is the process of educating others via the internet”. Law stressed that various methods such as one-on-one video calls, group video calls, and webinars can be used in this process irrespective of students backgrounds and geographical areas. Therefore, in online teaching, students can interact through different messaging platforms, email, video calls and the online resources shared through these can be done through audio, power-point presentations, videos lectures, and pdf/Microsoft guides. It is recommended that the instructors of online teaching tag on the following seven principles which are: encourage student participation, encourage student cooperation, encourage active learning, give prompt feedback, emphasize time on task, communicate high expectations and respect diverse talents and ways of learning (Sadiku, Adebo & Musa, 2018). Sadiku, Adebo and Musa maintained that the value, quality and effectiveness of online teaching has been questioned by its critics, however, It offers teacher-students interactions, flexibility and the convenience of time and space. Therefore, online teaching can stimulate and promote Chemistry students continued connection to the Chemistry curriculum.

From the foregoing it can be deduced that the use of online teaching can help towards the actualization of the Chemistry educational goals, however, Ezeugwu, Nji, Anyaegbunam, Enyi and Eneja (2016) averred that educational development and academic achievements of students vary with their location; while some places are known to have enough schools with facilities and teachers other does not. Thus, in the context of this study, urban and rural school locations were looked at in terms of the extent of implementation of Chemistry curriculum contents. The term school location according to Zudonu (2013) connotes the position of the school within the chosen area of study. This may be rural or urban. Rural areas refer to villages and areas away from the local government headquarters, and lacking major amenities like healthcare centres, tarred road, electricity and pipe borne water. On the other hand, urban areas depict areas within the local government headquarters with the key amenities such as healthcare centres, tarred road, electricity and pipe borne water.

Therefore, due to poor socio-economic structures, rural areas have greater challenges concerning educational development compared to the urban areas. As Abidogun (2006) reported that many teachers rejecting posting into the rural areas while those that do, treat their presence as a part time assignment. This situation may create difference in students’ achievement. Ogunkola and Fayombo (2009) found statistically significant differences in students’ science achievement in favour of urban schools as compared to rural schools. Also, Ezeugwu (2011) opined that difference in school location; different in method of teaching, difference in number and qualities of the teacher, different in study habit adopted by the students, to mention but a few give rise to the different in achievement of students in various subject including chemistry. Bosede (2010), show that location is not a significant factor in student’s academic achievement. In view of the above, this research therefore is an attempt to assess the extent to which senior secondary school chemistry curriculum contents are being implemented or covered in urban and rural areas of Nsukka local government.

In line with problem of the study, the main purpose of the study is to assess the extent of implementation of the senior secondary school Chemistry curriculum content in urban and rural areas: The role of online teaching. Specifically, the researchers sought to determine the extent of implementation of Chemistry curriculum contents of:

1. SS1 in urban and rural areas of Nsukka LGA.
2. SS2 in urban and rural areas of Nsukka LGA.
3. SS3 in urban and rural areas of Nsukka LGA.

In line with the purpose of the study, the following are the research questions that guided the study:

1. What is the mean extent of implementation of Chemistry curriculum contents of Senior Secondary School one (SS I) in urban and rural areas of Nsukka LGA?
2. What is the mean extent of implementation of Chemistry curriculum contents of Senior Secondary School two (SS II) in urban and rural areas of Nsukka LGA? and
3. What is the mean extent of implementation of Chemistry curriculum contents of Senior Secondary School three (SS III) in urban and rural areas of Nsukka LGA?

In line with the research questions, the following null hypotheses at 0.05 level of significance were put forward to guide the study:

HO₁: There is no significant difference in the mean extent of implementation of chemistry curriculum contents of senior secondary school one (SS I) in urban and rural areas.

HO₂: There is no significant difference in the mean extent of implementation of chemistry curriculum contents of senior secondary school two (SS II) in urban and rural areas.

HO₃: There is no significant difference in the mean extent of implementation of chemistry curriculum contents of senior secondary school three (SS III) in urban and rural areas.

Method

The study adopted a descriptive survey research design. The descriptive survey research design according to Nworgu (2015), is a research design in which a large or small population is studied by collecting and analysing data from the group through the use of a questionnaire or interview for the purpose of generalizing the findings to the population. Thus, the design is considered appropriate. The population of the study comprised 3,575 students offering chemistry in selected government owned Senior Secondary Schools in both urban and rural areas of Nsukka Local Government Area. The area was chosen because of the researchers' proximity and familiarity to the area. Three hundred (150 urban & 150 rural) senior secondary school chemistry students (100 SS I, 100 SS II and 100 SS III) were sampled randomly from six selected government owned Senior

Secondary Schools (3 urban and 3 rural areas) in Nsukka Local Government Area of Enugu State. The instrument used for data collection was 200-item questionnaire titled: Assessment of the Extent of Chemistry Curriculum Contents Implementation Questionnaire (AECCCIQ). The questionnaire was divided into two sections; Section A contained the personal data of the respondents while Section B contained the items of the questionnaire and divided into three clusters namely A, B and C. The questionnaire is a 4-point likert rating scale of: Very High Extent (VHE), High Extent (HE), Low Extent (LE), Very Low Extent (VLE). The instrument was validated by three experts; two from the Department of Science Education (one each from Chemistry Education Unit and Measurement and Evaluation Unit respectively) and one from the Department of Arts (Curriculum Studies Unit), all from Faculty of Education, University of Nigeria, Nsukka. The reliability of the instrument was determined using Cronbach Alpha and reliability coefficients of 0.76, 0.93 and 0.82 were obtained for clusters A, B and C respectively. Cronbach Alpha was used because AECCCIQ involved a polytomously scored items. The research questions were answered using mean and standard deviation while the hypotheses were tested at 0.05 level of significance using t-test statistics. The decision rule for the study is that any mean score from 2.50 and above stands for high extent while mean score below 2.50 stands for low extent.

Results

Table 1: Mean and Standard Deviation of the Extent of Implementation of Senior Secondary School one (SS I) Chemistry Curriculum in Urban and Rural Areas of Nsukka Local Government Area.

S/N	Curriculum Contents	Urban - No: 60			Rural - No: 40		
		\bar{x}	S.D	Dec.	\bar{x}	S.D	Dec.
1	Chemistry and Industries						
	a) Types of chemical industries	3.78	0.49		3.70	0.52	
	b) Importance to the individual and to the nation	3.95	0.22		2.80	0.41	
	c) Excursion to chemical industries.	1.07	0.25		1.18	0.38	
2	Introduction to Chemistry	2.93	0.32	HE	2.56	0.44	HE
	a) Definition of Chemistry	3.55	0.83		3.85	0.48	
	b) Career Prospects in chemistry	2.87	0.39		2.85	0.36	
	c) Applications and adverse effects of chemicals	2.82	0.50		2.80	0.52	
	d) Scientific method of inquiry	1.95	0.22		1.08	0.27	
3	Particulate Nature of Matter	2.80	0.49	HE	2.65	0.41	HE
	a) Physical and chemical changes	3.73	0.71		2.90	0.30	
	b) Atoms and molecules	2.88	0.37		2.83	0.50	

	c) Dalton's Atomic theory	2.95	0.29		1.90	0.30	
	d) Constituents of atoms	2.90	0.35		2.83	0.50	
	e) Arrangement of electrons around the nucleus	3.05	0.39		1.90	0.30	
	f) Atomic number, mass number and isotopy	3.02	0.47		1.95	0.39	
	g) Relative atomic masses based on C-14 isotope	2.90	0.48		2.10	0.44	
4	Symbols, Formulae and Equation:	3.06	0.44	HE	2.06	0.39	LE
	a) Chemical symbols of elements and their valences	2.97	0.26		3.13	0.33	
	b) Empirical and molecular formulae	2.88	0.37		1.88	0.33	
	c) Law of conservation of matter	2.93	0.25		1.93	0.27	
	d) Law of constant composition	2.00	0.32		1.08	0.27	
	e) Law of multiple proportions	1.95	0.22		2.10	0.30	
	f) Chemical equations	2.90	0.44		2.80	0.52	
5	Chemical Combination	2.61	0.36	HE	2.15	0.38	LE
	a) Periodic table of the first 20 elements	2.87	0.57		3.00	0.39	
	b) Electronic configuration of atoms	3.15	0.48		2.90	0.50	
	c) Types of bonds	3.05	0.67		1.93	0.27	
	d) Systems of naming compounds	3.05	0.22		2.95	0.50	
	e) States of matter	2.98	0.50		1.53	0.51	
	f) Kinetic theory and its applications	2.92	0.28		2.20	0.41	
6	Gas Laws	3.00	0.45	HE	2.42	0.43	LE
	a) Boyle's law	2.65	0.63		2.08	0.47	
	b) Charles' law	2.80	0.58		1.85	0.36	
	c) General gas equation	1.90	0.44		1.13	0.33	
	d) Gay-Lussac's law	2.83	0.38		1.85	0.36	
	e) Avogadro's law	1.90	0.30		1.10	0.30	
	f) Graham's law	2.93	0.25		2.60	0.78	
	g) Avogadro number and the mole concept	2.85	0.44		1.88	0.33	
	h) Molar volume of gases	1.97	.37		1.20	0.65	
	i) Calculations based on the gas	3.15	.61		2.90	0.30	
7	Standard Separation Techniques for Mixtures	2.54	0.44	HE	1.84	0.43	LE
	a) Classification of substances	2.80	0.40		2.90	0.30	
	b) Filtration	3.05	0.43		3.13	0.33	
	c) Evaporation	3.25	0.54		2.85	0.43	
	d) Decantation	1.87	0.34		1.10	0.30	
	e) Floatation	1.63	0.49		1.03	0.15	
	f) Frostation	1.83	0.38		1.93	0.27	
	g) Crystallization and Fractional Crystallization	1.95	0.22		1.90	0.44	
	h) Simple distillation and Fractional Distillation	2.93	0.36		2.05	0.45	
	i) Precipitation	2.88	0.42		2.93	0.42	
	j) Magnetism	1.92	0.28		1.68	0.47	
	k) Chromatography	2.85	0.57		3.03	0.48	
	l) Sublimation	2.72	0.58		2.58	0.50	

8	m) Pure And Impure Substances	2.93	0.25		1.93	0.35	
	Acids, Bases and Salts	2.51	0.40	HE	2.00	0.38	LE
	a) Characteristics of acids, bases and salts	1.92	0.28		1.85	0.36	
	b) Preparations of acids, bases and salts	2.93	0.36		2.90	0.44	
	c) Reactions of acids, bases and salts	2.92	0.33		2.60	0.71	
	d) Uses of acids, bases and salts	2.95	0.22		2.75	0.59	
	e) Relative acidity and alkalinity	1.93	0.25		1.83	0.38	
	f) Deliquescent, efflorescent and hygroscopic substances	2.90	0.30		1.75	0.44	
	g) Solubility of salts	2.87	0.34		2.58	0.75	
9	Water	2.63	0.30	HE	2.32	0.52	LE
	a) Sources of water	2.80	0.51		2.70	0.46	
	b) Types of water	2.68	0.60		2.18	0.38	
	c) Water pollutants	1.97	0.49		1.90	0.44	
	d) Laboratory preparation of water	2.77	0.56		2.55	0.75	
	e) Uses of water	2.70	0.62		2.60	0.67	
10	Carbon and its Compounds	2.58	0.56	HE	2.39	0.54	LE
	a) Carbon	2.67	0.68		2.63	0.70	
	b) Allotropes of carbon	1.92	0.42		1.10	0.30	
	c) Coal	1.65	0.58		1.18	0.38	
	d) Coke	1.88	0.32		1.08	0.27	
	e) Synthetic gas	1.85	0.36		1.13	0.33	
	f) Hydrocarbon and its main classes	1.95	0.39		1.18	0.38	
	g) Crude oil and natural gas	1.90	0.30		1.08	0.27	
	h) Importance of hydrocarbons	1.87	0.34		1.18	0.38	
Overall		2.66	0.41	LE	1.32	0.38	LE

Table 1 above indicates that the extent of implementation of some topics in the chemistry curriculum are high while some are low in both urban and rural localities. Using a cut off mean of 2.50, the extent of implementation of nine (9) out of ten (10) major SS I chemistry topics namely: chemistry and industries, introduction to chemistry, particulate nature of matter, symbols, formulae and equation, chemical combination, gas laws, standard separation techniques

for mixtures; acids, bases and salts; water; and carbon and its compounds are high in urban areas of Nsukka LGA. The extent of implementation of only one (1) topic is low in the locality. While the extent of implementation of only two (8) major chemistry topics namely: chemistry and industries; and introduction to chemistry are high in rural areas of the LGA. The extent of implementation of other eight (8) topics are low in the locality.

Table 2: Mean and Standard Deviation of the Extent of Implementation of Senior Secondary School two (SS II) Chemistry Curriculum in Urban and Rural Areas of Nsukka Local Government Area.

S/N	Curriculum Contents	Urban - No: 60			Rural - No: 40		
		\bar{x}	SD	Dec.	\bar{x}	SD	Dec.
1	Periodic Table						
	a) Periodic law	3.82	0.39		3.56	0.59	
	b) Blocks of elements	2.88	0.37		2.85	0.36	
	c) Families: s-p-d-f	2.90	0.30		2.65	0.77	
	d) Fundamental properties of elements down the group and across the period	2.88	0.45		2.22	0.48	
	e) Diagonal relationships	1.92	0.92		1.85	0.36	

	f) Ionization energy and electron affinity changes down the group and across the period	2.88	0.32		2.75	0.45	
2	Chemical Reactions	2.88	0.46	HE	2.65	0.50	HE
	a) Basic concepts of chemical reactions	3.68	0.59		3.42	0.71	
	b) Introduction to collision theory	2.85	0.36		2.92	0.27	
	c) Factors affecting rate of chemical reactions	2.83	0.38		2.82	0.45	
	d) Types of chemical reactions	2.92	0.28		2.95	0.22	
	e) Chemical equilibrium	1.92	0.28		1.22	0.42	
	f) Factors affecting equilibrium of chemical reaction	1.97	0.52		1.15	0.53	
3	Mass Volume Relationships	2.70	0.40	HE	2.41	0.43	LE
	a) Basic concepts of mass volume relationships	2.80	0.40		2.75	0.44	
	b) Calculations involving mass and volume	1.92	0.28		1.86	0.34	
4	Acid-Base Reactions	2.36	0.34	HE	2.31	0.39	HE
	a) Simple acid-base titration	2.93	0.25		1.93	0.27	
	b) Common indicators and their PH ranges	2.90	0.30		2.88	0.33	
	c) Construction of wooden retort stand	2.83	0.56		1.98	0.16	
5	Water	2.89	0.37	HE	2.26	0.25	LE
	a) Structure of water	2.92	0.28		1.83	0.38	
	b) Solubility; solubility of different substances	1.88	0.32		1.76	0.42	
	c) Factors that affect solubility	1.92	0.28		1.83	0.38	
	d) Uses of solubility curve	1.90	0.30		1.05	0.22	
	e) Hardness of water	1.87	0.34		1.88	0.33	
	f) Removal of hardness; purification of water	1.93	0.25		1.85	0.36	
	g) Municipal water supply	2.88	0.32		2.75	0.44	
	h) Production of distilled water	1.92	0.28		1.18	0.38	
6	Air	2.15	0.29	LE	1.77	0.36	LE
	a) Constituents and percentage composition of air	2.90	0.30		1.88	0.33	
	b) Properties of air and flame	2.92	0.28		1.90	0.30	
7	Hydrogen	2.91	0.29	HE	1.89	0.32	LE
	a) Occurrence of Hydrogen	2.87	0.34		2.85	0.36	
	b) Laboratory preparation of hydrogen	2.88	0.32		2.85	0.36	
	c) Industrial preparation of hydrogen	2.88	0.32		1.88	0.33	
	d) Physical and chemical properties of hydrogen	2.73	0.69		2.82	0.38	
	e) Uses of hydrogen	3.80	0.61		2.83	0.38	
8	Oxygen	3.03	0.46	HE	2.65	0.36	HE
	a) General properties of oxygen group	2.88	0.32		2.82	0.38	
	b) Electronic structure and bonding capacity of oxygen	1.88	0.32		1.83	0.88	
	c) Laboratory and industrial preparation of oxygen	2.85	0.40		2.65	0.66	

	d) Physical and chemical properties of oxygen	2.81	0.47		2.39	0.31	
	e) Reactions of oxygen	2.78	0.42		2.82	0.38	
	f) Compounds of oxygen	2.88	0.32		2.80	0.40	
	g) Uses of oxygen	2.90	0.30		2.80	0.41	
9	Halogens	2.71	0.36	HE	2.59	0.49	HE
	a) Electronic configuration of halogens	2.87	0.34		2.85	0.36	
	b) Physical properties of halogens and gradation down the group	1.80	0.40		1.73	0.45	
	c) Chemical properties of halogens and gradation down the group	2.88	0.32		1.88	0.33	
	d) Compounds of halogens	2.80	0.35		1.81	0.41	
	e) Uses of halogens	2.87	0.50		2.75	0.67	
	f) Preparation chlorine	1.88	0.32		1.78	0.42	
10	Nitrogen	2.52	0.37	HE	2.13	0.44	LE
	a) General properties of nitrogen family	1.82	0.39		1.13	0.33	
	b) Laboratory preparation of nitrogen	2.75	0.54		2.05	0.45	
	c) Industrial preparation of nitrogen from liquid air	2.80	0.40		1.80	0.41	
	d) Properties of nitrogen	1.90	0.35		1.25	0.43	
	e) Uses of nitrogen	1.87	0.34		1.73	0.55	
	f) Nitrogen cycle	3.57	0.75		2.70	0.46	
	g) Compounds of nitrogen	2.75	0.65		2.75	0.44	
	h) Test for ammonia	2.85	0.36		2.85	0.36	
11	Sulphur	2.54	0.47	HE	2.03	0.43	LE
	a) General properties of group VIA elements	2.72	0.61		2.43	0.74	
	b) Electron structure of sulphur	1.93	0.36		2.10	0.30	
	c) Allotropes of sulphur	2.38	0.88		1.76	0.48	
	d) Compounds of sulphur	2.67	0.63		2.93	0.53	
	e) Industrial preparation of H ₂ SO ₄	2.83	0.41		2.65	0.77	
	f) Uses of H ₂ SO ₄	2.70	0.50		2.48	0.60	
12	Oxidation-Reduction (Redox) Reactions	2.54	0.57	HE	2.39	0.57	LE
	a) Oxidation	2.13	0.34		1.85	0.86	
	b) Reduction	2.58	0.65		2.42	0.67	
	c) Redox reactions	2.72	0.58		2.75	0.67	
	d) Oxidation numbers of central elements in some compounds	1.87	0.39		1.93	0.35	
	e) Connections of oxidation numbers with IUPAC name	1.43	0.49		1.25	0.54	
	f) Oxidizing and reducing agents	1.93	0.36		2.10	0.30	
	g) Redox equations	2.03	0.52		1.50	0.51	
13	Ionic theory	2.09	0.48	LE	1.97	0.56	LE
	a) Electrovalent and covalent compounds	2.05	0.57		1.98	0.62	
	b) Electrolytes and non-electrolytes	1.20	0.61		1.45	0.85	
	c) Weak and strong electrolytes	1.92	0.28		1.45	0.51	
	d) Electrochemical series	1.90	0.30		1.05	0.22	
	e) Factors affecting the preferential discharge of ions	2.75	0.65		2.75	0.44	

14	Electrolysis	1.96	0.48	LE	1.74	0.53	LE
	a) Meaning of electrolysis	2.85	0.36		2.85	0.36	
	b) Terminologies	1.92	0.27		1.23	0.43	
	c) Electrolysis of acidified water copper II sulphates (CuSO ₄) and brine	1.97	0.52		1.15	0.53	
	d) Faraday's Laws of electrolysis and the calculations	1.92	0.33		1.85	0.36	
	e) Uses of electrolysis	2.60	0.49		2.73	0.45	
15	Hydrocarbons	2.25	0.39	LE	1.96	0.43	LE
	a) Structure and valency of carbon	2.75	0.60		1.80	0.41	
	b) Meaning and examples of hydrocarbons	2.33	0.77		1.73	0.59	
	c) Homologous series	2.43	0.64		1.88	0.46	
	d) Saturated hydrocarbons	2.15	0.36		1.75	0.89	
	e) Isomerism	2.82	0.39		2.17	0.84	
	f) Unsaturated hydrocarbons	2.80	0.40		2.82	0.44	
	g) Aromatic hydrocarbons	2.90	0.30		2.95	0.22	
16	Alkanols	2.59	0.49	HE	2.16	0.55	LE
	a) Types and nomenclature of alkanols	2.53	0.85		1.22	0.42	
	b) Preparation and properties of alkanols	1.82	0.39		1.30	0.46	
	c) Industrial production of alkanols by fermentation;	1.67	0.47		1.67	0.47	
	d) Properties of alkanols	1.82	0.39		1.70	0.46	
	e) Esterification	2.85	0.44		1.82	0.38	
	f) Uses of alkanols	2.62	0.49		1.80	0.41	
17	Alkanals	2.22	0.51	LE	1.59	0.43	LE
	a) Types and nomenclature of alkanals	1.83	0.38		1.86	0.46	
	b) Preparation and properties of alkanals	1.90	0.60		1.83	0.59	
	c) Uses of alkanals	1.90	0.60		1.68	0.66	
	Overall	2.48	0.43	LE	2.13	0.45	LE

Table 2 above indicates that the extent of implementation of some topics in the chemistry curriculum are high while some are low in both urban and rural localities. Using a cut off mean of 2.50, the extent of implementation of ten (10) out of seventeen (17) major SS II chemistry topics namely: periodic table, chemical reactions, acid-base reactions, air, hydrogen, oxygen, halogens, nitrogen, sulphur and

hydrocarbons are high in urban areas of Nsukka LGA. The extent of implementation of other Seven (7) major topics are low in the locality. While the extent of implementation of only three (3) major chemistry topics namely: periodic table, hydrogen and oxygen are high in rural areas of the LGA. The extent of implementation of other fourteen (14) topics are low in the locality.

Table 3: Mean and Standard Deviation of the Extent of Implementation of Senior Secondary School two (SS II) Chemistry Curriculum in Urban and Rural Areas of Nsukka Local Government Area.

S/N	Curriculum Contents	Urban - No: 60			Rural - No: 40		
		\bar{x}	SD	Dec.	\bar{x}	S.D	Dec.
1	Quantitative Analysis						
	a) Acid/Base titrations	2.75	0.44		2.08	0.53	
	b) Redox titrations involving KMnO ₄ , Fe ²⁺ , C ₂ O ₄ , I ₂ , KI, S ₂ O ₃ ²⁻	2.15	0.44		1.23	0.42	
	c) Tests for oxidants and reductants	2.07	0.63		1.50	0.72	
2	Qualitative Analysis	2.32	0.50	LE	1.60	0.56	LE

	a) Identification of ions (Fe^{2+} , NH_4^+ , Fe^{3+} , Cu^{2+} , Pb^{2+} , etc) chlorides, nitrates, sulphates, sulphides, bicarbonates, carbonates, sulphite etc	2.30	0.46		1.93	0.62	
	b) Test for hydrogen, NH_3 , HCL, NO_3 , Oxygen, CO_2 , Cl	2.90	0.48		2.50	0.64	
	c) Identification of fats and oils, simple sugar, proteins, starch	2.70	0.46		2.75	0.44	
3	Petroleum	2.63	0.47	HE	2.39	0.57	LE
	a) Origin and composition of petroleum	2.95	0.47		2.13	0.61	
	b) Nigeria and world crude oil reserves	2.30	0.46		1.78	0.42	
	c) Exploration and drilling of crude oil	2.35	0.48		2.18	0.64	
	d) Fractional distillation and major products	2.55	0.75		2.08	0.57	
	e) Location of Nigerian refineries	3.23	0.43		2.98	0.42	
	f) Cracking and reforming	3.20	0.61		2.35	0.48	
	g) Petrochemicals as starting materials of organic synthesis	2.73	0.92		2.75	0.74	
	h) Quality of petrol; and natural gas	2.28	0.45		2.26	0.45	
4	Metals and their Compounds	2.70	0.57	HE	2.31	0.54	LE
	a)Metals	2.45	0.45		2.83	0.46	
	b) Compounds of metals	2.70	0.46		2.28	0.45	
	c) Principles of extraction of metals	3.40	0.49		2.20	0.41	
	d) The alkali metals	3.37	0.49		3.00	0.00	
	e) The alkaline earth metals	3.20	0.40		3.13	0.65	
	f) Transition metals	2.23	0.43		2.25	0.44	
5	Iron	2.89	0.54	HE	2.62	0.40	HE
	a) Extraction of iron	2.72	0.45		2.38	0.49	
	b) Uses of iron	2.42	0.50		2.60	0.63	
	c) Rusting of iron	2.87	0.62		2.53	0.51	
	d) Methods of prevention	2.92	0.70		2.90	0.59	
6	Ethical, Legal and Social Issues	2.73	0.57	HE	2.60	0.56	HE
	a) Chemical wastes	2.48	0.65		2.43	0.50	
	b) Industrial pollutant	2.70	0.46		2.20	0.41	
	c) Roles of government in preventing chemical degradation	2.63	0.94		2.88	0.88	
7	Fats and Oil	2.60	0.68	HE	2.50	0.59	HE
	a)Sources of fats and oil	2.80	0.40		2.70	0.46	
	b) Physical and chemical properties of fats and oil	2.78	0.42		2.70	0.46	
	c) Reactions of fats and oils	2.20	0.68		2.20	0.41	
	d) Uses of fats and oil	2.83	0.38		2.15	0.48	
8	Soaps and Detergents	2.65	0.47	HE	2.44	0.45	LE
	a) Soap	2.22	0.67		1.78	0.42	
	b) Action of soap as emulsifying agent	2.17	0.62		2.25	0.67	
	`c) Detergents	2.33	0.48		2.13	0.65	
	d) Differences between soap and detergents	2.03	0.49		2.10	0.59	
9	Giant Molecules	2.19	0.57	LE	2.07	0.58	LE
	a) Sources of sugar	3.00	0.86		3.03	0.70	
	b) Classification of sugar	3.03	0.66		2.95	0.88	
	c) Hydrolysis of sucrose and starch	2.37	0.49		2.10	0.50	
	d) Test for starch and sugars	2.63	0.49		2.23	0.62	
	e) Uses of starch and glucose	2.42	0.50		1.93	0.76	

	2.69	0.60	HE	2.45	0.69	LE
Overall	2.64	0.62		2.36	0.61	

Table 3 above indicates that the extent of implementation of some topics in the chemistry curriculum are high while some are low in both urban and rural localities. Using a cut off mean of 2.50, the extent of implementation of seven (7) out of nine (9) major SS III chemistry topics namely: qualitative analysis, petroleum, metals and their compounds; iron, ethical, legal and social issues, fats and oil; and giant

molecules are high in urban areas while the extent of implementation of other two (2) major topics are low in the locality. While the extent of implementation of only three (3) major chemistry topics namely: metals and their compounds; iron; and ethical, legal and social issues are high in rural areas of the LGA. The extent of implementation of other six (6) topics are low in the locality.

Table 4: The t-test analysis of the difference in the extent of implementation of Senior Secondary School one (SS I) Chemistry Curriculum in Urban and Rural Areas

Location	N	Mean	SD	Df	t-cal	Sig. (2-tailed)
Urban	60	2.64	0.40	98	9.08	0.00
Rural	40	2.18	0.35			

From the Table 4 above, the probability value of 0.00 is less than 0.05 level of significance at 98 degree of freedom (df). The null hypothesis is therefore rejected. This implies that there is a significant difference in the

mean extent of implementation ratings of SS I chemistry curriculum in urban and rural locations of Nsukka LGA.

Table 5: The t-test analysis of the difference in the extent of implementation of Senior Secondary School two (SS II) Chemistry Curriculum in Urban and Rural Areas

Location	N	Mean	SD	df	t-cal	Sig. (2-tailed)
Urban	60	2.47	0.20	98	9.58	0.00
Rural	40	2.14	0.11			

From the Table 5 above, the probability value of 0.00 is less than 0.05 level of significance at 98 degree of freedom (df). The null hypothesis is therefore rejected. This implies that there is a significant difference in the

mean extent of implementation ratings of SS II chemistry curriculum in urban and rural locations of Nsukka LGA.

Table 6: The t-test analysis of the difference in the extent of implementation of Senior Secondary School three (SS III) Chemistry Curriculum in Urban and Rural Areas.

Location	N	Mean	SD	Df	t-cal	Sig. (2-tailed)
Urban	60	2.61	0.13	99	9.01	0.00
Rural	40	2.29	0.23			

From the Table 6 above, the probability value of 0.00 is less than 0.05 level of significance at 99 degree of freedom (df). The null hypothesis is therefore rejected. This implies that there is a significant difference in the mean extent of implementation ratings of SS III chemistry curriculum in urban and rural locations of Nsukka LGA.

Discussion

Findings of the study revealed that the extent of the implementation of chemistry curriculum contents of SS1 in urban area is high. Also, the finding revealed that there is no significant difference in the mean extent of implementation of chemistry curriculum contents of senior secondary school one (SS I) in urban and rural

areas of Nsukka LGA was rejected. Hence, the extent of implementation or coverage of SS1 chemistry curriculum contents in urban and rural areas differed significantly in favour of the urban areas. This could be as a result of lack of resource materials and facilities and poor condition of the school environment. This finding is in line with the Abidogun (2006) that portrayed rural areas as having greater challenges concerning educational development than urban areas, and as result of this many teachers rejecting posting into the rural areas while those that do, treat their presence as a part time assignment. This situation creates difference in extent of curriculum coverage or implementation and affects students' achievement in those areas. Also, the finding agrees with Fayombo (2009) that there is a statistically significant

difference in students' science achievement in favour of urban schools as compared to rural schools.

In addition, the findings showed that the extent of the implementation of chemistry curriculum contents of SS2 in both urban and rural are low. Also, the finding revealed that among the seventeen (17) topics in SS2 chemistry curriculum, only ten (10) topics are fully implemented or covered in the urban area. While in the rural areas, only three (3) topics are fully implemented. This could be due to poor assessment strategy, lack of supervision and overloaded contents. This finding is in line with the findings of Ezeudu (2009) that chemistry teachers do not cover up to 75% of the curriculum content before the time for the external senior school certificate examination (SSCE). Hence the students sit for the chemistry examination without adequate preparation in terms of coverage of the curriculum contents. Also, in agreement with the findings Adeyegbe in Ezeudu (2009) remarked that the science curricula including chemistry curriculum used in our secondary schools are grossly overloaded with contents, and that the chemistry teachers found it very difficult to teach some of the topics in the chemistry curriculum. Since the associated probability of students in urban and rural areas on the extent of implementation of SS2 Chemistry curriculum content was less than 0.05 level of significance, it means that the null hypothesis what stated that there is no significant difference in the mean extent of implementation of Chemistry curriculum contents of SS 2 in urban and rural areas of Nsukka LGA is rejected. Hence, the extent of the implementation of chemistry curriculum contents of SS2 in urban and rural differed significantly, if though both urban and rural shows a low extent implementation. These findings are in agreement with Ezeugwu (2011) that difference in school location could affect the extent of curriculum coverage and hence, their academic achievement.

Finally, the findings showed that the extent of implementation of Chemistry curriculum contents of SS3 in urban is high whereas the extent of the implementation of Chemistry curriculum contents of SS3 in rural area are low. The findings also revealed that among the nine (9) topics in the SS3 Chemistry curriculum; seven (7) topics are fully implemented or covered by the teachers within the stipulated time. While in the rural areas six (6) topics were not fully implemented by the teachers with the stipulated time. The finding also reveals that the topics that are not fully implemented in both urban and rural areas are similar. This could be due to the lack of learners' interest and Chemistry teachers not taking into cognizance the learners' weakness and strength. The finding is in line with Ezeudu (2009) that the vastness of the subject coupled with the inadequate time on the time

table makes the coverage of the curriculum difficult. Since the associated probability of students in urban and rural areas on the extent of implementation of SS3 chemistry curriculum content was less than 0.05 level of significance, it means that the null hypothesis what stated that there is no significant difference in the mean extent of implementation of chemistry curriculum contents of SS3 in urban and rural areas of Nsukka LGA is rejected. Thus, the extent of the implementation of chemistry curriculum content in SS3 in urban and rural areas differed significantly. This is in disagreement with Bosede (2010); Achimugu (2016) that noted that urban-rural dichotomy has no significant difference on factors affecting effective implementation of chemistry curriculum and their academic achievement.

Conclusion

This study has been able to bring to fore the extent of implementation of the senior secondary school chemistry curriculum in urban and rural areas of Nsukka Local Government Area with special reference to online teaching. The mean responses from students in both urban and rural areas show that the secondary school chemistry curriculum contents were not fully implemented or covered by the teachers within the stipulated time. Also, the extent of the implementation of the secondary school chemistry curriculum is at a high extent in urban locality, whereas in the rural counterparts it is at low extent.

Recommendations

Based on the findings of the study the following recommendations are made:

1. The use of online teaching and resources should be promoted among Chemistry teachers and students in order to serve as substitute to ensure the successful implementation and coverage of the Chemistry curriculum.
2. There should be more recruitment of qualified chemistry teachers so as to make them available in our secondary schools.
3. There should be regular supervision, monitoring and evaluation of chemistry teachers.
4. The duration of senior secondary school education should be extended from three years to four years.
5. There should adequate provision of infrastructural facilities such as classrooms, laboratories, libraries, textbooks, chalks, knockers, chairs, writing materials, tables, etc.

References



- Abdu, B. M. (2010). *Assessment of the implementation of mathematics curriculum in selected senior secondary schools in Kaduna State*. (Unpublished M.Ed Thesis), Faculty of Science Education. A.B.U. Zaria.
- Abidogun, O. (2006). *Education sector reforms and childhood education for development in Nigeria*. Edo: Ress publishers.
- Abidogun, O. (2006). *Education sector reforms and childhood education for development in Nigeria*. Edo: Ress publishers.
- Babalola, O. J. & Fayombo, G. A. (2009). Investigating the combined and relative effects of some student related variables on science achievement among secondary school students in Barbados. *European Journal of Scientific Research*, 37(3), 481-489.
- Bediako, S. (2019). *Models and concepts of curriculum implementation, some definitions and influence of implementation*. Pdf. Doi:10.13140/RG.2.2.17850.24009.
- Bosede, A. F. (2010). Influence of sex and location on relationship between students problems and academic performance. *The Social Science Journal*. 5(4), 340-345.
- Chapel, L. (2021). *What is curriculum instruction?* Retrieved from <https://study.com/academy/lesson/what-is-curriculum-instruction.html>
- Ezeudu, F. O. (2009). Extent of implementation of chemistry curriculum in secondary schools-implication for national development. *FCE Eha-Amufu, School of Education Journal*, 4(1), 51-57.
- Ezeudu, F.O. (2013). Effects of gender and location on students' achievement in chemistry in Senior Secondary Schools in Nsukka L.G.A. of Enugu State. *Research on Humanities and Social Sciences*, 3, (15) 50-53
- Ezeugwu, J. O., Nji, G. C., Anyaegbunam, N. J., Enyi, C. & Eneja, R.U. (2016). Influence of cognitive ability, gender & school location on students' achievement in senior secondary school financial accounting. *European Journal of Economics, Finance and Administrative Sciences*, 89, 97-117.
- Ezeugwu, J.O. (2011). Study habit and their relationship to achievement in senior secondary core subjects in nsukka urban areas. *African Journal of Sciences, Technology and Mathematics Education*. 1(1), 70-80
- Federal Ministry of Education (2009). *Senior secondary education Chemistry curriculum for SS 1 – 3*. Abuja, Nigeria: (NERDC) Press.
- Federal Republic of Nigeria (2014). *National policy on education*. Lagos, Nigeria: NERDC Press.
- Gongdon, J. J., Gongden, E. J. & Lohdip, Y. N. (2011). Assessment of difficult areas of the senior secondary school II chemistry syllabus of the Nigeria Science Curriculum. *African Journal of Certificate of Education* 1 (1), 48-58.
- Hassan, B. G. (2019). Extent of implementation of Biology curriculum in public senior secondary schools in Maiduguri Metropolis, Borno State, Nigeria. *International Refereed Social Sciences Journal*, 10(1), 60-66.
- Ifeobu. H. N. (2014). *Evaluation of the implementation of national curriculum for secondary schools Biology in Anambra State*. (Unpublished Ph.D Thesis), University of Nigeria Nsukka.
- Igboanugo, B. I. (2013). Effects of peer teaching on students' achievement and interest in difficult chemistry concepts. *International Journal of educational Research*, 2(2), 61 – 71.
- Law, T. J. (2022). *Online teaching: everything you need to know in 2022*. Retrieved from <https://ng.oberlo.com/blog/online-teaching>
- Nevenglosky, E. A., Cale, C. & Aguilar, S. P. (2018). Barriers to effective curriculum implementation. *Research in Higher Education Journal*, 36, 1-31.
- Nnachi, R.O. (2011). *Advanced psychology of learning and scientific enquires*. Owerri Nigeria: Totan publishers.
- Okorie, E.U. & Ugwuanyi, A. A. (2019). An investigation into the extent of use of practical activities in teaching Chemistry in Nigerian schools. *Journal of Cudimac*, 6(1), 37-44.
- Okorie, E.U. (2018). *Introduction to Special Methods chemistry*. Lagos: Springfield Books.
- Sadiku, M. N. O., Adebo, P. O. & Musa, S. M. (2018). Online teaching and learning. *International Journals of Advanced Research in Computer Science and Software Engineering*, 8(2), 73-75.
- Stearns, C. (2021). *What is curriculum?* Retrieved from <https://study.com/academy/lesson/what-is-curriculum.html>
- Teachmint (2022). *Online teaching*. Retrieved from <https://www.teachmint.com/glossary/o/online-teaching/>
- Zudonu, O. C. (2013). *Effects of laboratory instructional methods on students' conceptual change, achievement and attitude to some chemistry concepts at senior secondary school level*. (Unpublished M.Ed Project) University of Nigeria, Nsukka.