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EDITORIAL

It is my pleasure to present to you the Volume 3 Number 1 of STEM **JOURNAL OF ANAMBRA STAN (STEMJAS).** This is one of the products of the our Bi-annual conference of Science Teachers Association of Nigeria, Anambra State Chapter with the theme **Curriculum Crisis in Science, Technology, Engineering and Mathematics (STEM).**

The article were peer renewed and edited thus, gave rise to Volume 3 No.1 edition. The articles in this edition is centered on the conference theme.

The volume 3, No. 1 STEMJAS is rich and therefore recommended to students, science teachers, curriculum planners and indeed the general public.

Happy Reading.

Prof. Rita N. Nnorom
Editor-In-Chief

CRISIS IN SENIOR SECONDARY SCHOOL CHEMISTRY CURRICULUM DELIVERY IN NIGERIA

Benson I. Igboanugo
benson.igboanugo@funai.edu.ng, **benikigboanugo@yahoo.com**
Science Education Department,
Alex Ekwueme Federal University, Ndufu-Alike, Abakaliki, Ebonyi State, Nigeria.

Abstract

The aspiration for socio-economic development and recognition among the comity of nations cannot be assured in Nigeria without proper Chemistry curriculum delivery. The Senior Secondary School Chemistry curriculum in Nigeria looks fantastic and elaborate but its delivery is in crisis. This paper x-rays the general features of Chemistry curriculum and also the crisis situation by highlighting some of the causes of the crisis in Chemistry curriculum delivery in Nigeria senior secondary schools. The causes are classified into human factors and non-human factors. Some measures for resolution of the crisis are suggested which include among others: theory to be married with practical work during instruction, proper funding of Chemistry education, class size reduction and proper monitoring and supervision of Chemistry instruction.

Keywords: Crisis in Chemistry, curriculum delivery.

Introduction

The importance of chemistry cannot be over emphasized. Quality of life is enhanced by creation of goods and services; wealth and jobs through application of knowledge and skills acquired from chemistry (Igboanugo, 2019). Indeed chemistry education is synonymous to national building. Aspiration for national socio-economic

development remains an illusion if chemistry education is not effectively handled. In Nigeria, teaching and learning of chemistry starts at the senior secondary school.

At the senior secondary school level in Nigeria, chemistry instruction is bedeviled with a plethora of challenges (Unachukwu & Anakwe, 2013). These challenges mar the quality and the expected level of attainment of chemistry aims and objectives as stipulated in the national curriculum. Poor academic achievement in senior secondary school examinations and relative low enrolment in some chemistry oriented courses in the higher institutions of learning might attest to poor chemistry curriculum delivery (Igboanugu, 2018). As a core Science and the fulcrum of technology, the challenges in chemistry education might be responsible for the low global competiveness in Nigeria (Akpan, 2015). This puts a question mark on the functionality of science education (chemistry in particular) in Nigeria. Thus chemistry curriculum delivery in Nigeria is in crisis. It might be necessary that the sources of the crisis in chemistry curriculum delivery be made an issue of discourse and highlights of some measures for the crisis resolution be made. This surely will be an eye opener to stake holders in chemistry education and education in general to seek for a redress of the situation.

Chemistry Curriculum

Teaching and learning process in chemistry might not be fully discussed without discussing the chemistry curriculum. Curriculum is the totality of experiences, knowledge, skills and activities systematically planned to educate the learners for gainful employment or usefulness. Educationists like Esu (2007) and Oforma (2009) see curriculum as all the learning experiences which are planned or guided by the school whether carried out in groups or individually either in school or outside the school. Curriculum is viewed by Obunadike (2013) as a comprehensive scheme which specifies and fully describes the person to be educated, the content of the education to be given, how and the expected outcome of the education within the limit of a given environment that promotes quality assurance. Chemistry curriculum is thus a document which stipulates the topic, the content, activities (teacher's and students' activities), expected outcomes (performance objectives) within a given stage of teaching and learning process in chemistry. The curriculum also states the teaching/learning materials and evaluation guide for a given chemistry instruction.

The chemistry curriculum aims at development of the learner for useful living in the society which in turn develops the society (FME, 2007). The chemistry curriculum therefore becomes a blue print for realization of the societal aspirations and needs through chemistry education. The Curriculum carefully stipulates the total environment in which chemistry education takes place in attempt to realize the national aims and objectives through chemistry education. The environment includes the subject matter, the learner, the teacher, and the physical and psychological factors. Thus chemistry curriculum is planned and structured to take care of the nation/society's needs and aspirations.

The chemistry Curriculum was prepared by the Comparative Education Study and Adaptation Centre (CESAC) in December, 1984 updated and revised in 2007 by the Nigerian Educational Research and Development Council (NERDC). The curriculum in attempt to cater for the contemporary needs and aspirations of Nigeria has the following as its objectives:

(i) Develop interest in the subject of chemistry;
(ii) Acquire basic theoretical and practical knowledge and skills;
(iii) Develop interest in Science, Technology and Mathematics;
(iv) Acquire basic Science, Technology and Mathematics (STM) knowledge and skills;
(v) Develop reasonable level of competence in Information Communication Technology(ICT) applications that will engender entrepreneurial skills;
(vi) Apply skills to meet societal needs of creating employment and wealth;
(vii) Be positioned to take advantage of the numerous career opportunities offered by chemistry;
(viii) Be adequately prepared for further studies in chemistry.

In addition the chemistry curriculum tends to:

- Facilitate a smooth transaction in the use of scientific concepts and techniques acquired in the new Basic Science and Technology Curriculum and Chemistry;
- Provide students with the basic knowledge in chemical concepts and principles through efficient selection of contents and sequencing;
- Show chemistry and its inter-relationship with other subjects;

- Show chemistry and its links with industry, everyday life activities and hazards;
- Provide a course which is complete for students not proceeding to higher education while at the same time provide a reasonable adequate foundation for a post-secondary school chemistry course.

According to the curriculum, to realize the above stated objectives the three major issues shaping the development of all nations world wide, and influencing the today's world of knowledge were identified as follows: globalization, information/communication technology and entrepreneurship. Consequently, chemistry curriculum content is organized around four themes of:

(i) Chemical world;
(ii) Chemistry and environment;
(iii) Chemistry and industry;
(iv) Chemistry and life.

These themes are to be developed in three sections corresponding to the three years in the Senior Secondary School.

The main teaching methods emphasized by the chemistry curriculum include guided discovery, field trip, project, laboratory and demonstration methods. From the fore going, the Chemistry curriculum looks elaborate and encompassing. But the worth of the curriculum to the society lies on its effective delivery. However, the chemistry curriculum delivery in Nigeria is ravaged by crisis as indicated by poor learners' achievement and general poor level of socio-economic attainment in Nigeria among comity of nations (Igboanugo, 2018 and Akpan, 2016).

Causes of Crisis in Chemistry Curriculum Delivery

In this discourse, the sources of crisis in chemistry curriculum delivery in Nigeria would be classified into human and non- human factors.

a) The Human Factors: The human factors discussed here are the school proprietor factor and teacher factor

- School Proprietor Factor

Government which is the major school proprietor and the chief controller of education through policy making and policy implementation becomes source of crisis in chemistry curriculum delivery in many ways. The political will to make and enforce palatable policies for effective chemistry curriculum delivery lies with the government (Achimugu, 2012). Again, government/school proprietors' inability to build and equip chemistry laboratories and structures remains a serious clog in the wheel of chemistry curriculum delivery. This situation turns chemistry instruction into a paltry venture. The curriculum provides for adequate demonstration and practical exercises in chemistry instruction which is truncated by unavailability of equipments, materials and structures. The UNESCO policy of 26% annual government allocation to education is yet to be considered in Nigeria (Igboanugo & Egolum, 2017). A very meager of the national budget is allocated to education in Nigeria. By this only lip service is paid to pursuit of science and technology education in Nigeria. The much required commitment is below expectation.

Other teaching resources such as Information Communication Technology (ICT) gadgets, internet accessibility and adequate power supply which can help chemistry curriculum delivery are seriously lacking in schools (Binitie, Ezzeh & Akhator, 2017). Researchers such as Nnoli (2016) and Okafor (2017) assert that lack of such requisite teaching resources in secondary schools in Nigeria leads to examination malpractice and students' inability to acquire the required entrepreneurial skills through chemistry education.

Again government/school proprietors in Nigeria do not provide enough teaching and non-teaching staff for chemistry instruction and curriculum delivery. Laboratory assistants and technologists are very rare to come by in Nigeria secondary schools and the number of qualified chemistry teachers is grossly in adequate. The teacher-learner ratio is low (Oyelekan, Ayodele, Ovigwe & Eze, 2018). Low teacher-learner ratio can result to poor classroom management and lack of individual attention/feedback during curriculum delivery. School proprietors mostly rely on use of inexperienced youth corps members to teach chemistry in the senior secondary school instead of recruiting and maintaining more qualified and experienced chemistry teachers. Some of the youth corps members engaged in teaching chemistry at this foundation level are fresh graduates in Engineering, Biochemistry, Food technology and Agriculture. This situation jeopardizes chemistry curriculum delivery and can only lay a very poor foundation for acquisition of knowledge and skills in chemistry.

The few available chemistry teachers in schools lament over lack of incentives and motivation packages. This leads to despondency and mars creativity. School owners do not sponsor or encourage most chemistry teachers to attend professional workshops and seminars where current pedagogical issues in chemistry are discussed (Njelita, 2015). The chemistry teachers are thereby denied the opportunity for progressive capacity building.

- Teacher Factor

The chemistry teacher remains the most vital determinant of the quality of chemistry education offered in the school system. In line with this, Ugwuanyi & Enogu (2013) contend that the onus of adequate and effective chemistry curriculum delivery is on the teacher. The prior and continuous preparation of the chemistry teacher that will deliver the curriculum is therefore a vital issue (Igboanugo, 2019). It follows that the teacher's fit in terms of knowledge, year of experience and readiness is important in chemistry teaching and learning process. Olaleye (2011) establishes that there is relationship between teacher characteristics and curriculum delivery. The teacher characteristics found to be dominant in various country studies are related to; qualification, experience, gender, attitude and personality (Gravestock & Gregor-Greenleaf, 2008).

For a chemistry teacher to deliver the curriculum he/she must possess the requisite skills (Owodunni & Muhammad, 2013). Such requisite skills include efficient use of appropriate instructional approaches. Researchers however, report that most chemistry teachers lack skills for using effective instructional approaches hence they insist on the use of the less effective lecture method (Igboanugo, 2013; Achimugu, 2016 and Wagbara, 2017). The continuous use of lecture method by chemistry teachers for curriculum delivery is a mismatch to the curriculum provision which recommends the use of laboratory, demonstration, field-trip and discovery modes of instruction for the curriculum delivery.

Most chemistry teachers according to Igboanugo (2018) show laxity in the use of appropriate teaching resources found from the learner's locality as recommended by the chemistry curriculum. This situation denies learners the opportunity to relate chemistry concepts to their immediate environments and experiences thereby creating room for route learning. There is always a gap between the learner's past experience and the current classroom experience whenever appropriate teaching resource is not

used in chemistry instruction. Again the chemistry curriculum objective of creating link between chemistry, industry and everyday life activities is forfeited.

The curriculum recommends practical exercise/experiment for almost all the topics which most chemistry teachers over look for one reason or the other. By this, minds-on hands-on activities required for acquisition of science process skill through chemistry instruction is denied of the learner (Orji, Ezema & Ike, 2017). This situation makes learning of process skills during chemistry instruction practically impossible. When the process skills are not transmitted into the learner during chemistry instruction it becomes difficult to produce citizens who can apply skills to meet societal needs of creating employment and wealth as proposed by the chemistry curriculum.

Achimugu (2016) discovered that most chemistry teachers lack requisite ICT skills for chemistry instruction. There is also the gender divide in readiness to use ICT for chemistry instruction in favour of male teachers as reported by Igboegwu (2016). This truncates the chance of inculcating in the learner a reasonable level of competence in ICT applications that will engender entrepreneurial skills which is one of the aims of the chemistry curriculum. Again the use of computer assisted instruction by the teacher to help reduce abstraction in chemistry concepts/topics and foster the teaching and learning of chemistry becomes difficult (Egolum and Igboanugo, 2017).

b) Non-Human Factors: the non-human factors discussed here are the curriculum factor and the nature of chemistry.

- The Curriculum Factor

The chemistry curriculum in attempt to provide students with the basic knowledge in chemical concepts and principles and also have what represents a complete course in chemistry for students proceeding to higher education becomes over loaded with contents and activities (Njoku, 2015). This makes it impossible to allocate enough time to chemistry in the constricted school time table. In order to cover the over loaded scheme of work and syllabus for examinations, teachers gloss over certain details of the curriculum and use easy-going methods of instruction and evaluation. There is rarely enough time for adequate feedback. This creates a lacuna in the chemistry curriculum delivery.

- The Nature of Chemistry

Chemistry concepts/topics are abstract and students perceive them difficult for comprehension at this foundation level of chemistry in the senior secondary school (Igboanugo & Njoku, 2015). Teachers find it difficult for instance to make the concept of atom and its structure being the fulcrum of the senior secondary school chemistry understandable and exciting to the learners. Thus students at this initial stage show un-readiness and lack of interest to put the required zeal and commitment in realizing the lesson objectives (Igboanugo, 2014 and Ikoku & Okeke, 2017).

The chemistry language is also a constraint to chemistry curriculum delivery. Chemistry language involves symbolic representation and word representation. The symbolic representation involves the ever dreadful chemical formulae and equations (Njoku and Ugwu, 2017). According to Njoku & Ugwu (2017) learners continue to find it difficult to write and interpret the chemical formulae and equations which remain the main channel of communication in chemistry. Again the words used in chemistry nomenclature are ambiguous and alien. It is very difficult to translate chemistry language to native languages. This creates a great barrier in making meaning out of a given chemistry instruction by the learner and continues to build misconceptions in chemistry. The communication barrier is a bottle neck in chemistry curriculum delivery.

From the foregoing, chemistry curriculum delivery in Nigeria is indeed wretched by crisis. Having discussed some of the causes of crisis in chemistry curriculum delivery, it might be pertinent to highlight on measures for resolution of crisis in chemistry curriculum delivery.

Measures for Resolution of Crisis in Chemistry curriculum Delivery

The established poor curriculum delivery in Nigeria if allowed to continue without any serious check might lead the nation into a serious socio-economic dungeon for which there is presently a serious blink. The following are some suggested clues for resolution of crisis in chemistry curriculum delivery in Nigeria:

- Government/School Proprietors should ensure proper funding of chemistry education. By this, equipped chemistry laboratories and adequate structures will be put in place. Training and retraining of chemistry teachers on effective chemistry curriculum delivery should be ensured. Adequate incentives and attention to chemistry teachers should be provided.
- Chemistry class size should be reduced by recruiting enough qualified chemistry teachers. Orientation course/workshop should be organized for the newly recruited chemistry teachers before posting them to the classroom.

- Chemistry curriculum should be provided for every chemistry teacher as a companion and a basic tool for the job. This will make the chemistry teacher consult and be well acquainted with the provisions and demand of the curriculum. The present practice where teachers consult the diary for weekly topic/concept to be taught denies many chemistry teachers the opportunity to know the details of what the curriculum suggests or demands of the topic/content. This does not augur well for effective delivery of the curriculum.
- There should be proper monitoring and supervision of chemistry instruction by experts who know their onions in chemistry instruction. This will ensure on the spot professional evaluation and immediate feedback on proper chemistry curriculum delivery.
- Extramural chemistry classes should be organized to provide more time for chemistry curriculum coverage.
- ICT gadgets and internet facilities should be adequately provided for chemistry instruction and evaluation. Again chemistry teachers and students should be properly trained on the usage of ICT for chemistry instruction and evaluation.
- Chemistry teachers should marry theory with practical work during instruction. There is erroneous notion by some teachers and learners that chemistry practical work ends up with quantitative and volumetric analysis. Every topic in chemistry should have at least an associated practical work in most cases suggested by the chemistry curriculum.
- Chemistry Teachers should adopt effective teaching modes of instruction for chemistry curriculum delivery. Some of such effective instructional modes for chemistry curriculum delivery include cooperative learning, peer-teaching, science-technology-society instructional approach, concept mapping, analogy, field trip, simulation, computer assisted instructions, laboratory, project and scaffolding. Depending on the situation and the topic, the chemistry teacher should be eclectic enough to adopt the appropriate mode of instruction.
- Chemistry Teachers should use appropriate teaching resources generated from the school locality for chemistry curriculum delivery. This helps to connect chemistry instruction to the learner's culture. Learners should also be involved in providing teaching resources in chemistry.

- The content of chemistry teacher education programmes should be organized towards mastering features of the chemistry curriculum and pedagogical strategies for its effective delivery.
- Research findings on effective delivery of chemistry curriculum should be aggregated and made accessible to chemistry teachers and school administrators for guidance and implementation.
- Non-governmental organizations (NGOs) and Parent Teachers Association (PTA) should be involved in recognizing and rewarding dedicated and efficient chemistry teachers as encouragement for chemistry teachers to put in the best in chemistry curriculum delivery.

Conclusion

Chemistry curriculum is all encompassing in the issue of national development. Its delivery is a herculean task that will ever remain in crisis if the teacher is not supported by other stake holders in chemistry education and the society at large. Nigeria's dream and aspiration for emancipation from the present socio-economic quagmire shall remain an illusion until more serious steps are taken by the stake holders towards effective chemistry curriculum delivery. The government, teachers, school administrators, parents, and NGOs should awaken to reduce the crisis in chemistry curriculum delivery in Nigeria.

Recommendation

From this discourse, the author hereby recommends that the government including NGOs, teachers and other stake holders in chemistry education should adopt the above discussed measures for resolution of the crisis in the Senior Secondary School curriculum delivery in Nigeria. Thus the teacher education institutions should provide proper chemistry education programmes and trainings that can produce qualified chemistry teachers who are capable of the chemistry curriculum delivery. Ministries of education and NGOs should sponsor capacity building programmes for the in-serving chemistry teachers for an update in chemistry pedagogy. Again, school owners should ensure that enough qualified chemistry teachers are recruited in order to reduce class size and foster proper curriculum delivery. Furthermore, government and school owners should make provision for enough materials and supervision of chemistry instructions in schools. Effective control of crisis in the senior secondary

school chemistry curriculum delivery would no doubt help to develop the citizenry and boost the national development.

References

Achimugu, L. (2012). Political will of government in power: A way forward to successful implementation of STM education under universal basic education reform agenda. *54th Annual Conference Proceedings of Science Teachers Association of Nigeria*, 45-51.

Achimugu, L. (2016). Investigation into the extent of use of field tripinstructional strategy in the implementation senior secondary school Chemistry curriculum in Kogi State, Nigeria. *Journal of ScienceTeachers Association of Nigeria* 51(1), 142-151.

Achimugu, L. (2016). Teachers perception to factors affecting effective utilization of information and communication technology (ICT) in senior secondary school Chemistry in Kogi State. *57th Annual Conference Proceedings of Science Teachers Association of Nigeria*, 419-426.

Akpan, B.B. (2015). The place of science education in Nigeria for global competitiveness. *Journal of Science Teachers Association of Nigeria, 50(1)*; 1-23.

Akpan, B. (2016). Science education research and national development. *Journal of Science Teachers Association of Nigeria, 51(1)*; 105-116.

Anaekwe, M. C. (2010). Acquiring science process skills: The Teachers' Perspective. *Paper presented at the workshop of the Science Teachers Association of Nigeria,* Awka.

Binitie, A.P, Ezzeh, P.O & Akhator, D. (2017). Assessment of availability and usage of various information and communication technology (ICT) tools in combating examination malpractice in secondary school certificate examination (SSCE). *60th Annual Conference Proceedings of Science Teachers Association of Nigeria,* 304-313.

Egolum, E.O. and Igboanugo, B.I. (2017) Effects of Computer assisted instruction and power point presentation on academic achievement of secondary school Chemistry students. *Journal of Science Education, School of Science, Nwafor Orizu College of Education Nsugbe, Anambra State, 13 (1); 129-134.*

Esu, A.E. (2007). Capacity building curriculum: A necessity of sustainable development. *Journal of the World Council for Curriculum and Instruction, 5(2);* 1-2.

Federal Ministry of Education (2007). *Senior secondary education curriculum Chemistry for SS1-3*. Abuja. Nigerian Education Research and Development Council.

Gravestock, P. and Gregor-Greenleaf, E. (2008). *Student course evaluations: Research, models and trends*. Toronto: Higher Education Quality Council of Ontario.

Igboanugo, B.I. (2013). Effects of peer-teaching on students' achievement and interest in senior secondary school difficult Chemistry concepts. *International Journal of Educational Research, 12(2); 61-71.*

Igboanugo, B. (2014). Effects of cooperative learning on students' interest in senior secondary school difficult Chemistry concepts. *55th Annual Conference Proceedings of Science Teachers Association of Nigeria,* 271-278.

Igboanugo, B. I (2018). Interactive effects of science-technology-society instructional approach, teacher experience, gender and school location on students' achievement and interest in Chemistry. *Unpublished Ph.D. Thesis, University of Nigeria Nsukka.*

Igboanugo, B. I. (2019). Effects of teacher year of experience on the use of innovative instructional approach in Chemistry instruction: A case study of science-technology- society instructional approach. *Global Journal of Education, Humanities and Management Sciences, 1 (2);* 32-44.

Igboanugo, B. I. & Egoulum, E. O. (2017). Strategies for making science, technology, society and mathematics (STM) education accessible to all

citizens. *60th Annual Conference Proceedings of Science Teachers Association of Nigeria*, 8-12.

Igboanugo, B. I. & Njoku, Z.C. (2015). Effects of cooperative learning and peer-teaching on senoir secondary school students' achievement in some difficult Chemistry concepts. *Journal of Science Teachers Association of Nigeria 50(1), 151-162.*

Njoku, Z. C. & Ugwu, E. M. (2017). Analysis and classification of students' learning difficulties in the writing of chemical equations. *African Journal of Science, Technology and Mathematics Education, 3(1),* 10-21.

Nnoli, J. N. (2016). Assessment of available Chemistry material resources and secondary school students' level of acquisition of entrepreneurial skills. *Journal of Science Teachers Association of Nigeria, 51(1)*; 127-134.

Obunadike, J. C. (2013). Attitude and willingness in implementing integration of entrepreneurship education in secondary school curriculum for quality assurance. *International Journal of Education Research 12(2),*

Oforma, G. C. (2009). Curriculum across languages. *An inaugural lecture of the University of Nigeria Nsukka. Nsukka :* university press ltd.

Okafor, N. (2017). Teachers' perception of computer-based test for examining Chemistry candidates in june/july National Examination Council. *African Journal of Science, Technology and Mathematics Education, 3(1);* 153-167.

Olaleye, F.O. (2011). Teachers' characteristics as predictor of academic performance of students in secondary schools in Osun State, Nigeria. *European Journal of Educational Studies 3(3), 505-511.*

Orji, E. I., Ezema, M. J. & Ike, P. N. (2017). Effect of instructional technique on students' achievement and retention in senior secondary school Physics. *African Journal of Science, Technology and Mathematics Education, 3(1);* 106-113.

Owodunni, A. S. & Muhammad, H. A (2013). Competencies needed by vocational and technical teachers towords the development of entrepreneurial skills in students *International Journal of Educational Research, 12(2);* 296-311.

Oyelekan, S.O.; Ayodele, A.S.; Ovigwe, J. O.; Eze, P.N. (2018). Hand book on core subjects teachers training programme. Organised by *Anambra State Education Investment Project (ANSEPIP).*

Ugwuanyi, B.E. and Eneogu N.D. (2013). Economics curriculum integration diversification for entrepreneurship wealth creation in Nigeria. *International Journal of Education Research, 12(2); 212-226.*

Unachukwu, G.O. & Anakwe, M. C. (2013). Parental collaboration and secondary school student's achievement in Chemistry. *International Journal of Educational Research, 12(2);* 289-295.

Wagbara, O. S. (2017). Influence of cognitive styles and school location on secondary school students' interest in Chemistry. *African Journal of Science, Technology and Mathematics Education, 3(1);* 168-175.