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CALL FOR PAPERS
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EDITORIAL

Dear Readers,

We are excited to announce the launch of International Journal of Contemporary Issues in Integrated Science Education (IJCIISE). This Association Integrated Science Educators' Association of Nigeria (ISEAN) play a vital role in promoting scientific advancement, supporting science education, informing science policy, recognizing science excellence and fostering community engagement. The desire to float this journal was borne out of the passion to organize a yearly conference of Integrated Science by the Integrated Science Educators' Association of Nigeria, of which selected scholarly articles will be published after a thorough review. The journal dedicated to advancing knowledge and fostering dialogue within. Our mission is to publish high-quality research, innovative ideas, and critical analyses that contribute to the understanding and development of Integrated Science. At IJCIISE, we believe in the power of interdisciplinary collaboration and inclusivity. We welcome contributions from scholars, practitioners, and thought leaders worldwide, providing a space for diverse perspectives and groundbreaking work. As we embark on this journey, we invite you to submit your research, engage with our content, and join us in creating a vibrant academic community. Together, we can push the boundaries of knowledge and inspire future generations. Thank you for your support as we launch this exciting new endeavour.

This edition moves around issues that border on "**Enhancing Quality Assurance in Integrated Science in Nigeria.**" It is believed that diverse contributions from scholars and researchers expressed in this edition will provoke the understanding of issues that could foster education for societal transformations on a global scale
We look forward to your contributions!

For further information on future conference activities, visit <http://ijciise.org/index.php/ijciise>

Warm regards,
Professor O. S. Agboola
President, Integrated Science Educators' Association of Nigeria (ISEAN)

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**INTEGRATED SCIENCE CURRICULUM CONTENTS IN THE
CONTEMPORARY NIGERIA: RATIONALIZATION OF ITS
INTEGRATION**

Jacob Gbemiga AROWOLO, Ph.D.,

Amina ISYAKU,

Joshua OLALERE, Ph.D.,

Peter AGBENYEKU,

Augusta Ndidi OJOKO,

Ganiyu Oladimeji OLARONGBE

Integrated Science Department,

Federal University of Education,

Kontagora, Niger State Nigeria

Corresponding Author: arowologbemiga1@gmail.com

Telephone Number: ¹+2340877307328

Abstract

A discipline usually is designed to address long lasting yearnings of a nation. This paper examined the extent of integration of the curriculum contents in Integrated science. It examined the extent of integrating concepts in Integrated Science, ascertaining the perception of authors of Integrated science textbooks as well as teachers and advocated for all-inclusive overhauling in Integrated science curriculum contents structuring. A qualitative comparative content analysis was adopted to appraise the available curriculum themes, topics and contents in Integrated science in Nigeria. Results revealed that there existed a dichotomous Integrated science curriculum contents structure and treatment by authors of texts and teachers in the discipline; few foreign authors managed to integrate few concepts in their texts but inconsistently; a wider gap existed in the approach to science teaching in Nigeria and those of the developed nations; Nigerian science curriculum goals are more of expressive rather than provocative; there were no emphasis on hours required for hands-on and minds-on activities in science and technology in the Nigerian Integrated science curriculum contents treatment, and, Integrated science has not had a wider embracement like other science disciplines at the senior secondary school and the university. It is therefore concluded that the attention of Nigeria Educational Research and Development Council (NERDC) be drawn to lapses identified in the current science curriculum contents and a reform be effected to thoroughly generate a curriculum that shall contain contents which can truly actualize concepts integration. It was accordingly recommended that there should be a change in foci of school science curriculum from knowledge delivery to learners development, and, in structure from subject-centred to a life-oriented discipline, as well as encourage a more enquiry learning and problem solving to move learners from a receptive to an active participants in science learning among others.

Key words: Contents, Discipline, Knowledge, Learning, Science.

Introduction

Integrated science offered as Basic Science is a core and popular discipline at the basic-9 of the Nigerian education system. The popularity of the discipline can be associated largely to its philosophy which are of relevance content-wise and in materials presentation that align with the learners' experiences. The World Book (2004) has it that philosophy is a rational critical thinking of a more or less systematic kind, about the conduct of life, the general nature of the world, and the justification of belief. Due to intellectual history of the Western world, and beginning with the Greeks, a number of discipline like Mathematics, Natural Science, Social Sciences, Psychology and so on got themselves detached from philosophy. A symptom of this is the use of the word “philosophy” in terms not very long past to mean what we should mean by “science”, as in the phrase “natural philosophy” (World Book, 2004).

From earliest times, people were ill-informed about the world around them. This provided attempts to understand and control nature, in which case mathematics and medicine became the first sciences to develop, followed by the physical sciences, life sciences and social sciences (Encyclopedia Americana, 2006). Each of these science branches pursued knowledge differently. Physical sciences which include astronomy, chemistry, geology, metrology and physics examine the nature of the universe and study the structure and properties of nonliving matter from tiny atoms to vast galaxies. Life or biological sciences involve the study of living organisms as in botany for plants and zoology for animals, with other branches that include anatomy, physiology, genetics, molecular biology, paleontology, taxonomy, sociobiology and ecology, bacteriology, ornithology and marine biology.

From the origin of science as a discipline, scientific knowledge has grown and became increasingly complicated, many new fields of study have emerged. At the same time, the boundaries between scientific fields have become less and less clear-cut. Numerous areas of science overlap and it is often hard to tell where one science ends and another begins (World Book, 2004). Just as both chemistry and physics deal with atomic structure, so do paleontology and geology study the age of rocks in the earth. Many of the most important scientific advances have resulted from the exchange of ideas and method among different branches of science.

In some cases, sciences have come to overlap so much that interdisciplinary fields have been established. Such fields combine parts of two or more sciences as found in biochemistry (that combines Biology and Chemistry in structuring the chemical processes that occur in living plants and animals), economic geology which draws upon economic and geology in investigating the distribution of such natural resources as gold, silver and petroleum (Encyclopedia Americana, 2006). Arowolo, *et al.* (2021) outlined in their book “college Integrated Science 1” that scientists use a number of methods in making discoveries and in developing theories. These methods have from time immemorial cut across observing nature, classifying

data, using logic, conducting experiments, forming hypotheses, expressing findings mathematically and modeling with computers (World Book, 2004) or as presented by Tillery, Enger and Ross (2001) via: observe some aspects of nature, invent an explanation for something observed, use the explanation to make predictions, test predictions by doing experiment or make more observations to modify explanation as needed and so on.

Science education has been predisposed to series of reforms over the years due to the day to day global challenges. Chukwunke and Chikwenze (2012) have posited that functional education is determined by the quality of the curriculum content and its implementation while Offorma (2005) maintained that functional curriculum content must be valid, significant, learnable and consistent with social realities which is useful and reflects the interest of the learners. Integrated science as a discipline is one assumed to concern itself with the study of the environment, free of the limitation imposed by the separate subject disciplines. Though, the boundaries between the disciplines only appear as artificial and man-made constructs which interfere with unified view of nature as whole that learners at secondary level bring to the classroom.

This is why Integrated science is conceived to emphasize those concepts which are common to all of the separate science disciplines in the areas of process of science, the skills associated with them, and inquiry into the nature of the environment. It is expected that the scientific method of inquiry which has both cognitive and psychomotor aspects would be learned by learners and a prime aim of the programme to provide students with an introduction to the method and allow them to follow their own inquiries. The relevance of science to everyday life are to be examined around such great themes of science as energy, field and particle theories, conservation, balance and cycles in nature. As opined by Bolarin (2011) Nations that are considered as developed and largely civilized have achieved the status through purposeful scientific education of their citizenry.

The philosophy of Integrated science as documented in the minimum standard of colleges of education is affixed on fundamental unity of science, the use of scientific method as a common approach in solving problems and the role of and function of science in human everyday life and to prepare students for further studies in the course (FME, 2020). The Federal Government of Nigeria through Nigeria Education Research Development Commission (NERDC) accentuates the need to restructure and integrate science curricula of biology, chemistry, physics, mathematics, geography, agricultural science, physical and health education, information, communication technology and basic technology. The integration of the listed curricula is germane to promote the holistic view of science at the basic level for better understanding of contemporary and changing world and to infuse emergent issues that is of national and global concern as well as encourage innovative means that promotes creativity and critical thinking (FME, 2007, 2012). In order to achieve the holistic presentation of scientific and technological concepts and skills to learners, a thematic approach to content organization was agreed to be appropriate.

Statement of the problem

In Nigeria, the science curriculum at the primary, secondary and tertiary levels of the education system have in the past been re-examined and frantic effort geared at a thorough re-alignment and restructuring of contents so to speak have taken place. Teaching in general is a dynamic profession that requires continuous review in order to address contemporary issues and challenges. Issues bothering on national interests have always been addressed in schools through the curriculum- the overall learning experiences. As posited by FME (2012, 2020) there has been a general decline in the quality of science education in Nigeria which is why curriculum planners became compelled to assess the extent to which the societal aspirations were being met.

Since building a formidable science education is a condition for promoting the development of intellectual qualities and skills of the citizenry, Nigerian science education has ventured into developing a quantum of science education programmes by Science Teachers Association of Nigeria (STAN), Nigeria Integrated Science Project (NISP), National Primary Science and Mathematics Project (NPSMP), Comparative Education Study and Adaptation Centre (CESAC), United Nation Education Scientific and Cultural Organization (UNESCO), Nigeria Secondary School Science Project (NSSSP), Biological Science Curriculum Study (BSCS), Chemical Bond Approach (CBA) and Physical Science Study Curriculum (PSSC). With evolution of global issues that prick human attention on daily basis, it is expected that some paradigm shifts for quality assurance mastery of content as enshrined in constructivism which could assist learners construct their knowledge using activity-based and student centered approaches be embraced. In order to produce effective career-focused individuals in line with current best practices, a need to rationalize the extent to which integrated science is integrated is explored in this study.

Objectives

The main focus of this paper was centered on the extent to which the present Integrated Science defused the separate science disciplines as a unified whole in its content organization. This became expedient in the light of efforts at enhancing quality assurance in Integrated science study in Nigeria. It also examined the extent to which Integrated science was embraced and the perception of authors who produced textbooks on the discipline, as well as advocated for an all-inclusive overhauling of Integrated Science curriculum

Methods

A comparative review was adapted in this work to appraise the available curriculum themes, topics and contents in Basic/Integrated Science. The researchers having taught at the secondary school level before becoming lecturers in a college of education and at the moment facilitate courses in Integrated Science in affiliation to a Nigerian University made use of the Basic science and technology curriculum (FME

2012) of Basic education, the Minimum standard (FME, 2020) and the Benchmark of both institutions of higher learning respectively. Sample of themes, topics and contents in the curricula across levels of education in Nigeria was selected for comparison to justify whether or not Basic/Integrated Science contents have been ideally unified. A review of selected textbooks was conducted to ascertain whether or not authors could justify the extent to which concepts could be treated holistically. The approach adopted by Chinese science education system in unifying science was compared to underpin the gap if any in the style adopted in Nigeria. The areas of concern with regards to the Chinese science curriculum bothered on theme, content, resources required, methodology and depth of integration in comparison with the Nigerian science curriculum to accentuates the degree of quality in the science imparted and learned in Nigeria. We purposefully chose China because of the nation's recent transformational trajectory in the field of science and technology globally.

Results

First, we selected four themes and sample curricula contents from FME (2012, 2007) 9-year basic education science curriculum as well as FME (2020) Minimum Standard for Colleges of Education (COE) and Benchmark for Degree programme and reproduced them herein based on level:

Table 1: Curricula Content by Theme, Level and Topic

| Theme | Curriculum Level | Topic | Content |
|-----------------------------------|---------------------|--|--|
| 1: Learning about our Environment | Basic education 1-3 | Exploring the environment | Things in and around the classroom, school and home; types of roads within and outside the school; walking along the road and crossing the road. |
| You and environment | 4-6 | Changes in nature Family health (cleanliness) | Types of changes: temporary (reversible), permanent (irreversible). Personal cleanliness: meaning, methods, advantages/disadvantages |
| | 7-9/JSS1-3 | *Nil | |
| | SSS1-3 COE | Components of the environment I | *Nil Air, water, weather elements, soil. |

| Theme | Curriculum Level | Topic | Content |
|----------------------------------|---------------------------------------|--|---|
| | Degree | Components of the environment I | Structure of the earth crust, environmental concepts: earthquake, flood, erosion, wind rainfall and relationship with man, pollution |
| 2: Basic technology | Basic education 1-3 4-6 | Simple machines Technology and you | Meaning of: simple machine, safe use of simple machines. |
| Living and nonliving things | 7-9/JSS1-3 SSS1-3 COE Degree | Matter *Nil Nature of matter I Properties of matter | Meaning of technology, importance of technology, products of technology. Meaning, identification, classification and states of matter *Nil States, properties, laws, classification, structure of atom, elements, compounds and mixture Structure of solids, liquids and gases, stress, strain and young modulus, elasticity, ideal and non-ideal gas, surface tension, solid friction, fluid motion, thermal expansion, heat transfer, specific heat of metals |
| 3: Physical and health education | Basic education 1-3 4-6 | Moving our body parts Athletics | Leaping, walking, stepping, hopping and running, throwing, kicking and striking of objects, safety rules |
| Science and development | 7-9/JSS1-3 SSS1-3 COE Degree | Gravitation and weightlessness *Nil Man and energy Fields, waves and vibrations | Types of middle and long distance races: middle, long, steeple chase, skills in races: standing, take-off, running, arm action, finish Meaning of gravitation, weightlessness, effects of gravitation on objects. |

| Theme | Curriculum Level | Topic | Content |
|---------------------------|---------------------|---|---|
| | | | *Nil Force, workdone, energy, temperature, heat light, sound Force fields and inverse square law, magnetic, electric and gravitational fields, application of force fields to TV and satellites, wave equations |
| 4: Information technology | Basic education 1-3 | Parts of a computer | Description of a computer, parts of a computer, drawing of computer parts. |
| You and energy | 4-6 | Starting up the computer | Meaning of booting, types of booting, steps for booting |
| | 7-9/JSS1-3 | Energy | Meaning of energy, sources, forms, transfer, uses |
| | SSS1-3 COE | *Nil Workshop practices, skill acquisition and ICT | *Nil |
| | Degree | Harnessing energy environment | Improvisation, glass work, preparation of skeletons, herbariums, painting, metal workshop, ICT, instruments used in workshop, simple circuit connection and types elementary electronics, skill acquisition Biotic and abiotic environment, natural and man-made environmental problems, environmental hazards, energy environment, environmental degradation, solid wastes and recycling. |

As displayed In Table 1, the Integrated Science contents are outlined in tune with science disciplines dichotomy and were treated accordingly by authors (Ndu, & Somoye, 2009; STAN, 2003; Saidu, et al. 2023) and science teachers. A review of selected foreign texts to ascertain the justification for possible integration envisaged for the field of study also showed dichotomous science concept treatment. Integrated Science text by Tillery, Enger and Ross (2001) shows that the authors only skeletally

integrated some concepts treated, as revealed on “models and theories” in chapter 1 of their book where Biological and Physical considerations were presented around models of DNA and rainbow. An aspect of Chemistry on this concept was only compared to planetary structure without any diagram as accorded DNA and rainbow. This might create an impression in the learners that models do not exist in chemical science and teachers could equally teach it as same.

The chapter 2 of the book presented information on motion purely from the perspective of Physics, whereas if truly the concept is considered to be integrated could infuse the perspective of movement in Biology as a characteristic of living matter as well as eruption of molten magma from the earth crust to tap from Chemistry and Earth Science knowledge and or tectonic plate to bring to bear the geographical consideration of the concept holistically at once. Chapter 6 of the book discussed sound sentimentally from the view point of Physics, here though the structure of the ear could be viewed as a necessary component of the phenomenon, the biological relevance of ear was not emphasized neither was the Chemistry aspect of ionic impulse transmission of Na^+ and K^+ along the neurons as well as the transmitter chemicals that coordinate the link at the synapse given any attention.

However, our review of 2 other foreign Biology texts astonishingly provided a succor to what could hold as “integrated” of concepts in their entirety. First in “Biology Concepts and Application” by Evers and Starr (2006), the ingenuity of the authors to consider every concept presented in an integrated manner was spectacular at least from chapter 1 to 7 of the text. We equally examined chapters 2 and 3 of another Biology text by Mason, Losos and Singer (2014) that actualized what could be considered as “integrated” in their treatment of “the nature of molecules and the properties of water” as well as in “the chemical building blocks of life”. In our opinion, we advocate for concepts of these nature that may portray aqua-terrestrial life, atmospheric/space, environmental/forestry, biochemical, geophysics and the like to be the focus of Integrated Science to give room for domains rather than repeating or duplicating verbatim those of concern by the separate single science disciplines.

The Chinese versus Nigerian Science Curricula

In order to assess the quality of the Nigerian science curriculum contents, a comparison was made with that applied by the Chinese education system as stated under method for this study. Chinese primary school science in grades 1 to 3 is not taught as a separate subject but as part of the physical education programme (TIMSS & PIRLS, 2024). Their texts use stories about science, inventions, animals, personal hygiene and community sanitation to present science. The Chinese approach seems more appropriate than the exploration of the environment that Nigerian science curriculum presented for introducing science to Nigerian pupils. More also, most primary science teachers have fallen short of justifying the objectives of the topic: “exploring the environment” which requires that pupils observe and identify things in and around classroom, school and home, identify types of roads around and

outside the school as well as demonstrate walking along the roads and crossing the roads safely. If these objectives could be achieved at all, it could at best be experienced by pupils in localities where the roads are busy with traffics, even at that, teachers in communities where road traffics were noticed did not apply the methods indicated in the curriculum to accomplish these objectives.

Science curriculum in primary and lower secondary grades in China have a unique goal which is to increase science literacy. Their science literacy programme encompasses eight domains: knowledge of science and technology, science processing skills, development of processing intelligence, science applications, designing and producing, understanding the nature of science, understanding the development of science and technology and development of scientific attitudes. Here again, Nigerian science curriculum goals at these stages of educating Nigerian child scientifically are more of expressive rather than provocative. Nigerian science curriculum opts for process skill while Chinese science curriculum emphasizes and instills processing skills and processing intelligence development. The science processing skills of Chinese curriculum requires executive skills of conducting scientific inquiry, problem definition and evaluation, observation, comparison and classification, organization and connection, induction and inference as well as communication. Processing intelligence development requires deep scientific thinking to be used to define, develop and evaluate problems and ranges from comprehensive thinking, inferential thinking, creative thinking, critical thinking to problem solving.

The scientific application in Chinese science curriculum permits and leads learners to use scientific methods and knowledge learned in the classroom to solve daily life problems specifically in the areas of operation of machines and use of instruments. Their emphasis being on transferring problem solving strategies from school to daily life. This reveals the quality expectation in the science education provided the citizenry. The Nigerian Integrated science contents do not identify these salient areas of concern which may be reason why the subject looks like repeating theoretically the contents of the separate sciences in its approach to science learning. A look at design and producing domain of Chinese science curriculum guides their pupils to identify peoples' needs and conceive a way to satisfy such needs. In order to produce is to use technical and practical knowledge to choose appropriate tools and materials to create products that satisfy an identified need. This area totally does not form a part of the Nigerian integrated science course content which again could have provided the holistic view and quality expectation in the learners.

To understand the nature of science from Chinese point of view is to deal with the properties of scientific knowledge and research activities. Hence their learners would have to reflect on their science learning experiences, recognize the existence of natural laws and master scientific argumentation. By scientific argumentation, it requires that learners differentiate evidence from theory, consider the internal consistency of explanations and construct relationships between evidence and theories. Nigerian science curriculum been expressive has made authors and

teachers to also be on the superficial level of provoking learners thought on what they learn on nature of science.

Similarly, to understand the development of science and technology in Chinese setting, consideration was given to the creation and change of technology and the relationship among science, technology and society. Right from the onset, Chinese science curriculum under this concern provided three facets that encompasses: nature of technology which recognizes the importance and characteristics of technology and relationship between science and technology, evolution and advancement of technology through the agricultural, industrial and information eras and trends of technological development and technology and society by making sense of the ways technology interacts with human lives that include individual career planning, and the interaction between the development of industry and technology.

Chinese curriculum is such an interdisciplinary programme that encourages an enriching, cross-curricula approach with the aim of developing inquisitive thinkers rather than solely preparing candidates for examination process. The science curriculum for primary and lower secondary grades is meant for the enhancement of learners scientific thinking through learning activities that involve planning and designing, measuring, observing, evaluating procedures, examining evidence and analyzing data. At the primary school, science is taught as General studies which integrates science education, personal, social and humanities education and technology education. The curriculum design was based on the belief that pupils learning experiences should be connected and not compartmentalized to allow them develop a holistic view of themselves first as individuals in the community of their place in the natural world, and of the interaction of human being with the environment. In order to assist primary pupils master basic understanding of scientific concepts and cultivate the habit of exploring science with an open mind, it was recommended emphatically that pupils engage in at least 20 hours of hands-on and minds-on learning activities in science and technology in their grades 4-6. The Nigerian approach in this context is the dissimilar.

Conclusion

To manage curriculum implementation of any programme and of science in particular in any institutions requires careful monitoring to ensure effectiveness. It is important to determine if the implementation of the curriculum brings about the desired professionalism. To enhance Quality Assurance in Basic/Integrated science, it is contained in this paper that by comparison, Nigerian science curriculum could be overhauled in contents and approaches. There is the need to encourage innovation and re-orientation toward the changing needs of Nigerians. Integrated science would have to be concerned with good outcomes and not detailed specifications of curriculum content vis-a-vis authenticating and keeping samples of students results via cumulative grading of reports on contents learned. Likewise, a determination of the quality of input, process and output variables that provide information on

learning outcomes and their improvement for the purpose of decision-making and decision-taking would have to be the tenet of the discipline. It is believed that by holistic reform of the theme (as: Live science, Environmental science, Energy science, Health science, Science and Technology), objectives, content and ensuring appropriate choice of credible resources and methods are applied to the teaching and learning of the subject by pupils, Nigerian-child would equally prove to be a worthy ambassador in the community of scientists.

Recommendations

1. Changing the foci of school science curriculum from knowledge delivery to learners' development in such dimensions as knowledge and skills, process and methods as well as affective and value.
2. Changing the structure of Integrated Science curriculum from subject-centred to a more life-oriented and selective possibilities that reflects specialties in Aqua-fishery science (Aquatic and Fishery science); Astronomical science (Astronomy and Atmospheric science); Bioearthspace science (Biology, Chemistry, Earth and Space Science); Enviro-forest science (Environmental and Forestry science) as well as Oceano-physics (Oceanography and Physics).
3. Encourage more enquiry learning and problem solving in order to change learners learning from a receptive to an active way.
4. Encourage teachers to be more facilitative and interactive in their classroom teaching.
5. Invites educators to develop new approaches and techniques for assessment by snowballing students bi-monthly report presentation grading to liberate them from heavy pressure of examination.
6. The use of modules to present contents to learners in texts and bridging the gap from basic 9 to tertiary institutions are required

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