

Full Length Research Paper

Developing Nigerian integrated science curriculum

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Nigerian educational system has gone through various developments and changes viz-a-viz curriculum issues. The dynamic nature of the curriculum process informed the write-up of this paper. The selection and organization of curriculum content is one of the problems associated with the Nigerian educational system. This paper reviewed the genesis of integrated science curriculum development in Nigeria to ascertain its present status. In doing so, this paper defines the concepts of curriculum and curriculum development. This paper also discussed the process of curriculum development, analysed the current curriculum in integrated science and emphasised some of the short-comings of the design in relation to its implementation in the classroom. This paper also identified and discussed some of the fundamental problems in Nigerian integrated science education that are militating against the achievement of integrated science curriculum objectives, and proffered useful recommendations.

Key words: Curriculum, curriculum development, curriculum objective, integrated science.

INTRODUCTION

Science education plays a vital role in the lives of individuals and the development of a nation scientifically and technologically (Alebiosu and Ifamuyiwa, 2008). It is widely and generally acknowledged that the gateway to the survival of a nation scientifically and technologically is scientific literacy which can only be achieved through science education. To make her citizens show interest in science education, Nigerian government came up with a policy that 60% of the students seeking admission into the nation's universities, polytechnics and colleges of education should be admitted for science oriented courses, while 40% of the students should be considered for arts and social science courses (Ajibola, 2008). This government's effort cannot be said to have yielded much fruits given the dwindling nature of students seeking admission into science-oriented courses in the Nation's tertiary institutions, more students are seeking admission into art and social science courses than those of the science-oriented courses on yearly basis.

Disturbed by this ugly development, researchers in the field of science education in Nigeria embarked on series of studies to find the logic behind this ugly development. They found that the problem stemmed from the first form of science a child comes across at the JSS (Junior Secondary School) level, that is integrated science. Integrated science provides students sound basis for further science education study, hence a child that is not

well grounded in integrated science at this level would not show interest in offering core science subjects (biology, chemistry and physics) at the SSS (Senior Secondary School) level which are the prerequisites for studying science-oriented courses at the Nation's tertiary Institutions. They also found that lack of qualified teachers, lack of equipments and facilities for teaching, lack of practical works, insufficient allotment of time for integrated science on the school time-table and poor methods of teaching are the major factors militating against the successive implementation of the core curriculum in integrated science (Afuwape and Olatoye, 2004).

The aforementioned problems of teaching integrated science did not include non sequential arrangement of some of the integrated science concepts in the curriculum. It is believed that if integrated science concepts are not taught from known to unknown and from simple to complex, it is likely that students might find it difficult to understand the concepts taught. This has lead to the development of negative attitude towards the subject by the students, which has lead to many of them not showing interest in offering core science subjects at the senior secondary school level and science-oriented courses at the Nation's tertiary institutions because of their dismal performance in integrated science examination at the JSSCE (Junior Secondary School Certificate

Examination). It is against this background that this paper reviewed the Nigerian integrated science curriculum in order to ascertain the sequential arrangement of the concepts.

WHAT IS CURRICULUM AND CURRICULUM DEVELOPMENT?

Curriculum issues, either in an explicit or an implicit manner, are inextricably linked to current thinking and action on educational concerns and reforms around the world. Experiences of educational reform almost all over the world have shown that curriculum is at the same time a policy and a technical issue, a process and a product, involving a wide range of institutions and actors (Ajibola, 2008). The curriculum provisions are immense and profound for school teaching and learning (Ajibola, 2008). The process of constructing the curriculum is unique to each national setting. It is a complex outcome of the opinions and solutions that key stakeholders propose for society's requirements and needs.

The term curriculum has been defined by many people in many places. One cannot talk precisely of right or wrong definitions. Curriculum is a vehicle through which education is attained (Offorma, 2005). This Offorma's definition is a narrow view of curriculum. What examiners require the teachers to emphasize in their teaching, like that of WASSCE (West African Secondary School Certificate Examinations)/ JAMB Joint Admission and Matriculation Board) syllabus, is an example of narrow definition of curriculum. The broad definition of curriculum sees it as a process, that is the package and the continuous work involved in bringing the package into being, the thinking behind the package, and the continuous efforts of making curriculum serve the needs of society (Obayan, 2004a). The totality of the syllabuses of activities carried out under aegis of a school, in response to societal demands is an example of the broad definition of curriculum.

Having known what a curriculum is, it is pertinent we have an idea of what curriculum development is. Curriculum development is vital to educational success and nation building. Nations expend vast amounts of time and resources on designing what ought to be learned in schools in order to elevate social consciousness and improve economic viability (Ofoha et al., 2009). Curriculum development is not a new concept in Nigerian educational system today. Curriculum development is a continuous search for qualitative improvement, in response to societal changes. This implies that the search for improvement is a continuous activity among human beings. The reason being that conditions of things in the world are never static, they are dynamic. Curriculum development is determined by a large number of factors; the most important being the learner, the changing nature of schools, changes in society and

changes in the nature of disciplines.

HISTORY OF CURRICULUM DEVELOPMENT IN NIGERIA

Agitation for curriculum reform is nothing new to Africa. It started more than half a century ago; what is new is the increased momentum it has gathered since the rise of nationalism and subsequent attainment of political independence by many African states in the sixties. Before then, there was no single co-coordinated and well-planned curriculum in any of the school subjects, including the sciences. The tendency then was to expand the existing structure of education system while maintaining the old syllabuses which had been in existence since the beginning of the colonial era. In the sixties (and the early seventies) many educators and politicians felt that the old curricula had outlived their usefulness as they had little relevance to the needs, aspirations and values of post-independence Africa (Fafunwa, 2002; Akpan, 2010).

In Nigeria, for example, several commissions and committees were set up to examine school curriculum in particular and the education system in general. The series of events which culminated in the development of the NPE (national policy on education) commenced quietly but effectively at the national curriculum conference. The main objective of the conference was to develop strategies for a new national curriculum at all levels of the Nigerian education system. In addition to some recommendations, a list of national educational objectives was produced which later formed the core of a philosophy for Nigerian education (Omotayo et al., 2008).

Statement of problem

In 1972, the federal ministry of education commissioned a group of Nigerian science educators to work on integrated science as a subject (Olaewaju, 1994). The result of their deliberation was documented in STAN's curriculum development newsletter No. 1, which marked the beginning of integrated science teaching and learning in Nigeria. The questions which this study will like to provide answers to are: (1) the major topics in the Nigerian integrated science curriculum being used at the Junior Secondary Schools I to III, are they sequentially arranged from simple to complex, known to unknown? and (2) does the learning of certain topics at lower level lead to the better understanding of topics at upper level?

Purpose of the study

This study purposes to look, critically, into the Nigerian integrated science curriculum at the JSS level in order to

find out the arrangement of topics at each of the level. It is hoped that if integrated science topics are well arranged from known to unknown, simple to complex, students at the JSS level will find integrated science interesting and this will motivate them for further study in higher science education.

RESEARCH DESIGN

The descriptive survey research design was adopted for the study. This method was deemed appropriate as it involved the collection of extensive and cross-sectional data for the purpose of describing and interpreting an existing situation under study.

Population

The target population for this study included all students and Integrated science teachers from public and private junior secondary schools in Nigeria.

Sample and sampling technique

The study adopted multi-stage random sampling procedure. Out of the six geopolitical zones in Nigeria, three zones were selected, namely; North west, South east and South west. Their selection was purposeful in order to have a data that is nationally representative. Using the ballot technique, one state per zone was selected.

Instrument

The only instrument for data collection was the JSS integrated science curriculum for JSS 1 to 3.

Validation of the integrated science curriculum

To establish the validity of integrated science curriculum used, the instrument was given to experts in the field of science education and psychology who are knowledgeable in curriculum planning to comment on the authenticity of the instrument. Experts in English Language education were also contacted for their comments in relation to diction and sentence construction of the curriculum.

Procedure for data collection

Three research assistants were recruited to assist in the collection of the integrated science curriculum. To ensure uniformity of the curriculum in all the schools, the state ministry of education of each of the sampled states was contacted to collect the integrated science curriculum which was compared with the ones collected from the sampled schools. This was done in the first term of 2009/2010 academic session which lasted for three months.

Process of integrated science curriculum development

In recent times, the parameters of curriculum development have increased in number, size and complexity. Consequently, the products or outcomes of curriculum development have also increased. For instance, the personnel that are involved in curriculum development vary in category from curriculum experts to classroom

teachers and the outcomes from examinations syllabus to classroom instructional materials and tests.

Examination syllabus, which is usually developed by an examining body, e.g. WAEC, consists of a list of subject contents and notes on specific areas that the examination will focus on. Thus, it is expected to be used as a guide by both the teachers and the examinees in preparing for a specific examination. The curriculum, on the other hand, consists essentially of the subject contents intended objectives, relevant activities and evaluative strategies. Such curriculum, according to Offorma (2005), focuses mainly on the effective teaching of the subject rather than on its examination. Therefore, it always serves as a blueprint for the writing of textbooks, work-books, teachers' guides and other instructional materials.

Different personnel, groups and agencies often specialize in the development of different types of curriculum outcomes (Ajibola, 2008). However, all of them use the national policy on education as their guide. This aspect focuses only on the development of integrated science curriculum.

For the purpose of this paper, the process of developing integrated science curriculum in Nigeria is discussed in three stages viz: identification of objectives, identification of learning experiences and their organization.

Identification of objectives

NPE has unequivocally provided the basic objectives as well as the structure and dimension of science education in our primary and secondary schools. This is why designers and developers of science curriculum have always used the policy as a fundamental blueprint (Adeniyi, 2001). Olarewaju (1994) stated the following as the principal reasons why UNESCO started the integrated science programme:

1. It has become increasingly apparent that science must be an element in the general education of all children. However, the majority of children in many parts of the world do not get beyond primary school. Clearly, science needs to be introduced as an element in primary education and such science must of necessity be of an integrated type.
2. At secondary level, if science is to be an element of general education, at least in the lower cycle of secondary education, some form of integrated science teaching is likely to be more appropriate than courses in the separate disciplines of physics, chemistry and biology.
3. Integrated science teaching at primary and secondary levels provide a sound basis for continuing science education either in specialist subjects or further integrated science.
4. The world is so engulfed by science that every living being deserves a rudimentary or general knowledge of it for his existence. Since everybody cannot and does not train as a specialist, the non-science people can learn science in the form of integrated science. This enhances the scientific literacy of the citizenry.
5. Man's environment is not compartmentalized into subjects like biology, chemistry, physics, etc., but involves the combination and interaction of these and some of the subject areas in other spheres of human endeavor. The division of science into the various subjects was fashioned out by man for his convenience. Man's environment needs to be understood in its totality rather than in fragments. Thus, for him to gain composite knowledge of his environment, he will necessarily have to learn integrated science.
6. Teaching science through an integrated approach helps the young learner to have a general view of the world of science and also appreciate the various opportunities that are open to him in science. Even though the learner may specialize in any of the science subject later in life, he will not be totally out of tune when discussions are going on in other branches of science. He can thus be regarded as an educated man in science.

7. Science itself is not fragmentary and the developments in modern science show the interdisciplinary nature of science. For instance, during the course of learning integrated science, students will be exposed to concepts in biology, chemistry, astronomy, geography, physics, etc., and when they come across such 'hybrid' subjects as biophysics, biogeography, geophysics, biochemistry, astrophysics, geochemistry etc., they will be able to recall and demonstrate some understanding of what is involved.

8. The processes of science serve as a unifying factor for the various science subjects. It is necessary for the learner to know these processes through the integrated approach to learning science.

9. General science failed to inculcate the processes and thus the spirit of science in students. Teachers of general science, being specialized in their various subject areas, were teaching it as biology, chemistry and physics. Science was then considered as fragmentary.

LEARNING EXPERIENCES: IDENTIFICATION AND ORGANISATION

In Nigeria, the Federal Ministry of Education or its parastatals is usually responsible for coordinating curriculum planning and development. The comparative education study and adaptation centre (CESAC) before its demise or the Nigerian educational research and development council (NERDC) has always coordinated the development of integrated science curriculum. The officers in these parastatals usually invite subject specialists from the universities, colleges of education and secondary schools to a workshop at which the invited subject specialists and the agency officers then constitute the curriculum team. It is this team that sets on to the major tasks, namely:

1. To identify the learning experiences in their subject areas that are appropriate, adequate and relevant to the educational level(s) for which the curriculum is intended.
2. To organise the selected learning experiences in a manner that reflects the accepted conceptional framework of the developers
3. To suggest the appropriate method(s) and instructional strategies for achieving the stated broad and performance objectives, individually and severally.
4. To identify appropriate teaching aids and other material resources that will help in accomplishing the objectives.
5. To construct the appropriate evaluative strategy for each sub-topic.
6. To write a draft of the curriculum.

ANALYSIS OF THE CORE-CURRICULUM IN INTEGRATED SCIENCE FOR NIGERIA JUNIOR SECONDARY SCHOOL (JSS)

This part reviews only the integrated science core curriculum for JSS for two major reasons:

1. The Federal Government has endorsed the use of the core-curriculum in all secondary schools in Nigeria and thus ensuring its high degree of acceptability and usage.
2. It is, to some extent, similar in concept, structure and methodology to its precursor known as Nigerian integrated science project (NISIP) and Nigerian secondary schools science project (NSSSP) in integrated science which was developed by the defunct CESAC.

As indicated earlier, the integrated science curriculum

for JSS is meant for the current 6-3-3-4 (now 9-3-4) system of education in Nigeria. It is intended to provide modern integrated science course for three years to all junior secondary school students. By design, it is expected to satisfy the needs of the society through the relevance and functionality of its content, method, processes and application. The objectives of the curriculum were derived from the NPE (NPE, 2004).

Structurally, the integrated science curriculum for JSS, as stipulated by the federal ministry of education (1981), consists essentially of six themes: topic(s), performance objective(s), content, activity and notes. By this arrangement, each topic has four aspects across the columns. The fifty-four major topics treated in the curriculum document focus mainly on six themes in integrated science, viz: 1. Concept of living thing. 2. Basic ecological concepts. 3. Living components of the environment. 4. Non-living components of the environment. 5. Energy and machines. 6. Controlling the environment.

The fifty-four topics are expected to be covered over a period of three academic sessions, that is, from JSS 1 to JSS 3.

The objectives

By convention, curriculum objectives form the focal point of any systematically planned educational programme because without them the achievement, effectiveness, suitability and receptability of the programme cannot be assessed (Bloom, 1974).

The cardinal objectives of the curriculum are to prepare pupils to acquire:

1. adequate laboratory and field skills in integrated science;
2. meaningful and relevant knowledge in integrated science;
3. ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture; and
4. reasonable and functional scientific attitudes.

These cardinal objectives are appropriate and meaningful because they emphasize:

1. enquiry and experimentation as vehicle for science learning/teaching;
2. relevance of knowledge and skills taught; and
3. functionality.

These ideals are the pillars of modern science teaching today. Secondly, they cover satisfactorily the cognitive, affective and psychomotor domains of learning. The performance objectives are commendable since their organisation would provide the maximum guide to the classroom teacher. It will also help teachers in self-

evaluation of their own teaching and the achievement levels of their students.

The curriculum starts with the topics of direct relevance to the community. These include you as a living thing, you and your home and living and non-living components of the environment. The performance objectives are appropriate and are in line with the cardinal objectives of the syllabus.

The content

In planning the integrated science curriculum, the spiral (or concentric) approach to sequencing a science course was adopted. In the approach, the concepts to be taught are arranged in such a way that they run throughout the three-year course; in a progressional order of depth as the course matures over the years. This approach is worthy of note as it presupposes in the cognitive development skill that a junior secondary school 3 student will comprehend more than a junior secondary school 1 student.

The question may be asked, are the contents really spiral? The topic, nervous system and reproductive system which were not introduced in year 2 features in year 3. The curriculum planners should have introduced them in Year 2 so that the approach to sequencing a science course will be adopted to help the pupils to follow-up in Year 3 when the topics are treated again. All other themes of integrated science, apart from theme one, are arranged in a progressional order of depth.

Theme 1: You as a living thing

Year 1

1. Characteristics of living things.
2. Characteristics of animals.
3. Human beings as higher animals.
4. The functioning of the human body-feeding.

Year 2

The functioning of the human body-movement, circulatory system, respiratory system, excretory system and digestive system.

Year 3

1. The functioning of human body, nervous system and reproductive system.
2. Health.
3. Keeping the body fit.

The topics in year 2 should have been repeated in Year 3

for easy understanding of the topics. It is stated in the syllabus that pupils should acquire adequate laboratory and field skills in integrated science; but in the curriculum there is no special time allocated for it and usually the time-table is overcrowded with too many subjects. As such, the objectives are never attained. The curriculum developers provide topics that are of direct relevance to the community. Since there is not enough time to treat all the topics, why put them all in the curriculum?

Theme 2: You and your home

Year 1

Health and family-importance of personal cleanness to family health.

Year 2

1. Child's growth and development-Physical growth.
2. Energy and appliance-Types of energy.

Year 3

1. Continuity of family.
2. Child's growth and development-care of child.
3. Energy and appliances-appliances in the home.

From Theme 2, there is correlation in the topics starting from year 1 to year 3.

Theme 3: Living components of the environment

Year 1

1. Classification of matter.
2. Grouping of organisms.
3. Activities of living things.

Year 2

Ecology-specific habitat studies, including land and aquatic.

Year 3

Resources from living components of the environment.

Theme 4: Non-living components of the environment

Year 1

1. Observing non-living components.

2. Investigating the properties of matter.
3. Measurement.
4. States of matter.
5. Air.
6. Water.
7. Man in space.

Year 2

1. Pure and impure substances.
2. Further investigation of air and water.
3. Hydrogen.
4. Rusting.
5. Energy.

Year 3

1. Acids, Bases and Salts.
2. Chemical symbols, formulae and equations.
3. Atomic structure.
4. Metals and non-metals.
5. Activity series.
6. Energy conversion and transfer.
7. Energy and work.
8. Kinetic theory.

From Themes 3 and 4 earlier, the classification of matter included in year one theme 3 should not have been included in year one theme 3, it should have been included in year one theme 4 because it will make the learning of properties of matter, states of matter, air and water as they are under year one theme 4 understandable. If a child is taught classification of matter before being taught properties of matter, states of matter, air and water; the learning would progress from known to unknown and this would enhance students' learning.

Theme 5: Saving your energy

Year 1

1. Science related occupation.
2. Tools (machines) for work.
3. Force.

Year 2

1. Effect of force.
2. Simple machine.
3. Maintenance of machines.

Year III

1. Energy and work.
2. Energy conversion and transfer.

Theme 6: Controlling the environment

Year 1

1. Environmental sanitation, refuse and sewage.
2. Disease vector.
3. Preventive medicine-clean water and immunization.

Year 2

1. Maintaining balance in the environment.
2. Pollutants in the environment.

Year 3

1. Our disappearing forest.
2. Controlling the water.

From themes one to six, apart from the few observed mistakes in the arrangement of some topics, there is correlation in the topics from Year I to Year III.

Teaching strategies

The integrated science curriculum is child-centred and emphasis is laid more on learning science as a process than as a body of knowledge. Learning science as a process is not a common practice in science teaching in Nigeria, and hence it behoves the planners of the new curriculum to specify the methods of teaching to be adopted in handling the materials. Among the methods to be used, the following were specifically recommended:

1. Use of guided discovery teaching strategy;
2. Use of laboratory exercise (STAN, 1970); and
3. Field trip.

The guided discovery strategy is an innovative way of teaching integrated science. It enables the students to find answers themselves. A change usually occurs in students' learning when they are actively involved in the learning process (Olaewaju, 1994). The use of guided-discovery in teaching integrated science is not usually practised since this strategy is time consuming and the progress is comparatively slow. Apparatus has to be set up and result of the investigation awaited. The strategy is good for a small class where effective teacher supervision is easy to achieve. This is not the case in most of our secondary schools where a teacher is assigned to teach more than 40 students in a class. The teacher should be made to use other teaching strategies and allowed to use the appropriate ones. If the guided-discovery strategy, however, becomes imperative for a large class, the class could be divided into groups to

enhance effective supervision.

Laboratory activities are important in fostering understanding of certain aspects of the nature of science, in promoting intellectual and conceptual development and particularly, in developing positive attitudes towards science. Laboratory activities seem to be an important ingredient in the development of certain problem-solving skills. Learning through laboratory strategy extends and reinforces theoretical learning through reality.

It is often said that nature is the grand teacher of integrated science; one of the strategies of teaching integrated science is by taking students to the field to provide first-hand experience of organisms in their environment. Such experiences are not available within the confines of the laboratory. Most of the objectives are not achieved because the time allocated to integrated science class is not enough to employ some of the strategies mentioned earlier (Oludipe, 1997). Apart from this, some teachers do not know what is actually involved in guided-discovery method or how to attain the educational aims and objectives.

Integrated science involves various activities. These include project work, demonstration, lecturing, individual practical work, small group discussion, visits to museum or zoos, building models, explaining phenomena to students and a host of other verbal and non-verbal activities. The choice of approach depends on several factors, one of which is the object of the activity. The teacher should be made acquainted with all these and allowed to use the appropriate ones instead of being restricted to certain strategies recommended by the curriculum.

The integrated science curriculum has no column for evaluation and reference list: no curriculum should be considered complete unless it lists an abundance of reference materials and this reference lists or bibliography should be of two types:

1. There should be rich reference lists of source materials for pupils and teachers in connection with each unit or phase of the subject.
2. Teachers like to exercise more freedom and variety in their teaching to meet the needs of the individual differences in pupils but are handicapped by lack of a convenient listing of suggested source materials in the form of a general bibliography.

The column for activities in the curriculum will help the students and teachers to work on the practical aspect of the theories learnt.

PROBLEMS AND PROSPECTS

This paper has attempted to examine critically the design and development of integrated science curriculum materials in Nigeria. On the whole, the curriculum

developers have achieved a lot although there are few shortcomings. This is because the implementation of their laudable work in the JSS is marred by a myriad of problems. At present, we teach integrated science with little or no science equipment, materials, laboratories and other essential infrastructures.

Integrated science teachers, many of whom are unqualified for the job they are doing (Odetoyinbo, 2004), instruct children in a language which is foreign and difficult for most of them to understand. It is, therefore, not surprising that the children who have to suffer through this shameful process are disenchanting and apathetic and ipso facto develop a negative attitude toward integrated science (Oludipe, 1997). In the following, researcher discusses briefly some of the major problems and proffer some solutions.

Learner's readiness

The state of integrated science teaching /learning is fast deteriorating in our secondary schools. This view is attested to by the abysmally low rate of enrolment of students in core science subjects like physics, chemistry and biology. Consequently, students become disenchanting and apathetic towards science. Some measures must be taken to reverse the negative attitude of our students toward integrated science.

It seems that we need to reappraise integrated science curriculum objectives vis-à-vis the intellectual status of the average learner at the secondary school level. Two main pedagogical problems must be considered, viz: reading for learning and english as a medium of instruction.

There are two schools of thought on the issue of readiness for learning. The older school opines that age and level of intelligence should be the determinants of the depth of knowledge that should be imparted to students at any and every stage. But the new school believes in the concept that any topic could be taught to any student at any level provided the subject matter is simplified enough to be easily digested by the students.

Both concepts have their merits. It is imperative that we consider the cognitive level of the average students, especially in the junior school when we are writing their curriculum. In addition, the teacher who will teach the content must familiarize himself with the level of development of the child and adopt the best means of conveying the ideas to be put across to the child (Ofoha et al., 2009).

The more serious issue is the perennial problem of english (a second language) as a vehicle of instruction in Nigerian schools. It is quite obvious that unless a student has a good proficiency in the language of the classroom, his ability to have a meaningful learning experience in the school setting will be hampered. Some international studies (Bloom, 1974) seem to show that whatever the

language, verbal ability is the key to learning. Better proficiency in classroom language is, of course, expected to lead to better learning in school. In fact, a study by Collison (1972) suggests:

“the vernacular might be preferable as the language of science teaching since (the) findings show that process skills like conceptualization, modeling, hypothesizing might be more easily developed by students using their own language”.

The effects of the two issues discussed in the preceding pages are immense as far as the teaching/learning of integrated science is concerned and thus may determine one way or the other the achievement of integrated science curriculum objectives in Nigerian schools.

Integrated science teachers

As mentioned earlier, integrated science teachers in Nigeria remain the only hope for improving science teaching in primary and secondary schools. But, unfortunately, they are in short supply for the task at hand. Furthermore, many of the classroom integrated science teachers are inexperienced, untrained and, in some cases, unqualified for the job they do (Oludipe, 1997).

Besides, certain measures must be taken to improve the quality of integrated science teachers. Such measures should include:

1. Better recruitment and possibility of better selection;
2. Better substantive education in teacher training institutions;
3. On the job training of younger teachers by more experienced ones; and
4. In-service and long-vacation courses to continue the education of teachers.

SUMMARY AND RECOMMENDATIONS

In the write-up, this paper has attempted to review the genesis of integrated science curriculum development to ascertain its present status. In addition, this paper discussed the process of its development and analysed the current curriculum in integrated science. During the exercise, the paper emphasized some of the shortcomings of the design vis-à-vis its implementation in the classroom. Lastly, this paper identified and discussed some of the fundamental problems in Nigerian science education that are militating against the achievement of our curriculum objectives.

Consequently, the researcher wishes to make the following recommendations:

1. It is obvious that the time allocated for the teaching of integrated science in the JSS is inadequate. Therefore, it

should be increased so that the pupils will, at the end, develop power to perceive, understand, experiment, discuss, hypothesize and draw conclusions.

2. Teachers should, as prescribed in the curriculum, take students out on field trips and excursions. To facilitate this exercise, teachers should be provided with an imprest to cover the cost of transport and other expenses.

3. Federal and state ministries of education should ensure that every integrated science teacher attends at least one workshop or seminar every year. Moreover, in-service training should be approved for many unqualified integrated science teachers in our secondary schools.

4. Experimentation, enquiry and functionality are the pillars of modern science education. These cannot be achieved without effective laboratory activities. It is, therefore, imperative that all schools should be supplied with functional laboratories and other infrastructural facilities.

5. Lastly, the federal and state governments should improve the working conditions of science teachers and upgrade the status of the teaching profession and provide appropriate incentives so as to stem the unfortunate high turnover of experienced and dedicated science teachers.

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APPENDIX A

Integrated science curriculum for the Junior Secondary Schools

Theme 1: you as a living thing

Year 1

1. Characteristics of living things.
2. Characteristics of animals.
3. Human beings as higher animals.
4. The functioning of the human body-feeding

Year 2

1. The functioning of the human body-movement.
2. circulatory system
3. respiratory system
4. excretory system
5. digestive system

Year 3

1. The functioning of human body, nervous system, reproductive system.
2. Health.
3. Keeping the body fit.

Theme 2: You and your home

Year 1

Health and family-importance of personal cleanness to family health.

Year 2

1. Child's growth and development-Physical growth.
2. Energy and appliance-Types of energy.

Year 3

1. Continuity of family.
2. Child's growth and development-Care of child.
3. Energy and Appliances-Appliances in the home.

Theme 3: Living components of the environment.

Year 1

1. Classification of matter.
2. Grouping of organisms.
3. Activities of living things.

Year 2

Ecology-specific habitat studies, including land and

aquatic.

Year 3

Resources from living components of the environment.

Theme 4: Non-living components of the environment

Year 1

1. Observing non-living components.
2. Investigating the properties of matter.
3. Measurement.
4. States of matter.
5. Air.
6. Water.
7. Man in space.

Year 2

1. Pure and impure substances.
2. Further investigation of air and water.
3. Hydrogen.
4. Rusting.
5. Energy.

Year 3

1. Acids, Bases and Salts.
2. Chemical symbols, formulae and equations.
3. Atomic structure.
4. Metals and non-metals.
5. Activity series.
6. Energy conversion and transfer.
7. Energy and work.
8. Kinetic theory.

Theme 5: Saving your energy.

Year 1

1. Science related occupation.
2. Tools (machines) for work.
3. Force.

Year 2

1. Effect of force.
2. Simple machine.
3. Maintenance of machines.

Year 3

1. Energy and work.
2. Energy conversion and transfer.

Theme 6: Controlling the environment**Year 1**

1. Environmental sanitation, refuse and sewage.
2. Disease vector.
3. Preventive medicine-clean water and immunization.

Year 2

1. Maintaining balance in the environment.
2. Pollutants in the environment.

Year 3

1. Our disappearing forest.
2. Controlling the water.
(Ministries of Education; North West, South East and South West)

APPENDIX B**Integrated science curriculum for the Junior Secondary Schools.****Theme 1: you as a living thing****Year 1**

1. Characteristics of living things.
2. Characteristics of animals.
3. Human beings as higher animals.
4. The functioning of the human body-feeding

Year 2

1. The functioning of the human body-movement.
2. circulatory system
3. respiratory system
4. excretory system
5. digestive system

Year 3

1. The functioning of human body, nervous system, reproductive system.
2. Health.
3. Keeping the body fit.

Theme 2: You and your home**Year 1**

Health and family-importance of personal cleanness to family health.

Year 2

1. Child's growth and development-Physical growth.
2. Energy and appliance-Types of energy.

Year 3

1. Continuity of family.
2. Child's growth and development-Care of child.
3. Energy and Appliances-Appliances in the home.

Theme 3: Living components of the environment.**Year 1**

1. Classification of matter.
2. Grouping of organisms.
3. Activities of living things.

Year 2

Ecology-specific habitat studies, including land and aquatic.

Year 3

Resources from living components of the environment.

Theme 4:Non-living components of the environment**Year 1**

1. Observing non-living components.
2. Investigating the properties of matter.
3. Measurement.
4. States of matter.
5. Air.
6. Water.
7. Man in space.

Year 2

1. Pure and impure substances.
2. Further investigation of air and water.
3. Hydrogen.
4. Rusting.
5. Energy.

Year 3

1. Acids, Bases and Salts.
2. Chemical symbols, formulae and equations.
3. Atomic structure.
4. Metals and non-metals.
5. Activity series.

6. Energy conversion and transfer.
7. Energy and work.
8. Kinetic theory.

Theme 5: Saving your energy.

Year 1

1. Science related occupation.
2. Tools (machines) for work.
3. Force.

Year 2

1. Effect of force.
2. Simple machine.
3. Maintenance of machines.

Year 3

1. Energy and work.
2. Energy conversion and transfer.

Theme 6: Controlling the environment

Year 1

1. Environmental sanitation, refuse and sewage.
2. Disease vector.
3. Preventive medicine-clean water and immunization.

Year 2

1. Maintaining balance in the environment.
2. Pollutants in the environment.

Year 3

1. Our disappearing forest.
2. Controlling the water.

(Selected Junior Secondary Schools in the North West, South East and South West region).