

## **BASIC SCIENCE AND TECHNOLOGY EDUCATION FOR ATTAINMENT SUSTAINING DEVELOPMENT GOALS (SDGS) IN NIGERIA**

**BY**

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### ***Abstract***

*This paper reviewed basic science and technology education for the attainment of Sustainable Development Goals (SDGs) in Nigeria. The paper traced the origin of general science from pre-independence era to its evolution to elementary science then integrated science and now to basic science and technology. Also, reviewed include rationales and objectives of basic science and technology education and challenges facing the implementation of basic science and technology education. The paper examined trends in reforms which led to the adoption of sustainable development goals by nations globally. The explored ways basic science education can be used in attaining sustainable development goals (SDGs) in Nigeria Trends about the basic science and technology education in Nigeria suggests that there is need for improvement in the programme. Thus, in this paper, strategies have been outlined in order to reposition the basic science and technology education programme for meaningful contribution in attaining the noble objectives of Sustainable Development Goals (SDGs) in Nigeria.*

**Keywords:** Basic Science and Technology Education, Attaining Sustainable Development Goals (SDGs) in Nigeria

### **Introduction**

Science deals with the acquisition of knowledge through step by step observation and collection of data for analysis to get a precise, result. Science is a systematic process of

obtaining verifiable and testable knowledge about nature and natural occurrences utilizing careful observation and experiments (Okeke, 2017). Basic science is the integration of science subjects as a whole such as: chemistry, Biology, physics and mathematics. Basic Science plays vital role in the Nigeria education system because it prepares learners at the junior secondary school level to study core science subjects at the senior secondary school level and to further prepare students to undertake science related career or courses at the tertiary level of education. According to Aina (2017), basic science is an approach to the teaching of science in which concepts and principles are presented so as to express the fundamental unity of scientific thought and void of premature undue stress on the distinction between the various scientific fields. It is also a science in which its concept and principles are presented so as to express the fundamental unity of scientific thought and avoid the undue stress on the distinction between the various scientific fields (Waidrip, 2012). By these principles, teaching and learning of basic science as a subject should among other things, foster learners' acquisition of scientific knowledge and skills. This will equip learners to be involved in decision making and problem solving process in the Nigerian society. Hence, this will contribute to the actualization of the national objectives geared towards achieving the targets of SDGs in Nigeria.

It is worthy of note, that the basic science programme is guided by spelt out objectives in the National Policy on Education (Revised, 2018), The objectives spelt out in these documents provided a framework for the national objectives in the SDG project in Nigeria. Among other things, the rationale for the SDG project in Nigeria is to ensure that by the year 2030, Nigeria should be ranked among the first twenty best economically buoyant nations of the world. Thus, this paper will further consider the historical background and of development since independence; whether it has achieved the desired outcome or not.

### **History and development of Basic Science Education in Nigeria Since independence to date**

Originally, science was learnt in Nigeria as general science. The general science was introduced into the educational system of Nigeria as early as 1878 (the 19<sup>th</sup> century) Later, the general science was divided into the various science subjects such as physics mathematics agricultural science, chemistry and biology. Integrated science was formally adopted as a course in the later part of the 1960s (independence era) due to curriculum development and innovation in many parts of Africa, including Nigeria.

Following the request by West African Examination Council (WAEC), Science Teachers Association of Nigeria (STAN) reviewed science subjects syllabuses in 1968, integrated science was fully added to the science curriculum. In 1970, a document containing the philosophy, methods, contents and evaluation of integrated science as a subject was published. The philosophy for teaching integrated science in Nigeria comes from two main sources. That is: (i) STAN Integrated Science material; and (ii) the National Core curriculum for Integrated Science. According to the National policy on Education (NPE, 2018), under the auspices of the Federal Ministry of Education, the philosophy guiding the teaching of integrated science as a course is as follows: i. To stress the fundamental unity of science; ii. To ensure it is relevant to child's needs and experience; iii. To lay adequate foundation for subsequent special study; and iv. To add a cultural dimension to Science Education.

In 1977, the National Policy on Education (NPE) which contains decision on the educational system in Nigeria (6-3-3-4) was published. The digits '6-3-3-4' implies: six years of primary school, three years Junior Secondary (JS), three years Senior Secondary (SS) and four years University education. This, was different from the previous '6-5-2-3' system. Under the new system of education, the arrangement is that basic science would be taught at the primary level of education for six (6) years then to Junior Secondary (JS I to JS III). While the subjects will disintegrate to individual science subjects (mathematics, biology, physics, and chemistry) at Senior Secondary.

In 1982, ten states of the federation began to implement the junior secondary school programme of the new education system. The basic science core curriculum covers a period of six years of primary education and three years of Junior Secondary School after which a Junior Secondary Certificates Examinations (JSCE) is organized for participating students. The integrated science core curriculum is developed around themes, which are spiral or eccentric in nature. The topics discussed under each theme get increasingly more detailed and complex as the years progress. Besides, professional single science subjects teachers in tertiary institutions are involved in teaching basic science at primary and junior secondary schools in Nigeria.

With the re-introduction of the Universal Basic Education (UBE) scheme launched by president Olusegun Obasanjo on 30<sup>th</sup> September, 1999 and in recent years by recent administration there is a new dimension to the basic science education in Nigeria. By this scheme, there is need for the restructuring of the entire teachers' training programme. This restructuring has begun through the existing 62 colleges of education and 93 universities to improve the training scheme for basic science teachers for the UBE scheme.

Among other things, one of such recent innovations in integrated science programme in tertiary institutions is the conversion of integrated science departments from a double major to a single major course, especially in colleges of education (National Commission for Colleges of Education, 2018).

### **Objectives of Basic Science Education**

The course basic science is devised and presented in such a way to achieve the following key objectives:

- i. To gain the commonality of approach to problem of scientific nature.
- ii. To gain an understanding of the role and function of science in everyday life in the world children live in and
- iii. To gain the concept of the fundamental unity of science (FRN, 2014).

### **The rationale for basic science education in Nigeria**

Among other things, the following are rationales for basic science education in Nigeria.

5. Basic science education provides opportunity for acquisition of skills among teeming population of youths in Nigeria.
6. It reduces emphasis on science concepts or form one perspective rather emphasize science from a unified approach or interrelatedness among science discipline.

7. It serves as a bedrock for citizens in Nigeria to pursue science related discipline or career which account for rapid development among nations in the 21<sup>st</sup> century.
8. Basic science education stresses the fundamental unity of among science discipline.
9. It opens frontiers to knowledge through research and collaboration among educators and fosters cross- cultural interaction among nations.
10. It contributes greatly to improving living and working conditions of individual citizens through the application of acquired concepts and skills.
11. Management of natural human and natural resources, reduction in environmental hazard, increase in energy supply and high productivity in the economy is achievable through basic science education.

### **Basic Science Curriculum**

The basic science curriculum varies in terms of scope or content from developing countries to the developed countries. In the past, content of basic science curriculum in many parts of the world was aimed at inculcating knowledge of science concepts to learners. However, in recent times, the need to tackle social, health and environmental problems or challenges have necessitated modification of basic science curriculum in many countries (Obioma, 2012).

The curriculum content is spiral as it deals with concepts from simple to complex. For instance, in Nigeria, at junior secondary school which is presently known as Basic Science and Technology (BST), a learner is expected to know basic issues about man and his environment and use of various forms of energy and so forth. The concepts are arranged in this order to prepare learners gradually to acquire among other things aptitude for science related careers and develop problem solving skills. (Adeniyi, 2007).

The existing basic science curricula of many countries especially in developed countries focus mainly in preparing learners to tackle problems in their environment. The basic science curriculum in most developed countries places emphasis on the use of inquiry-based strategies that focus minds-on and hands-on approach to teaching and learning science concepts in order to develop problem solving skills among learners.

Another unique feature of basic science curriculum in recent years is the emphasis on the use of appropriate assessment or evaluation tools to measure the learning objectives as spelt out in the curriculum. In recent times, experts have called for the adoption of the continuous assessment (CA) based type of evaluation techniques which best assess learners than the traditional types of evaluation techniques (Ogundele, 2019).

Webster (2019) defined development as using scientific and technical knowledge to meet specific objectives. Development can also mean improvement in human lives as a result of increasing availability of social infrastructures such as good roads, health facilities, schools and abundant food production. Of course, there can be no development in an atmosphere of insecurity.

Development can also mean socio-cultural changes in which new ideas are introduced into a social system in order to produce per capital income and high standard of living through the

application of modern science and technology to improve social organization (Ibrahim, 2018).

The need to achieve Sustainable Development Goals (SDG) proposed by the United Nations in 2015 has led to the call for sustainable innovations in science education programme in Nigeria. According to Webster, (2015), sustainability is the desire to meet the needs and aspirations of the present without compromising the ability meet those of the future. It is the process of starting and continuing a thing. On the hand, innovation is concerned with creativity, risk taking and experimentation (Brewer and Tiemey, 2012), which must be a part of the education system (in this case, science education).

### **Assessment of Trends in basic Science Education in Nigeria since independence and in relation to Sustaining Development Goals (SDGs)**

Based on the philosophy or principles guiding the integrated science education earlier outlined, the integrated science programme is intended to achieve the following objectives in learners.

- i. Make meaning out of what is observed accurately
- ii. Organize information acquired
- iii. Apply knowledge acquired in solving problems
- iv. Predict as a result of generalization
- v. Design experiment to check prediction. Other objectives include:
- vi. Gain the commonality of approach to problem of scientific nature
- vii. Gain an understanding of the roles and function of scientists in everyday life,
- viii. Gain the concept of the fundamental unity of science. (Kolawole, 2017)

Taking a cursory look at the philosophy, aims and objectives of integrated science education in Nigeria, the question therefore is (i) to what extent have these aims and objectives been achieved? (ii) How relevant is the programme in view of the goals of SDG? (iii) What can further be done to ensure that the programme contribute in achieving the goals of SDG?

It is worthy of note that these objectives and goals of the interest programme are incorporated in the goals of the vision SDG project. The goals of SDG goals are contained in the United Nations SDGs, 2030) document. The goals are anchored on this frame work: i. Value orientation of the citizenry ii. Poverty eradication iii. Skills acquisition and job creation iv Wealth generation through public and private sector reforms; and v. Using education to empower the people.

Based on framework guiding the SDG project, it is needful to examine or assess whether or not the integrated programme has achieved the desired outcome of the programme along these guidelines.

In terms of the curriculum, trends in integrate science education earlier reviewed in this paper, shows that the existing integrated science curriculum emphasizes among other things leaching and learning of content man hands-on-activity learning. This implies that learning has mainly been focused mainly on learners' acquisition of knowledge of science lo skills development. Thus, this undermines present need for entrepreneurial and basic science and technology in Nigeria.

In terms of funding and provision of instructional facilities, the integrated science education has not fared too well. In spite of government efforts in provision of textbooks, libraries, laboratories and classroom among other things, there is still much to be done in respect of the integrated science programme.

Also, there is problem of shortage of man power. This is because single science graduate teachers who major in any of biology, chemistry and physics still feel inadequate to teach aspects of the integrated science curriculum unfamiliar to them. Present challenges of the vision SDG goals, demands adequate training and retraining of integrated science specialist teachers in order to teach the subject in view of the massive population of upcoming UBE pupils who will later offer basic science at JSS level. Based on the foregoing discussion, the following underlining strategies are recommended in using integrated science education in achieving targets of the SDG goals in Nigeria.

Basic science refers to the interaction of subjects such as chemistry, biology, physics and mathematics with aim of teaching science from a unified approach. General science was taught in primary schools and replaced by elementary science in Nigeria in the 19<sup>th</sup> century. Following the adoption of National Policy on Education in 1977, elementary science was changed to integrated science. Educational reforms in Nigeria education system in early 2000 resulted into reviewing of 6-3-3-4 system of education to 6-9-3. This brought about some notable changes in several subjects curriculum such as the integrated science curriculum which was changed to basic science to broaden the objective and scope of the subject (National policy on Education, 2014). The subject was structured to assist learners to develop interest in science and technology. The subject basic science was intended to lay a foundation for science and technology education by the end of the junior secondary school, presently known as basic 9 as spelt out in basic science curriculum (Obioma, 2012; Adeniyi, 2012). It is worthy of note that the followings are the objectives of the basic science curriculum.

- (i) meaningful and relevant knowledge in Biology
- (ii) adequate laboratory and field skills in basic science,
- (iii) ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture and
- (iv) reasonable and functional scientific attitude.

The framework of the New Basic Education Curriculum according to Adeniyi (2012) reflects the following:

- (vi) The curriculum is designed to properly target pupils and students' needs and interests to make provision for appropriate core and elective subjects for a well-rounded education at the different age levels.
- (vii) The lower and middle Basic Education curricula (for primary 1 to 6) will be in full use by the year 2014 and the upper Basic Education curricula (for JS 1 to 3) will be achieved by the year 2011.
- (viii) Every child is expected to complete primary 6 before being placed in Junior Secondary (JS1).

### **Challenges Facing Basic Science Education in Nigeria**

The challenges facing integrated science programme vary from one country to another. In a report by the United Nation Education, Scientific and Cultural Organization (UNESCO. 2014), the problems facing basic science education include:

#### **Poor funding**

This problem is more pronounced especially among developing countries due to bad state of their economy. Even when such funds are voted, it goes down the drain due to corruption and mismanagement.

#### **Poor planning**

Despite the noble objectives of basic science education, the programme does not get adequate attention among administrators especially in developing countries. This accounts for the failure of the programme especially in developing countries.

#### **Poor implementation**

Another challenge facing basic science education is poor implementation. For instance, in Nigeria one of the causes of the failure of the integrated science education programme in the early 1980s was as a result of poor implementation

#### **Inadequate professional preparation**

The Nigeria example shows that those teaching basic science are either graduates in Nigeria Certificate in Education (NCE) or graduates of single science subjects. More often, these teachers approach the teaching of the subjects with more emphasis on aspects of the syllabus that are relevant to their area of specialization in science.

#### **Lack of facilities**

In most developing countries, schools are ill equipped with learning facilities. Such learning facilities like laboratories, libraries, and Information Communication Technology (ICT) facilities are either scanty or are not available at all. This, to a large extent affects teaching and learning.

#### **Low level of research**

Except for developed countries where much effort, have been made in research, the reverse is the case in developing countries. Other challenges facing basic science education include; poor teacher remuneration and instability in school calendar as a result of incessant strike action by teachers.

Webster (2019) defined development as using scientific and technical knowledge to meet specific objectives. Development can also mean improvement in human lives as a result of increasing availability of social infrastructures such as good roads, health facilities, schools and abundant food production. Of course, there can be no development in an atmosphere of insecurity.

Development can also mean socio-cultural changes in which new ideas are introduced into a social system in order to produce per capital income and high standard of living through the

application of modern science and technology to improve social organization (Ibrahim, 2018).

On the other hand, goals is defined as desires or outcome intended to be achieved in a given period of time (Webster, 2019). There can be no meaningful development in any society if there are not set goals and objectives. As such, the need in this paper to examined the set goals of the SDGs document cannot be over-emphasized. Reports have shown that lack of development in many countries of the world especially in third world country is a s result sustainable effort in pursuing set goals or policies. This as a result of factors such as religious bigotry, tribalism, greed and bad governance among other things. (United Nations, 2018; Negedu, 2021).

### **Strategies in using Basic Science Education in attaining Sustaining Development Goals (SDGs) in Nigeria**

1. Curriculum experts should sustain efforts in areas like curriculum review, delivery, teachers' output, structures, facilities and course duration among other things to ensure quality control in the basic science programme.
2. The government should improve existing incentives like scholarship to students and better remuneration to basic science teachers. Also, such schemes should be introduced in states and local government where it does not exist.
3. Science educators should organize seminars that will provide policy makers and implementers the opportunity to gain insight into better ways of implementing laudable policies and research findings.
4. More time should be allotted to teaching basic science lessons. This is because basic science lessons involve more of hands-on-activity approach to teaching and learning lecture method,
5. There should be regular curricula review to ensure that content and methods of existing science curricula including the basic science curriculum conforms to current trends in science and technology education. This will go a long way in achieving the SDG goals in Nigeria.
6. Well-equipped laboratories and libraries with modern instructional facilities-should be built in all schools across the country, to facilitate integrated science teaching and learning.
7. More basic science specialist teachers should be retrained through in-service programme. for greater efficiency on the job.
9. Schools' administrators should regularly organize workshops, seminars and conferences, with themes that will aim at exploring ways of uplifting standards in basic science programme to ensure maximum output or result. This will contribute in achieving the desired outcome in Nigeria.
10. Basic science teaching should emphasize hands -on- activity and vocational skill development among learners; such skills can later be transferred by learners into vocations after leaving school. This will promote entrepreneurship in the society.

### **Conclusion**

The relevance of basic science education in attaining Sustaining Development Goals (SDGs) in Nigeria cannot be overemphasized. A careful review of trends in basic science programme

in Nigeria since independence in this paper is aimed at identifying strength and gaps yet uncovered in this programme. This will go a long way in helping science educators, administrators, policy makers and implementers to gain insight into appropriate measures that can be taken to ensure that the programme contributes to achieving the desired outcome of Sustaining Development Goals (SDGs) in Nigeria.

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