

REVISITING SCIENCE EDUCATION AND NATIONAL DEVELOPMENT: NIGERIAN SITUATION AND THE WAY FORWARD

Christiana Okwuoyibo Nwachukwu (Ph.D.)

Faculty of Education and Arts

Madonna University, Okija, Nigeria. West Africa

Abstract

A good science education programme is expected to achieve an appreciable national development. But, it is a reality that Nigeria as a nation is not developed in spite of the proposals of the successive governments as contained in the national policy on education. This means that the Nigerian science education programme is not contributing to the national development contrary to expectation. The impotence and disabilities are attributable to defects inherent or associated with certain factors like: historical evolution; aims and objectives; parental influence; gender factors; curriculum factors; teachers and teaching methods; availability of resources; evaluation processes; research and review among others. All stakeholders in education are involved. This situation tantamounts to a lack of agreement between intents and implementations. Likely remedial steps are therefore highlighted as well. The recommendations made include, proper use of research findings; adequate and proper training and retraining of teachers in contents and processes of science education; revisiting and off-loading the existing science curricula, elimination of gender biases; counseling parents/youths on the much needed national development; and; ensuring that all practices in science education are monitored and evaluated from time to time, with shift of emphasis away from paper certificates and rote learning, to, an integration of science, technology and society.

Introduction

The growth of any nation is a measure of its level of science education. That was why Orukotan (2007) stated that science education has introduced a lot of changes in our world today and it will continue to do so in the future. Achievement in science education will go a long way in reducing illiteracy and poverty, which

are impediments to national development (Nwachukwu, 2008).

Akpan (2008) opined that science contributes to the quality of life in such areas as health, nutrition, agriculture, transportation, material and energy production, and industrial development. He further stated that it ensures that the air we breathe, and the water we drink are life sustaining, and not vectors of disease and decay. He finally concluded that if science and technology form the bedrock of sustainable development, that this revelation should constitute a beacon to our nation, so that science education must be given prominence in Nigerian schools. Again, Ware (1992) stated that the International Council of Scientific Unions-Council on Teaching of Science (ICSU-CTS) summarizes the importance of science and technology to economic development as follows:

“Long term sustained growth can be assured only if the money invested in science and technology is matched by the provision of funds for complementary educational programmes directed both to the preparation of scientists and technologists and to the improvement in science literacy of the population as a whole..... At all levels from the ubiquitous “a man- in –the-street” to the most influential ministers, there is a tendency to take education for granted. But unless it is supported on the necessary scale, long term development will not be successfully achieved”.

It is in fact *generally* accepted that the adoption of scientific frame of mind is a prerequisite for development. Science has therefore become a crucial factor for sustainable development worldwide. Again, in any country, issues of education are of considerable importance for economic prosperity. In fact, no economy can be more stable than the nation’s education sector. That was why Adikwu (2008) opined that for any nation to experience economic growth, there must be a strong stimulation of science. There is really a yawning- gap between what the experts know and the untapped knowledge which should be known by the teachers and

students. This is because the rate of generation of new scientific knowledge is very fast.

This paper therefore dealt with historical overview of science education in Nigeria, the problems facing science education and possible remedies. Finally, some conclusions and recommendations were made.

Historical Overview of Evolution in Science Education in Nigeria

A historical sketch of curriculum development in Nigeria prior independence reveals that the curriculum then was geared towards the needs and aspirations of the colonial masters and missionary agencies. Hence, foreign curricula and materials were imported and adopted in Nigerian schools. Equipments and materials used were based on foreign prescriptions without recourse to Nigerian conditions, and aspirations. The curricular content was bookish. Skill acquisition and sciences and technology were embarrassingly absent in the colonial curriculum, a situation which was inimical to national development (Wokocha 1993). That was why Mba and Leghara (2008) stated that the genesis of science education in Nigeria is one of evolution rather than revolution. Before the year 1859, science was not included in the curricula for the primary and secondary schools in Nigeria. Rudiments of science in form of nature study were introduced in the school curriculum with the establishment of church Missionary Secondary school Lagos in 1859.

The period from 1859 to the present has witnessed the gradual development and implementation of science education in Nigeria. Between 1900 and 1960, the improvement was gradual. Thereafter, the science subjects became accorded priority attention in education following awareness that science and technology education is a prerequisite for technological and industrial progress. During an international Conference on Science held in Israel in 1960, there was an agreement

to explore the potential application of modern curriculum development technique to educational needs of Africa. This gave rise to African Primary Science Programme (APSP). In the mid-1960s the regional ministries of Education developed Primary Science Programmes such as Mid-West Primary Science Project (MPSP); Primary Education Improvement Programme (PEIP), etc. These projects were all imported from Britain and U.S.A. and adopted in Nigeria with the hope of serving our needs. Even though most of these are now defunct, the ideas got from them were used by Nigeria in developing indigenous projects being utilized today.

An urge for the need to re-examine the science curricular objectives, content, and evaluation led to the National Science Curriculum Development Conference in 1969. At this conference, several constraints and defective instructional procedures facing school sciences were identified (Bajah 1983). Thus, the defunct Comparative Education Study and Adaptation Centre (CESAC), with support from Science Teachers' Association of Nigeria (STAN), and other individual scientists developed the Nigerian Secondary School Science Project (NSSSP) including the texts in Biology, Chemistry, and Physics between 1970 and 1972. CESAC acted as the primary centre which played the role of a developer, facilitator, stimulator, and supporter. The centre trained personnel and helped in sourcing non-human resources for the successful implementation of its pilot projects through its pilot schools, workshops, and, evaluated studies of this project.

The philosophy of science teaching at this stage is to prepare the young ones for useful living; and provide adequate solid foundation for those proceeding for higher education. The emphasis is more on acquisition of scientific concepts and process skills. In the late 1970s, the Federal Ministry of Education assembled a group of Nigerian science educators to design a modern science curriculum in line

with the new policy on education. From this emerged the core curriculum for primary science, integrated science for junior secondary, Biology, Chemistry, and Physics, for senior secondary schools (SSS). The new SSS science curricula replaced NSSSP to meet the demands of the new 6-3-3-4 educational system. The contributions made by the Nigerian Educational Research Development Council (NERDC), and the West African Examinations Council (WAEC) and other bodies cannot be overlooked in this narrative on science education. These historical developments together with their inherent and associated factors have culminated into the state of science education in Nigeria today (Nwachukwu and Chukwuneke 2008).

Challenges of Science Education in Nigeria

Students have been performing very poorly in science disciplines at Senior School Certification Examinations (SSCE) as is evident from Chief Examiners' Reports (2000, 2003, and 2004). In view of the fact that the quality of science and technology education is a sine qua non for advancement of any nation, identification of major problems facing it will help to adopt the appropriate remedial steps. Aspects of science education occur knowingly or unknowingly during the informal, formal and non-formal education. This is because science is linked in many ways to society, especially through its technological application. Hence Ziman (1980) suggested that "the basic need in science education is to teach about Science Technology and Society (STS) and the various ways they interact with each other". But, this is not the case in Nigeria. The challenges of science education in Nigeria are subsumed in the above suggestions from Ziman. These challenges are associated with goals of science education, childhood home orientation/education gender issues, research and review, curriculum issues, training of teachers/educators, methods of teaching; use of computer and internet,

evaluation processes; issues of resources among others, and form the subsequent sub headings.

Constraints to Attainment of Aims and Objectives

The goals of science teaching included “.....produce scientists for national development” FME (2004:29).

The problem is that classroom teachers do not even think about the goals, and may even not know what the policy demands from their work. It is important that science teachers be trained and retrained on the goals of teaching science, since teaching without aims is like traveling without knowing the destination. In addition, having clear aims before teaching enables the teacher to select the content to be learnt by the learners, and to determine the methods to be used during teaching in order to achieve the aims. This will also help in the assessment procedure for evaluating or judging whether the aims have been achieved. The society should also be educated on the goals of science education. This will enable parents play their own role in the early education of the children before transition to school. It will also help to minimize gender-stereotyping of roles if females are encouraged to display their full potentials for national development from childhood period.

Role of Parents and Childhood Orientation

Much of what a child will become in future depends largely on how his childhood is formed. Parents should not withhold any useful information or knowledge from their children because this will impede their intellectual development. Every child ought to receive a smooth transition from home to school (Nwachukwu and Ogbamgba, 2006). Parents can prepare their children for transition from home to school by engaging in healthy discussions with them; telling them stories about great lives and places; exposing them to the world of

book; explaining situations and circumstances to them, taking them out for sight-seeing to places of educational interest; and guiding them to interact with their peer group (Nwachukwu, 2007, Ajaegbo 2000). Parents should also develop in their children reading, writing, and listening habits early enough in life by providing them with all relevant learning materials such as books, chalkboard, pictures, symbols, toys, crayons, pencils etc.

In addition, they should monitor and guide the use of these learning materials as well as encourage inquisitiveness and creativity. Children should be allowed to ask questions like what?, how?, when?, where? and why?. They should also be encouraged to watch educative programmes over the television. Teaching them how to operate the television, radio and toys during the early period of their childhood with supervision of these activities enables them develop their creative abilities. Illiterate and uneducated parents should seek help from their educated neighbours and relations. These early experiences contribute to preparation of an individual for active role in nation building since skills acquired in childhood are not easy to abandon (Nwachukwu 2008[b]).

Gender Challenges

Njoku (2008) opined that for any nation to achieve sustainable and rapid economic development, it is imperative that the females participate actively in science and technology activities. This is in line with the view expressed by Nyerere (1988) when he stated that “the way nobody walks far or fast with only one leg is the same way that no nation develops much or fast if half of her population the female folk, are left out in the science and technology (S&T) enterprise. Furthermore, Justice Development and Peace Commission (JDPC 2005) stated that women’s educational status in any nation correlates to its level of

development. That was why Nwachukwu (2008) investigated ways of enabling girls achieve maximally in science classrooms and found out that girls outperformed boys in cooperative learning environment in chemistry concepts. She then suggested that it is important that enabling environment for maximum performance of both males and females be adopted in all spheres of life. This will uplift the aspirations, confidence, image and intellectual development of the females in S&T education. In addition, many researchers at both local and international levels have documented the gender-disparity and differences in subject enrollment and achievement in S&T based courses and professions (Nwachukwu, 2005, Asoegwu 2008). According to Nkpa (1993) the enrollment ratios of males and females in undergraduate and postgraduate courses in Nigerian Universities were consistently skewed in favour of males (up to 67:1). Again, Odebode (2001) pointed out that, “it is disheartening to note that a very small percentage of employed females are in the Science, Technology and Mathematics (STM) education”. She further noted that in many countries the participation rate is higher in the primary and tertiary sectors than in the secondary sector of industrial production. This situation poses a threat to smooth national development and must of necessity be rectified. Possible remedial courses need to be identified and exploited with a view to giving a final solution to national development of Nigeria. This is because, there is an adage that “if a man is trained an individual is trained, but when a woman is trained, a nation is trained.

The Status of Curriculum Content

Offorma (2005) described curriculum as a vehicle through which education takes place. She further stated that it is the totality of the environment in which education takes place. In addition, she viewed it as involving the learner, the teacher; the content; the subject; the resources; the methods of teaching; the

evaluation as well as the physical and psychological environment, which must be adequate and conducive for learning to take place.

Science education curriculum is expected to equip learners with skills that will make them self-reliant, prepare them to enter into jobs and progress in them. This means that the curriculum should prepare the learner for entrepreneurship. The big snag here is that the curriculum operated in Nigerian schools is based on European culture which significantly differs from the culture where it is executed. As a result, students find it difficult to relate what they already know to what they are to learn due to cultural settings. Again, the language of delivery is foreign to the students.

Another very important problem is the place of West African Examination Council (WAEC) syllabuses in the curriculum. The WAEC has been an accredited examining body for award of certificates at the expiration of secondary school career. In Nigeria, a great importance is attached to end certificates. Similar cases are problems emanating from textbooks which might not have been properly edited, and might likely furnish wrong information.

In addition, there is problem of curriculum overload, which, according to Offorma (2005), is the first set back to attainment of the goals of education in Nigeria. She opines that the number of subjects offered by secondary school students for certification is rather many. Adeyegbe (2004) was of the view that some of the contents of science curriculum are of little relevance to the general education of the intended level and cannot even be covered within the time limit. Other researchers also held the same view based on investigations. They therefore concluded that if the objectives of science education are to be achieved for sustainable development, that curriculum planners should off load the curriculum.

That was why Adikwu (2008) stated that the problem with science education

is a lack of good curriculum, that curriculum must be developed, and that there should be a readily-available inquiry-based curriculum. He further stated that curriculum development is a very costly, time consuming process, requiring long-term revision, field-testing, and evaluation by a highly talented, motivated, and educated development team. He continued that one reason to develop new curriculum is to introduce modern scientific techniques derived from current laboratory experiments. He also advised that teachers should always be trained on new curriculum. And finally that science curriculum at all levels must be global and must address the millennium development goals if Nigeria must not be left behind in the globalizing world.

Adherence to these widely researched statements, opinions, and suggestions would serve as remedial steps to short comings of science education in Nigeria.

Problems in the Science Classrooms

Issues Relating to Science Teachers and Methods of Teaching

Most practicing science teachers do not possess adequate training for the job. Since the science world is continuously changing teachers, require to be constantly trained and retrained to update and upgrade their knowledge in the job and in the contents to be facilitated. It is a common adage that no educational system can rise above the level of its teachers.

Two spheres of science teachers exist in the school system. The first groups are the proper professionally trained teachers and educators who lack in-depth knowledge of the science subject content. The second groups are those who have mastery of the subject but are not professionally trained teachers. These two categories form the implementers of the science curriculum in Nigeria schools. They all perfect on the job with years of experience. The snag is that at this period

when they should be displaying expertise in classroom, they become head teachers and go into administration. Their services as classroom teachers/educators get lost to the system.

Science teaching has both content aims and process aims. The guiding principle should be: connecting knowledge to life outside the school; ensuring that learning shifts away from rote method; and enriching the curriculum so that it goes beyond textbooks. In addition, there should be emphasis on sensitivity for preservation of environment and social harmony and building a culture of peace. This could be achieved by making examinations more flexible, and, integrating them with classroom life and, nurturing an identity soaked in caring concerns, with the democratic policy of the country.

That was why Busari (1998) documented that “the challenges of science education are to bring the full range of young people a comprehension of the nature of science as a humanistic enterprise”. This is in line with the intended goals of F.M.E.(2004). Again, focusing the process aims, Garson (1988) stated thus:

“.....if children are to learn science.....we must give them respect for observations rather than the pronouncements of the textbooks and teacher prophets we must see to it that children understand experimentation as a means of compelling nature to answer their questions children must know that no one really knows. If we can give children these insights, they will have learnt science, no matter what content they have covered”

The development of thinking, practical and communication skills, is an important aim of science. These processes are vital to science teachers and learners. Science students should be able to use certain tools, make and record accurate observations etc. This is hands-on method of teaching.

Hands-on activities are very rare in the Nigerian secondary schools. This is because of the following reasons: non-availability of materials; lack of fund for

procurement; inadequate preparation of teachers; use of WAEC syllabuses for teaching etc. In addition, researchers have found out that no one single method is best for teaching, and that it is the responsibility of the teacher to find out the best approach to conduct his lesson. Teachers who properly understand and appreciate science and reasons for teaching science are conversant with the best methods for achieving the goal.

That was why Nwachukwu (2005) investigated the effect of use of cooperative and competitive interaction strategies in teaching chemistry on Nigerian secondary schools. The research revealed that the two strategies are superior to the conventional practices in Nigeria. Infact, the female students out performed the males in cooperation whereas the males out performed the females in competition. Also, Chukwneke and Nwachukwu (2006) investigated the use of concept mapping in teaching biology in Nigerian Secondary schools. The study revealed that use of concept mapping enhanced the acquisition and retention of biology better than the conventional practices. The problem with Nigerian educational sector is that education research findings are not utilized for the education benefit of the masses. Hence, problems in science education continue unabated.

Use of Computers and Internet in Classrooms

Non-usage of Computers and Internet for Science Teaching.

These facilities are generally lacking in the nation's science classrooms. According to Olele (2008), application of computer and Internet technology in education is a primary concern for education all over the world. In developed countries, Computer and Internet are utilized in the classroom for teaching and learning different subjects. Research in education has revealed that the use of

computer-based resources enhances the teaching , scientific enquiry and scientific literacy. Using computer skills, application programmes, accessing information from the internet or CD-ROMs, interactive video disc instruction, Computer Assisted Instruction (CAI), Computer Based Instruction (CBI), Computer Learning (CBL), e-learning etc, offer certain advantages over traditional methods. These make learning easier, faster, exciting, and interesting to the learners.

In Nigeria, the government at all levels, has not done enough generally, to provide the resources to support the use of computers in education. Computer can only be spotted in few primary and secondary schools. This situation also poses some constraints to effective teaching of science education for nation building. This is because, enabling the learners see what the developed countries have achieved and the processes adopted in the achievements, could serve as a motivation for them to imitate development.

Problems of Evaluation in Science Education.

Evaluation in education has a purpose as well as the process. The purpose of evaluation is to improve the quality of teaching and learning. It is the improvement of practice in education so that aims and objectives can be realized. Where the aims and objectives are not achievable, then they may need to be evaluated so that they can be attained. This means that all educational practices which include the following: aspects of learning and teaching like the curricula; teaching methods used; assessment procedures employed; aims and objectives as well as the performance of individual learners, should of necessity, be evaluated.

The Nigerian educational system emphasizes the evaluation of the performance of the individual learner, hence the emphasis on paper certificates. Learners hence struggle to get certificates by any means which culminates in

examination malpractices. These certificated ex learners are fake products, and, are not self-reliant. This is a defect in the programme of science education of the nation. Also, the non-evaluation of other science educational practices is a serious problem in implementation of science education in Nigeria Secondary Schools.

Inadequate use of Research and Review

The presence of a vibrant research machinery is very essential for the success of any developmental venture. However, it is on record that the universities and polytechnics, the research division of WAEC, the NERDC, etc are making attempts to perform these functions, though, more is expected of them. The problem is that Nigerian government is not adequately utilizing the findings from these researches for review of the situation in the education sector. This poses a problem to development.

Problem of Resources in Science Teaching

The key resources are financial resources, human resources, infrastructure and equipment. The Nigerian government provides the fund for running the public schools at all levels, with exception of the private schools. The government also recruits and pays the staff salary; attempts to provide some infrastructure and science equipments.

With the proliferation and politicizing of schools, it is not possible that the government alone can provide adequate resources for these schools. This means that resources for proper science teaching are lacking at all levels.

Remedial Steps/Way Forward

The government as well as concerned associations, like STAN, individuals,

are putting in some efforts to remedy the situation in science education sector. The journey of a mile starts with a step. The Federal republic of Nigeria FRN (2004:5) stated the government far-reaching intention as:

“..... Far reaching provisions Should transform all aspects of the nation’s life overtime. To this end, the government set up a National Policy Implementation Committee to translate the policy into workable blue prints that would guide the bodies whose duty it would be to implement the policy. The committee was also to develop monitoring system for educational plan as it evolved”.

If the above plan materializes, then most of the challenges of science education would have been tackled.

The establishment of ‘special science schools in the country in the 1980s helped to boost the scientific section of the country. A good percentage of the products found it easy to emerge as computer scientists, medical doctors, engineers, pharmacists and other sciences and science-related professions. Again the introduction of Universal Basic Education (U.B.E) is a remedial step for eradication of scientific illiteracy at least at the junior secondary school (JSS) level. This is because, with free compulsory 9 years education (3 years JSS inclusive), more children will be exposed to integrated science learning at JSS level.

In addition, job employers nowadays de-emphasize certificate/paper qualifications and watch out for what an individual can do. That is why today in Nigeria, you find a Pharmacist working in a bank, due to possession of computer skills. Nigerian Universities nowadays conduct University Examinations/aptitude test for placement of students in various academic disciplines.

Again, inclusion of entrepreneurial education in general studies in the Nigerian Universities will enhance the output in science education, which will in turn aid development of the nation.

The government is trying to improve the salary of the teachers. This will

give them job satisfaction and enhance their productivity.

The establishment of women education unit of the federal ministry of education in 1986 is an effort to improve female education generally and science and technology education in particular. It is necessary that all these moves by the government be monitored, supervised and evaluated from time to time, to be brought to fruition.

Conclusion

The paper gave an overview of the evolution of science education in Nigeria, highlighted some shortcomings in the overall effectiveness of the programme in national development. These shortcomings were traced to the following: aims and objectives; home childhood orientation; gender factors; curriculum issues; classroom interactions-teachers, teaching methods, computer and internet; evaluation processes, research and review, and problems of resources. Possible remedial steps adopted by the government were highlighted and the following recommendations made.

Recommendations:

- 1** Proper use of findings and recommendations from scholarly research and review should be made for uprooting the impotence and disabilities of Nigerian science education in development.
- 2** Nationwide and JDPC programmes should be organized for youths and young parents on the role of parents and childhood orientation to science education for national development.
- 3** The science and technology curricular should be de-sexed, and gender-inclusive textbooks in science and technology should be popularized.
- 4** Inclusion of learning about computer and its functions as goals in themselves

and as a means to an end must be enforced as a sine qua non in science education for both the individual and nation building. The epileptic power supply in Nigeria should be controlled if any meaningful science educations for nation building should ensue.

- 5 The S&T curricular be offloaded. The contents should be selected to reflect the culture, needs, demands, and aspirations of the society based on the criterion of significance.
- 6 Evaluation of all science educational practices must be done from time to time. There should be both formative evaluation and summative evaluation to ensure that the aims and objectives are attained.
- 7 Adequate training, retraining, and motivation of teachers is very necessary for effectiveness. Adiukwu (2008) suggested that a few highly motivated teachers be trained to act as master teachers who will produce “trickle down” reform when they return to their schools.
- 8 Laboratory work should be beefed up. Over-crowded science classes should be discouraged.
- 9 Classroom interactions which will enable both males and females achieve in science disciplines should be adopted for sustainable individual and national development.
- 10 Ways of generating money to fund all aspects of science disciplines should be evolved and utilized by the government.
- 11 Examinations should be made more flexible and integrated with classroom life and patriotic feelings. Finally,
- 12 Ensuring that knowledge acquired in science education is connected to life outside school, that learning shifts away from rote methods, and enriching the curriculum so that it goes beyond textbooks; that is to teach science,

technology and society (STS), and their interactions with one another as a way of uprooting the impotence and disabilities of science education.

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