Strategic Issues in Promoting Effective Science, Technology and Mathematics Education for the Achievement of Millennium Development Goals (MDGs) in Nigeria

By

DR. OMIKO AKANI
Department of Science and Computer Education, Ebonyi State University, Abakaliki.

Abstract
This paper reviewed the issues in science education in Nigeria from pre-independence to the present day; the paper also highlighted the strategies that would be employed by Science Educators and Nigerian government in achieving the Millennium Development Goals. Such strategies include proper Funding of Education, provision of Information Communication and Technology (ICT) Training Programme for Science Teachers in Nigeria, provision of Infrastructure, Quality Admission of Students into Education Courses, proper Implementation of Science Curriculum and total eradication of Examination Malpractice, among others.

Science education first appeared in the Nigeria curriculum in 1859 when the Church Missionary Society (CMS) Grammar School, Lagos introduced the rudiment of nature study. Baja (1982) in Igwe (2003) described it as the learning of the environment and hygiene. Other schools like Saint Gregory’s College, Lagos; Hope Waddel institute, Calabar and Baptist training, College, Ogbomoso, followed later in teaching nature study. By this time, according to Abdullahi (1990), a rural science syllabus was formulated for science teaching at the primary school and other biology related subjects were introduced such as botany, physiology and agriculture at the secondary schools level.

Several world events related to science and technology has affected the teaching of science not just in Nigeria or in Africa but throughout the world. According to Dienye and Gbamanja (1990), Ali (1998) such world events include gaining of independence by many countries of the world and movement to the moon, among others.

In Nigeria, science education curriculum has undergone several changes; this is done with the aim of meeting the industrial and scientific needs of the country. Ebina (2010) observed that the cooperative arrangement between the Science Teachers Association of Nigeria (STAN) and the defunct Comparative Education Study and Adaptation Centre (CESAC) now merged into the Nigerian Educational Research and Development Council (NERDC) heralded the first national effort at science curriculum development to improve science education in Nigeria in 1969. The result of this 1969 Curriculum Conference was the formation of two major Science Projects, the Nigerian Integrated Science Project (NISP) and the Nigerian Secondary Schools Science Project (NSSSP). Later, the National Primary Science and Mathematics Projects (NPSMP) were developed. Presently there is the Basic Science and Technology Project (BSTP) for the primary schools. The innovations introduced by this curriculum changes centered on the integration of theory and practicals into the students-activities based science curricula.

In order to achieve good results in the Science Curricula Projects Government Policies were specially geared towards encouraging science teaching and learning at all levels. Ivowi (1990) observed that Government Science Policies have aimed at boosting and improving science education. However, despite the gains in curriculum development and efforts at their implementation stage reports clearly show poor students achievement, Science Teachers Association of Nigeria STAN (1995), Ivowi (1995) and Okebukola (1995) in science, particularly at the secondary school level of education. Some studies in research in science education, Ogunleye (1994) and Omiko (1997) indicate very few studies in teaching and learning of science and lack of adequate attention to the students learning difficulties. Hence, those issues need to be tackled in order to meet the Millennium Development Goals (MDGs) in Basic Science and Technology and Mathematics Education in Nigeria.

**Issues in Funding of Science and Technology Education**

Grossly underfunding of science education in Nigeria has resulted in several problems encountered in our secondary schools. Such problems include lack of adequate and appropriate instructional materials and equipment, empty laboratories or laboratories that exist in name only or sometimes in dilapidated or shoddy buildings, inadequate and sometimes poorly trained Science staff, poorly motivated staff and students; lack of Science programmes geared toward the processes and products of science or toward individualization to meet the students needs; interest and abilities and lack of a clear understanding of what our science education objectives are and how to achieve these objectives.

**Issues in the Content of Science Curriculum and its Implementation**

Adequate curriculum content is very important for effective science education. Offorma (2005) stated that functional education is determined by the quality of the Curriculum Content and its implementation. Ivowi (2009) stated that functional science curriculum content must be valid, relevant, significant, learnable, consistent with current social realities of the country, useful and reflect the interest of the learners.
Ebina (2010) stated that valid curriculum must be related to the philosophy and objectives of education. Curriculum planners and developers according to Ebina (2010) attempted to take care of these issues but there are still some barriers to the attainment of goals of Science education in Nigeria. Some of the barriers according to Omiko (1997) include, curriculum overload, overcrowded classes, population explosion in schools, lack of motivation of the Science teachers by the government, poorly equipped laboratories, and examination malpractices among others.

The present science and technology education curriculum in Nigeria advocates hands-on processes and skills acquisition, most of our children in both primary and secondary schools are not exposed to these real situations in schools. This means that the scientific, vocational and technical aspects of education of our children are lacking. In some schools, there are no laboratories or workshops for practicals and where laboratories are available, practical works start very late, at times two weeks to the external SSCE/NECO practical Igwe (2003) and Omiko (1997).

**Issues of Teaching and Learning of Science and Teacher Quality in Nigeria**

Teaching as a profession needs special skills, the issues of teaching and learning of science revolve around the quality of teachers, the teaching strategies adopted, instructional materials (infrastructure and equipment) available for the teacher to use. In agreement with the above statement, the Federal Republic of Nigeria (FRN, 2004:39) stated that since no education system may rise above the quality of its teachers, teacher education should continue to be given major emphasis in all educational planning and development. Teacher education is one of the principal factors for education and national development in any society. Ukeje (1995) stated that education unlocks the door for modernization, but it is the teacher who constitutes the primary and vital aspect of education and national development, since the teacher translates theory into practice. The implication of the above statement is that teacher education in Nigeria should adequately prepare the teacher for Professional Competency. Without good teachers we cannot have good education and without good education we cannot achieve satisfactorily our national development scientifically and technologically. Onyejemezi (2001), stated that a system of teacher education that is most suitable for the preparation of science and technology teachers for a more fulfilled role is Competency-Based Teacher Education Approach (CBTEA) in the training of science and technology teachers. This approach will provide the teachers with the necessary competencies in teaching all the science and technology concepts. Therefore, we need to develop an approach or strategy where the teachers and learners of science should be engaged in various activities during the teaching and learning process.

**Issues of Science Teachers Education Programmes**

There are basically two institutions that produce qualified teachers in Nigeria; Colleges of Education and Faculties of Education in Nigerian Universities. The entry/admission requirements into these two institutions vary; this variation in admission requirements and certificate obtained at the end of the training causes differences in the qualities of teachers we have in the teaching profession. Currently
there are debates among scholars and science educators on the effectiveness and quality of Nigerian education. The issues of quality of teachers need to be addressed if we must achieve our Millennium Development Goals.

**Problems of Teacher Education**

Adegoke (2000) stated that the following are some of the fundamental problems facing teacher education in Nigeria. According to him the problems bothered on the following questions and issues.

- What should the education of teachers be like in Nigeria?
- How should teachers be educated?
- Should teacher education in Nigeria only focus on subject mastery?
- Should teacher education pay adequate attention to both subject mastery and pedagogy?
- Should pedagogy come later or be an integral component of teacher education?
- Is the present arrangement in favour of education courses to the detriment of subject mastery?
- How should the components of teachers’ education be proportioned, combined and ordered?
- What should be the duration for teacher preparation and how should it be structured?
- What should be the scholastic background of the recruits in order to make possible the introduction of effective and adaptive teachers?
- How can teachers centres/institutes relate their curricular more realistically to the needs of the society; and that of the trainees?
- How can the problem of balance and integration in the structure of teacher education be solved?
- How does the country solve the problem of recruitment, selection and retention of competent and qualified people in the teaching profession?
- How can the low status often ascribed to teaching be converted to high status?
- How can the dwindling enrolment in teacher training institutions be arrested?
- Should the government reduce or remove its financial obligations to education studies?
- How motivating are the conditions for granting study leave with or without pay for practicing teachers?
- How satisfactory is practice teaching organization and evaluation?
- How adequate are the infrastructural facilities for teacher education? Among many other questions and issues. These issues and questions are very crucial in teacher education in Nigeria. They are all true and they signify problems facing science, technology and teacher education in our country. These problems must be solved if we must achieve our educational objectives.
Science Teachers’ Competencies and Self-efficacy in their Instructional Delivery

A teacher must be competent to teach the subject he has been trained to teach at the appropriate level. The present system of education, through the National Policy on Education (FRN, 2004) has made adequate provision for the professional training of teachers to enable them to teach all the subjects in schools. This is to motivate teachers and provide adequately for their initial training and upward growth in the teaching profession. Ivowi (1987 and 2009) stated that the National Policy on Education (FRN, 2004) provided for teachers competency in the following ways:

- Mastery of subject matter, appropriate and relevant knowledge of fact, principles, concepts and laws needed to sustain cognitive development of the students.
- Pedagogy, exposure and experience in principles and practice of education and in the art of teaching as an aid to meaningful learning.
- Skill processes: facilitate the development and acquisition of appropriate manipulative and other skills in students and also laboratory management techniques and workshop practices where applicable.
- Resourcefulness, improvisation of teaching aids of relevant descriptions, some measures of detection and maintenance/repairs of minor faults in laboratory apparatus, equipment and teaching aids.
- Behaviour motivation, through appropriate behaviour, mode of dressing, and reaction to stimuli in the normal course of interacting with students with a view to stimulating interest in them.
- Evaluation, self and students’ evaluation through appropriate construction of tests, their analysis and prediction/inference.

The question is how many teachers possess these competencies? For a teacher to teach effectively he/she must possess all of these competencies? Omiko (2011).

Issues of Teaching Strategies, Provision of Infrastructure, Apparatus /Equipment and Laboratory Management and Organization

Science and technology are activity-based subject. They are taught through the use of laboratory activities. Basic science and technology, Biology, Chemistry and Physics are subjects that demand hands-on activities. These subjects need to be taught in the laboratory where science equipment/materials are provided. In some schools, there are no science laboratories, and where laboratories are available, there may be no equipment or materials needed for practical works.

The government should equip the laboratories and provide or employ laboratory assistants who would have the knowledge of laboratory work. This would help to reduce the work load on the part of the science teachers and improve their efficiency. The attitude of some science teachers is discouraging some of them refuse to conduct practical lessons until very late in the final year of the students. Some of them start teaching the practical aspects of the sciences only when they get the WAEC/NECO instructions. This type of attitude should be discouraged if we must develop scientifically and industrially. The equipment and instructional materials
available in the laboratory should be used for the benefit of the learners and the society at larger.

**Issues of Providing Information Communication and Technology (ICT) Training Programme for Science Teachers in Nigeria**

ICT is a new innovation in science education in Nigeria. The task of integration of ICT in science education is facing a lot of challenges because most science teachers lack the requisite knowledge on how the (ICT and computers) are used in instructional delivery.

Information and communication technologies (ICTs) are major tools for advancing science teaching, learning and research. It can help broaden access to education and improve learning outcomes. The internets can help teachers and lecturers to obtain current authentic and quality information needed in their subject area. Presently, only few teachers and lecturers know how to browse and down-load necessary learning materials. Therefore, exposure of science teachers to ICT will definitely change their teaching qualitatively. The government can assist through a good incentive welfare package that could make it attractive for ensuring that science teachers undertake training in ICT in order to acquire the skills and knowledge they need in using ICT in their instructional delivery. Unless science teachers model effective use of technology in their own classes, it will not be easy to prepare a new generation of teachers who would effectively use the new tool for teaching and learning of science.

**Issues of Quality Admission of Candidates into Teacher Training Institutions**

The era of admitting students who scored very low marks in the JAMB into Faculties of Education should be over. There is that strong belief that input determines output. Steps should be taking to ensure the admission of high quality candidates for science teacher education programmes and to give them necessary training that would assure them of a rewarding career so that they turn out willing and quality teachers.

**Issues of Payment of Science Teachers’ Allowance/Motivation**

Non-payment of science teachers allowance and poor remuneration make it extremely difficult for the teaching profession to attract and retain the top quality personnel that are required to function in the system. Teachers are poorly paid and denied their professional rights and other benefits enjoyed by other civil servants. Lack of motivation hinders science teachers’ effective performance. To enhance teachers productivity; they need to be treated equally like other civil servants their rewards should be both on earth and also in heaven.

**The Issue of Examination Malpractice**

Performance of students in examination is the major yardstick for measuring, judging and selecting manpower for jobs. Unfortunately, it does appear from current experience that student teachers use various means and methods to manipulate
examination conditions to their own advantage. This bad behaviour has to stop if we must inculcate the right attitude and produce competent teachers.

Conclusion

The issues raised in this paper are crucial and need to be taken seriously by the Government, Teachers, Parents, and other Stakeholders in Education sector.

The issues of Funding of Education, provision of Information Communication and Technology (ICT) Training Programme for Science Teachers in Nigeria, provision of infrastructure, quality admission of students into education courses, science curriculum and its implementation and Examination Malpractice need to be addressed if the millennium development goals (MDGs) are to be achieved.

Recommendations

This paper reviewed the critical issues in science education and education in general. These issues need to be tackled urgently if the nation is to achieve meaningful development in the education sector. To tackle the issues raised, I make the following recommendations.

- Issues concerning education should be borne out of principles: that is the governments should evolve principles and policies that would help to enhance the development of science and technology education.
- Government should not play politics with science, technology and mathematics education
- Money meant for education should be provided to the school authorities or Ministries of Education for proper development of our schools.
- Government should make policies that should serve as guidelines in the provision of science and technology education, facilities and equipment for schools and on a sustainable basis without which no school would be recognized or approved for the Senior Secondary School Certificate Examination (SSCE) and National Examination Council (NECO).
- There is the need to redefine the focus of science education at the basic (primary) education level, where the foundation of science and technology education is adequately provided for other levels would also benefit.
- There is the need to use sound educational objectives, because it has been identified to be an indispensable component of curriculum development. They provide basic communication devices between the developers on the one hand and the teacher and students on another.
- Qualified science teachers, with at least NCE certificate should be employed to teach the basic science and technology at the primary school level. When qualified teachers are assigned to teach at the basic education level, they know the key concepts in science and technology and educational principles, they would be in a better position to impact their knowledge to the students.
For the quality of knowledge students obtain from science education to be a reflection of the quality of the teachers, specialized teaching should be adopted in our primary and secondary schools.

Adequate funding of science, technology and mathematics education should be ensured by enacting a law that would appropriate a specified percentage of National, States and Local Government budgets to science education and other education sectors.

References


