

**THE UNFINISHED AGENDA OF RE-INVENTING SCIENCE  
EDUCATION IN NIGERIA: MYTHS AND POLICY OPTIONS****Jacinta A. Opara, PhD**Center for Environmental Education,  
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Chalco-Mexico**Abstract**

*Throughout history, science has been an important instrument per excellence for development. As a tool in technological advancement and contributing to social and economic growth, science teaching-learning has become an accepted and indispensable aspect of the mainstream of educational systems in developed and developing countries. Globalization has its challenges amongst which conversation of the environment, population explosion, desertification, soil erosion, pollution, HIV/AIDS and increased use of science and technology. It is imperative to strengthen all the instruments of Science, Technology and Mathematics (STM) education especially the curriculum so that may equip learners adequately for survival in age that will be dominated by science and high technology. The close and mutual beneficial trilateral relationship among STM education will equip the learner with functional scientific knowledge for technological development. This issue becomes important once again in resonating with research on STM education as a way forward in the context of globalization.*

**Keywords:** Science, Technology, Mathematics, Education, Students, Teachers, Curriculum, Nigeria

**INTRODUCTION:** Science and technology have long been recognised as the instrument per excellence for nation building. Every country today craves for science and technological advancement. Science is a way of knowing things about the universe we live. The study of science provides bases for the utilization of facts, theories, laws and principles in technology. Technology can be said to be invention of new things and processes or the improvement of older ones to the services of humankind. Science and technology have since become very closely linked. The symbiotic existence and its unification have assumed an objective reality.

The actual conception of mathematics is quite clear. The subject in whom pure and applied mathematics is used for the purpose of solving system is desirable because natural barriers placed on human by nature are removing by the system. Mathematics is a complex field and not really a single subject. It is the study of quantities and relations through the use of numbers and symbols (Aghadiuno, 1992).

Science and technology are two sides of the same coin. They are therefore indispensable components of the development challenge, and mathematics is fundamental. A nation that cannot use science, technology and mathematics education is not only beginning to change but is yet to become pronounced as to modify things for a suitable national development.

Government of Nigeria in its determination and intended commitment to ICT utilization for educational, economic, socio-cultural and political development released a 59-page policy statement to ensure that Nigeria is not left behind in the global ITs. It has been stated for example in the policy that ICT should be used in schools and that universities should introduce in their curriculum a course on "...ICT use in education" (FRN, 2001).

The potentials of ICT to facilitate students learning, improve teaching, enhance institutional administration and restructure of education programmes and classroom facilities have been established in literature (Kazu & Yovulzalp, 2008; and Yusuf & Balogun, 2011). Teacher attitudes toward computer technology may be a significant factor in the use of computers in education. To promote computer literacy of both teachers and students, the government is investing considerably. But issues such as inadequate ICT facilities and utilization are still persistent. ICT is influential in providing equal education for all students.

Nigeria developing country cannot be said to have drastically changed to attaining this target. At the verge of new millennium, this is an issue that deserves close examination. The idea of STEM education has been identified for long as a possible path to technological development. Despite these efforts Nigeria remains backward. It is on the basis of these earlier attempts that we are in the new millennium and its attendant challenges, expectations and realities.

**SCIENCE CURRICULUM REVISITED:** To teach any subject effectively, one must know what the subject is all about and for what purpose the subject has been introduced into the school curriculum (Obomanu, 1999). Hence, it is pertinent for science teachers to raise questions such as Fafunwa (1969) cited in Opara *et al* (2010) raised, thus:

*For what purpose was science first introduced into elementary and secondary school programme? What are the historical backgrounds of the development of science programme from their early appearances as part of the general education of children? What are the trends of continuity that has occurred in Nigerian schools science programme? And finally, how has educational / psychological theories influenced the selection, organization and presentation of science materials as part of the school programme?*

The questions are important for those engaged in the teaching of science whether at the elementary or secondary school level. It is no gain-saying that interest in science learning is increasing in all countries of the world. Each country is striving towards producing more and better trained corps of scientists, engineers and technologists. This is justified for; science has lately assured the importance of the foundation of national power and productivity. Therefore, the primary task of the science teacher is the transmission of selected experiences in science to students.

The Encyclopedia International (1979), define teaching as “the art of informing or instructing or providing guidance, suggesting activities and supplying materials to stimulate learning. The actual process of teaching therefore is the transmission or communication of what is to be learned by the “teacher” to the “learner” in a manner that will enable the learner to develop the necessary skills for the understanding and utilization of what is to be learned.

Teaching may be, regarded according to Gbamanja (1992), as the organization of curricular and relevant resources, and the directions of experiences and activities to facilitate meaningful learning and this leads us to the question, “What is science?”

The science manpower project 1960, defined science as a cumulative and endless series of empirical observations which result in the formulation of concepts, laws and theories with both concepts and theories being subject to modification in the light of further empirical observation . Based on this definition science is both body of knowledge and the process of acquiring and refining the knowledge. As a method for tackling problems, the scientific method consists of the processes of observation, and experimentation leading to a rational explanation for the nature of things or of processes. Often new ways of doing things are discovered in the effort (Opara and Ellah,2009).

Furthermore, the new educational system generally known as the 6-3-3-4 system of education was in a bid to utilize an educational system which should be related to the aims and goals of Nigerian society. According to National Policy on Education (1981), one of the educational aims is to “inculcate creativity” to the child. Teachers can aid, creativity by stimulating students, by uncovering latent talents and by respecting the originality and individuality of their students through inquiry emphasis. The goal of science teachers should be to lead the student from passivity to activity and from imitation to creativity. This new educational system is aimed at presenting the sciences as system of inquiry rather than simply as bodies of knowledge.

**CRISIS – STATE OF STM EDUCATION:** The National Policy on Education of Nigeria (1981) encourages the study of science and mathematics in our schools. At the pre-primary

level, children practice put together and take-away, colours, shapes, nature of toys and scientific games, at the primary level, pupils study addition, subtraction, basic science and primary science. In secondary school, students study different subjects such as further/additional mathematics, mathematics, physics, chemistry and biology and also the inclusion of technical subjects such as applied electricity, metal work, electronics technical drawing, woodwork, building construction and Auto-mechanics. At the higher education level, pure and applied mathematics including various advanced sciences are studied.

In spite of the efforts made by Nigeria government to the promotion of a sound educational policy, the schools appear to have failed to meet the nation's expectations and realities especially in the science, technology and mathematics education. Several Nigeria studies have revealed that pupils and students are not achieving sufficiently in these subjects studied in the schools. Studies have also attempted to probe the poor performances of the students in the schools (Onwu and Asuzu, 1987; Ahiakwo, 1993; Ahiakwo, 1991) factors such as teacher education (Adigwe, 1993a,) Colonialism (Opara,2003) lack of interest/motivation (Busari, 1991; Akpan, 1991) robustness of the syllabus (STAN, 1992) negative attitude (Maduabum, 1993) inadequacy of science laboratories (Oladumeji, 1978), Government policies (Igwilu, 1993) and language (Olawaju, 1991;Opara, 2011) associated with the student's poor performance.

Also some studies have attempted to probe into how the students perceive various topics taught in the STM education (Onwu and Ahiakwo, 1986; Onwu and Okpeke, 1985). The findings of some of these studies are as follows:- students perception of the difficulty of topics and also the image of science; schibeci and Sorensen, 1983). Findings of these studies have implications for STM education. Such education has been as involving magic, white-man's lies. Besides the type of science taught by the teachers and learnt by their students may be close to "bucket science" (Gordon, 1984) or "Pop science" (Basalla, 1976) different from popular science which relates to the actual practice of the science community.

STM education is an enterprise, forming an integral part of human society. Few students now chose to study science subjects at senior secondary school level. Because of misconception and negative perception of STM education and also late entrance into the study of science makes science attain a mystical nature in the school. Students now feel it is a difficulty and unattainable subject to study. Even the production of introductory technology teachers at the junior secondary schools level in few colleges of education (technical) in Nigeria is very low. Some academic year entrance is than 1000 students. This is an issue because greater percentage of students diverts their interest to arts and social studies. As a

result of these crisis sate in STM education the student’s achievement as well as that of the nation is at the level. The following SSCE result between 1988 – 1994 in science and mathematics states a decline in academic achievement of the students.

**Table1: Statistic of Achievement in SSCE (Science/Mathematics) 1990-94**

YEAR	MATHEMATICS		BIOLOGY		CHEMISTRY		PHYSICS	
	Grade 1-6	No. SAT%	Grade 1-6	No. SAT%	Grade 1-6	No. SAT%	Grade 1-6	No. SAT%
1988	93,657	(11.0)	89,342	(9.3)	34,508	(20.7)	26,279	(31.5)
1989	91,142	(8.8)	87,710	(11.8)	35,702	(10.8)	28,525	(9.5)
1990	195,133	(6.3)	285,690	(25.6)	80,059	(4.1)	63,161	(20.1)
1991	294,079	(6.3)	285,690	(25.6)	116,526	(10.3)	96,742	(16.3)
1992	361,506	(11.4)	355,582	(28.1)	140,856	(19.0)	122,809	(16.3)
1993	491,756	(13.2)	481,034	(28.7)	170,537	(23.0)	152,276	(24.4)
1994	518,118	(14.2)	508,384	(11.4)	161,232	(23.7)	146,000	(14.7)

Source: Office of the Senior Deputy Registrar, WAEC, Lagos percentages passes at grades 1-6:

**Table 2 : Statistic of Achievement in SSCE (Technical subjects) 1988-89**

Subjects	1988	1989
Metal work	760 (37.1)	1058 (27)
Wood work	1185 (11.7)	1404 (3.8)
Auto mechanics	490 (30)	444 (7.9)
Technical drawing	6,303 (13.9)	5,256 (13.5)
Building construction	218 (34)	189 (20.6)
Applied electricity	611 (2.8)	535 (19.8)
Electronics	234 (31.6)	266 (9.4)
Total	9831	9149
Average %	(23.0)	14.6)

From WAEC 1989 and 1990 Annual Reports percentages at grade 1-6

STM education in Nigeria lags behind and is surrounded with various crisis as discussed as curriculum crisis.

Government policy crisis

Language crisis

Inspection/supervision crisis

Teacher education crisis

Science enrolment crisis

Laboratory crisis

Image of science crisis

Instructional methodology crisis

Technological development/innovation crisis.

Nigeria is left out of the current efforts of fashioning appropriate science curriculum and instructional methodology that could actualise the visions of STM education. The issue is that the impact of this crisis is slowing down the rate of the required development. The way out these problems is to eliminate this crisis to enhance STM education for sustainable development.

**THE UNFINISHED AGENDA :** The world in which Nigeria is part is changing so rapidly in knowledge explosion and technological development. To face the challenges, we have to refocus research in science, technology and mathematics education adequately to survive in this era. The National Mathematics Centre Abuja, awarding scholarships to mathematics students is worthy of note and STAN efforts in diagnosing the problems and attempts of enhancing STM education in Nigeria from the themes of their conferences/workshop and other related activities are highly commendable.

YEAR	THEME
1980	Development of human and material resources for science education.
1981	Linking science with productivity
1982	Science education in the primary school, a need for radical approach
1983	Integrated science education at the junior secondary
1984	Teaching science within limited resources
1985	Science, the Nigeria experience
1986	The challenge of students under achievement in science
1987	Winning more students in interest and technology
1988	Sustaining students in interest and technology
1989	Science and technology education for rural development
1990	New directions for science, technology and mathematics for the 90's
1991	Teaching science, technology education and mathematics in the mother tongue
1992	Conducive classroom environment for science education in Nigeria
1993	Professional development and retention of personnel for effective STM in Nigeria.
1994	Difficult skills in STM
1995	Practical skills in STM
1996	Understanding the contents of STM
1997	Innovations in STM
1998	Communicating STM
1999	Evaluating STM
2000	Enriching science, technology and mathematics
2001	Women in science, technology and mathematics
2002	Science, technology and mathematics education for sustainable development in Africa
2003	Information and communication technology (ICT) and science, technology and mathematics STM education

These themes cover a board spectrum of education and curricula problems in science, technology and mathematics at all schools levels. Also the formulation of national policy on



education (1977), the national policy on science and technology (1986), the establishment before cancellation; of the federal ministry of science and technology and frequent review of these policies and programmes were all re-position aimed at promoting STM education.

Having identified the crisis state of STM education, there is needed to outline the necessary strategies that would facilitate the expected changes.

To re-invent STM education the curricula will have to be carefully designed and implemented to encourage creativity independence, the adoption of new teaching/learning approaches. The curriculum should determine whether or not the content possesses internal and external relevance and is thus capable of providing a functional STM education. The internal relevance includes inculcating learners to make rational decisions. The training of the mind in the understanding of the world around and as well equip students to live effectively with increase use of service and technology. While external relevance deals with how curriculum related to external requirements such as trends and changes within the value system, meeting foreseeable needs and goals and evaluation of its importance.

The curriculum in every society must indeed reflect what the people feels, believe and do. Yet it must be seen as the deliberate, systematic and planned attempt not only to change behaviours of children and youth, but also to enable them gain the social insight, but also to enable them gain the social insight and power to build a society with the rapid increase in knowledge in the new world order. The universities, polytechnics and colleges of technology should also play a vital role. Individuals and technological institutions must form partnerships in research to determine appropriate STM education curriculum for Nigeria.

Though we yearn for technological advancement, we should realised that what is appropriate for a country may not be appropriate for the other. We cannot swallow the knowledge or technology developed elsewhere without taking cognizance of it resonates or concur with the country's vision and national aspiration. There must be adjustment to meets local needs. The Nigeria environment according to Okwu (1981) laden with scientific activities waiting to be tapped. While Ikoku (1973) called for an appropriate secondary school curriculum that would arm student with a fair knowledge of raw materials, their importance, location and how they could be transform into more useful materials. On this basis, the government should make clear its goals and expectations of STM education in Nigeria.

Meeting the future of STM education, teaching should be professionalized. Science or teacher based on the training and not dumping ground. The teacher training and re-training periodically meet up with new developments in content and methodology. Provision of STM

teachers with the intellectual and professional background adequate for their assessment and make them adaptable any changing situation and environment. New approaches in STM teaching should be use that which encourages child centred activities, hand-on, and mind on activities etc. in addition period conduction of continuous assessment and evaluation of STM education is highly needed to determine the level of changes in comparison with what is expected, STM supervisors, evaluators and examination board should ensure this. The worth and quality of any certificate is determine by the quality of instruction and the examination conduct that brought it into existence.

The morale and remuneration of STM education teachers should be improve. This enhances their image, prestige, dedication and satisfaction of the job for effective and efficient delivery of STM education. Students would be armed academically and psychological to study many subjects from the field of STM education with great achievement. This will motivate the students, cushion examination malpractices, poor enrolment and poor achievement in STM education. Learning has a lot to do will resources the more resources that are made available, the better the chances of attaining quality STM education.

STM education requires that teaching and learning materials be available. This includes laboratory equipment, chemicals and reagent etc. so also computers, video tape instruction, television, models and other learning kits(Opara,2011). But the situation is different, these materials are not available, and in some cases the little available are not utilised and maintained. Some STM education teachers are not competent enough to use them for instructional purposes. Scienc3e is taught in well equipped science laboratories and students learn science with much ease if taught through activities in the laboratory (Njoku, 1990). It is therefore necessary that all schools offering science subjects should have well equipped laboratories with competent teachers and the auxiliary personnel needed to facilitate the work of the science. If science is properly taught in a well equipped science laboratories, the students especially the less able ones will develop more positive attitudes to science (Abdullahi, 1979) it will help the students see the relevant and meaningful to the students.

Again, language is the event that tries to unite the world of the learner and that of the teacher. The extent to which success is achieved in STM education is largely dependent upon the degree to which meaning is shared between the learner and the teacher. The language should be means of enabling the learners to internalize concepts in education process and facilitating their articulation of this outcome by allowing them to voice their own assessment of the achievement they have attained at any stage of the learning process (Opara, 2003).



English language is the *lingua franca* and the medium of instruction in Nigeria schools which is not our mother tongue. Scientific ideas and concepts are expressed, explained and communicated in the English language through class learning, textbooks or in laboratory. In this, there is tendency that there should be relationship between a child's understanding of English language and his performance in STM education. The use of unfamiliar technical words and misconceptions based on the level of understanding makes STM education unrealistic and meaningless.

Despite the suggested advantages of mother tongue instruction, quality learning and teaching can be achieved through the English medium, however with serious reorientation of our classroom management principles and practices.

The government as well as organised bodies should as a matter of urgency create a special incentive for students of STM education in schools; this will go a long way to enhance the interested students to go into careers and professions leading to the technological development of the nation. For instance, national mathematical centres Abuja awarding scholarships to students for study of mathematics are a way forward. At the same time several training institutions for STM education should be established by the government to make admission into such places less cumbersome. More so, the provision of adequate and suitable human and materials resources for STM education.

Finally the world is being reduced to a global village through high information technology. The new increased information technology has created new potential in STM education which has enriched our cultural dimensions of teaching/learning. The schools should be equipped with computer facilities as well as internet to follow the new trend of teaching STM education. Technological development once begun, promotes scientific, educational, cultural, economic and social development. And quickens the accumulation of materials wealth to eradicate extreme poverty and hunger and other millennium development goals (MDGs), NEPAD Agenda, WSSD initiatives and Agenda 21.

**CONCLUSION:** This paper identified the crisis state of STM education in Nigeria schools. The effort so far made by the government and Science Teachers Association of Nigeria (STAN) toward the solution of this problem are commendable. However, more efforts are needed to promote effective teaching and learning of Science education in Nigeria. It is on the basis of these, that this paper attempts that we need to refocus research on the whole concept and the quality of STM education curriculum design and implementation. The provision of adequate human and materials resources should be directed toward the right direction. This is a challenge to re-inventing STM education for national development .

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