

# POSITION OF THE TEACHER IN THE REFORM OF STEM EDUCATION IN NIGERIA

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## **Abstract**

The paper examines the importance of STEM education in Nigeria. It traces the history of the reform in Nigeria right from the 2<sup>nd</sup> world war. It establishes the need for the reform of STEM in response to profound and multifaceted changes occurring in the world today. The paper in establishing the position of STEM teacher in Education reforms in the country revealed the neglect and non-involvement by recommending that STEM teachers should be informed trained and should participate actively for overall success of STEM education in Nigeria.

Science, Technology, Engineering and Mathematics (STEM) education have often been perceived as the driving force behind economic development in the industrialized countries. This view has led many developing countries like Nigeria to invest in STEM education in the hope of promoting economic development. STEM education has become a social institution that is transnational in character. The institutionalization of STEM education as a world-wide phenomenon is very much related to the development of nation states. As new nations strive for socio-economic development and competitiveness, the role of STEM education is increasingly perceived as being of crucial importance in increasing the efficiency of these societies. Thus, strong social support and resources are mobilized to advance the teaching of STEM in schools and higher institutions of learning so as to promote a scientifically literate society and to produce a scientific manpower to meet the economic needs of society. The Nigeria situation was captured in an address by the then president of STAN, Lawrence Achimugo at the 51<sup>st</sup> Annual conference held at Benue State University, Makurdi, August 2010. According to him, we are making efforts to provide the type of STEM education that will ensure that we meet the challenges of the 21<sup>st</sup> century knowledge based society. He observed that significant role played by STEM in the development of a nation in contemporary times stares us in the face and the world wide movement towards STEM for all underscores this.

However, in the communiqué for the 51<sup>st</sup> Annual Conference, STAN observed that the entire concept of STEM as it is used in daily practice is missing from conventional STEM education in schools; the need for relevant curricula in STEM to be imparted to students in a proper manner; and the need to give students opportunities for guided inquiry in STEM education.

## **History of Reform**

STEM education reform occasioned by the 2<sup>nd</sup> world war was basically on two areas.

1. Updating of content to take care of the scientific development that had occurred during the war.
2. Methodological transformation that is, the substitution of lecture method by the activity method where the laboratory method was preponderant. The laboratory practical would involve the students in activities fulfilling the need to motivate them and help them to understand the concepts that made up the programme as well as the acquisition of process and procedural skills of STEM.

Hence just before and after independence (1960) Nigerian STEM education leaders were very critical of the colonial curriculum inherited from the British. The STEM curriculum was criticized for being too bookish, lacking in science and technology and in psychomotor skills and so awkward and western oriented that it lacked relevance to Nigeria environment. There was general agreement that salvation lay in reforming curriculum to give STEM its rightful place. STAN also observes that educational innovations in the country have rarely lived up to the expectations of their proponents (Oloruntegbe, Duyilemi, Agbayewa, Oluwatelure, Adare and Omoniyi, 2010). However, the need to revise and update existing educational curricula in response to profound and multifaceted changes occurring in the world today is widely recognized. Thus reform is inevitable; it is a part of life.

By the time sputnik I was launched in 1957, which occasioned the landing of the first human on the moon by Russia, developing and developed countries had begun to realize that a new science age had begun. The enthusiasm for STEM was further enhanced as a result of the competition spirit between the United States and the Soviet Union. Thus, by the time the benefits of STEM were beginning to be realized in African countries, another event self-rule, catapulted the enthusiasm for science unto reality (Jegade 1988, Ali 1998). According to Ali, a sudden Spurt of attention and interest came from government, industry, schools and indeed society such that the science educator became involved with curriculum planning, development, implementation and evaluation.

The first major attempt at reforming the educational programme of the country (STEM inclusive) took place in 1969, through a curriculum conference held in Lagos. The conference brought about radical changes in the country's educational system, (Fafunwa 1974 reported in Yusuf and Yusuf 2009). This led to the first independent policy, tailored to meet the local needs of the nation. Thus the National Policy on Education (FRN, 1977) revised 1981, 1998 and 2004

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made radical departure from the educational policy inherited from the British colonialists.

Thus, an added impetus to the STEM curriculum development in Nigeria came from.

1. The apparent dysfunctionality of the inherited educational programmes that were largely imported into the country through colonialism
2. The experience some members of the Nigerian scientific community gained by their sojourn abroad in search of further education and
3. the prevailing climate of political independence which by implication, extended to other areas of the country's aspirations (Jegede, 1988 P 400)

Worthy of note is that although the STEM reform programmes departed significantly from the factual and expository method of teaching, to a more progressive one of teaching the learner what science is and how scientists works, and in spite of the fact that the National Policy on Education appears to project the modern aims and objectives of STEM education, example inculcating in the child the spirit of inquiry and creative thinking, only minimal changes have been noticed in the learner and the system as a whole (Jegede, 1988, Bozimo,1985). It is observed that the STEM teachers are neither positively disposed towards, nor effectively trained to cope with the demands of the new curricula. As summarized by Jegede, Okebukola and Adeniyi (1987) in Jegede 1988, by and large, the teaching of science has been by the didactic practice essentially on the 'new' concepts on which some practical laboratory hours were spent undertaking presumably confirmatory trips dictated by the teacher. This is in spite of the daily sermon over the traditional rote learning method.

### **The Present Status of the Reform**

The major changes from earlier educational policies are enunciated as follows: First the nine – year basic education eliminates disconnection between the primary and the junior secondary school thereby ensuring a continuous curriculum (Obioma and Ajagun, 2006). It is structured into three levels: lower Basic (Primary 1-3) where 9 core subjects and a maximum of three electives are offered; Middle Basic (Primary 4-6) where 9 subjects and maximum of three electives are offered; Upper Basic (junior Secondary 1-3) where 10 core subjects and maximum of three electives are offered. Secondly, the need to reform secondary school education is supported by several UNESCO researches which emphasized the need to take secondary school education beyond the general Secondary Education, (Yusuf and Yusuf, 2009). This is to incorporate Technical and Vocational Education Training which is called the convergence of knowledge and practical skills. Thirdly, the consolidation of tertiary institutions

and merging of tertiary institutions, which is the merging of Colleges of Education and Polytechnics with Universities, was envisaged. Other basic areas included the merging of educational commissions and agencies from over 30 to 11 targeted at reducing redundancy and ensuring quality service delivery.

### **The Position of STEM Teacher**

The teacher has become the focus of attention in modern world as it becomes increasingly clear that no nation can rise or develop without the caliber of teachers (FRN, 2004). It is equally recognized that whatever levels of development a particular nation passes through will largely be a true reflection of the caliber of the teachers. Today, teachers gained more prominence not only in teaching but in the development of learning materials (curriculum) for students.

As regards the roles of teachers in curriculum development, implementation and change, (Oloruntegbe et al 2010), posits that the responsibility of the teachers is now more extensive than in the past. It is observed that their roles have been situated along major development indices that resonate between classrooms and the larger community which have been described variously by scholars as “critical connections” and “extended professionals”, “principal role-players”, “sole implementor”, researchers, trainers and curriculum workers, (Oloruntege et al 2010).

Researchers have, however revealed the neglect or non – involvement of teacher in curriculum reforms. Carl (2002) in Oloruntegbe et al (2010) affirmed that the “voice” of teacher is to a large extent ignored or not heard. According to Yigzaw’s study reported in Oloruntegbe et al (2010), 85% of the 110 subjects stated that they had not been involved in the development of curricula. That even in the implementation, 63% reported that the most serious problem in this area was that materials were usually not sent to them on time or that they were not informed of the innovations before hand. Thus, while teachers were not recognized as sole implementers of curricula change, many times, they received little or no orientation on innovations. Hence, one can see why teachers often resisted or were reluctant or were slow to implement innovations.

It is observed that most curricula innovations in Africa were initiated “top-down”, through power coercive” or “unilateral administrative decisions” in utter negligence of the much powerfully-embraced” grassroots’ (Oloruntegbe et al, 2010, Rogers, 1995), or the “normative re-educative”, “rational – empirical” or bottom –up approach. These according to observers further inform the reasons for teachers’ reluctance. It is suggested that innovation must be locally driven and collaborative (Nomdo, 1995), to make it widely acceptable.

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Collaborative efforts (Oloruntegbe et al, 2010) were observed in the national curriculum project (NCP) in Australia and curriculum 2005 of Gauteng Department of Education in South Africa and they were very successful. The NCP frameworks are “intended as teacher –development tool as much as curriculum planning tools” and the project a form of curriculum consciousness-raising for teachers. These ideas are summed up in Sttenhouse’s (1980) writing as ‘ No curriculum development without teacher development” and that “curriculum development is about teacher development”. In the case of curriculum 2005, there was a development programme for “foundation phase teachers “(Ramparsad, 2001). This was done to enhance teacher’s involvement in the design, dissemination and evaluation phases which according to Ramparsad was initially not emphasized. Kennedy and Kennedy (1996) submits that change is complex and that part of the complexity is teacher’s attitudes in the implementation of change.

Furthermore, sustainability of reform initiatives relies on teachers (Cohen and Hiltz, 2001) maintaining alignment with the intent of the initiative. Thus, curriculum reform can only be successful if teachers are involved in the development and implementation of curriculum and structural changes, for expecting teachers to embrace new instructional approaches without sufficient training and information on why such changes are necessary or warranted, often result in inadequate adoption of the curriculum mandate. Combs (1968) reported in Igunnu (2001) that educational system will not be modernized until the whole system of teacher training has been drastically overhauled, stimulated by pedagogical research ,made intellectually richer, more challenging and extended far beyond pre-service training into system for continuous professional renewal and career development for all teachers. Unless the programme of training and retraining of STEM teachers is invigorated alongside substantial motivation and remuneration, our quest for technological breakthrough in Nigeria will remain a mission unfulfilled. The success of any curriculum reform therefore rests largely on the availability of highly motivated, conscientious and efficient classroom teachers who are both intellectually and profoundly equipped to teach the curriculum content in the classroom and laboratory situations.

Again, the curriculum operated in Nigeria primary and secondary education systems are developed centrally by the Nigeria Educational Research and Development Council (NERDC). They were purchased by the Federal and State Ministries of Education and distributed to schools. However, there are other agencies such as Nigeria Union of Teachers (NUT), National Teachers Institute (NTI), subject association like the Science Teachers Association of Nigeria (STAN) and others who have variously engaged in curriculum development, implementation and change, (Oloruntegbe et al, 2010).

Oloruntegbe et al carried out a study using 630 secondary school teachers drawn randomly from six South Western States of Nigeria in their involvement in curriculum reform in Nigeria. The result show Nigerian teachers' several and mixed usage of the national curriculum and the syllabi of the various examination bodies in the country. 95% of the teachers agreed that teachers should be involved in curriculum development but only a few 38% claimed that they were ever involved and their involvement was through seminars meant to introduce the NERDC curriculum to them. Majority implemented the versions prepared as syllabuses by examination bodies like WAEC, NECO and NABTEB. A large number of the teachers used the NERDC version modified by ANCOSS. Thus, there was no commitment to the implementation of the national curriculum. A number of teachers 30.4% claimed that the curriculum they implemented cannot get the nation anywhere which means that they were not convinced of the change inherent in the implemented curriculum. This agrees with the observation that there are two major causes of failure for the NERDC curriculum to achieve its declared goals in relation to students' understanding of STEM:

1. STEM teachers' own inadequate views about the nature of STEM.
2. A degree of confusion in the philosophical stance implicit in many contemporary STEM curricula.

It is either that the teachers were reluctant to implement the change as noted by Kennedy and Kennedy (1996); they were unsure and uninformed or they were in a way calling for change in the existing curriculum.

## **Conclusion**

The conclusion is that STEM teachers in Nigeria are seldom involved in the process of curriculum development and reform and that may account for the reluctant in implementing any reform.

## **Recommendations**

The following recommendations are hereby made:

1. There is need to appreciate the double role of the STEM teachers in the curriculum enterprise both as a developer and as autonomous implementer.
2. The overall success of STEM reform programme development should be initiated at the teacher level and should involve active participation in decision making, research and development work.
3. During the period of reform STEM teachers must see the need for change and understand the basis for the proposed reform. Otherwise they may resist the reform. In this regard STEM teachers should be informed trained and actively involve in the reform which should be initiated from the grassroots bottom-up. Curriculum reform emerging

from this process will be more acceptable. The question of STEM teacher's reluctance in implementing the reform will not arise.

4. Furthermore, during period of reform, it is important to organize in-service training for STEM teachers in form of seminars, workshops, conferences, vacation and week end programmes on regular basis till the reform takes root properly.
5. Again during period of reform, international collaboration towards the improvement of STEM should emphasize reflections on the problems involved, the training of human resources and the development of work methodologies and new ideas as well as production of materials for use.

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