PROBLEMS AND PROSPECTS OF EFFECTIVE SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) EDUCATION DELIVERY IN NIGERIA

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Abstract

The relevance of Science, Technology, Engineering and Mathematics (STEM) Education as a pivot for development is no longer in doubt. The Nigerian STEM Education delivery today is bedeviled with enormous problems. This challenges are not however insurmountable as there exist laudable springboard for improvement. This paper focuses on the challenges of STEM Education delivery in Nigeria as well as its prospects. Some recommendations have also been proffered as a panacea for effective STEM Education delivery.

STEM is an acronym for Science, Technology, Engineering and Mathematics Education. STEM Education is an important pre-requisite for the development of any nation. It is the pivot upon which technological advancement revolves. STEM Education is fundamental to the strengthening of higher levels of education, capacity building and self reliant development. The inter-related nature of science, technology, engineering and mathematics is such that as a seamless robe, it is integrated into one entity "Science Education" whose principles and structure are anchored in mathematics (Okoro, 2013). STEM education contributes to general educational development and practice. It has become a stimulating elixir and a necessary catalyst which has engendered the spirit of technological, economic and sustainable development throughout Nigeria.

Current Trends in STEM Education

The current state of STEM Education in Nigeria should be a matter of priority and concern to all science teachers and stakeholders. A look at our school system today shows that something is wrong in many ways. Enrolment into the different disciplines of science in our tertiary institutions is highly disproportionate (Akpan, Umoh, 2012). This may be due to the student dwindling performance in the Senior Secondary Certificate Examination (SSCE).

A close look at the educational practices in Nigeria today reveals that the average science teacher sees the learner as a vessel in which to pour knowledge, thus relegating the potentials for self-directed learning to the background. In this approach, the emphasis is on impartation and regurgitation of facts. This makes students mere on-lookers, learning about science and not learning science. (Umoh, Akpan, Udongwo, 2013). Classroom activities are still characterized by the memorization of factual knowledge with the teacher as an informer and controller of the learning process (Akpan, Umoh, 2013). Learners are not provided the opportunity to express their understanding of concepts and relate knowledge claims to evidence in a systematic way. This type of learning according to Ajewale (1997), is one of the major factors opposing effective science teaching and learning in Nigeria.

Problems of STEM Education Delivery Large Class Size

The explosive enrolment due to the UBE programme has resulted in overcrowded classes. STEM demands that students should be involved in practical work. Okeke & Chinwe (2006), emphasized that all learning in science must begin and end in the laboratory. The laboratory according to them is a place where students explore problems, generate and test the related hypotheses and ultimately discover newly invented concepts. Due to the over-crowded condition of the classes coupled with the absence of laboratory support staff, teachers in majority of cases carry out practicals only two or three weeks to external examinations such as SSCE because they are overburdened with the task of combining their teaching job with that of the laboratory support staff in the face of the large classes. This state of affairs will have a negative effect on overall productivity.
Deficient Curriculum

Teacher education programmes in Nigeria are long overdue for review. There seems to be a mismatch between the teacher education programmes and the secondary school curriculum requirements which has led to the inadequacies found in some graduate teachers. Ovute in Ovute & Ugwanyi (2011) reported that the current minimum standard at the College of Education level seems not adequate for the 9 years Basic education curriculum. According to Ovute, most N.C.E graduates cannot adequately fit into the new Basic Education classroom for effective delivery of the U.B.E programme. Similarly Lesi, Awobodu & Adegbamigbe (2009) stated that there is a large mismatch between the skills required for the modern economy and the education imparted to most of the students in higher learning. Teachers, teach according to the way they were trained (Mgbono, 2013).

Poor Teacher Supply

Nigeria is facing shortage of STEM teachers. This shortage is even worst in the rural schools. Akinsola, Lawaf & Oyedokun (2007), reported that very low percentage of teachers are found in the rural areas. The dearth of teachers makes a single teacher handle virtually all the students for that particular subject in the school. This situation makes the teacher worked up each day and cannot be effective. Most teachers therefore avoid the student-centred approaches to teaching e.g project, field trip, excursions, demonstrations etc. They rather resort to the teacher centred methods which are not effective for science teaching.

Poor Teacher Quality

Some teachers in our schools today are highly incompetent. They lack content knowledge as well as pedagogical skills as a result of laxity during their undergraduate days. Today/ they find themselves in schools and are not able to deliver. According to Amuzie (2008) these category of teachers showed high level of compromise in their college days. When they scored 39% or 40% in an examination that was rated to be 100% they celebrated with great excitement and enthusiasm. Such teachers do not teach but cheat and bring poor image to the profession.

Unavailability of Teaching Facilities

Nigerian schools lack teaching equipments and facilities necessary for effective teaching and learning (Mgbono, 2013). Most schools especially in the rural areas lack laboratory spaces and the necessary equipments. There is a limit to what teachers can improvise. The extensive sourcing for and preparation of teaching materials at every stage coupled with problems of overcrowded classrooms, and sometimes administrative work, etc becomes very cumbersome.

Overloaded Syllabus

There is need to reduce pressure on science teachers. To be good scientist and innovators the process skills are needed. However, this ingredient is lost because in an attempt to cover grounds for the purpose of examinations, effective science teaching is not carried out. Lawal (2011) found out in a survey that the SSCE biology curriculum was overloaded. Similarly Ofoegbu (2003), Adeeyebe & Oke in Lawal (2011) lamented the overloaded syllabus in each of the sciences. This they pointed out makes teachers skip or haphazardly treat some topics.

Inadequate Incentives

STEM education has mostly to do with practical work in and out of the laboratories. It sometimes involves hazardous exercises and the use of poisonous chemicals. In the oil companies and firms, workers who do hazardous jobs are covered by insurance policy either in cases of injuries or death and are paid some special allowances. In the case of science teachers no recognition is given. In some states they are paid peanuts e.g &1000.00 as science allowance. This uncompensated working condition does not motivate teachers and so they can choose to do their work haphazardly.
Poor Work Environment

Teachers need to be accorded respect and honour for the work they do. It is observed that teachers work in harsh conditions. Some lack tables to work on and even manage half broken chairs in over-congested staff rooms. In many cases they manage with dirty non functional toilets.

Capacity Building

Science is dynamic in nature. New methods and strategies are continually being evolved to facilitate teaching. Teachers need to update and upgrade themselves by attending training programmes. These enables them live up to expectation by exhibiting mastery of subject matter as well as distinguish themselves pedagogically.

However, due to personal financial constrains and lack of sponsorship teachers hardly attend workshops and conferences. Awosika (2006) in a survey found out that only 25% of his subjects had attended workshops, seminars, conferences and symposia for the past 10 years.

Prospects of STEM Education Delivery

Although the problems enumerated seem enormous, there is still hope for the future as regards adequate STEM education delivery in Nigeria. The curriculum guidelines are adequate and the policy on education is clear on what is expected for national development through STEM education (Chinwe, 2003). The efforts on ground for improvement are encouraging. There is potential for a better tomorrow as:

1. The establishment of more universities and colleges of education with specifications for minimum academic standards would solve the problem of both professional teacher supply and quality of instruction. With enough teachers, large class size would be effectively handled.
2. The science equipment centres already established in some parts of the country would provide enough standardized equipment for effective delivery of instruction and for the laboratories.
3. Research results on the effects of innovative teaching styles and better ways of improving our curricula delivery would equip teachers to better fulfill their roles.
4. More research findings are becoming available for improving teacher education at various levels of teacher training institutions.
5. There is a movement towards a unified syllabus in each STEM subject at the Secondary School level and a national guideline at the primary level.
6. There is local production of standardized STEM equipment by both government and some private firms.

Conclusion

The challenges militating against effective STEM education in Nigeria are quite enormous. This does not in anyway mask its laudable objectives. Research findings have revealed a number of areas of improvement for the attainment of our STEM objectives.

Having reviewed some of the common challenges in vogue in STEM Education and considering some prospects, it becomes necessary for stakeholders to rise up to the challenges which this 21st century may bring in terms of STEM education delivery. STEM teachers must be ready to create or provide situations where students can learn effectively and by themselves.

Recommendations

In order to make further progress in STEM education in Nigeria the following recommendations are proffered:

1. Professional STEM Education teachers alone should be allowed to teach STEM subjects in our secondary schools, while the non-professionals should be encouraged.
2. Following the encouraging efforts made so far by curriculum development experts, our Governments are called upon to increase the present level of funding of these agents so that more innovations in STEM education may be enhanced.
3. The Federal Government should encourage individuals and organizations to embark on the manufacturing of STEM equipment through the granting of incentives such as tax relief and import liberalization.
4. Government should seriously consider the issue of employing laboratory assistants to
support STEM teachers to cope with the enormous demands of effective laboratory activities involving large classes.

5. STEM Education teachers should be encouraged to enroll as active members of Science Teachers Association of Nigeria (STAN) and other professional bodies by assisting them pay membership subscription and purchase relevant journals. STEM teachers should also be sponsored for workshop in their subject areas to update knowledge.

6. There should be greater and enhanced incentive by way of science and hazard allowances for all STEM teachers.

7. Model STEM laboratories and workshops should be provided in our schools for appropriate use by STEM teachers and students.

References


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