SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) EDUCATION IN NIGERIA: STATUS, CHALLENGES AND OPPORTUNITIES

BY

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ABSTRACT

This paper discussed Science Education in Nigeria, the status, challenges and opportunities. Thus efforts made by the government agencies, professional association such as Science Teacher's Association of Nigeria (STAN), Non-governmental Organization and International Donor Organizations like UNESCO and UNICEF etc are discussed. Also reviewed are the current situation of Science, Technology Engineering and the Mathematics (STEM) education, challenges facing STEM education such as funding, curriculum, enrollment, language of instruction at of Basic school, classroom practices, instructional materials, equipment and facilities, teaching method etc. In addition, opportunities in STEM education are addressed and recommendations made. Recommendations among others include STEM education should reflect resources and product of our endowed environment, our rich ethno science, STEM classroom should be technology based, community participation in STEM education etc

Introduction

It is not certain as to when science, Technology, Engineering and Mathematics (STEM) education also understood as science education started in Nigeria. But from available data it can be traced to 1859 when rudiments of science were introduced by Christian Missionary

Society (CMS) of Nigeria at the CMS Grammar School Lagos. The science subjects included hygiene, geography geometry, zoology, botany etc. The missionary schools and teachers training centres where rudiments of science teaching started in Nigeria includes (Omolewa, 1977)

CMS Grammar School Lagos	1859
CMS Girls School Lagos	1869
St Gregory's College Lagos	1878
Baptist Boys High School Lagos	1885
Waddel Institute Calabar	1861
St Andrew's College Oyo	1876
Wesleyan Training Institute Lagos	1905

At inception of STEM education in Nigeria classroom activities were more of outdoor activities or observations of living and non-living things. Teaching was mainly by talk-chalk method and learning was by rote memorization of facts and figures. However, there was no much differences in STEM education curricula package and lesson delivery in Nigeria and the rest of the world (Katcha, 2017).

With the advent of sputnik 1 of 1957 there was a revolution in STEM education resulting in shift in emphasis from traditional teaching approaches to more innovative teaching/learning approaches of STEM education in U.S.A. Consequently there were STEM education curricula reforms all over the world. In Africa reforms in STEM education curricula started like bush fire during dry season in Nigeria. According to Ogunleye (1999) in Nigeria curricula reforms efforts started after National curricular conference of 1969. The Federal Ministry of Education (FME), Science Teachers' Association of Nigeria (STAN) and West African Examination Council (WAEC) were in forefront and central to STEM education curricula reforms. The efforts in curricula reforms resulted in the developments of Nigeria Integrated Science projects (NISP) Nigeria secondary school science projects (NSSSP) National Science curricula for Biology, Chemistry, Physics, Mathematics etc. Today curricula reviews, planning and development for Basic School and Senior Secondary Schools STEM is vested in the hands of National Educational Resources and Development Council (NERDC) of Nigeria. At the tertiary institutions each educational institution develops its own STEM curricula subjects to minimum standard set aside for by the appropriate commission. Examples National Universities Commission (NUC) regulates teaching and research at all Nigeria Universities public or private, National Commission for College of Education (NCCE) for colleges of Education etc.

The economy of nations is dependent on STEM education. The strength of economy of each nation is not above the strength of its STEM education. The economy of a nation grows and develops as much as does the STEM education. Thus, economies are knowledge based and knowledge driven especially STEM knowledge.

Serious efforts are being made in order to improve STEM education in Nigeria the efforts includes curricula reforms and reviews, establishment of STEM education institutions at all levels of education across the country,establishment of STEM education agencies such as Mathematical Centre Abuja, specialized research institutes etc.

Current Situation of STEM Education

Generally the performance of learners of STEM education from Basic school through senior secondary school to tertiary institutions is below the expectations of stakeholders. The performance of students at core science subjects offered at external examinations for Senior Secondary Certificate Examination (SSCE) is not encouraging over the years. In most cases students have not been able to make 5 credits pass in Science subjects including English Language and mathematics required for admission to study STEM courses at tertiary institutions especially in a University in Nigeria. In essence access to study STEM at University level is limited with implication that only fewer Nigerian students are able to make occupational choices in STEM career options.

Within a period of 10 years (between 1998 - 2008) Nigerian scientists published 10,000 papers, Egyptian scientists 30,000 papers while South African scientists 47,000 papers the same number published by the Netherland scientists in one year. The issue here is not the number of publications that is disturbing as it might not be true as the information is of gleaning from the internet. The disturbing fact is that Nigeria has fewer research output hitting the market compared to other African countries with less population like Kenya Tanzania (Adikwu 2016).

Challenges Facing STEM Education

The challenges facing STEM education in Nigeria includes but not limited to the following Corruption is at the root of so many problems facing STEM education in Nigeria. The meager subventions from Government are stolen in phases from sources till it reaches the school authorities who do the same and, are at the receiving end.

Funding is poor and mismanagement is a norm rather than exception. There is gross inadequate budgetary allocation to education sector at all levels of government. At the Basic School level funding comes as counterpart funds from Federal Government, State

Government and international donor organization. At the tertiary institutions funds come as government appropriation and irregular support from Tertiary Education Trust Fund (Tet-fund) office.

Insecurity is everywhere with implication that lives and properties are no longer safe in schools, the school facilities and instructional equipment and materials are often vandalized by criminals or occupied by Internally Displaced Persons (IDPs) for a long time.

Our STEM education curriculum is theory loaded and little or no relationship with our environment. School STEM curriculum should reflect our environment and indigenous knowledge. To achieve this there is need to have National Science Curriculum Conference such that 'gown' and 'town' could meet and draw a road map of a relevant STEM curriculum that will enable our graduate to participate with competitive advantage in a globalized economy.

The enrolment of pupils at Basic School is explosive for STEM education because at this level Basic Science and Technology is a compulsory subject. Thus, the enrollment figures are not commensurate to the available STEM education human and material resources. The enrollment figures thins out right from senior secondary to tertiary institutions as many would opt for Arts and Humanities instead of STEM education programs. Professional STEM teachers are grossly inadequate and many of them hardly enjoys re-training opportunities that will add value to and make them relevant in the profession. University graduates who are 1st rate and who require only professional certificate program to make them good STEM teachers normally opt for jobs in other professions beside teaching.

Language of instruction in Nigeria is English. Teaching STEM at Basic school using English Language is a limiting factor. At this level of education mother tunge should be the norm because they are learning to write, read and speak in English with very limited number of English words. In addition, mother tongue enhances the use of ethno science teaching strategy, teaching from known to unknown, simple to complex and citing examples using Indigenous knowledge (IK) can facilitate interest and knowledge creation (Katcha et at (2018).

School facilities are grossly inadequate and mostly in bad shape across the country. Buildings are often poorly constructed and therefore lessons are conducted in buildings that are in bad shape or under the trees. There are schools without classroom furniture, laboratories and libraries. According to Katcha and Yabagi (2015) in the 70s conventional class size used to be 1:25 to 1:35. Today the ideal class size ranges between 1:30 to 1:50

anything above will be regarded as large class size. Class size defer from public to private institutions. In some private institutions you can have as lowest as 1:10 class size while in public Basic Schools and Senior Secondary Schools you can have up to 1:100 to 1:150 class sizes. Thus, large class size does permit best classroom practices. Large class size is the order of the day instead of being an exception. A class size of 1:100 and above is actually a large class size phenomenon. In such situation teaching and learning becomes real problematic. It breeds indiscipline with its attendant negative results on the teacher, learners, community and school authority. The STEM teacher becomes frustrated and stressful since laboratory practicals and classroom activities can no longer results in STEM lessons or an activity that produces meaningful and active learning (Katcha 2019).

Instructional materials and equipment are often in short supply and of low quality. Laboratory equipment and materials are inadequate, expired or not available. Library holdings are very few and outdated. Subscriptions into virtual libraries are inadequate and golden when and where you have them.

STEM teaching is not learner-centred and activity based. At Basic and senior secondary schools pupils 'minds' and 'hands' are not on science activities and therefore cannot subject science to sensory experience. The learning of STEM is by rote memorization of facts and figures as innovative teaching approaches are not invoked but expository methods such as talk- chalk method.

By the 1991 census women constituted about 50% of Nigeria population yet they are grossly underrepresented and underperformed in STEM education This is blamed on stereotyping, socio-cultural practices and socialization patterns. The girl child is often discriminated in the STEM text materials and classroom practices. In addition to wrong perception of STEM education held by women, they have low occupational options in STEM education.

Welfare and reward system for STEM teachers and students are not adequate and not defined. Motivational strategies must be defined and available for STEM teachers to pursue. Corruption is the greatest barrier standing tall between teacher productive and rewards.

Solutions

Solutions lie with government and government official's commitment and dedication to fight corruption in our schools system. The anti-corruption war in school system should start with corruption free implementation strategies of STEM education policies. In addition retired teachers, non-practicing STEM professional teachers, community leaders, human right advocates etc. could form an NGO to particularly fight corruption in school system and

ministries/departments of education. Confidently, if corruption is reduced to its barest minimum everything in the school system will take shape (Shaibu 2002; 2014).

Opportunities

There is abundance of opportunities for STEM education students. If youths and indeed every one receives relevant STEM education the economy of the nation will be turn around for good of all. Thus STEM education stands to benefit in a number of ways including but not limited to the following:-

1. Scientific and technological literacy
2. ICT skills and expertise
3. Self-reliance opportunities
4. Good governance
5. Community responsiveness and development
6. Industrial revolution (the country will be able to participate in fifth (5) industrial revolution).

Recommendation

1. STEM education should reflect resources and products of our endowed environment and rich indigenous knowledge (ethno science).
2. Teaching and learning of STEM should be technologically based.
3. Massive STEM skills and capacity building for STEM teachers should commence immediately.
4. Community participation in STEM education should not only be encouraged but enforce.
5. Collaboration and partnership with relevant international organizations such as KOICA, NEPAD educational agencies such as SUBEB, Mathematical Centre, Research Institutes, educational institutions with Secondary Schools example Faculty of Education with a Secondary School etc. will go a long way to add value to STEM education policies formation and implementation.

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