Factors Militating against Science, Technology, Engineering and Mathematics (STEM) Education Development in Nigeria: The Way Forward

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Abstract

The study examines factors militating against STEM education development in Nigeria. The research adopted a descriptive survey design. The sample for the study consisted of twenty-one lecturers drawn from three tertiary institutions in Akwa Ibom State. A stratified random sampling technique in the ratio of 1:1:1 was adopted for the study. A twenty items questionnaire tagged (MFSTEMQ) developed by the researchers was used to collect data. Data was analyzed using mean and standard deviation, the result of the finding shows that student under training in STEM education lack the perquisite knowledge to meet up with their global counterpart. Also, there was lack of infrastructural resources in tertiary institutions considered in the study. Based on the findings of this study, it was recommended among others that the retraining of teachers" educators on ICT utilization which is now a global phenomenon is very necessary. The training should cover the utilization of modern electronic gadgets in their lecture theatres.

Keywords: *Science, technology, engineering, mathematics, education development*

Introduction

In our educational institutions, the qualities of students, curriculum and teachers are no doubts threatening the foundation and the quality of STEM education for sustainable economic growth. Since the quality of a nation‘s education will define the nature of its economic growth and tis sustainability, Mustapha (2009 and Danmole 2011) believes that the development of any nation beings from classroom, therefore, Science, Technology, Engineering and Mathematics (STEM) Education is the instrument for change and national development. It is the driving force of the current world and a major instrument of globalization. Development simply means technological advancement and economic stability of a nation. To them, STEM education is the gateway to socio-economic advancement, industrial development and a road to self-reliance, that is, the engine room of economic development that can move Nigeria from backwardness to modernity, from being dependent to being self-reliant and from being a non-industrialized nation to an industrialized nation.

Wasagu (2009); affirmed that Nigeria, a member of UN with remarkable potentials, population of 150million, resourceful people, the 8th largest world oil exporter, the 6th largest producer of gas, with 34 different commercially viable solid minerals, fertile arable land and

friendly climate is still lagging behind in the world emerging order in areas such as information and communications technology (ICT) and Science Technology, Engineering and Mathematics Development which are driving the world in a fast and dynamic manner. This means by implications STEM education have not been helpful to Nigeria in term of socio-economic progress and industrialization. Why? This is despite series of science education reforms in Nigeria. Educational reforms refers to the modification of existing curriculum components such as the objectives as well as the content, its structure and organization, methods of instruction as well as evaluation in the context of prevailing circumstance aiming at providing a better programme and achieving improvement in the education system (Gusau, 2008).

The Nigeria science education system took its genesis from the traditional or indigenous education practices in which various vacation such as farming, weaving, blacksmithing, pot making, traditional medicine and hunting etc in pre-colonial period (Ifamuyiwa and Alebiosu, 2008). The establishment of Church Missionary Secondary school Lagos in 1859 marked the introduction of rudiment of formal science education in form of nature study in the school curriculum that is, the colonial period or pre-independence. In 1954 due to agitation of self-rule by Nigeria. British Colonial Rulers changed the educational system in operation from 8-6-2-3 system to a new system 6-5-2-3 (Mba and Legbara, 2008) and (Gusau 2008). Wasagu (2001) revealed that, the 1969 national curriculum conference held from 8th – 12th September in Lagos mark the remarkable turning point in curriculum development amd ‒home-grown policy on Education‖ (NPE). Wasagu, (2001) added that, that conference became the platform for jettisoning the colonial educational garb with doubtful relevance to our national science and technological goals and aspiration, consequently, the conference recommended changes in the system from 6-5-2-3 system to 6-3-3-4 system.

Mba and Legbara (2008) said that new structure of 6-3-3-4 system of education necessitated a group of Nigerian science educators to design a modern science curriculum in line with the new policy in education. From this emerged the core curriculum for primary science, integrated science for junior secondary schools, biology, chemistry and physics for senior secondary schools. This is the breeding ground for future experts in STEM which supposed to integrate into the emerging world order. The 21st century STEM has become STEM electronically/globally information and communication technology (ICT)-driven, Nigeria as a global community cannot be an exception or operate in isolation (Onwuliri, 2006). According to Womboh & Abba (2015), information and communication technology (ICT) is a composite term, which embodies three important concepts. Dewattevitte & Gilbert (2000) in Wombot, & Abba, noted that ‒information is whatever is capable of causing a human mind to change its opinion about the current state of the real world. In the same vein communication refers to the transfer or exchange of information from person or from one place to another.

That is, when an action produces a reaction, whether positive or negative, communication has taken place. Communication could be seen as a process: a transfer of information, ideas, thoughts and messages. It involves a sender, a receiver, code and a language that is understood by both the sender and receiver. Technology on the other hand implies the use of scientific knowledge to invent tools that assist human beings in their efforts to overcome environmental hazards and impediments to comfort.

From the above definitions ICT can be defined as the acquisition, analysis, manipulation, storage and distribution of information, and the design and provision of equipment and software for these purposes. (Dewatteville and Gilbert (2000). In regards to the above ICT information refers to the things that are integral part of our daily lives globally such as computer, telephone/Global system of mobile communication (GSM) handset, television, radio etc the current global realities (global technologies/world order) in this 21st century has tremendously accelerated the forces of globalization (Christian, 2009). Globalization is a process of interaction and integration among the people, companies and governments of different nations, a process

driven by international trade and investment and aided by information technology. This process has effects on the environment, on culture, on political system, on economic development and prosperity and on human physical well-being in societies around the world. Globalization is not new, for thousands of years; people and later co-operations have been buying from and selling to each other in lands at great distances, such as through famed silk road across Central Asia that connects China and Europe during the middle ages (Globalization 2011).

Christian (2009) noted that the invention of ICT and other global technologies such as microelectronics, space science, engineering, medicine, trade, commerce and finance have combined to make the world a global village a single community that is connected by electronic communication system which had gingered socio-economic development on a fast-tract approach. This without doubt necessitates a paradigm shift in STEM education in Nigeria, that is, the application of these technologies into the STEM education system in order to improve teaching and learning. To cope with the exigencies, curriculum reforms were undertaken in the universal Basic Education programme and the senior secondary school programme.

The two educational levels curricula were approved by National Council on Education (NCE) in December 2006 (Rabiu 2007, and Idoko, & Olisa 2011). With the present ICT-driven education in Nigeria, certain technology concepts that are used in education are continuously been propagated. Such concepts are:

(a) **e.Education (Electronic education):** That is Education (teaching/learning) with the aid of computer commonly called Computer Assisted Instruction (CAI). It also implies education online which is the exploration and exploitation of education websites/worldwide web (www) e-mail boxes etc to access academic textual materials in education and information worldwide.

(b) **e.Classrooms**: Simply means non-face to face teaching and learning classrooms. In this situation, the teacher (tutor) and students exchange or post ideas or lecture notes or/and questions on each other‘s e-mail boxes. This ensure easy and efficient teaching/learning and assessment to progress without hitches.

(c) **e.**Library: This simply means paperless library – a network of computers through a category of institutions nationwide or worldwide.

(d) **e.Communication:** Use of Global System of Mobile Communication (GSM) in Telecommunication sector of economy for various transactions.

(e) **e.Government:** Government activities online e.g. list of civil servants on the net, payment electronically etc.

(f) **e.Medical**: Hospital services and medical activities using computer e.g. diagnosing of patients and prescription of drugs and medications. All these are highly required in Nigeria to promote STEM education but are highly inadequate in Nigeria education system.

These global realities have in no doubt divided the world into advanced and developing nations. The advanced nations are the ones with highly educated citizens as well as good economic indices, which is reflected in their high technological advancement. The developing nations, in contrast, are characterized by low educational attainment, poor economic indices and low technological development. By the above definitions Nigeria is a developing country. The Global monitoring report of the UNESCO indicated that 71% of Nigerians population survives on less than $2daily. UNDP (daily Champion, 2010). Wasagu (2009) reported that, Nigeria ranks 32nd in Africa and 160th in the world by Human Development Index (HDI), 36th in Africa and 171st in the world by World Gross Domestic Product (GDP).

Akpan (2008) in Wasagu, (2009) indicated that STEM education is believed to have now become a crucial factor for sustainable development worldwide. Nigeria is believed to have invested much in STEM education since independence but up till date there is no commensurate achievement in the area. For instance, the mean percentage failure of students in Biology,

Chemistry and Physics for May/June WASSCE 2015 – 2018 are 41, 82, 31, 52 and 25, 56 respectively. This is highly reflected of a lot of inadequacies prevalence in the STEM education system to cope with the demand of the emerging world order. The emerging world order has made the world one. Here and there and in every sphere of life the term globalization ring bell. Globalization means the speed up of movements and exchanges (of human beings, goods and services, capital, technologies or cultural practices) all over the planet. One of the effects of globalization is that it promotes and increases interactions between regions and populations around the globe. According to WHO, globalization can be defined as ‒the increased interconnectedness and interdependence of peoples and countries.

It is generally understood to include two inter-related elements: the opening of international borders to increasingly fast flows of goods, services, finance, people and ideas: and the changes in institutions and policies at national and international levels that facilitates or promote such flows‖. From an economic point of view, globalization is defined as the increasing interdependence of world economies as a result of the growing scale of cross-border trade of commodities and services, the flow of international capital and the wide and rapid spread of technologies. It reflects the continuing expansion and mutual integration of market frontiers and the rapid growing significance of information in all types of productive activities and marketization are the two major driving forces for economic globalization‖. From the for-going it could be deduce that globalization is seriously fuel by electronic activities. Our students need these activities to be better inform of the global world and this key into the global economic blueprints of the global sphere. STEM education could only be seen and perceive as the only subject that could help to liberate the citizen if well implemented in schools.

There are few prospective which are believed to be militating against STEM education and development in Nigeria. These perspectives are:

(a) Poor STEM Teachers Preparation

It is also evident that available teachers for the implementation of the STEM curriculum are weak. These teachers were prepared by institutions that lack facilities and vision for the realization of the global competitive educational goals. As we know, there is no education system that can rise above the quality of their teachers. Wasagu (2009) raised a serious alarm about the poor quality of STEM Teachers in Nigeria and warned that no effective reform can take place without due consideration to teacher quality.

(b) Infrastructural Issues

Effective functioning of the school is a function of basic infrastructure. Today the Millennium Development Goals (MDGs) and Vision 20:20 have come and gone without commensurate effect in the citizen. These was because the goals/visions require modern system that will equip our youths with knowledge and skills to compete with developed nations. The present infrastructure in all levels of our education system is a joke and a mockery of our vision. Our schools lack classrooms, laboratories, and modern structures necessary for effective teaching and learning. Reform efforts should focus on basic and fundamental infrastructures. This will go a long way in achieving desired reforms in STEM education.

Omadibi (2006) addressed general impediments to functional Science Education. Wushishi, Ohize and Ezenwa (2011) also noted other general problems of Science and Technology Education that calls for urgent reform. These include teacher understanding of the philosophy and objectives of STEM education, capacity building, quality if curriculum delivery, production and provision of instructional material, enrolment and class size, new areas of emphasis, mode of assessment and conduct of examination, monitoring, supervision, inspection and evaluation. Wasagu (2009) focused more on issues of STEM teachers which includes inadequate exposure to teaching practice, poor classroom management and control, shallow subject matter knowledge, poor computer skills, inability to communicate effectively, lack of

self-reliance and entrepreneurial skills and poor attitude to work. In addition Omadibi (2006) identified other general problems that are general impediments to functional science education. They include language barrier, proliferation of private schools and the attendant recruitment of below average teachers, knowledge explosion and brain drain, corruption/embezzlement of education fund, unstable economy and get-rich-quick syndrome among STEM teachers. Overcoming these issues or addressing them squarely by government will surely bring about progress in STEM education and consequently the development of Nigeria in the current world order.

Purpose of the Study:

The study was specifically designed to:

1. Find out the extent to which STEM teacher's preparation at the tertiary institutions help students to solve global challenges.
2. Find out the extent to which STEM infrastructure at the tertiary institutions are utilized in solving global challenges.

Research Questions

The following research questions guided the study:

1. To what extent does STEM teacher's preparation at the tertiary institutions help students to solve global challenges?
2. To what extent does STEM infrastructure utilized in Nigeria tertiary institutions help students to solve specific global challenges?

Methods:

The study made use of descriptive survey design. The population of the study comprised of all STEM teachers educators in three tertiary institutions in Akwa Ibom State saddled with the responsibility of training STEM teachers. The institutions were College of Education Afaha Nsit, Faculty of Education Akwa Ibom State University, and Faculty of Education University of Uyo. The sample size consists of 21 lecturers drawn from three tertiary institutions. Stratified random sampling technique was used to draw the teachers educators from the institutions considered in the study in the ratio of 1:1:1. In each of the tertiary institutions, 7 Teachers educators were drawn, making a total of 21 teachers in all. Militating factors of STEM teachers questionnaire (MFSTEMQ) developed by the researchers was used to collect data for the study. The instrument consisted of 20 items divided into two parts. Part one sought information on factors militating against STEM education in Nigeria while part two sought information on utilization of instructional resources and was constructed on a four point LIKERT scale of Strongly Agreed(4), Agreed(3), Disagreed(2) and Strongly Disagreed(1). Two lecturers in Test and Measurement from the Department of Science Education University of Uyo and Akwa Ibom State University, Ikot Akpaden perused the instrument to ensure content validity. The items were selected and restructured based on their comments, corrections, suggestions and modification. The instrument was administered to the selected samples in their offices. The rated questionnaires were retrieved immediately by the researchers for analysis. The results obtained were analyzed using mean and standard deviation.

Table 1: **Respondent response on factors militating against STEM Education in Nigeria**

S/N	ITEMS	SA(4)	A(3)	D(2)	SD(1)	Mean	SD
1	All STEM teachers under training in the department are computer literate	3	6	12	3	2.57	.75
2	All stem teachers under training in the department can process information logically using computer	3	5	13	0	2.52	.75
3	All STEM teachers under training in the department can explore educational website worldwide	4	3	8	6	2.24	1.09
4	All STEM teachers under training in the department can exchange or post ideas or lecture notes on e-mail boxes	4	4	8	5	2.33	1.06
5	All STEM teachers under training in the department can access government activities online	4	4	8	5	2.33	1.06
6	All STEM teachers under training in the department can access hospital services and medical activities using computer	1	4	10	6	2.00	.84
7	All STEM teachers under training in the department have a refine knowledge that make them self -employed after training	2	2	10	7	1.95	.92
8	All STEM teachers under training in the department have a course content that have a prototype activities that make them have economic breakthrough at the end of their training	0	4	12	7	1.95	.67
9	All STEM teachers under training in the department are tailored toward self-independence and reliance	3	3	10	5	2.19	.98
10	All STEM teachers under training in the department are allowed to engaged in practical project activities as opposed to theoretical write ups	0	3	15	3	2.00	.55

Results

Results in Table 1 reveal that the respondents-STEM teacher‘s educators agreed with items 1and 3 which indicate that their STEM students under training were computer literate and could also process information logically using the computer. However they disagreed with items 3,4,5,6,7,8,9 and 10 whose means were below the criterion mean of 2.50. This implies that their knowledge of computer and logical processing of information could not help them to meet with the global challenges hence could be adjudged that STEM teachers preparation lack the necessary ingredient that could help the students to meet up with their global counterparts

Table2: Respondent response on utilization of instructional resources

SN	ITEMS	SA(4)	A(3)	D(2)	SD(1)	Mean	SD
1	I have a well-equipped computer laboratory in my department for students training	7	1	9	4	2.52	1.17
2	My department is blessed with a standard generating set which operate 24/7	10	4	7	0	3.05	.91
3	All stem students in my department have equal access to computer operations.	10	3	7	1	2.81	1.02
4	My department utilizes standard electronic library for learning	8	4	6	3	1.57	1.12
5	My department utilizes standard simulation equipment and apparatus for students learning	0	0	12	9	2.38	.51
6	Every student in my department have a comfortable bench in the laboratory/materials for their practical	5	2	10	4	1.71	1.07
7	My department utilizes white board which is electronically compliance for students learning.	0	0	15	6	1.76	.46
8	My department utilizes interactive films on virtually all courses that requires it.	0	0	16	5	1.10	.44
9	My department have well-arranged tables and seats for students learning	9	5	7	0	1.81	.89
10	Lecturers in my department utilizes updated knowledge in the use of electronic gadgets for students learning‘	0	0	17	4	1.91	.40

Results in Table 2 showed that STEM teachers educators agreed with item 1, 2 and 3 which indicated that STEM teachers trainee utilized computer laboratory, standard generating set and have access to computer operation. However they disagreed with items 4, 5, 6,7,8,9 and 10 indicating that the training offered to the STEM teachers and utilization of instructional resources was negative which means that students after training may lack self-reliance.

Discussion of Findings

The findings of this study in Table 1 reveals that STEM student‘s trainees have a knowledge of computer as students were able to process information logically using their computers. This may be so because presently students come into higher institutions through JAMB online examination and the student must have acquired little training on computer that enable them to use the computer for their examination. However those students on arrival in tertiary institutions they seem to be a gap between the mundane lecturers who taught the students through their normal way of lecturing without the backup of the electronic gadgets. This invariably affect the students both in time and after their completion of higher learning in that there is currently a shift in emphasis for students to acquire knowledge that will enable them to compete favorably globally. The knowledge required globally is the knowledge of self-reliance which is anchored in student‘s acquisition of information, communication and technology (ICT). Students cannot attain or obtain this knowledge where the teachers are lacking behind as shown on educators response to items 3,4,5,6,7,8,9 and 10 as shown in the questionnaire. The result of this findings is in line with Sambo & Udofia (2017) who noted that teachers educators are lacking behind and as a matter of urgency should move away from

analogue system of assignment and lesson presentation to students to the digital system were the students e-mail addresses or other platforms can be utilized.

The result of data analysis presented in Table 2 went further to confirmed the respondent responses on the issues that resources utilization in tertiary institutions militate against students acquisitions of basic knowledge that will enable them to be globally prepared. The respondent responses on item 4-10 is negative indicating that these resources covered in the questionnaire may not be utilized by the trainees. This is a clear indication the resources may or may not be available. If it is available and unutilized then the lecturers themselves lack the real power or knowledge on how to utilize such materials for students learning in their lecture theatre. However the material may be underutilize because this learning resources may not be available in the school. Hence the outcry by academic staff union and continuous strike toward revamping higher institutions in the country. The findings lean credence to the work of Ezenwa (2011) who opined that material resources utilization is an anchor point in all educational endeavors and required reform.

Conclusion:

Based on the findings of this study it is concluded that teacher trainee lack the basic knowledge that would enable them compete favorably with their counterpart globally due to lack of exposure to global ICT and utilization of the needed resources during their training.

Recommendations

Based on the findings of this study it is recommended as follows:

1. The retraining of teachers‘ educators on ICT utilization which is now a global phenomenon is very necessary. The training should cover the utilization of modern electronic gadgets in their lecture theaters
2. There is a serious need to revamp all tertiary institutions both at the State and Federal levels with learning resources that would make students self-reliance at the end of their training.
3. Theoretical approach to learning at tertiary institutions which make room for white collar job seeking should be replaced with practical activity oriented approach which would empower the students to be self-reliance after graduation.

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