

**Rebuilding Trust in STEM Education as a Panacea for Sustainable
Development in Nigeria**

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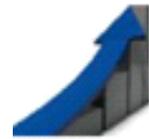
Abstract

Science, Technology Engineering and Mathematics (STEM) Education is considered the key to effective development strategies. STEM literacy helps to alleviate poverty, promote peace, conserve the environment, improve the quality of life and help achieve sustainable development for Nigeria. Proper STEM education is an instrument for empowerment which drives the wheel of development all over the world. It stimulates individual recipients towards different opportunities in all aspects of human endeavor. This paper discusses the state of STEM Education in Nigeria, the challenges as well as its prospect for sustainable development. It suggests measures for achieving good qualitative STEM education and concludes by calling on stakeholders to rise up to the challenge of providing effective STEM education programme in our secondary schools as a panacea for sustainable development in Nigeria.

Keywords: Education, Engineering, Mathematics, Rebuilding Trust, Science, Technology

Introduction

STEM is the acronym for Science, Technology, Engineering and Mathematics Education. STEM have been described as the primary drivers of progress of nations and have constituted a veritable instrument that makes material and human development march forward (Akpan, 2008). Okeke (2007) maintained that nations today are divided into "developed" and "developing" countries due to the level of scientific and technological development therein. Nations at the forefront of development are those that have invested enormous resources over considerable time in three major areas: first in the establishment and nurturing of a stable, well-supported science and technology system; second, in the promotion of mission-oriented research in the basic sciences, coupled with a long term strategy for technological development; and third, in the institution of a large scientifically literate workforce (Okoro, 2012).



STEM Education is considered as one cohesive teaching and learning paradigm in the creation of a discipline based on the integration of other disciplinary knowledge into a new whole. These interdisciplinary bridging offers students the opportunity to make sense of the world holistically rather than in piece meal. STEM Education is not just science education, equations and formulas but about getting students to love subjects that would lead them into careers that will make them to break new grounds. Okoro (2013) suggested that science education for Nigeria should:

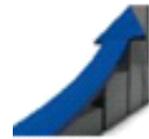
- (i) improve the quality of life of citizens;
- (ii) serve as a tool for functional skill acquisition and job creation leading to poverty reduction;
- (iii) help to mobilize and develop public-private partnership to support and fund general education; and .
- (iv) Promote information and communication at all levels.

STEM education therefore emphasizes on knowledge and skill in the areas of technology, design, deductive and inductive reasoning and critical thinking. Mathematical and scientific reasoning will go a long way in helping students to understand the world and be able to apply science to improve on existing technology for sustainable development. Stakeholders in STEM education include teachers, the government, non-governmental organizations (NGOS), parents and students.

Sustainable Development

According to the World Council for Environment and Development (WCED, 1987), sustainable development is that development that meets present needs without compromising the ability of future generations to meet their needs. The goals of development in both developed and developing countries must be defined in terms of sustainability. Emphasis must be on the development that meets today's needs in the way that will not jeopardize future generations. Sustainable development must be based on principles that aim at not only the quality of life of the people around them, but the entire world (Yero, Saleh, 2002). Sustainable development can be seen as a process of improving the range of opportunities that will enable people to achieve their aspirations and full potentials over a period of time while maintaining the resilience of economic, social and environment systems. Basically, it involves a knowledge base which revolves round three basic concepts, viz: economy, the environment and the society.

Nations around the world have embraced the need for education to achieve sustainability, but lack of vision and awareness has impeded progress in Nigeria (Emeke, Michael, 2018). This can be partially attributed to lack of planning and improper supervision of well-designed policies. By addressing these



critical issues, the government can prevent or reduce delays or derailment of sustainable development projects and ultimately attain sustainability. To achieve these, relevant focal points for sustainable development must be identified and addressed.

The State of STEM Education in Nigeria

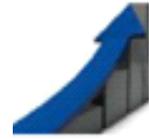
The current state of STEM education in Nigeria is significantly sad and should be a matter of concern to all stakeholders. The dismal performance of students in the Senior Secondary Certificate Examinations (SSCE) attests to the fact that something is wrong with our school system (Umoh, 2016). The average science teacher sees the learner as a vessel to pour knowledge; thus, relegating the potentials for self-directed learning to the background. The emphasis is on impartation and regurgitation of facts. Students become mere on-lookers, learning about science and not learning science. Memorization of facts characterizes classroom activities with the teacher as an informer and controller of the learning process. Students are not provided the opportunity to express their understanding of the concepts or relate knowledge claims to evidence in a systematic way. Some of our classroom teachers still use the traditional methods in teaching STEM subjects, which is not in line with the philosophy of modern syllabi. Traditional teaching methodologies are based predominantly on passive acquisition and reproduction of knowledge. Modern teaching methods (such as activity, team teaching, inquiry, concept mapping, among other innovative approaches) are of a heuristic character where passive learning is replaced by active acquisition of knowledge. The probable cause of students' poor performance in both internal and external examinations has been traced to strict adherence to methods that does not conform to the needs, desire and philosophy of the new curricular (Umoh, Akpan, & Udongwo, 2016).

Apart from all these, STEM subjects have from time immemorial been perceived as extremely difficult, and hence, only the brightest and most hard-working students could successfully pursue them. Consequently, this has been an elitist area of study-and relatively very few students, both male and female have in the past pursued STEM studies. However, on the realization of the vital importance of these subjects as a major corner-stone for development, efforts were made worldwide to encourage more people to acquire both basic and higher education in STEM, and hence a lot of reforms have been undertaken to remedy the situation. These efforts have paid off in the developed countries. In Nigeria however, the number of students who study STEM is still very low relative to those who take non-science subjects (Mulemwa, 2002).

The Challenge of STEM Education in Nigeria

Experience of the past forty years have brought a strong awareness in Nigeria that the present form of STEM taught in our secondary schools does not prepare students to function well in societies undergoing transition from rural economies to modern economy.

The goal of education is to produce human beings who are self-reliant. But the current STEM education programme in our secondary schools cannot prepare the school leaver for useful living. Also, the



government has in no way positively supported and sustained action programmes to make science education functional with a view of replacing or complementing academic preparation. Our secondary schools' curricula are rather deficient of appropriate technology for the transformation of rural life. The examination system is inadequate, and yet has a strong hold on the education system. Regrettably, both federal and state governments often time institute far-reaching changes in curricula or educational system at relatively short notice and sometimes without cognizance of professional opinion (Okoye, 2002).

The lists of the problems so far enumerated are by no means exhaustive. The problem ranges from lack of adequate textbooks, lack of cooperation by school administrators, the pressure of external certificate examinations etc. to lack of proper monitoring and feedback mechanism, poor preparation of teachers who teach the new programmes, lack of motivation among teachers, rapid rate at which teachers are transferred from one school to another or out of the profession, the use of archaic teaching methods, poor implementation procedure, overwhelming number of activities demanded by the new curricula, shortage of qualified science

teachers, lack of clear-cut goals, scanty research reports on the performance of the programmes, prevalence of superstitious beliefs and the general lack of reinforcing home environments.

What is needed is not only the education of the individual students in the fields of science and technology but also, the education of the nation's educational stakeholders on STEM and its effective management for development. In Nigeria, science and technology professionals have to fight for survival. The scientist, the intellectuals, and the science teachers are not accorded high social status. This has led to low morale, brain drain among science and technology experts and massive drift among prospective scientists to other areas of more rewarding occupation.

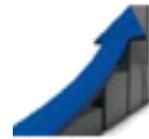
The problems listed above have persisted, widened in scope over the years and eventually have laid the foundation of the present stress and crisis confronting STEM education in most secondary schools in Nigeria (Maduemezia, 1997, Okoye, 2002).

The Prospect of STEM Education for Sustainable Development in Nigeria

A good STEM Education for our students can also mean better things for the society.

By STEM Education practices/ethics, students can develop into more responsible citizens who help to build a strong economy, contribute to a healthier environment and bring about a brighter future in Nigeria. The more science-literate individuals are, the stronger the society would be.

Emeke and Michael (2018), summarized the impact of STEM Education for Sustainable Development to include but not limited to:



1. Producing more Responsible Citizens

Students who have learned to think critically and have a healthy dose of skepticism can better make their own, informed decisions, which can make them more enlightened, informed voters and stronger consumers. Also, the sense of responsibility and caution that science provides — along with the understanding of how things work (be they chemical reactions, human development, or nutritional needs) — can help future parents to provide safe, healthy environments for their own children, and be more responsible pet owners and neighbours.

2. Helping to Build a Strong Economy

The communication, research, reporting and collaboration skills that science provides can produce a generation of individuals who are better prepared for any career and can make greater contributions to society. Also, students who have solid knowledge base in science will later be more open to emerging technologies and ideas that can boost businesses and stimulate the economy. It has been noted that the difference between developed countries is based on the quantity and quality of science and technology they possess (Ochu, 2007).

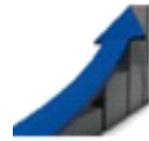
3. Ensuring Future Support for Scientific Research and Advancement

A science-literate society will provide the necessary support, funding and promotion to ensure that future generations continue to improve upon modern advances that benefit everyone. A society aware of the benefits of science will work to ensure it remains scientifically competitive.

4. STEM teachers' Role/Responsibilities

Teachers are the builders of the nation. STEM teachers create various opportunities for students to engage in doing activities that will enable them make sense of the world around them, make new discoveries, solve interesting problems and develop skills that are sustainability driven.

Science teachers need to recognize the nature of scientific endeavours and how it relates to science teaching if they are to help their students completely understand the content and underlying principles of science. Effective and consistent implementation of STEM curriculum will lead to poverty alleviation, increase in productivity and rapid economic growth. This will surely reduce the capital flight incurred on importation of goods. STEM teachers are increasingly realizing the necessity to become agent of change in order to better meet the needs of students, families and communities they serve and thus fulfill society's expectations about science educators' civil responsibility (Emeke, Michael, 2018).



STEM teachers play crucial role in shaping the students' mind towards sustainability as they impart the knowledge of science. STEM teachers help to develop sustainability skills for students such as:

- a. mastery of subject matter in STEM;
- b. motivating students to learn STEM subjects;
- c. psychomotor skills;
- d. facilitating team work and;
- e. Becoming skilled personnel.

5. Strengthening Higher Levels of Education.

STEM Education is fundamental to the strengthening of higher levels of education, capacity building and self-reliant development.

It has been proved to be a potent tool for sustainable development in Nigeria. The strategic and inimitable role of STEM Education towards the development of the world is beyond doubt.

6. Contribution to General Educational Development.

Significantly, STEM Education contributes to general educational development and practice. It has become a stimulating elixir and the necessary catalyst which has engendered the spirit of sustainable development worldwide (Okoro, 2013).

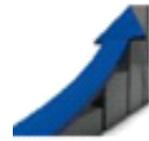
7. Preparation for Challenges ahead

STEM education is a worthy platform for preparing Nigerian youths for challenges ahead in a highly technological world. International competitiveness is increasingly being defined in terms of ability to access, learn, adapt, utilize and innovate available technology (Akpan, 2008). The implication is that nations that fail to innovate lose their competitive position. Okoro (2013) maintained that a sound and veritable STEM based oriented education at the grassroot holds the key to the answer.

Conclusion

Proper STEM Education programme in our secondary schools is a strong tool that can be used to facilitate the prosperity and advancement of Nigeria. Effective STEM Education will contribute to general educational development, skill acquisition, job creation and prepares Nigerian youths for the challenges ahead.

Although this development is not fully achieved due to the poor state of our STEM Education delivery, wonderful prospects still abound.



Nigeria must improve upon her STEM delivery programme and rebuild trust on it as the panacea for sustainable development.

Suggestions

To ensure sustainable development of Nigeria through Science, Technology, Engineering and Mathematics Education, the following suggestions are proffered:

1. STEM teachers should use student-centered approach in the teaching-learning process to ensure students' participation. This will avoid rote-learning / regurgitation of facts.
2. Discovery learning, field trip and other innovative learning strategies should be adopted by STEM teachers.
3. STEM practitioners should be given enabling environment / incentive by the government to enhance their optimum potential.*
4. The Federal and State Governments should give STEM Education her rightful position in their budgetary allocation. This would provide for the recruitment, training and retraining of professionals and provision of instructional materials.
5. More science laboratories should be established and the existing ones equipped and adequately staffed by the government to enhance effective research.
6. Local production/improvisation of STEM equipment by teachers should be encouraged by the government, NGOs and private individuals.
7. STEM research findings by Nigerian scientist and researchers should be utilized and incorporated in decision making and economic planning by the government to enhance student learning.
8. STEM teachers training programmes in tertiary institutions across the country should incorporate entrepreneurship. This will encourage skill acquisition and job creation for school leavers..
9. Basic education should be made free, compulsory, qualitative and well-funded by the government at the state and federal levels.
10. The government, corporate bodies and NGOS should sponsor STEM practitioners to attend conferences, workshop and seminars for knowledge update on current research findings and breakthroughs. .

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