

A Need for Acceleration in Science and Mathematics Education for the 21st Century Technological Development in Africa: Challenges and the Way Forward

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Abstract

Our enthusiastic voyage to the 21st century and beyond is likely to remain bumpy and slow if the role of science and technology continues to be accorded a mere lip-service. The need for science and technology has been stressed. The problems militating against the full implementation of the laudable ideas surrounding science and technology have been listed and discussed. Strategies for implementation of science and technology are charted. Finally, threshold recommendations are made.

Keywords:

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Background to the Study

Let us focus briefly on the sub-theme of this paper: A need for acceleration in science and mathematics for the 21st century technological development in Africa. To develop means to transform existing structures functions and institutions. It means increasing our capabilities to deal effectively with social, economic and political, problems facing Africa. It means the transformation of this country into a technologically strong and independent nation with capacities to meet the needs of the 21st century generations. Development means valid power supply, adequate food supply a healthy and optimistic population, functional and productive industries, a high level, quality manpower, and a dynamic economy not just producing for home consumption but also ready to assert itself in international economic system.

Finally, development means we will be ready as a nation to meet the internal and external demands in all spheres of our national experiences in the 21st century. To do all of these things, we must start with the fundamentals. There is no doubt that two of these fundamentals are science and mathematics. Although there are other dimensions of national transformation like values but the acquisition valid science education by a greater percentage of our population, and the creation of conditions for the implementation of our scientific ideas is a necessary condition for national development.

Similarly, mathematics is the language of science, and a nation that is afraid to speak this language will remain underdeveloped in the face of giant progress by other nations. Why is it that after our excitement with science and mathematics in the early seventies and eighties, we seem to have fallen asleep presently? Our science laboratories lack basic equipment and are even absent in many schools. Our enrolment figures still show a scarcity population of willing students ready to follow the path of science. The ratio of mathematics and science teachers per secondary school is indeed very low.

Above all, we are skill technologically, economically and culturally dependent on other nations. Electricity even where it exists, the epileptic supply punctuated by prolonged period of power failure or absence of power for months does not make the teaching of science and mathematics easy. The use of computers has come in recent times as a key to innovation in learning but how can computers be used if they are purchased, without power (light)? These and many other problems plague the teaching of science and mathematics. One reason for our failure is the lack of appropriate supportive cultural orientation as a necessary framework for development of science and mathematics education. There is need to develop scientific and mathematical culture as appropriate framework for development of science and mathematics education.

A rational society is far more positively related to the development of science and mathematics than an irrational society. the inculcation of appropriate scientific and mathematics culture should be the starting point of a lasting science and mathematics education. This means that we must begin to move away from the dry and abstract approach to the creative living approach. We must reach out to the barriers created by sex, language and located and above all in power of thought. Science and technology together constitute the foundation on which

industrialization and true economic development hinge. The state of science in the Nigerian secondary schools is still inadequate. The acute absence of science education is obvious. The visible absence of interest in science and mathematics by our teeming youths makes a persuasive case for educators to go an extra mile to stimulate this lukewarm interest, we have no choice but to accelerate science, technology and mathematics in our schools.

Nigeria requires science and technology for plant construction projects, oil processing engineering, rice-mills and rice thrashing. Agricultural equipment for higher productivity such as tractors, bull-dozers combined hamsters, ploughs and so cannot be made or used without some knowledge of science and technology. We need scientists in the medical area to mitigate the present variegated cargo of diseases which tend to vitiate the quality of labour and the general health of citizens. Child-killer diseases take a gross toll of our children Science will provide research answer to some of these diseases.

We need scientists to increase the productivity in the food sector so as to defeat the present food shortage that tends to stultify the healthy development of citizens. Furthermore, we need science and technology for clean water, good road construction, decent houses/building, efficient communication, constant electric power and many more benefits for a higher standard of living. The need for the school curricula to emphasize these priority areas cannot be contested. Our enthusiastic voyage to the 21st century and beyond is likely to remain bumpy, rugged and slow if the role of science and technology continues to be accorded a mere lip – service. Science and technology is a gate-way into industrial development. It is a fulcrum on which technological development pivots, the nation's socio-economic, political and industrial development hinges on the technological and scientific status of the nation.

Major Challenges

In order to achieve technological boom in the 21st century, we need to promote the study of other sciences and mathematics. There are several challenges and hurdles to surmount. The neurotic fear of mathematics and science subjects must be combated with sound pedagogical approaches. The dearth of science teachers should be tackled by a higher rate of production at the tertiary level and a better care of those we have. Other problems are as follows:

- i. A lack of interest in mathematics
- ii. An acute shortage of qualified mathematics teachers
- iii. A shortage of mathematics laboratories and instructional materials
- iv. Overcrowding in mathematics classes which makes sharing of limited mathematics instructional materials almost impossible
- v. A near complete absence of educational trips to acquaint students with what they learn in theory.

Actually, science education is expensive. But benefits that fallout from this monumental task far outweigh the investment. We need science education to harness our vast mineral, forest and agricultural resources.

Concept of Sustainable Development

There are numerous definitions of sustainable development but the most widely quoted definition is from the world commission on environment (brundtland Report) which defined it as the development that meets the needs of the present without comprising the ability of future generations to meet their own needs (Nosike, 1996)

Izuegba (1995), defined it as the sum total of all the processes by which a nation is transformed from primitive to contemporary civilization. The writer defines Sustainable development as a present contribution made by individual or groups that will bring about future positive impact to the progress of the society. it therefore means new techniques and new ways of doing things which allows us to improve quality of today's life in all economic, environmental and social aspect without impairing the ability of future generations to enjoy quality of life and opportunities sustainable development requires balanced and integrated analysis from three main perspective; social economic and environmental. Each overview corresponds to a system that has its welfare, primarily through increase in the consumption of goods and services. The environmental domain focuses on protection of the integrity and resilience of ecological systems. The social domain emphasizes the enriched of human relationship and achievement of individual and group aspiration

What is Science?

The word 'science' is derived from a Latin word "Science" meaning to acquire knowledge. Thus it was restricted to fields which provide knowledge, **science** is the knowledge ascertained by observation and experiment critically tested, systematized and brought under general principality;

Technology: The practice of any or of the applied sciences that have practical value and/or industrial use and

Mathematics: The science of magnitude and number and all their relations from the main thrusts of progressive education. They should be seen as subsets of a family. It suffices to say that science is regarded as 'know 'why' and technology as 'know how". The interwoven of these subjects makes fair knowledge in them imperative before a student can be regarded as performing well in them

One of the aims and objectives of the national policy on Education is the acquisition of appropriate skills, abilities and competence, both mental and physical as equipment for the individual to live in and contribute to the development of his society and the spring boards of those are science, technology and mathematics. The extent to which students are able to perform in these depends on how solid the foundation and implementation of the educational policies and programme are at all levels of education.

Science Problems in School

At the primary school level, children are merely expected to be made aware of the existence of science around them. The sources of rainfall, the origin of rainbow, what living things need to

grow, the science of numbers in mathematics and so on. Children at this level can spend time to observe science and technology in operation both at home and in school, children can be taken to the school farms to see how seeds grow and how some pests hinder them from doing well. But very often the concept of science becomes so mystified that teachers and their children show very little interest in studying science especially mathematics. Furthermore, there are few learning materials to concretize learning at this lower educational level.

In addition to that, there is a serious dearth of suitable books on science and technology to give some sound, grounding to young children. Many teachers at the primary level lack the necessary patience to teach children difficult concepts. They tend to rush at their own pace, thus frustrating young children even more. The need to motivate children by explaining to them some advantages of acquiring some understanding of science in their future lives can help sustain their interest.

At the secondary school level, children are expected to start learning integrated science. They are however, beset by problems such as:

- i. Mystifying science and dreading science subjects.
- ii. A lack of interest in science subject
- iii. An acute shortage of qualified science teachers
- iv. A shortage of science laboratory and teaching materials
- v. Overcrowding of science classes which makes the sharing of limited science equipment almost impossible
- vi. A lack of practical relationship between the science learnt in class and the science found in children's environment
- vii. A new complete absence of educational trips to acquaint children with what they learn in theory.

Present Problems

One is amply aware of the plethora of problems militating against the teaching of science education in Nigeria. The following problems may be highlighted:

1. Acute shortage of materials, both equipment and teaching materials. Many laboratories tend to be empty
2. A shortage of science teachers at all levels of education
3. Fear of science subjects. Most youths mystify science subjects and how little or no interest in studying them.
4. Poor maintenance of equipment even when they are available
5. There are far too many children per science class-in courses that are compulsory for all children. This overcrowding effect makes it almost impossible to share limited science learning facilities.
6. A lukewarm attitude to science by teachers and children. The importance of science is felt, but the attitude is lackluster (dull)
7. Most of the teaching of science is theoretical. There is a poor relationship between theory and practical. The environment is full of scientific evidence, but most learning is theoretical.

8. Science education is quite cost intensive. Many schools often find it difficult to equip science laboratories adequately. What they call 'laboratories' do not even resemble laboratories. Experiments cannot be effectuated in this case.

Strategies to Foster Science and Technology

The need for science and technology has been stressed. The problems militating against the full implementation of the laudable ideas surrounding science, and technology have been listed and discussed. Now, the following strategies for implementation of science and technology are charted.

1. Better life for science and technology teachers should be assured. If the need for science and technology for national development is that high, the teachers of these aspects of education should be motivated and encouraged through incentives like a special salary and housing allowance for teachers teaching those areas.
2. A programme promising a better life for science and technology teachers must be evolved immediately
3. A science and technology culture should be developed among the youths. The language, of science and technology should be taught to children. The science and technology concepts should be integrated or correlated with several subjects so that the children will learn science without the threatening labels that characterize specialized science subject.
4. The significance of science and technology should be entrenched in the Nigerian Philosophy of Education. It is not too adreme a more to make school children recite some meaningful science slogans like they recite the national pledge. Such a recitation should be backed up with practical illustrations of what science and technology can do for a nation.
5. The present emphasis placed on admission of science students in the Nigerian universities should continue.
6. A special curriculum combining some science subjects with some Arts and Social sciences subjects should be evolved. This practice will increase the number of science literates in Nigeria.
7. Educational technology should be given more prominent in all the instillations where teachers are trained. If teachers are well trained in the theory and application of instructional technology it could be easier to concretize those aspects of learning that could otherwise be too intangible for learners to perceive or understand
8. A task – force approach is needed to ensure that science and technology budgets are utilized expeditiously and exactly as allocated. Furthermore, the present monetary incentives gives to the Nigerian universities who adhere strictly to the stipulated, ratio 60:40 science others ratio should be maintained.
9. The state of science education at the secondary school level should be strengthened so as to facilitate the flow of the required number of science students into tertiary institutions

Educational Implications (Manpower, Development for Science and Technology Education)

The need for manpower development in the teaching of science is a necessary tool that would enhance scientific and technological development of a nation. It has been observed that the quality of any educational programme in any country is the function of those who teach it. It is therefore expected that teachers who are to teach science and mathematics should be intellectually and professionally competent and dynamic enough to adopt to the world of today's scientific growth and development. This is because a good curriculum and a well stocked laboratory could not still give the desired result in the hands of the incompetent teachers.

The use of archaic, didactic method of teaching resulting in memorization and regurgitation of scientific facts and which make students passive receivers of knowledge must be discontinued instead, instructional strategies that are activity oriented should be adopted by the teacher such that students are active participants in the classroom.

Conclusion

The welfare of any society depends on technology whose foundation is in mathematics and science. There is no alternative to life and this is why the government of any nation devotes a large part of its annual budget to technological education and research. It is therefore, very imperative that all beneficiaries of the gains of science, technology and mathematics must contribute by awarding scholarships, donating STM books and equipment, organizing STM quizzes and contents sponsoring excursions to industries etc. in order to encourage the learning of science, technology and mathematics. This is the only way to achieved total technological emancipate.

Recommendations

1. Science should be integrated in the study of a child's environment right from the primary level of education so as to make the learning of science natural, thus demystifying the chronic fear which the youths nurse about science including mathematics
2. Special science schools need to be built and equipped since it is not reasonably likely that developing a full science centre in every school will be possible within the foreseeable future. A number of such special schools can be established for each local government area.
3. A rapid training of science teachers should be undertaken with an attractive bias to lure potential science students and a reasonable "science teacher allowance" to motivate and retain science teachers.
4. A special science and technology programme should be develop in Colleges of Education, Polytechnics and universities to train teachers in these critical areas. This does not replace the regular science-based courses that yield a B.Sc degree
5. Activities and games that promote the knowledge of science should be intensified in schools, with deliberate patronage by school administration.

6. Science Teachers' Association of Nigeria (STAN) should generate more curricular innovations to popularize science teaching and learning
7. The government budget for education should set aside a reasonable slice for the development of science and technology

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