

## GLOBAL CHALLENGES OF SCIENCE EDUCATION IN AFRICA

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### *ABSTRACT*

*Science education in every sense is one of the fundamental factors of achieving sustainable economic development through investment in human capital. Science education fosters self-understanding, improves quality of lives and raises people's productivity and creativity thus, promoting entrepreneurship and technological advances. It also plays vital roles in securing economic and social progress thus improving income distribution which may consequently salvage the people from poverty. The paper, therefore, examined the concept of science education, standard for science education, importance/transformations through science education in Africa and global challenges of science education in Africa. The paper also draws some conclusion and provides some recommendations.*

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### **INTRODUCTION**

Science education deals with sharing of science content and process with individuals who are not considered traditionally to be member of the scientific community; the individuals could be students, farmers, market women or a whole community. Science education in Nigeria concentrates on the teaching of science concepts, method of teaching and addressing misconceptions held by learners regarding science concepts.

Science education is very important to the development of any nation that is why every nation must take it very serious in all institutions of learning. Many of the developed worlds were able to achieve so much in science and technology because of science education. Launching of sputnik by the Russian government in October, 4 1957 would not have been possible if not for the position they placed physics in science education.

Science education comprises three subjects namely biology, chemistry and physics which are combined with education and over the year here has been low enrolment of these courses in our institutions as identified by (Wasagu, 2004). Causes of this low enrolment include society disdain, mockery of teacher and low prestige of teachers.

Science education deals with sharing of science content and process with individuals who are not considered traditionally to be member of the scientific community; the individuals could be students, farmers, market women or a whole community. Science education in Nigeria concentrates on the teaching of science concepts, method of teaching and addressing misconceptions held by learners regarding science concepts.

Interestingly, as important as these courses are, students' performance has not been encouraging in them and this is worrisome and called for investigation. Despite all the great things science education can accomplish in the national development of a nation there are many problems militating against it especially in Nigeria. This paper focused on the importance of science education and problems militating against the development of it and the way forward.

### **Concept of Science Education**

The word science is derived from a Greek word "SCIENTIA" meaning knowledge. Baiyelo (2001) defined science as a set of theories about the behaviour of nature and the many inventories of man, a way of thinking and viewing the world, and a way of relating facts about the universe. Science can be defined as a body of knowledge that is verifiable and applicable in the solution of everyday challenges of life. Wasagu (2004) perceived science as dynamic and as a process of seeking new knowledge that helps to explain events and phenomena in nature.

Science is a process as well as knowledge. Children learn science by being involved not only with its content, but also with its methodology. The effective science facility accommodates both. Science study requires a variety of unique instructional materials in addition to those materials common to all of education. A science facility must have space to accommodate this variety in combination with hands-on instructional strategies. Science instructional areas have spatial and material needs that are different from those considered in designing a general use classroom.

National, state, and local efforts, public and private, are underway to improve science education. Both the National Research Council, through the *National Science Education Standards*, and the *American Association for the Advancement of Science*, through "Science for All Americans", have emphasized the necessity for scientific literacy for all citizens. The maintenance of a democratic society requires this effort.

As early as possible, students need to become acquainted with the nature of science and the processes of science. It is imperative that all students have a full science educational experience starting from kindergarten, and that an increasing number of students pursue science education throughout their secondary school years and beyond.

Space allocated for science must be designed to support all full science programme classrooms require space for students to have different kinds of learning experiences using a variety of materials and equipment as well as space to prepare and store these materials and equipment. In addition, space needs to be allotted for students to work on long-term projects and for teachers to plan student activities using a variety of teaching strategies.

Changes in methodology, equipment, and materials of instruction require rethinking the arrangement of the traditional teacher-centered classroom. Advances in technology have brought electronic communications into the fabric of the science program. Communication and teamwork skills are built when students interact with each other as they demonstrate creative thinking and learn to respect it in others. Flexibility in the use of space must be considered, in order to sustain a variety of teaching and learning strategies, as supported by the Maryland Science Outcomes. In addition to traditional lecture-style methods of instruction, strategies may include: cooperative learning activities, hands-on laboratory experiments, interdisciplinary team teaching, computer simulations, distance learning, independent projects and other methodologies.

Science education is a process which involves the teaching, learning and applications of science (Wasagu, 2004). For operational purposes he observed that science education can be conceptualized in the following three (3) ways:

- The Teaching and Learning of Chemistry: Here, a study of the content and methods of science education is the major issue.
- Direct Teaching and Learning about Science Education: The quest here is to develop an understanding of the nature of science education, inquiry into its methods with attempts at gaining understanding of application and implication of science education in society or man's life.
- Being socialized into the Theory and Practice of Science Education: This connotes developing expertise in science education, becoming a practitioner, a chemist or a worker in the fields of science education (Wasagu, 2004).

### **Standard for Science Education**

The need for global competitiveness requires that the standard of science education in Nigeria should offer prospect and values that will offer the national comparative advantage. Science teaching worldwide has standard and if the objectives of science education are to be achieved, the standards should be followed.

. These are:

- Teachers of science should plan inquiry-based programme for their students.
- Teachers should interact with students to focus and support their inquiries recognize individual differences and provide opportunities for all pupils to learn.
- Teachers should engage in ongoing assessment of their teaching and resultant students learning.
- Conditions for learning should provide students with time, space and resources needed for successful science learning.
- Teachers should foster habits of mind, attitudes and values of science by being good role models for these attributes and
- It is important for teacher to become active participants in on-going planning and development of the school science programme.

Furthermore, the National Science Teachers' Associations (NSTA) standard for science teacher preparation in America (NSTA, 2003) which provides foundation or a performance assessment system, through which teacher candidates must satisfactorily demonstrate their knowledge and abilities at stable assessments point gateways in the science teacher preparation programme. The standard addresses the knowledge, skills and dispositions that are deemed important for teachers in the field of science.

The standard comprises of ten critical items which are: content, nature of science, inquiry, issues, general skills of teaching, curriculum, science in the community, assessment, safety and welfare and professional growth.

Although this benchmark was designed for the American Education, they find relevance in all other countries too. Abimbola and Omosemo (2012) found that Nigerian Teacher Educators agreed that the benchmark is very relevant to Nigeria situations.

In pursuance of the implementation of the Science and Technology Post Basic Education Project (Step-B-Project), the National Commission for Colleges of education (NCCE) came up with science and technology, standards for teacher educators in Nigeria College of Education (NCCE, 2010) and the implementation manual. The standards and the implementation manual are to guide the knowledge, values and practices of S & T Teacher educators in the Colleges of Education. The standards addresses what the educators should know and be able to do as well as their dispositions towards their work. The standard is divided into three broad segments with

each segment having subsections. The broad segments are: Programme Content Standards, Professional Development Attribute Standards, ICT Attributes Standards for Instruction.

### **Importance of Science Education**

Science education is very important to the development of any nation in many areas. A graduate of physics education can be employed as opined by ( ). Many of the physics graduates have some knowledge of electronics that is enough for them to be able to have a little period of training as apprentices and then stand alone as electronic technician. For instance, semiconductor is very important in the modern technology that if properly learnt it is enough for one to stand upon for a living; semiconductor physics is part of what any graduate in physics will learn and should learn. Semiconductor, is very important in a growing economy like ours in Nigeria. It is useful in ceramic industry and a well-trained physics education graduate can be well established in ceramic industry.

Without science education Information and Communication Technology would be impossible. Science and technology will not be possible without science education. For instance engineering, medicine, architecture etc will not be possible if there is no one to teach the students the core subjects needed for these courses.

Akpan (2008) opined that science contributes to the quality of life in such areas as health, nutrition, agriculture, transportation, material and energy production, and industrial development. He further stated that it ensures that the air we breathe, and the water we drink are life sustaining, and not vectors of disease and decay. He finally concluded that if science and technology form the bedrock of sustainable development, that this revelation should constitute a beacon to our nation, so that science education must be given prominence in Nigerian schools. Again, Ware (1992, p. ) stated that the International Council of Scientific Unions – Council on Teaching of Science (ICSU-CT S) summarized the importance of science and technology to economic development as follows:

“Long term sustained growth can be assured only if the money invested in science and technology is matched by the provision of funds for complementary educational programmes directed both to the preparation of scientists and technologists and to the improvement in science literacy of the population as a whole. At all levels from the ubiquitous “a man-in-the-street” to the most influential ministers, there is a tendency to take education for granted. But unless it is supported on the necessary scale, long term development will not be successfully achieved.”

It is in fact generally accepted that the adoption of scientific frame of mind is a prerequisite for development. Science has therefore become a crucial factor for sustainable development worldwide.

### **Transformations through Science Education in Africa**

- **Agriculture Food and Nutrition:** Industrialization of agricultural production through the development of high-yielding varieties of cereal grains resistant to plant pest and disease, expansion of irrigation infrastructure, hybridized seeds, synthetic fertilizers and pesticides is a boost to food production. They help to meet the food and nutrition needs of growing population, (Gaud, 1968, p. ). Chemistry contributes immensely in this

regard. This include: chemistry of the soil, pollution monitoring, creation of better methods of plant crop production, helping to develop new, more productive and more robust varieties and preservation techniques.

- **Health:** Health as it is popularly said is wealth. It is only a healthy citizenry that can be an active agent in any transformation agenda. The nature of health challenges faced in every part of the world is changing, as a result of shifting patterns of disease, the globalization of health threats, changes in the environment and in human behaviour. Some of the key health challenges and roles for chemistry in meeting them are highlighted below.

Non-communicable Diseases (NCDs – e.g. cancer, diabetes, heart diseases and stroke) are becoming the most prevalent causes of ill-health and death everywhere. Other infectious diseases e.g. HIV/AIDs and tuberculosis are prevalent globally and some specific to tropical regions (e.g. malaria, African and South American trypanosomiasis, visceral and cutaneous leishmaniasis, schistosomiasis) chemists have a central role to play in the discovery of new drugs which are safe, effective, affordable and suitable for use.

- **Quality of Living:** Demographic changes are occurring at an unprecedented scale of speed and scope. The world's population grew from a level of about 1 billion in 1800 to 2 billion around 1920 and then leaps to 6 billion in 2000. It is predicted to reach around 9 billion by 2050 UNDP (2010). These demographic shifts have major implications for patterns of consumption and demands. Science education can make a major contribution, not only to the development of new drugs, diagnostics and medical devices appropriate to these changing populations but also to the creation of new materials that enhance their quality of life, science education (Chemistry) and allied sciences such as chemical engineering and materials, food, energy and sewage treatment sciences have much to offer in helping to ensure the availability of salubrious living conditions including healthy dwellings, clean water, sanitation and safe foodstuffs (United Nations Human Settlement Programme, 2010).
- **Natural Resources Exploitation:** Exploitation of the earth's physical and biological resources has always been a feature of human activities and the pace and extent of this exploitation has increased markedly. This development has attendant consequences which chemistry can mitigate by developing cleaner, more efficient, less energy-intensive and less polluting extraction and refining methods for minerals; methods for the recycling of inorganic and organic materials, and new substitute.
- **Housing, Transport and Communication:** From housing, road construction, bridges to the various modern means of transportation, the influence of chemistry is very pervasive. Input from chemistry is very essential in the overall mix of materials or the required for their construction and or operation. The accessories, lightings electronic devices in use have a lot of input from chemistry.
- **Security and Defence:** Without security, no meaningful transformation can take place no matter how well meaning the intention of the government is. Chemistry is very relevant in security defence related issues either in the form of production of equipment for their defensive or offensive purposes. It is amazing to note the breakthrough of chemistry in areas of bullet proof wares and vehicles used largely in the military. Also, gadgets like security light, CCT use Neon or Aron light as their lighting source and is basically from chemistry techniques, which may aid crime control.

- **At the Domestic Level:** Toiletries, detergents, soap, disinfectants, scurry powder among others which are indispensable domestic items for cleaning, air freshening, general sanitary purposes are products of chemistry.
- **In the Industry:** Whether petrochemical, agro allied industry or any other industry depends heavily on raw material of chemistry extraction or expertise from chemistry in the whole production chain.
- **Climate Change/Environmental Control:** Human activities over time is accountable for a significant rise in average global temperature and a concomitant increase in extreme weather events such as floods, droughts, heat waves and severe winters. If continued unchecked, this global warming and shifts in weather patterns may threaten the lives and livelihoods of many millions of people, due to drought, desertification, floods, disruption of agriculture and the spread of water and vector borne diseases (Pauchauri and Reisinger, 2007). The consequences of climate change are severe (Campbellendrum & Woodfruff, 2006).  
Chemistry has already made innumerable contributions to identifying climate-related problems (e.g. through environmental analysis of ozone depletion and greenhouse gas emissions); understanding their underlying causes and contributing solutions.

#### **GLOBAL CHALLENGES OF SCIENCES EDUCATION IN AFRICA**

Students have been performing very poorly in science disciplines at Senior School Certificate Examinations (SSCE) as is evident from Chief Examiners' Reports (2000, 2003, and 2004). In view of the fact that the quality of science and technology education is a sine qua non for advancement of any nation, identification of major problems facing it will help to adopt the appropriate remedial steps. Aspects of science education occur knowingly or unknowingly during the informal, formal and non-formal education. This is because, science is linked in many ways to society, especially through its technology application.

Hence, Ziman obsolete suggested that "the basic need in science education is to teach about Science technology and Society (STS) and the various ways they interact with each other", this is not the case in Nigeria. The challenges of science education in Nigeria are subsumed in the above suggestions from Ziman. These challenges are associated with goals of science education, childhood home orientation/education gender issues, research and review, curriculum issues, training of teachers/educators, methods of teaching, use of computer and internet.

- **The Status of Curriculum Content**

Offorma (2005) described curriculum as a vehicle through which education takes place. She further stated that it is the totality of the environment in which education takes place. In addition, she viewed it as involving the learner, the teacher, the content; the subject; the resources; the methods of teaching; the evaluation as well as the physical and psychological environment, which must be adequate and conducive for learning to take place. Science education curriculum is expected to equip learners with skills that will make self-reliant, prepare them to enter into jobs and progress in them, This means that the curriculum should prepare the learner for entrepreneurship. The big snag here is that the curriculum on operation in Nigeria schooled is based on European culture which significantly differs from the culture where it is executed.

As a result, students find it difficult to relate what they already know to what they are to learn due to cultural settings. Again, the language of delivery is foreign to the students.

In addition, there is problem of curriculum overload, which, according to Offorma (2005), is the first set back to attainment of the goals of education in Nigeria. She opined that the number of subjects offered by secondary school students for certification is rather many. Adeyegbe (2004) was of the view that some of the contents of science curriculum are of little relevance to the general education of the intended level and cannot even be covered within the time limit. Other researchers also held the same view based on investigations. They therefore concluded that if the objectives of science education are to be achieved for sustainable development, that curriculum planners should off load the curriculum.

- **Problems in the Science Classrooms**

Most practicing science teachers do not possess adequate training for the job. Since the science world is continuously changing, teachers require to be constantly trained and retrained to update and upgrade their knowledge in the job and in the contents to be facilitated. It is a common adage that no educational system can rise above the level of its teachers. Two spheres of science teachers exist in the school system. The first groups are the proper professionally trained teachers and educators who lack in depth knowledge of the science subject content. The second groups are those who have mastery of the subject but are not professionally trained teachers. These two categories form the implementers of the science curriculum in Nigeria schools. They all perfect on the job with years of experience. The snag is that at this period when they should be displaying expertise in classroom, they become head teachers and go into administration. Their services as classroom teachers/educators get lost to the system.

Science teaching has both content aims and process aims. The guiding principle should be: connecting knowledge to life outside the school; ensuring the learning Science teaching has both content aims and process aims. The guiding principle should be: connecting knowledge to life outside the school; ensuring that learning shifts away from rote method; and enriching the curriculum so that it goes beyond textbooks. In addition, there should be emphasis on sensitivity for preservation of environment and social harmony and building a culture of peace. This could be achieved by making examinations more flexible, and, integrating them with classroom life and, nurturing an identity soaked in caring concerns, with the democratic policy of the country. That was why documented that "the challenges of science education are to bring the full range of young people a comprehension of the nature of science humanistic enterprise". This is in line with the intended goals of

F. M. E (2004). Again, focusing the process aims, Garson (1988) stated thus:

*"If children are to learn science, we must give them respect for observations rather than the pronouncements of the textbooks and teacher prophets, we must see to it that children understand experimentation as a means of compelling nature to answer their questions. children must know that no one really knows. If we can give children these insights, they will have learnt science, no matter what content they have covered".*

The development of thinking, practical and communication skills is an important aim of science. These processes are vital to science teachers and learners. Science students should be able to use certain tools, make and record accurate observations etc. This is hands-on method of teaching.

- **Non-usage of Computers and Internet for Science Teaching**

These facilities are generally lacking in the nation's science classrooms. According to Olele (2008), application of computer and Internet technology in education is a primary concern for education all over the world. In developed countries, Computer and Internet are utilized in the classroom for teaching and learning different subjects. Research in education has revealed that the use of computer-based resources enhances the teaching, scientific enquiry and scientific literacy. Using computer skills, application programmes, accessing information from the internet or CD-ROMs, interactive video disc instruction, Computer Assisted Instruction (CAI), Computer Based Instruction (CBI), Computer Learning (CBI), e-learning etc, offer certain advantages over traditional methods. These make learning easier, faster, exciting, and interesting to the learners.

In Nigeria, the government at all levels, has not done enough generally, to provide the resources to support the use of computers in education. Computer can only be spotted in few primary and secondary schools. This situation also poses some constraints to effective teaching of science education for nation building. This is because, enabling the learners see what the developed countries have achieved and the processes adopted in the achievements, could serve as a motivation for them to imitate development.

- **Problems of Evaluation in Science Education**

Evaluation in education has a purpose as well as the process. The purpose of evaluation is to improve the quality of teaching and learning. It is the improvement of practice in education so that aims and objectives can be realized. Where the aims and objectives are not achievable, then they may need to be evaluated so that they can be attained. This means that all educational practices which include the following: aspects of learning and teaching like the curricula; teaching methods used; assessment procedures employed; aims and objectives as well as the performance of individual learners, should of necessity, be evaluated.

The Nigerian educational system emphasizes the evaluation of the performance of the individual learner, hence the emphasis on paper certificates. Learners hence struggle to get certificates by any means which culminates in examination malpractices. These certificated learners are fake products, and, are self-reliant. This is a defect in the programme of science education of the nation. Also the non-evaluation of other science educational practices is a serious problem in implementation of science education in Nigeria Secondary Schools.

- **Gender Challenges**

Njoku (2008) opined that for any nation to achieve sustainable and rapid economic development, it is imperative that the females participate actively in science and technology activities. This is in line with the view expressed by Nyerere (1988) he stated that "the way nobody walks far or fast with only one leg is the same way that no nation develops much or fast if half of her population the female folk, are left out in the science and technology (S&T) enterprise. Furthermore, Justice *Development* and Peace Commission (JDPC) (2005) stated that women's educational status in any nation correlates to its level of development. That was why Nwachukwu (2008) investigated ways of enabling girls achieve maximally in science classrooms and found out that girls outperformed boys in cooperative learning environment in chemistry concepts. She then suggested that it is important that enabling environment for maximum performance of both males and females be adopted in all spheres of life. This will uplift the aspirations, confidence, image and intellectual development of

the females in S&T education. In addition, many researchers at both local and international levels have documented the gender-disparity and differences in subject enrollment and achievement in S&T based courses and professions (Nwachukwu, 2008, Asoegwu 2008). According to Nkpa (1993) the enrollment ratios of males and females in undergraduate and postgraduate courses in Nigerian Universities were consistently skewed in favour of males (up to 67:1). Again, Odebo (2001) pointed out that, "it is disheartening to note that a very small percentage of employed females are in the Science, Technology and Mathematics (STM) education". She further noted that in many countries the participation rate is higher in the primary and tertiary sectors than in the secondary sector of industrial production. This situation poses a threat to smooth national development and must of necessity be rectified. Possible remedial courses need to be identified and exploited with a view to giving a final solution to national development of Nigeria. This is because, there is an adage that "if a man is trained an individual is trained, but when a woman is trained, a nation is trained."

- **Inadequate use of Research and Review**

The presence of a vibrant research machinery is very essential for the success of any developmental venture. However, it is on record that the universities and polytechnics, the research division of WAEC, the NERDC, etc. are making attempts to perform these functions, though, more is expected of them. The problem is that Nigerian government is not adequately utilizing the findings from these researches for review of the situation in the education sector. This poses a problem to development.

- **Problem of Resources in Science Teaching**

The key resources are financial resources, human resources, infrastructure and equipment. The Nigerian government provides the fund for running the public schools "at all levels, with exception of the private schools. The government also recruits and pays the staff salary; attempts to provide some infrastructure and science equipments.

With the proliferation and politicizing of schools, it is not possible that the government alone can provide adequate resources for these schools. This means that resources for proper science teaching are lacking at all levels.

#### DATA ANALYSES AND RESULTS

##### Answering the Research Questions

##### Research Question One

What are the global challenges of Science Education in Africa?

The research question sort to find out the global challenges of Science Education in Africa.

In order to answer the question, percentage analysis was used. (See table 1)

<b>PERCENTAGE ANALYSIS</b>			
<b>Global challenges of Science Education in Africa</b>	<b>FREQ</b>	<b>%</b>	<b>Remark</b>
Overload of Curriculum Contents and uses	29	11.6	5 <sup>th</sup>
Inadequate goals of science education	22	8.8	6 <sup>th</sup>
Non-usage of Computers and Internet for Science Teaching	67	26.8	1 <sup>st**</sup>
childhood home orientation/education gender issues	13	5.2	7 <sup>th</sup>
Inadequate use of Research and Review	41	16.4	2 <sup>nd</sup>
Inadequate training of teachers/educators	35	14	4 <sup>th</sup>
Problem of other resources in science teaching	38	15.2	3 <sup>rd</sup>
Poor methods of teaching/problems of Evaluation in Science Education	5	2	8 <sup>th*</sup>

<b>Total</b>			
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**Highest Percentage\*\***

**Lowest Percentage\***

From the result of the above table 1, it was observed that the highest Global Challenges of Science Education in Africa was “Non-usage of Computers and Internet for Science Teaching” with 67 (11.6%) while the lowest was “Poor methods of teaching/problems of Evaluation in Science Education” with 5(2%).

### Research Question Two

What are the transformations through Science Education in Africa?

The research question sort to find out the transformations through Science Education in Africa. In order to answer the question, percentage analysis was used. (See table 2)

<b>PERCENTAGE ANALYSIS</b>			
<b>Transformations through Science Education in Africa</b>	<b>FREQ</b>	<b>%</b>	<b>Remark</b>
Agriculture Food and Nutrition	49	19.6	2 <sup>nd</sup>
Health	53	21.2	1 <sup>st**</sup>
Quality of Living	5	2	9 <sup>th*</sup>
Natural Resources Exploitation	38	15.2	3 <sup>rd</sup>
Housing, Transport and Communication	32	12.8	4 <sup>th</sup>
Security and Defense	10	4	8 <sup>th</sup>
Domestic Level	15	6	7 <sup>th</sup>
Industry level	22	8.8	6 <sup>th</sup>
Climate Change/Environmental Control	26	10.4	5 <sup>th</sup>
<b>Total</b>			

**Highest Percentage\*\***

**Lowest Percentage\***

From the result of the above table 2, it was observed that the highest Transformations through Science Education in Africa was “Health” with 53 (21.2%) while the lowest was “Quality of Living” with 5(2%).

### Conclusion

Science education curriculum is expected to equip learners with skills that will make them self-reliant, prepare them to enter into jobs and progress in them. This means that the curriculum should prepare the learner for entrepreneurship. The big snag here is that the curriculum in operation in Nigerian schools is based on European culture which significantly differs from the culture where it is executed. As a result, students find it difficult to relate what they already know. to what they are to learn due to cultural settings. Again, the language of delivery is foreign to the students.

The role of science education, technology and mathematics will make the difference as to whether African countries will enter the scientific age and international transformation standard

and become a manufacturer of scientific products to transform its scientific science education sector and ailing industries to become one of the industrialized nations or remain a reckless consumer of science products. The transformation agenda of the federal governments is a great visionary leap for the economic emancipation of Africa. The items of the transformation agenda were examined in context. The various ways in which research science education and technology mathematics may contribute towards the actualization of the transformation agenda were identified and discussed. Recommendations were also made towards the success of STME and the federal government transformation agenda.

### **Recommendations**

- Proper use of findings and recommendations from scholarly research and review should be made for uprooting the impotence and disabilities of Nigerian science education in development.
- Inclusion of learning about computer and its functions as goals in themselves and as a means to an end must be enforced as a sine qua non in science education for both the individual and nation building. The epileptic power supply in Nigeria should be controlled if any meaningful science education for nation building should ensue.
- Evaluation of all science educational practices must be done from time to time. There should be both formative evaluation and summative evaluation to ensure that the aims and objectives are attained.
- Scientific and research culture is lacking in Africa. There is need for the government to entrench and promote science education and technology research culture in the country. This can be done by providing environment that is conducive and research friendly. ICT infrastructure and access continued to be an issue. Access to chemicals of integrity, relevant textual materials and other basic amenities needed for research continue to lack.
- A conducive and attractive remuneration for secondary school teachers is necessary to provide job satisfaction at this level. Science teachers should be given at entry at least a step higher ahead of their non-science counterpart. This should also apply to the tertiary institutions.
- Our universities and tertiary institutions should be repositioned and reequipped to pursue their primary role which is teaching, research and dissemination of research information and community service.
- There is need for a national rebirth, value re-orientation and priority reordering if the desire for national transformation can see the light of day.
- Funding in general, education is poorly funded in Nigeria. We operate far below the 26% of budget funding prescription by United Nations, As evident in the inadequacy of personnel, research facilities for the training of science teachers and students in science, technology and mathematics education. Thus, adequate and substantial amount should be allocated to education to cater for its needs.

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