

# SCIENCE AND TECHNOLOGY EDUCATION DEVELOPMENT AND THE NIGERIAN CHILD: CHALLENGES AND PROSPECTS

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## **Abstract**

*The Nigerian child accounts for about forty five percent of Nigeria's population. Forty percent of children between the ages of 6-11 do not attend any primary school with the northern region recording the lowest school attendance rate particularly in insurgencies areas. It is estimated that about 4.7 million children of primary school age are still not in school despite the increased enrolment. There are many challenges in ensuring quality education and satisfactory learning achievement. It is not rare to see cases of 100 pupils per teacher or pupils sitting under trees outside a school building because of lack of enough classrooms. The number of school facilities and qualified teachers available for basic education remain inadequate for the eligible number of children and youths. This is more in urban areas where there is population pressure. Under these conditions teaching and learning science and technology cannot be effective. Science is an arduous human enterprise that dominates our lives and presents society with tremendous opportunities and challenges. It is exciting, perplexing, and enlivening yet seen by many students as difficult science. It is indictment that the common science and technology committee reported that many students loose enthusiasm about science. This paper describes the Nigerian child, defines the challenges faced by the implementation of quality science and technology education in basic schooling, the professional qualities of the ideal science teacher. The paper also discusses the essential qualities of a highly proficient science teacher, and the characteristics of a highly effective technology teacher. Suggestions are proffered towards addressing challenges.*

**Keywords:** Nigerian Child, Science Education, Technology Education, Science Teachers and Technology Teachers.

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## **Introduction**

One of the key problems in evolving a development strategy for a developing country like Nigeria is lack of the capacity for appreciation and application of science and technology through developmental efforts (Aina, 2012). The society is dominated and even driven by ideas and product from science and technology. The influence of science and technology on people's lives will continue to increase in the years to come. Scientific and technological knowledge as well as skills invade all realms of life in modern society. The society is increasingly dependent on new as well as established technologies, knowledge and skills in science which are crucial for most of our actions and decision, even as workers, voters, and consumers (Albone, 2011). Modern societies need people with science and technology qualifications, as well as a general broad understanding of science and technology contents, methods and as a social force shaping the future. Science and technology are major cultural products of human history which all citizens of different occupations need to be acquainted with this part of human culture. Science and technology are important for the economic well-being, but also seen from the perspective of a broadly based liberal education.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) released a shocking report indicating that one out of every five Nigerian children is out of school. This is clearly a national dishonor for a country that is the world's eighth largest oil producer. The UNESCO Education for All Global Monitoring Report (EAGMR) says Nigeria holds the world record of having the highest number of its young people out of school (Abdulrahman, 2015). With approximately 10.5 million kids out of school, Nigeria dominates twelve other countries with which it accounts for 47 percent of the global out-of-school population. The other countries are Pakistan (5.1 million), Ethiopia (2.4 million), India (2.3 million), Philippines (1.5 million), Cote-d'ivoire (1.2 million), Burkina Faso (1 Million), Niger (1 million), Kenya (1 million), Yemen (0.9 million), Mali (0.8 million) and South Africa (0.7 million). According to UNESCO Nigeria is among the four countries that has experienced the highest increase since 1999 (Agbowuro, Oriade & Shuaibu, 2015). The central purpose of national development is to substantially build up to empower the capacity of a nation to confront national problems on human existence successfully to its advantage through the effective use of science and technology. Science and technology are two crucial components of all efforts aimed at fostering growth and socioeconomic development. Science is the concerted human effort to understand the history of the natural world and how the natural world works, with observable physical evidence as the basis of understanding. This is done through observation of natural phenomena and/or through experimentation that tries to simulate natural processes under controlled conditions. It is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe. Technology is a means of harnessing and exploiting it. Every model of development in the modern world presumes the application of science and technology.

## **The Concept of Technology Education**

The International Test and Evaluation Association (2000) define technology education as the study of technology in which students learn about the processes and knowledge related to technology. As a field of study, it covers the human ability to shape and change the physical world to meet needs, by manipulating materials and tools with techniques. As a concept, technology education concerns an array of tools such as

media, machines and networking hardware, as well as considering underlining theoretical perspectives for their effective application (Abdulalu, 2016). Technology education is a means of preparing for occupational fields and for effective participation in the world of work, as an aspect of lifelong learning a preparation for responsible citizenship and an instrument for promoting environmentally sound sustainable development (Agbowuro, Oriade & Shuaibu, 2015). It provides trained manpower in applied sciences and technology. It proffers the technical knowledge and vocational skills necessary for agricultural, commercial and economic development (Odu, 2017).

### **The Concept of Science Education**

Science education is the field concerned with sharing science content and process with individuals not traditionally considered part of the scientific community (Albone, 2011). The learners may be pupils, students or adults within the general public. The field of science education includes studies in science content and process (The scientific method) and teaching pedagogy. According to Abah (2008) Science is a process as well as knowledge. Children learn science by being involved not only with its content, but also with its methodology (Mohammed, 2017).

### **Goals of Science Education**

1. To excite and enthuse children with a sense of awe and wonder at the natural world.
2. To give pupils enough evidence-based knowledge to be able to make informed personal judgments in order to live healthy, safe, comfortable and environmentally sustainable lives.
3. To develop pupils' understanding and experience of the scientific method, to understand its value and limits, and to enable them to apply the method.
4. To be proficient at practical work and use of scientific equipment.
5. To know, understand at an abstract level, and be able to apply important scientific theories.

### **Issues Surrounding the Teaching /Learning of Science and Technology**

There has been a growing public anxiety about the teaching and learning of science in Nigerian schools. Studies such as Ogunmade (2015) showed that large numbers of students learn little science in school. This learning tends to be by rote and most students find learning of science to be difficult. The quality of science teaching and learning has also been questioned over time by parents, science educators, the general public and even the government. Science teaching in Nigeria has been criticized because of poor performance of Nigerian students in science subjects relative to their counterpart in other countries. This is evident from the second international science competition in which Nigerian students came last in primary science and secondary science among the participatory countries in the world (Ogunmade, 2015).

The problems of science and technology education in Nigeria are diverse. They arise from inadequate supply of instructional materials, lack of motivation, lack of well-equipped library, lack of workshops, tools and machineries, frequent curriculum changes, lack of well-articulated in-service education programmes, insufficient university admission for the training of the technology teacher, poor professional, personal and public image, dearth of qualified technical educators.

According to the 2010 Nigerian Educational Survey and Digest Statistics (NESDS) report 21% of children ages 5-16 cannot read at all in the South-West compared to 31%

in the South-South, 32% in the South-East, 58% in the North-Central, 72% in the North-West and 83% in the North-East. Efforts by the government to deliver free and compulsory education to the Nigerian child at primary and junior secondary school levels through the Universal Basic Education (UBE), has so far been ineffectual. Many public schools lack basic infrastructure and are therefore not conducive for effective teaching and learning (Akighir, 2015). Other challenges are:

**1. Outdated curriculum:**

Pupils perceive school science as lacking relevance. It is often described as dull, authoritarian, abstract and theoretical. The curriculum is often overcrowded with unfamiliar concepts and laws. It leaves little room for curiosity and a search for meaning. It often lacks a cultural, social and historical dimension, and seldom treats contemporary issues.

**2. The difficult Nature of Science:**

Scientific knowledge is by nature abstract and theoretical. It also often contradicts common sense. It is also often developed through controlled experiments in artificial and idealized laboratory settings. Learning science often requires hardwork and intellectual efforts, (although school science should be tailored to meet the needs and abilities of pupils!) and concentration, which is not part of the present youth culture. In a world where so many channels compete for the attention of young people, such subjects become unpopular.

**3. Inadequate Qualified Science and Technology Teachers:**

There is shortage of qualified science and technology teachers in many Nigerian schools. Who are often poorly trained. The so called science and technology teachers are not professionally qualified. They may have the knowledge of science but lack knowledge of effective method of teaching (Kola, 2012). Worst still are the primary school teachers who are jack of all trade.

**4. Stereotypical image of Scientists:**

Many learners perceive science as stereotypical and problematic. Scientists (especially in physical sciences) many pupils often perceived science to be closed and boring. They are not perceived to be kind or helping and working to solve problems of humankind.

**5. Contradictory and Optimistic Trends:**

From the falling enrolment in science, one may deduce that there is a falling interest in Science and Technology. While on the other hand, young people are more than ever interested in using all sorts of new technology. It is a paradox that countries which have the most problems with recruitment to science and technology are also the countries with the most widespread use of new technologies among the young people. (Cellular telephone, personal computers, internet etc) There seems to be an eagerness to use the new technologies, but a reluctance to study the disciplines that produce the very same products is alarming.

**6. Science and Technology in Schools:**

Science and technology education in most countries are criticized for being traditional and rather old-fashioned. The implicit image of science is that it is mainly a massive body of authoritative and unquestionable knowledge. Most curricula are overloaded

with facts and information at the expense of concentration on a few 'big ideas' and key principles. There is often repetition, where the same concepts and laws are presented year after year. Such curricula often lead to rote learning without deep understanding.

It should also be noted that science is often seen as demanding and difficult. The ideas are not always easy to grasp. Their understanding often requires concentration and hardwork over a long period of time. The youth of today are not used to coping with such demands. If one could hope for such efforts, pupils will need a strong motivation, and they need to find something that is seen as very valuable. This is not always the case. Although science per se can be seen as difficult, the demands of school science may of course be adopted to suit the age of learners.

### **Prospects of Science and Technology Education**

One might expect that the increasing significance of science and technology should be accompanied with a parallel growth in the interest in these subjects as well as increasing understanding of basic scientific ideas and ways of thinking. This however, is not the case. Lack of ideal resources for science teaching and learning in Nigerian schools has been a major issue of concern. Majority of schools lack the essential resources for imparting the knowledge of scientific concepts to learners. Many learners learn little science and learning tends to be by rote and many students find science not interesting thus boring (Ogunmade, 2015).

Inadequate teaching has been advanced as one of the problems of science and technology education (Omorogbe & Ewansiha, 2013). Omorogbe and Ewansiha (2013) identify the use of in-appropriate non-effective teaching methodologies as a major factor hindering students understanding and achievement in science. Onose, Okogun and Richard (2009) posited that many teachers teach in abstraction thereby making science lessons boring as students find it difficult to grasp scientific concepts, skills and principles. Abdulalu (2016) observes that most teachers emphasize theory rather than the practical aspect of science and that most of them lack adequate knowledge of the subject matter and the competence to deliver. In addition, Abdulalu stressed that the teaching of science has been reduced to a descriptive exercise through the use of lecture method.

According to Grima (2011) education is stereotype and not revolutionary. The author sees the history of scientific discovery as presented to students as a mode of memorizing. Grima alludes that students are not properly trained to understand and apply knowledge for the purpose of innovation and positive rational problem solving. Grima (2011) sees the Nigerian scientist and technologist as a product of bad educational system. This system produces students and teachers that have lost contact with science and merely engage in routine recitation of scientific facts. Although, the Nigerian government attempts to engage itself in the application of international standards and in the elaboration of a national legislature to be able to provide better conditions for the children, the challenges of the Nigerian child are still many, associated with socio-cultural factors, unfavorable policies, inefficient education system, lack of basic attitude to think, excel, and negligible parental guidance. Many Nigerian children do not attend school because their labour is needed to either help at home or to augment income in the family. Many families cannot afford the associated cost of sending their children to school. For others the nearest school is a major distance.

Other cause of low enrolment, especially in the Northern part of the country are cultural and religious biases. Even when children enroll in schools, many do not

complete the primary cycle. According to current statistics, 30% of children drop out of school. Reasons for this low completion rate include child labor, economic hardship and early marriage for girls. For all these reasons, the prospects of Nigeria achieving education for all by 2020, seems a mirage.

### Essential Qualities of a Proficient Science Teacher

A great teacher is one a student remembers and cherishes forever. Teachers have long lasting impacts on the lives of their students, and the greatest teacher inspires learners towards greatness. Besides possessing personal qualities, every science teacher should fulfill the following broad requirement (Himanshu, 2012).

1. **Practical knowledge of Child Psychology and Of Learning Processes:** A science teacher must have practical knowledge of child psychology and of the process of learning. The science teacher should be able to cater for individual differences in the class. Knowledge of child psychology helps a teacher to guide students according to their interests, capabilities, vocation and personal problems. Beside these, a science teacher should be a scientific, rational in approach to problems, free of bias, innovative, inquisitive about the world around him. A science teacher should regularly evaluate his/her teaching so that he/she can keep improving and also help him identify his/her weakness.
2. **Trained in Modern Methods and Techniques:** A science teacher must be trained in modern methods and techniques of teaching science. New methods and techniques are being advocated for the teaching of science. Teachers should develop precise, measurable, learning outcome and assess them using a variety of method. Improvisation of apparatus, programmed instruction, teaching machine and many other new concepts are coming in. It is therefore, desirable that a science teacher is trained and is well versed in:
  - i. Development of aquaria, vivaria, and terraria.
  - ii. Knowledge of preserving specimen of plants and animals.
  - iii. Maintenance and the use of science equipment.
  - iv. Lesson and unit planning
  - v. The various innovative teaching methods in use today
3. **Basic Academic Requirement:** The basic academic qualifications are laid down by the Ministry Of Education. A science teacher should have at least a B.Sc.Ed
4. **Sincerity of Purpose:** A teacher should have love for his profession. He/she should be seriously and sincerely committed to his/her duties and work. He must be on the path of excellence both for his own personal achievements and that of his pupils.
5. **Studious and Learned:** A desirable quality of a teacher is his taste for reading. He should have the habit of keeping himself in touch with the latest development especially in his subject area. He should be a voracious reader of the knowledge available to him from multidimensional sources.
6. **A Good Communicator of Ideas:** A science teacher should be clear in speech and should be able to convey his ideas to his pupils with ease and effectiveness. His blackboard and sketching should be quite neat, bold and effective.
7. **Impartial Behavior and Attitude:** A teacher should not have any biases and prejudices of any kind towards any of his pupils. A science teacher should not distinguish and discriminate one pupil from the other and should try to drop all

notions of favoritism or antagonism by giving a solid proof of his impartial behavior and attitude towards all his pupils.

8. **Leadership and Love for Discipline:** The science teacher must possess the trait of a good leader in whom the pupils may have genuine faith. He should be able to inspire the pupils to seek knowledge with sincerity. A disciplined and sincere teacher will be able to inculcate the values of sincerity, discipline and obedience among pupils. This will channel the energy of his pupils towards constructive activities.
9. **Self Confidence:** A teacher must have confidence in his abilities. This confidence must be demonstrated through his behaviour in general and his classroom teaching in particular.
10. **Mastery of His Subject:** A science teacher should have profound knowledge of his subject so that he/she may not cut a sorry figure before his pupils. He should be able to keep his head high and be able to answer all questions and problems put to him by his pupils up to their satisfaction in all areas of science.
11. **Scientific Thinking and Attitude:** A good science teacher tries to imbibe scientific thinking and attitude. For inhibition of such traits, a science teacher must attempt to provide science education in such a way as to inculcate in the pupils a habit of testing the validity of certain beliefs and facts by their own independent observation and experimentation.
12. **Efficient in the Preparation and Use of Teaching Aids:** A good science teacher should have sufficient skill and dexterity in improvising and constructing his/her own aids in teaching of science according to the local needs and situations. He/she should have full self-confidence in handling all types of demonstration of equipment and materials as well as in using all types of audio-visual aids for making science teaching and learning effective.
13. **Knowledge of Curriculum and Standards:** A good science teacher has thorough knowledge of the science curriculum and standards that must be upheld and ensures those standards are met.
14. **Knowledge of Methods of Teaching:** It is also essential for a science teacher to be trained in current techniques, strategies and methodologies of teaching science that include the use of all type of teaching aids materials and developed technology.
15. **Taste of Scientific Activities:** a good science teacher should have taste and love for organizing and participating in scientific activities like establishment of science museum and science club, organizing scientific excursions and fair as well as engaging in purposeful scientific hobbies. Such activities constitute real education and help in the proper development of scientific attitude among learners.
16. **Ability to Raise the Curiosity Level of Learners:** A good science teacher should be able to inculcate a sense of curiosity in learners. He/she must know how to make learners wonder about all that exist and think about what could exist.
17. **Flexibility in Teaching Methods:** A science teacher must use teaching methods that bring out the desire to learn. Some of these methods may be unorthodox but effective, e.g. a visit to the museum instead of a theory class that is more boring than illustrative, a class held outdoors to demonstrate the laws of physics instead of just making learners to memorize.
18. **Ability to Tap the Potential of Learners:** Good teachers know the potential of every child in their class. They do not talk to the walls or mumble to the

blackboard, rather, they make sure that everyone is involved in every science lesson.

19. **Patience:** A good science teacher should not lose his patience and unnecessarily get edgy over mistakes and shortcomings of his pupils but must demonstrate a lot of equanimity in dealing with them: Pupils should not live in constant fear of the teacher.

### **Characteristics of an Effective Technology Teacher**

According to Fina (2015), an effective technology teacher should possess the following qualities:

1. The teacher creates learning environment where learners are active participants as individuals and as members of collaborative groups
  - a. Uses digital tools to facilitate learning
  - b. Designs online spaces and opportunities for learners to collaborate online with others within/outside the classroom.
2. Creates an environment that models the seamless use of technology for teaching and learning.
3. A teacher motivates students and nurtures learners' desire to learn in a safe healthy and supportive environment which develops compassion and mutual respect.
4. A teacher displays effective and efficient classroom management that includes routines that promote learning.
5. A technology teacher encourages students to accept responsibility for their own learning and accommodates the diverse learning needs of all students.
6. Provides a variety of digital tools to make the content accessible to address the learning needs of all learners.
7. Develops technology-enriched learning environments that enable all learners to pursue their own educational goals, manage their own learning, and assess their own progress.
8. Uses digital tools to manage an effective classroom.
9. Draws on the technical expertise of their pupils and gives them roles in managing the technology.
10. Helps students learn the content of the curriculum while gaining technological skills.
11. Teacher provides students equitable access to technology, space, tools and time.
12. Provides learning experiences by using technology to actively engage all learners irrespective of time zones or physical distance.
13. Teacher effectively allocates time for learners to engage in hand-on experiences discuss and process content and make meaningful connections.
14. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources.
15. Teacher creates an environment where students work is valued, appreciated and used as a learning tool.
16. Promotes, supports, and model creative and innovative thinking and inventiveness.



## Conclusion

With the large population of vibrant children and youth, Nigeria is a nation of immense promise. Given the right environment Nigeria could develop into a significant nation of a happy, united and prosperous people, since the most benevolent nature has provided the country with the resources and conditions for economic development. The challenge therefore is that of educating the youth in responsible thoughts, skills and expertise as a starting point to serve as the necessary and inevitable leaven to transform the beleaguered economy, in practically all areas of education, agriculture, industry, society, economy financial market and politics. A relevant science and technology education therefore, is the strategic tool needed to ensure that societal goals, values and aspirations are consistent with the nature of man.

## Recommendations

1. All teachers of primary, secondary, and tertiary institutions should work towards a quality teaching to ensure they are experts in teaching as well as in their teaching subjects.
2. The government should employ Science and Technology Education technicians for schools to assist teachers in practical science and technology
3. The government should also ensure that every primary school has access to at least one subject specialist teacher in both science and technology.
4. The government should train teachers to engage fully in the digital technologies to improve students' experience of and attainment in science and technology.
5. School authorities should build career awareness from primary school onwards by exposing children to role models, such as professional scientist, engineers and technologist.
6. Teachers should challenge students to experience their school learning in open-ended, real-life contexts and encourage students to think for themselves.
7. Teachers should respect and value students' contributions.

## References

- Abah, C.O (2008). Science, Technology and Mathematics Education: A key driver to achieving the Federal Government's Seven Point Agenda. *Nigeria Journal of Science and Education Research*, 4, 1-8.
- Abdulalu, A. (2016). Functional science, technology and mathematics education for national economic empowerment and development. Paper presented at the Federal College of Education conference, Zaria, Nigeria. *International Journal of Education, Learning and Development*. 4(1), 60-69
- Abdulrahman, A. (2015). Nigeria holds world record in number of children out of school. Retrieved from <http://www.premiumtimesng.com/news/138442-shocking-nigeria-holds-world-record-in-number-of-children-out-of-school.html#> on 5<sup>th</sup> February 2019
- Agbowuro, C., Oriade, L.T. & Shuaibu, S. (2015). The Nigerian child, science and technology education, current challenges and possible solutions. *International Journal of Education, Learning and Development*, 4(1), 60-69. Retrieved from [www.eajournals.org](http://www.eajournals.org) on 19<sup>th</sup> February, 2019.
- Akighir, S. (2015). Street hawking and the Nigerian child. Retrieved from <http://ecdinitiative.or/download.php?>

- Albone, E. (2011). Science Education: The importance of school scientist partnerships. Retrieved from <http://www.cliftonsscientific.org/pubs/parliamentary.html> On 9th February 2019
- Grima, G. (2011). *A vision for science education in Malta*. Malta: Salesian Press.
- Fina, P. O. (2015). Children in science and technology. Paper presented at eighth international conference on potentials of children in science and technology. University of Ado-Ekiti, Ekiti State.
- Himanshu, M. (2012). What are the qualities of a good science teacher. Retrieved from <http://www.preservearticles.com/2012041930710/what-are-the-qualities-of-a-good-science-teacher.htm/>.
- Kola, A. J. (2012). Importance of science education to national development and problems militating against its development. Retrieved from <http://pubs.sciepub.wm/ed/1/7/2/index.html>. on 10th February, 2019
- Mohammed, A.S. (2017). Commercializing entrepreneurship and scientific skills for self-reliance and job creation in Nigeria: Issues and challenges. *Journal of Teacher Perspective*. 13(1), 113-123
- Odu, K. O. (2017). Human capital development in science and technology education: Challenges and new responsibilities of the teacher. *American-Eurasian Journal of Scientific Research*, 6(1), 39-46.
- Ogunmade, T. O. (2015). The status and quality of secondary school teachers and learning in Lagos State, Nigeria. Doctoral dissertation, Edith Cowan University, Joondalup, Western Australia). Retrieved from <http://www.researchgate.net/publication/49282187>. On 2<sup>nd</sup> February 2019
- Omorogbe, E. & Ewanshiha, J. C. (2013). The challenge of effective science teaching in Nigerian secondary schools. *Academic Journal of Interdisciplinary Studies*, 2 (7) 181-190
- Onose, G. M., Okogun, E. A., & Richard, J. (2009). Reforms and innovation in training and retraining of science and mathematics teachers to meet the challenges of global development. *Journal of Teacher Perspective*. 52 (1), 24-25
- The International Test and Evaluation Association (2000). Standards for technological Literacy. Content for the study of technology. Retrieved from <https://en.m.wikipedia.org/wiki/technology-education> on 9th February, 2019