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VISION 20:2020: IMPLICATIONS FOR SCIENCE AND TECHNOLOGY EDUCATION

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Abstract

This paper focused on the review of science and technology education in Nigeria, and its importance to national development. It is an analytical synthesis of the problems militating against science education. Science teaching is a complex activity that lies at the heart of the vision of science and technology education. The teaching standards provide criteria for making judgments about progress towards the vision; they describe what teachers of science and technology at all levels should understand and be able to do. To attain the vision of science education a reform is needed in the entire system. Teachers will need to work within a collegial, organizational, and a policy context that is supportive of good science teaching. The vision of science education portrayed by the effective teacher of science creates an environment in which they and the students work together as active participants. Teachers must have theoretical and practical knowledge and abilities about science, learning and science teaching. What students learn is greatly influenced by what they are taught. The educational system must act to sustain effective teaching. The routines, rewards, structures, and expectation of the system must endorse the vision of science teaching portrayed by standards. Teachers must be provided with resources, time, and opportunities to make a difference. The study adopted the survey design. The population was made up of the three tiers of the education system. The study population was made up of18254217 students and pupils. The cluster sampling technique was used to obtain a sample of 157 respondents. A structured questionnaire was utilized to collect data. Simple percentages were used for analysis. Results revealed challenges in the educational system such as the 1: 60 teacher-student ratio in primary and secondary schools and the 1:1000 ratio in general courses in tertiary institutions. Recommendations encompass the need for science teachers to have practical knowledge and abilities in science learning and teaching.

Keywords: Vision 2020, Education, science, Technology, Implication and National development

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Background to the Study

The science, technology and innovation policy reflects the renewed commitment and aspiration of the government and people of Nigeria to deployscience and technology as the fulcrum of all activities geared towards realizing the nation's potentials as a regional power in Africa emerging as a global economic power .The policy seeks to build a nation that is able to provide steadily and on a progressive basis , high standard of living and quality life for it citizens by harnessing science and innovation outputs as well as the strategies and the talents of its highly resourceful people. The policy is thus formulated to enable science and technology maximally impact on the national development landscape with a view to ensuring that Nigeria emerge and remains among the top 20 economies in the word by the year 2020 and beyond.

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. It is done through observation of natural phenomena and/or through experimentation that tries to stimulate 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. One of the key problems 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 (Anina, 2012).Our society is dominated and even driven by ideas and product from science and technology. The influence of science and technology on our lives will continue to increase in the years to come. Scientific and technological knowledge and skills invade all realms of life in our 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, as workers, voters, and consumers.

Science plays a very important role in the economic and technological advancement of any nation. Through advancement in science, great improvements have been made in the field of agriculture, medicine, transportation, communication etc. In the field of agriculture for instance, science has among others led to the development of genetically modified crops which in turn has brought about higher productivity, disease and pest resistant varieties of crops, crops with desired traits, early maturing varieties and many other improvements which is helping man to meet with the challenges of feeding the growing human population as well as providing needed raw materials for industries. In medicine, advancements in science have brought about succor to man on many issues that hitherto could not have been tackled. An example is the stem cell research which is helping in the production of human spare parts in the laboratory that can be used to replace damaged organs. The improvement of information and technology has helped to make the world a global village. Developments in science have led to the improvement of the quality of life which also impacts positively on the economic wellbeing of the people.

Technological breakthroughs such as immune engineering genetically engineered immune cells are saving lives of cancer patients. GRISPR offer an easy way to alter genes to create traits of drought tolerance. Rockets typically destroyed on their maiden voyage, now can make an upright landing and be refueled for another trip, setting a stage for a new era in spaceflight. Google pushed strongly in the world of healthcare with its glucose-detecting lenses, the Google Genomics cloud storage project, most notably, its new cancer-detecting pills. The pill contains magnetic nanoparticles that attach themselves to cancerous molecules that may be flowing through the bloodstream. The pill will then actually be able to notify the person whenever it has accomplished its cancer purging. The Argus Retinal Prosthesis is the first of its kind, a bionic retinal implant that helps people see in the same way hearing aid helps people hear. The new helium-filled hard drives introduced by western digital storage technology can now cram 6 TB of capacity. In 2013 the first flying car was tested in public, the year also saw the printing of things like the first workable gun, jet parts, and even a human embryonic stem cell.

Modern societies need people with science and technology qualifications, as well as a general public with 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, all citizens independent of occupational need needs 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 broadly based liberal 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 hence boring (Ogunmade, 2006).

Inadequate teaching has been advanced as one of the problems of science and technology education (Omorogbe&Ewansiha, 2013). Ayoodele (as cited in Omorogbe&Ewansiha, 2013) identified the use of in-appropriate non-effective teaching methodologies as a major factor hindering students understanding and achievement in science. Onse, Okogun and Richard (2009) posited that many teachers teach in abstraction there by making science lessons boring and the students find it difficult to grasp scientific concepts, skills and principles. Abdulalu (2007) observed 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, he stressed that the teaching of science has been reduced to a descriptive exercise through the use of lecture method. According to Etim (as cited in Grima, 2011) education is stereotype and not revolutionary. He sees the history of scientific discovery as presented to students as a mode of memorizing. He alludes, that students are not properly trained to understand and apply knowledge for the purpose of innovation and positive rational problem solving. He 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.

Statement of the Problem

There has been a growing public anxiety about the teaching and learning of science and technology in Nigerian schools. Studies such as Ogunmade (2005) has showed that large numbers of students learn very little science at school, 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 and the general public and even the government. Science teaching in Nigeria has been criticized because of poor performance of Nigerian students in science subject 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, 2005).

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 programs, 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 (NEDS) 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. The public schools lack basic infrastructure and therefore not conducive for effective teaching and learning of science and technology (Akighir, 2015). 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 it seldom treats the contemporary issues related to science and technology (Svein, 2002). From the falling standard of enrolment in science and technology, one may deduce that there is a falling interest in science and technology related courses. While on the other hand, young people are more than ever interested in using all sorts of new technology, it is a paradox that the country which has the most problems with recruitment to science and technology is also the country with the most widespread use of new technologies among the young people. There seems to be an eagerness to use the new technologies, but a reluctance to study the disciplines that underlie the products.

Most primary school children are enthralled by the world around them. They have a spirit of enquiry and an enthusiasm for life that needs to be encouraged in every way. But most primary school teachers come from a background in the humanities and are ill-equipped for the increasingly complex questions about science that primary school children might ask. A particular problem at secondary schools is recruiting and retraining well qualified science teachers. A related issue is assess to modern technologies.

Purpose of the Study

The study is an analytical synthesis of the state of science and technology education in Nigeria. The specific objectives are:

1. Find out if science education is linked to students everyday life
2. Find out if laboratories exist in all schools at all levels

3. Assess whether laboratories and workshops are well equipped
4. Reveal the type of teaching method used by science and technology teachers
5. Unearth the adequacy of classrooms
6. Establish the availability and utilization of ICT in teaching science and technology
7. Uncover teacher-student ratio
8. Ascertain the state of collaborative scientific research at all levels of education
9. Unmask the state of interest of students in science subjects
10. Disclose how current science and technology course content are
11. Determine if the science and technology curricula contain research components
12. Find out if workshops exist for technological studies
13. Find out how effective laboratory technologists are
14. Find out about the type of laboratories in schools

Research Questions

1. How often do teachers link their lessons to students' everyday life?
2. What type of laboratories do schools have?
3. How equipped are laboratories and workshops in Nigerian schools?
4. What type of teaching methods do teachers use in teaching science and technology?
5. How confortable are classrooms?
6. What is the level of availability and utilization of ICT facilities?
7. What is the teacher-student ratio?
8. What is the level of interest of students in science and technologyrelated subjects?
9. How current is the science and technology curricula?
10. What is the level of research component in the science and technology curricula
11. How effective are the laboratory technologists?
12. What is the ratio of laboratory/technology equipment per student?
13. What are the qualifications of the science and technology teachers?
14. What is the ratio of laboratory /technology equipment per student?

Significance of the Study

The findings of this study will be beneficial in several ways to teachers, policy makers, curriculum planners, the government, researchers, pupils and students. The result the study will provide an insight for science and technology teachers in respect of the need to adopt appropriate and innovative mode of instruction. The highlight of the study will challenge science and technology curriculum experts, to review the curriculum to address issues of modern, adequate approaches in teaching science and technology. The study will call for the government to put in place structures that will remove undue effect factors on pupils and students. The policy makers can utilize the result of this research in formulating policies that will make the teaching and learning of science and technology relevant and more interesting thereby expanding the scope of technological development. The findings of the study will go a long way to convince the government and funding agencies of the need to equip schools with modern technologies such as computers, audiovisuals which will be fully assessable to pupils and students.The study would be of help to bridging the ideology of variation in academic achievement and retention which is largely due to ineffective instructional strategies and ill exposure of teachers to multimedia and multisensory strategy of the teaching and learning

process. The study will be of help to research associations especially the Nigerian Educational Research Development Council (NERDC) in respect of organizing workshops, seminars and conferences. Evolving teaching methods will be of utmost importance to students. Innovative teaching methodologies adopted will help learners to develop scientific skills especially observational skills which will help to develop practical skills.

Theoretical Framework

Jean Piaget theory of teaching science

Constructivism helps students build their understanding of science. It is a major learning theory, and is particularly to the teaching and learning of science. Piaget suggested that through accommodation and assimilation individuals construct new knowledge from their experiences. Constructivism views learning as process in which students actively construct or build new ideas and concepts based upon prior knowledge and information. The constructivist teacher is a facilitator who encourages students to discover principles and construct knowledge within a given framework or structure. Piaget theory of constructivism impacts learning of the curriculum because teachers have to make a curriculum plan which enhances their students' logical and conceptual growth. The teacher must put emphasis on the significant role of experiences or connections with the adjoining atmosphere. For example teachers must bear in mind the role those fundamental concepts such as the permanence of objects, when it comes to establishing cognitive structures. Piaget theory of constructivism argues that people produce knowledge and form meaning based on their experiences. Hence students taught based on practical science and technology activities will ultimately have their perceptions altered and bring about meaningful learning. Piaget theory covers teaching methods and education reform. The role of the teacher is considered very important. Instead of giving a lecture the teacher in this theory function as a facilitator whose role is to aid students understand scientific concepts. The resources and lesson plan that must be initiated for this learning theory take an approach away from the traditional lecture method. The facilitator is to lead students to come to conclusions on their own term, this leads to discoveries and new ideas. In line with Piaget theory teachers must challenge the student by making them effective, critical thinkers and not merely a teacher but also a mentor, a consultant and a coach.

Methodology

The descriptive survey research design was adopted because it is considered conclusive due to its quantitative nature. It is preplanned and structured so that information collected can be statistically inferred on the population. It also defines better the opinion held by the group of people on the giving subject and measures the significance of the results on the overall population being studied. The population of the study includes all the public schools of the three tiers of education in plateau state. The population was estimated to 18254217 students. The cluster sampling technique gave a sample of 157 respondents. The instrument for data collection was a questionnaire consisting of 14 items on the state of science and technology education in Nigerian schools

Results and Discussions

Research Question One: How often do teachers link their lessons to students' everyday life?

Table 1: Frequency of the Relatedness of Science Classes to Students' everyday life

	Often	%	Very often	%	Rarely	%	Never	%
Primary	39	57	5	7	15	22	9	13
Secondary	19	76	2	8	5	2	0	0
Tertiary	13	18	11	16	27	39	18	26

57 % of pupils inferred that their science lessons are linked to their daily lives. A lower percentage of students asserted.

Research Question Two: What type of laboratory do schools have?
Table 2: Types of laboratories found in Schools

	Biology	Chemistry	Physics	Integrated
Primary	0	0	0	0
Secondary	3	2	0	22
Tertiary	50	3	8	8

Laboratories did not exist in primary schools. Most secondary schools and some tertiary institutions have integrated laboratories.

Research Question Three: How equipped are laboratories and workshops in Nigerian schools?
Table 3: State of laboratories and workshops

	Well equipped	%	Inadequately Equipped	%	Not available	%
Primary	5	7	7	10	55	83
Secondary	4	15	12	44	11	41
Tertiary	7	10	62	90	0	O

Most laboratories are ill-equipped or non-existent

Research Question Four: What type of teaching method do teachers use teaching science?
Table 4: Pedagogy

	Lecture	%	Practical	%	Others	%
Primary	68	100	0	0	0	0
Secondary	13	48	12	44	2	8
Tertiary	49	71	13	19	7	10

The lecture method is the dominant teaching strategy in use especially in primary schools

Research Question Five: How comfortable are classrooms?

Table 5: State of classrooms

	Comfortable	%	Very comfortable	%	Not comfortable	%
Primary	26	37	6	9	38	54
Secondary	15	58	2	8	9	34
Tertiary	25	36	0	0	44	64

Most classrooms are not confortable due to population pressure

Research Question Six: What is the level of availability and utilization of ICT facilities in classrooms?

Table 6: Availability and utilization of ICT facilities in classrooms

	Available	Not available
Primary	24	44
Secondary	8	19
Tertiary	0	69

Most schools do not have ICT facilities

Research Question Seven: What is the teacher- student ratio?

Table 7: Teacher -student ratio

	1:20	1:40	1:60	1:100
Primary	16	22	25	0
Secondary	16	5	6	0
Tertiary	15	7	16	24

Tertiary institutions have the highest teacher-student ratio

Research Question Eight: What is the level of interest of students in science and technological related subjects?

Table 8: Level of students' interest in science

	Interesting	%	Not interesting	%
Primary	28	43	40	57
Secondary	25	93	2	7
Tertiary	44	64	25	36

The level of interest in primary schools is lowest

Research Question Nine: How current is the science and technology curricula?

Table 9: Relevance of the science and technology curricula

	Very current	%	Current	%	Not current	%
Primary	0	0	0		0	
			0		0	
Secondary	0		0		0	
	0		0		0	
Tertiary	16		32		14	
	26		52		23	

The context was not understood by most respondents. 22 percent affirmed that the curricula are not current.

Research Questions Ten: What is the level of research component in the science and technology curricula?

Table 10: Level of research component in the science and technology curricula

	High	Low
Primary	0	0
Secondary	0	0
Tertiary	40	29

The level of research components in the curricula were termed as low.

Research Question Eleven: How effective are the laboratories technologist?

Table 11: Competence of laboratory technologists

	Competent	%	Incompetent	%
Primary	0	0	0	0
Secondary	15	56	12	44
Tertiary	25	40	37	60

The concept was not applicable to primary schools. Most of the respondent in the tertiary institutions expressed dissatisfaction

Research Question Twelve: What is the ratio of the laboratory/technology equipment per student?

Table 12: Ratio of the laboratory/technology equipment per student

Ratio	1:1	1:10	1:20	1:30
Primary	0	0	0	0
Secondary	6	6	14	1
Tertiary	8	26	11	17

The table expresses inadequacy of laboratory and technology equipment

Research Question Thirteen: What are the qualifications of the science and technology teachers?

Table 13: Qualifications of teachers

	NCE	First Degree	Masters	PhD
Primary	56	12	0	0
Secondary	9	14	4	0
Tertiary	0	7	21	41

The primary sector has the least qualified teachers

Discussion

The inference in table 1 is indicative that science is taught in abstractness which concords with Hernan (2005) observation that the teaching of science is theoretical and robs students of their interest in science related courses. Non-innovative pedagogy dominates the teaching process. This is devoid of scientific applications (Arinaitiwe, 2007). Most laboratories in secondary schools are integrated and ill-equipped. Most classrooms are congested due to population pressure and lack ICT facilities. This explains the high teacher -student ratio. The curricula are obsolete and contain no research component. The laboratory technologists are basically in-effective. Laboratory equipment is at an average of 1:30 students. The qualifications of the teachers in primary schools are practically non- science NCE holders. It is evident that the education sector needs a review.

Conclusion

High quality science education experiences development of scientific talents and interest. Good science programs interest, motivate, and encourage students to prepare and to work in the growing science-related professions, as scientists, health care professional, technicians, and other science-related fields. Good science programs emphasize the value of inquiry encourage curiosity, and reward persistence and patience.High quality, inquiry based science programs motivate and provide students with intellectual skills and positive attitudes and values. Hence teachers, Boards of education, principals, the community at large, and government at all levels should make commitment to support and develop high quality science and technology education at all levels. It is only then that science education can have a tremendous impact, and revolutionize science and technological achievements in Nigeria**.**

Recommendations

1. Curriculum developers at both national and local levels should ensure the design of a holistic and relevant curriculum with learning approaches and materials that promote transformative learning aimed at fostering capacity for life-long learning and for secured employment and livelihood
2. Teaching dimension of the curriculum should establish clear and progressive learning objectives in addition to giving clear directives on assessment approaches and the content of assessment
3. Teaching and learning that engages students in collaborative learning projects that apply critical analysis and problem solving aimed at addressing real life problems to support development of transformative skills should be adopted
4. Local relevance and cultural appropriateness of the curriculum content and structure should be emphasized
5. There should be teacher competence building through training on pedagogies and learning methodologies
6. There should be safe and effective learning environment, providing dynamic opportunities for engaged experience-based learning
7. Government should transform schools into hubs for community learning, local participation, contextualized learning opportunities to meet local needs

References

Abdulalu, A. (2007, April). *Functional science, technology and mathematics education for national economic empowerment and development*. Paper presented at the Federal college of education conference Zaria, Nigeria. Retrieved from http://www.mcser.org/journal/index.../1693

Akighir, S. (2015). *Street hawking and the Nigerian child.* Retrieved from http:/www.ecdinitiative.org/download.php?

Anina, M. (2012). *Science and technology*. Retrieved from: https:/za.linkedin.com/in/aminamumm

Arinaitiwe, K. (2007). *Challenges of science education in Africa*. The Ugandan science. Retrieved from http:/www.ways.org/…/challenges-science education

Grima, G. (2011). *A vision for science education in Malta*. Malta: Salesian Press.

Hernan, C. (2005). Science teacher education in America. The case of Argentina, Colombia and Chile. *Journal of Teacher Education*. Doi.1007/51072-015-9420-9

Ogunmade, T. O. (2005). *The status and quality of secondary school teachers and learning in Lagos state* (Ph. D thesis). Retrieved from:
http:/www.researchgate.net/publication/492827-

Omorogbe, E., & Ewanshiha, J. C. (2013). The challenge of effective science teaching in Nigerian secondary schools. *Academic Journal of Interdisciplinary Studies*, 2 (7), 181.doi:10.5901/ajis

Onose,G. M., Okogun, E. A. & Richard,J. (2009). Reforms and innovations in training and retraining of science and mathematics teachers to meet the challenge of global development. *Journal of Teacher Perspective*, 3 (2), 188. Retrieved from http:/www.mcser.org/journal/index…/1693

Svein, S. (2002). *Science and scientists.* Acta Didactica. (2nd ed.). Oslo, Unversiyt of Oslo. Retrieved from http://folk.uio.no/sveinsj/