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Mathematics, Science and Technology Education: Their Place in the Nigeria National Transformation Agenda

¹Akase Jir, ²Mwekaven, S.S., ³Awuhe, R.T., ⁴Tombuwua, P.T^{1,2}Department of Basic Sciences, Akperan Orshi College of Agriculture, Yandev P.M.B. 181, Gboko, Nigeria³Department of Computer Science and Statistics, Akperan Orshi College of Agriculture, Yandev-Gboko, Nigeria.⁴Department of Agricultural Engineering Technology, Akperan Orshi College of Agriculture, Yandev-Gboko, Nigeria.

ABSTRACT

Mathematics, Science and Technology Education is indisputably recognised worldwide as essential tools for effecting national development. The developed economies of the world such as Japan, China, Germany and United State of America (U.S.A) have always accorded mathematics, science and technology high priority to the extent that 10% of their enormous Gross National Product (GNP) is spent on science and technology. In Nigeria however, in spite of the proliferation of universities, polytechnics and research institutes, less than 1% of GNP is budgeted for funding of science and technology. Hence, the transformation agenda of the Nigerian Government and its Vision 20:2020 would be a mirage except mathematics, science and technology takes the central and leadership role as the major driver of the nation's program. It is based on this that the research is focused on the implication of mathematics, science and technology on the national transformation agenda of the Federal Government of Nigeria. The research also highlights some missing links on how mathematics, science and technology can transform the economy and the challenges of the opportunity of using the skills and knowledge acquired in Mathematics, Science and Technology to bring about the most needed scientific and technological growth in Nigeria. The research recommends among others that the Nigerian Government should adequately fund mathematics, science and technology programs and research in higher institutions. The research concludes that the federal government should make it mandatory for the industrial sector to join international bodies in order to facilitate scientific and technological development by commercializing research results in mathematics, science and technology.

Keywords: *Mathematics, Science, Technology, Education, Transformation Agenda.*

1. INTRODUCTION

The Federal Government of Nigeria enunciated the Vision 20:2020 Programme of development aimed at catching up with the rest of the most industrialized nations of the world in the year 2020. The big anticipated problem is whether this vision of government can be realized without mathematics, science and technology education. This program would be a mirage except mathematics, science and technology education take the central role as the focal point of the nation's educational sector [Ogodo, 2009]. The case of the developed nations and fast growing economies has shown that a deliberate and strategic policy implementation is the magic for achieving target goals and sustainable economic development. In Nigeria, the long neglect of Mathematics, Science and Technology including poor funding of research and development are more responsible for her economic woes. However, according to Okafor [2012], it is now clear that Mathematics, Science and Technology have become part and parcel of the world's culture and every person and nation now want to use them maximally for adequate development and improvement of the society hence, the implication of this sector of education to the transformation agenda of the Federal government of Nigeria cannot be over emphasized.

2. MATHEMATICS AND MATHEMATIC EDUCATION

According to Ezeamenyi in Eze [2008] mathematics is the study of size, numbers and patterns. Mathematics is the most international of all subjects, and mathematical understanding

influence decision making in all areas of life-private, social and civil [Anatomy&Walshaw,2009].It is the subject that enables scientists and technologists to develop relationships among biological, chemical, geophysical and physical qualities; understand and explain natural phenomena. Mathematics education is a key to increasing post-school and citizenship of young people. The knowledge of mathematics is an essential tool in the society today. According to Yara [2009], the contribution that mathematical knowledge and skills has made to economics, industrial and technological growths of modern world are quite obvious to almost everyone.

Statistics have shown that mathematics has a key role to play in job creation, wealth generation, poverty alleviation, economics and finance, management, business and enterprise, information technology, agriculture and natural resources which are the core components of vision 20:2020 [Iji,2014]. The Nigerian Government, having discovered the important role of mathematics and science in national development, declared 2012, "National mathematical year". The Ministry of Education was mandated by the Federal Government to demystify mathematics through innovated teaching, since it is a key to national transformation [Nkechi, 2012]. It was therefore noted that government's commitment to mathematical sciences will invariably enhance the capacity of citizens to contribute to national development and increases productivity of the GNDP [Uka, Iji and Ekwueme, 2012]. Nigeria Transformation Agenda cannot be sustained without Mathematics because; Mathematics has economic value since

no business can thrive without proper mathematical and statistical system. In the National Transformation Agenda, no progress will be made without adequate use of mathematics. It is the queen or mother of sciences. It should be used in the National Transformation Agenda as an essential tool in many fields, including natural science, engineering and technology, medicine and social sciences. Applied mathematics is relevant to the National Transformation Agenda because, it is the branch of mathematics that concerns itself with mathematical methods that are typically used in science, engineering and technology; business and industry [Okafor, 2012].

3. SCIENCE AND SCIENCE EDUCATION

Science has been defined by several authors in several ways. According to Hornby [2000], science is the study of knowledge which can be made in a system and which usually depends on seeing and testing facts and stating general natural laws. Merriam-Webster [2004] define science as knowledge of facts, phenomena, laws and proximate causes gained and verified by exact observation, organized experiment and correct thinking. Uza, [2014] define science as “cumulative verifiable and communicative knowledge”. According to writer, pure science is the investigation of nature to satisfy the need to know, while applied science is the application of pure science to solve practical human needs. Aniodoh [2002] defined science as the systematic study of man and his environment based on the deductions and inferences which can be made, and the general laws which can be formulated from reproducible observation and measurements of events within the universe. From the above definitions, science can be regarded as a way of thinking in the pursuit of understanding nature and a way of investigating a body of established knowledge. It is a process as well as a product, and may also be looked at as attitude formation usually regarded as the scientific attitude. These characteristics and attributes of science are very necessary for the sustainability of the Nigeria National Transformation Agenda. As a scientific process, it is a basic enquiry about things, an endeavour which leads to discovery and seeks to explain man’s immediate environment. Through scientific processes like observation and experimentation, a body of knowledge is arrived at which leads to scientific product. The scientific attitude, are those attributes or traits which scientists must exhibit anytime, anywhere in their lives. The implication of these characteristics to our National Transformation Agenda according to Okafor [2012] is that science should train the citizenry to be persistent, industrious, objective and fair minded. Other important traits associated with science include but not limited to curiosity, humility, scepticism (or critical mindedness), objectivity, rationality, suspended judgement, open-mindedness and honesty [Okafor, 2012].

Science education is the instruction or training by which people learn to develop their critical thinking. Science education fulfils this function through basic and integrated process skills. The concept “science education” as used in this context, does not just mean instruction or training in only Science Education Department but also in those other branches of learning such as natural, physical, social and

applied sciences, plus all other aspect of human endeavour [Okafor, 2012]

The science education goals for our National Transformation Agenda therefore should include the following;

- i. improving the quality of life of all Nigerians.
- ii. serving as a tool for functional skills acquisition and job creation leading to reduction in poverty.
- iii. helping to mobilize and develop public-private partnerships to support and fund general education.
- iv. promoting Information and Communication Technology (ICT) at all levels; and
- v. seeking to re-orientate the Nigerian society towards scientific thinking with a view to developing new technologies towards transformation of all sectors of the nation’s economy.

4. TECHNOLOGY AND TECHNOLOGY EDUCATION

Okeke [2007] defines technology as a disciplined process of devising and utilizing techniques to convert resources to material objects. Uza [2014] defined technology as a body of knowledge and devices by which man masters his environment. It is a systematic study of the methods and techniques employed in the industry, research, agriculture and commerce to improve the life of man in his environment. Technology is not synonymous with applied science being more empirical in its approach to solving problems. Uza [2014] further stressed that the three major technologies – agriculture, medicine and engineering all made substantial progress before they were wedded to science. Fundamentally, technology is an extension of man’s capacity to see further and clearer, hear more, travel faster and for greater distances etc.

Technology is the making, usage and knowledge of tools, machines, techniques, crafts, systems or methods of organization in order to solve a problem or perform a specific function [<http://en.wikipedia.org/wiki/technology>] In Nigeria, it can adequately be applied to our transformation agenda. Technologies significantly affect human as well as other animal species’ ability to control and adapt to their natural environments. Recent technological developments including the television, telephones, printing press and the internet have lessened physical business to communication and allowed humans to interact freely on a global scale. It should be noted however that not all technologies have been used for peaceful purposes. The development of weapons of mass-destruction has progresses throughout history. In Nigeria, the objectives of National Transformation Agenda will be achieved if the development and use of weapons of mass destruction can be controlled. This will usher in peace, security and economic growth. Apart from using technology to produce destructive weapons, many technological processes produce unwanted by-products such as pollutants and deplete natural resources to the detriment of the earth and its inhabitants. As Nigeria faces the challenges of National Transformation Agenda, there is the need to develop technology industries which will provide the basis for chip production, information and communication and computer system. Technology education is unarguable the key, the hub or catalyst that drives the

developmental efforts of any nation. This is clearly seen in the transformation experiences of Asian countries like China, Malaysia, Singapore and Korea etc [Orkaa *et al* 2011]. Technology Education for National Transformation Agenda should be able to contribute in solving societal problems such as insecurity, provision of food, shelter, health, clothing, transportation, communication, raw materials, energy, agriculture, power, printing, photographing, potable water, beverages, navigation of land, sea and air, as well as defence and other social amenities.

The driving force for technological development for our National Transformation Agenda is economic and physical survival. To achieve the above goals of our National Transformation Agenda, physically, Nigerians needs food, good health, defence capabilities and safe shelter. For economic survival there is also the need to develop transportation, communication, trade, machine tools and information devices. Formal education in science and technology will help develop high technology products for meeting the needs of the National Transformation Agenda.

5. EDUCATION TOWARDS NATIONAL TRANSFORMATION AGENDA

Education is one concept that has a dynamic definition depending on one's perspective. It is a universal concept that differs from society to society. Education could be regarded as instruction or training by which people learn to develop and use their mental, moral and physical powers [Merriam-Webster 2004]. It involves acquiring literacy and numeracy, being proficient in a job and ability to live in a society. According to Okafor [2012], education is the transmission of what is desirable to individuals to make them knowledgeable and contributing members of the society. It must involve knowledge and understanding such that it characterizes the person's way of looking at things and is committed to the positive use of that knowledge. The implication of education to the Nigerian National Transformation Agenda is that education should make people change for better, socially morally and economically. Mathematics, science and technology education are the tools needed to meeting the developmental goals. To achieve these goals, there should be a deliberate policy to promote and encourage the development of indigenous technology and the application of such to local developmental goals [Afolabi, 2009]. In order to attain this, the environment must be right for the learning of science. The right equipments must be available and of course the right teachers must be engaged. The curriculum must also be right. For instance, Japan significantly reviewed the educational curriculum of the children and made science and technology compulsory for every child [Ogodo, 2012]. Today Japan is a world power to reckon with in anything science and technology. The result of Japan's decision to make science and technology compulsory for every child is clear for all to see today. Today Japan is one of the most highly developed and respected country in the world. This status is certainly not based on Japan's prowess in football, but on the expertise of its citizens in science and technology. However, it is pertinent to note that science and technology as a way of life is not a field for short-term engagement but a full-life engagement. Scholars whose names top the list of contributors to mathematics, science and technology in the

world did not only start as children but actually devoted their lifetime to it [Ogodo 2012].

6. COLLABORATION WITH NATIONAL AND INTERNATIONAL AGENCIES

The Nigerian Government must think of ways to partner with international bodies to move mathematics, science and technology education forward. We should take a look at foreign technologies exhibited and compare with ours so as to enable us train the young scientist to the quality of the foreign scientist [Ogodo, 2011]. Many countries will be attracted to establish their collaborative efforts with us having seen how possible it is with us. Our capacity building through technology transfer can compete to some extent with the imported ones and even better than the ones from Asia which are not as good as was taught. With time, our technology transfer will compete favourably with other parts of the world [Ogodo, 2011]. We require exchange of experience and input between communities, agencies and nations. The collaboration can be done at two levels such as;

1. Technical support and capacity building- this area of collaboration is accessed through bilateral arrangements between Nigeria and other countries/agencies within the framework of such arrangements.
2. Collaboration in program delivery- project delivery should be facilitated through a network of collaborative activities with local communities, local and state Governments, and Agencies [Ogodo, 2011].

7. COLLABORATIVE RESEARCH AND NATIONAL DEVELOPMENT

Collaborative research, development and deployment are positively influencing development in nations of the world. A great number of nations have remarkably improved their social-economic problems through huge investments in collaborative research where individuals in the state of harmony bring their expertise together to solve a typical problem beneficial to the society, such synergy results in breaking down barriers in the way of inventions, discoveries or innovations which otherwise would not have been possible when one individual is working on the project all alone. Instances abound where such an approach has worked wonders [Ogodo, 2012]. Collaborative research is also yielding huge investments in India, Japan, China, Malaysia, Singapore etc. Such collaborations will have serious implications of our National Transformation Agenda.

8. IMPLICATIONS ON NATIONAL TRANSFORMATION AGENDA FOR MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION.

Mathematics and technical education are necessary for the sustainability of our National Transformation Agenda. This is because they are instruments per excellence for social and economic reformation, reconstruction and then transformation.

Consequently, the implications therefore, are using mathematics science and technical education to;

1. inculcate transparency and good governance in people.
2. develop sustainable 21st century skill;
3. develop appropriate technology
4. evolve appropriate private–public partnership; and
5. inculcate adequate entrepreneurial and ICT skills in our youth.

Okafor [2008] agrees with the above implications and also stressed that, adequate mathematics, science and technology for sustainable National Transformation Agenda should involve the following;

1. Establishment of post basic Education Vocational Enterprise Institutions (VEIs) and post secondary Education Innovative Enterprise Institutions (IEIs). The VEI's vocational courses should be based on science and technology and should include those for requisite skills to operate in the labour market and desire to be engaged in productive technical/technological/business activities.
2. Training to cover competences and skills acquisition required for job opportunities in construction, beauty, hospitality, music, travel industries and enterprises and would provide ground work for career in a wide range of areas.
3. Develop civic education to strengthen value-orientation.
4. Create direct link to large number of businesses and industries that will put graduates in touch with leading companies for recruitment; and
5. Improve access to enhance employment-oriented skills training for the eradication of poverty and generation of employment and wealth.

Similarly, in line with the National Transformation Agenda, the Innovative Enterprise Institutions (IEIs) should take care of the development of creative thinking and transformation of knowledge through technological and scientific processes into wealth and broader economic base. There should also be innovative technologically based training that promotes application of expertise to improving our society and thus, fulfilling our national goals. Added to the above is the need to try and keep improving the creative process with fresh ideas. More scientific ways of sustaining the National Transformation Agenda include having;

1. Information, Communication Technology (ICT) institutions.
2. The school for oil and gas technology
3. Fashion institute of technology
4. The film academy
5. Academy for creative Arts
6. The Construction and Engineering Institute
7. The Paralegal Institute
8. Institute of Welding and Fabrication
9. Sports Academy.

RECOMMENDATIONS

Based on the scenario portrayed in the preceding sections of this study, the following recommendations are made:

1. The dynamic nature of Mathematics, Science and Technology Education must be appreciated by the government at all levels. Teachers should therefore be exposed to regular training to keep abreast with current trends. There should be a periodic review of the curriculum to suit evolving technologies. Training methods should also change. Students should be engaged in field work and made to write reports.
2. Government has a major role to play in order to achieve this paradigm shift. Education must be looked at holistically. Education should be adequately funded. Institutions created to support Mathematics, Science and Technology Education and necessary equipments should be provided with the wherewithal to perform these functions.
3. Government should encourage the commercialisation of successful research in Mathematics, Science and technology in our institutions of higher learning. This will lead to innovations and inventions and create “technology incubation centres” near people.
4. Government should make it mandatory for the industrial sector to join International Bodies to facilitate development.
5. Government should ban importation of certain goods or place high tariffs on them and encourage local production of goods. This will force the nation to look inwards just like the Asian countries had done in the past.
6. There should be an increased awareness of the importance of Mathematics, Science and Technology Education. Our roadside mechanics and other technicians with talents but lack training in a formal school setting could be helped to improve. This awareness could be done through seminars and workshops.

10. CONCLUSION

Ever since the declaration of the Nigeria Transformation Agenda by Federal Government and the declaration of Nigeria Vision 20:2020, various governments in Nigeria have been trying to make sure that the goals of the agenda are met. This they do by designing programmes that will drive the long term goals of energy production, poverty reduction, employment generation, wealth creation, health, agriculture, and value orientation in the country. The transformation Agenda, this study posited could only be achieved by repositioning Mathematics, Science and Technology Education properly. This is because Mathematics, Science and Technology Education are the keys to open all doors to civilisation of every nation.

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