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Science Education and Sustainable Development in Nigeria: An Analytic Approach

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Abstract: This paper titled science education and sustainable development in Nigeria: An analytical approach informs that that functional science education is urgently required in order to promote scientific knowledge for the purpose of sustainable development. In this wise, the development of Nigerians and Nigerian society could be hinged on the pragmatic efficacy of science education. Mention is made of the essential impact of science education on sustainable development as well as challenges of science education and sustainable development in the Nigerian context. Furthermore, an analysis of science education and sustainable development was made. The paper concludes that the curriculum for science education should be reformed to reflect the needs of Nigerian society in terms of practical skills required for individual development as well as national development. It is therefore recommended that the Nigeria government should make provision for science and laboratory tools to attract and promote scientific skills and knowledge among students.

Keywords: Science education, sustainable development, national development, skill acquisition.

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I. INTRODUCTION

There is no doubt that a sound educational system is the pivotal for national development and particularly, sustainable development of every nation. This explains why Nnaboua and Asodike (2014) described education as a process by which human beings and societies reach their fullest potential. Education is thus viewed as a critical tool for promoting and improving the capacity of the people in addressing environmental and developmental issues. Thus

Thus educational system must be anchored on a sound philosophical foundation that encourages partnership for exchange of people, ideas and support facilities. This assertion indicates that education has a role to play in combating modern environmental and developmental challenges Of the African continent and Nigeria in particular.

Currently Nigeria needs a functional science education to meet the needs of the local industries, citizens as well as satisfy the practical needs of the society. Needless to say science education is directed towards acquiring critical thinking and exploration, leading to sustainable development. This lends credence to Pember and Humbe (2009) view that science education is a process of teaching. Pember and Humbe (2009) viewed science education as a process of teaching or training especially in school to improve one's knowledge about environment and to develop one's skill of systematic inquiry as well as natural attitudinal characteristics.

Science education is germane to scientific and technological advancement of any nation, Nigeria inclusive. This is because science education involves the In-depth study of verified scientific concepts and principles according to Lewis (2015), science education identifies natural phenomena appropriate to child's interest and skills. This implies that science education equips teachers, learners and the society with knowledge, skills, equipment and freedom to perform noble task useful for improving socio-economic standard. Thus, the goal of science education is to produce a sufficient number and diversity of skilled and motivated future scientists, engineers, and other science-based professionals. The views of Lewis (2015) buttresses an earlier assertion by Omole and Ozoji (2014) who had stated that science education courses are designed to produce capable scientists who contribute meaningfully to academic excellence of the society and raise the economic level of nations internalizing science process skills are essential to economic development of an individual and Nigerian society at Large.

The approach is characterized by hands – on – activities which encourage the teaching and learning of science via critical thinking and in a real and practical term, as it encourages critical thinking and exploration

thereby leading to a sustainable development. In a bid to achieve the goals of sustainable development, one important and strategic thing to do is to employ education, especially science education as a vital tool towards this objective. On one hand, education empowers individuals and maximizes national intellectual resources for social and economic sustainability whilst on the other hand science education provides epistemological grounds for scientific and technological advancement of the nation. It is against this backdrop,that this paper analyses and synthesizes science education for sustainable development in Nigeria.

Impact of Science Educationon Sustainable Development

Generally, science is considered as the process through which knowledge is arranged in an organized pattern. That is, science could be described as the structure and behaviour of the physical and natural world and society, especially through observation and experience (Omole& Ozoji,2014). Nnaboua & Asodike (2014) opined that the knowledge of science is derivable from experience, observation and experimentation.

The definitions above reveal that science is linked with observation of the environment, which proper understanding is plausible through experimental process. It further shows that science is the sensory process of epistemological comprehension of nature that aid man logically discovers and interprets the principles through which man controls his environment naturally. Put differently, it is the process of penetrating nature with the aim of discovering the laws that aid man to live sustainably.

In sustaining the relationship between man and his environment, Ekanem (2007) described science as a careful and objective study of the nature of the relationship. This implies that science is targeted at man's development in his natural environment.

Based on the statement above, science education emerged as an applied field of education saddled with the responsibility of disseminating scientific skills and knowledge. In other words, science education is the field concerned with the sharing of scientific knowledge with people not traditionally considered part of the scientific community. It must be emphasized that science education transforms the typical teacher-centered classroom lecture into a discovery and problem-solving arena.Omole & Ozoji (2014), submitted that the process of science education encourages creativity and originality, which demands active engagement of students in Identifying problems and looking for the solutions. Invariably, teaching and learning of science education address issues that are typical to local environment and culture; and expose students to national issues in other cultures around the world thereby producing students that are globally-inclined in thinking and culture.

The significant role of science education to attainment of educational objectives at all levels of education cannot be underestimated. Okpala (2013) supported that government policies emphasize the development of science education at all levels of education in the National Policy on Education 2004. In recognition of essential role of science education to individual and national development, FRN (2013) contends that science education shall emphasis the teaching and learning of science process and principles. It further highlighted the goals of science education as to:

i. Cultivate inquiring, knowing and rational mind for the conduct of a good life and democracy;
ii. Produce scientists for national development;
iii. Service studies in technology and the cause of technological development; and
iv. Provide knowledge and understanding of the complexity of the physical world, the forms and the conduct of life (FRN, 2013).

Despite the laudable goals of science education to national development, Nigerians and indeed Nigeria have not harnessed the benefits of science education since independence and as a result, science education has not been able to serve as a tool for sustainable development. According to Momeke (2007), science education has failed to produce skilled human resources needed for sustainable development. The implication of this is that Nigeria does not have scientific and technological prowess to be among the leading scientific nations in the world- acquisition of obsolete technology. According to Ekanem, Ekanem, Ajue and Amimi (2010), science education exposes students to a catalytic process for social, educational, training and public awareness- the values, behaviour and lifestyles required for a sustainable future.

Challenges of Science Education in Nigeria

The views of Momeke (2007), Bower and Pire (2009) reveals that the study of science education has failed to ensure acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social lifeBower and Pire (2009) Identified some challenges of science education in Nigeria as including the followings:

- Inadequate qualified science teachers: Competent science teachers are not sufficient in public schools in Nigeria. Nada (2008) observed that the status of competency in secondary school appears very low. Stressing that majority of teachers who are already in the system seem to lack initiatives and skills that are imperative to move science education standard forward to meet the global best practices.

- Poor working conditions, remuneration and teachers' welfare: It is a known fact that conducieveworking condition for teachers directly contribute to the good quality of science education (Okoli, Obiajulu& Ella, 2013). Again, there is need for the government to rehabilitate and restore the image of science teachers by enhancing teachers' packages, housing/accommodation and utility allowances so as to retain and attract qualified teachers to teaching profession.
- Lack of teachers' training and development: Scientific Knowledge, ideas and concepts are dynamic and witnessing changes constantly, as such it is imperative for teachers to be constantly trained and re – trained so as to keep abreast with the new and emerging facts and principles.It is assumed a teacher with adequate materials, enough time and sound content knowledge still requires further training on classroom and science experimental management skills in order to provide students with an excellent science education with remarkable achievements.
- Insufficient funding: Quality science education requires funding. This is because inadequate funding militates against the provision of infrastructure, facilities and needed number of science teachers. Indeed, Nwangwu (2014)stated that ill-equipped workshops, libraries and laboratories exist because of serious shortfalls and inadequacies in education funding.
- Inadequate instructional materials: Instructional materials are facilities and equipment used by the teacher to illustrate and explain the lessons for better comprehension of students. UNESCO (2010) stated that instructional materials are important in the actualization of the science curriculum. While some aspects of science are abstract concepts which pose problems to the students in their understanding, availability and use of instructional materials in teaching such difficult concepts make better understanding thereby ensuring achievement of the objectives of science education.
- Large class size: Teacher-student ratio is a serious challenge to science teacher. It could be said that one of the consequences of shortage of qualified science teacher is augmentation of workload for the available ones. The situation is worst to the extent that most of the public secondary schools in Nigeria operate a teacher-student ratio 1:60 which is contrary to 1:35 stipulated by the National Policy on Education (Mbakwe, 2015). Needless to say that large class size incapacitates and creates interactional gab between the teacher and students.
- Teaching methodology: One of the qualities of a professional teacher is the use of appropriate teaching method. Mbakwe is of the opinion that, methodology of teaching is what makes a teacher a professional. The old method only presents students as mere spectators listening to all that comes from the teachers. In order to achieve the objectives of science education, teachers should employ teaching strategies that will enable learners to develop adequate learning strategies which will eventually assist them to acquire basic knowledge, values and skills with some degree of freedom that allow learners to initiate and complete learning with minimal interference.

Sustainable Development in Nigeria Context

The concept of 'Sustainable Development' is not gifted with a univocal definition due to its broad nature. Sustainable development investigates and emphasizes the development of the present without compromising the future of the upcoming generations. It is a concerted efforts geared towards present human and national development without declining development of future generation. Okoli et al. (2013) defined sustainable development as an approach that combines the development needs and aspirations of the present without compromising the ability of the future while also maintaining ecological integrity. This shows that sustainable development is a developmental process that is equitable and sensitive to ecological and environmental issues, which requires the initiative, resourcefulness, and discipline of human beings who are the directors of developmental programmes.

Evidently, striving for sustainable development has become a source of concern to all and sundry. As noted by Maclean (2008), there are many keys to development, such as improved infrastructure (e.g., dams, roads, telecommunication facilities, ports and the likes); nevertheless, education is regarded as being the master key to economic, social and sustainable development.Ugoh (2008) argued that sustainable development is plausible when it is agreed and indeed practical steps are taken to raise the level of scientists in the society. Science education programmes are now considered as the tools with which one can achieve development and its sustainability. In other words, quality science education is capable of unlocking the doors to poverty alleviation, equity, justice, mainstreaming of the marginalized and vulnerable groups in society as well as ensuring sustainable development.

The assertion above suggests that sustainable development is a process of improving the range of opportunities that will enable people to achieve their aspirations and full potential over a period of time while maintaining the resilience of economic, social and environmental systems. in line with this, McKeown (2012) streamlined knowledge base surrounding sustainable development into three basic concepts namely; the economy, the environment, and the society. By implication, the members of a society are economically

empowered and responsible to not damage the environment so that the future generation is not compromised. That is, sustainable development is a construct, which envision development as meeting the needs of the present generation without compromising the needs of the future generation.

The above justifies why many nations around the world have embraced education to achieve sustainable development (America, Japan, China, among others). As noted by Nnabuoet al. (2014) that the roles of education world over vary from place to place and change from time to time, in accordance with the needs of the particular age, and circumstances of the time. Simply put, world over, the demand is on education that ensures sustainable development. Currently Nigeria needs an effective science education to ensure a safer, healthier, more prosperous and environmentally sound citizenry, while simultaneously contributing to social, economic and cultural progress, tolerance and international cooperation.

Analytic View of Science Education and Sustainable Development in Nigeria

The essential role of science education for the attainment of sustainable development cannot be understated. Put differently, science education is a conditio-sine-qua-non for sustainable development in Nigeria. In line with this, Gunmade (2006) had reiterated that for Nigeria to attain sustainable development; there is need to recognize science education as a priority area of education for her citizens. This calls for the massive education of the citizens in science and science related courses. So also, there is the need to redesign the philosophy of science education in Nigeria. The 21st century requires citizens that are able to explore; understand and decide their own fate in the society on the basis of scientific and technological advancement. Hence, science education promotes and advocates scientific literacy and the practical application of scientific knowledge to bring about economic, environmental and societal development.

Moreover, it must be reiterated that science courses create numerous opportunities for students to engage in doing activities that enable them decipher the world around them, make new discoveries, solve social problems and develop skills that are sustainability driven. By and large, scientific knowledge is directed at addressing core objectives of sustainable development (economy, society and environment). For Omoifo (2012), core science subjects expose students to natural phenomenal and help students understand the underlying principles of the world. Therefore, effective science education will help students understand their local, national and international milieu thereby preparing them for both man-made and natural environmental challenges; and measures to be taken while caring for environment(s).

It is worthy to note that science educators have realized the necessity to become agents of change in order to achieve the goals of sustainable development and fulfill societal expectations about science education. That is, science education plays a crucial role in shaping the knowledge of students towards sustainable development. In fact, Okoli, Obiajulu, Ella, (2014) maintained that activities of science education bring about the social value and benefits of scientific literacy. Scientific literacy in this context, includes reference to science for citizenship and concern for the knowledge of science with specific attention to the process of science (Umoren, 2013); it also involves scientific culture (Ajeyaleni, 2013); scientific enlightenment (Hurd, 2010); science related attitude (Akindelun, 2009); the habit of scientific thinking (Noll, 2008); and the spirit of science (Educational Policies Commission, 2006).

From the above, scientific literacy implies that scientifically literate students know the role of science in society and appreciate the cultural conditions under which science survives and know the conceptual inventions and investigative procedures. Scientifically literate students understand the interrelationship of science and society, ethics which control scientists, the nature of science which includes the basic concepts and the interrelationship of science and humanities. For Hurd (2010), an effective science education for citizens mean better things for the society- helping citizens develop into more responsible citizens who help to build a strong economy, contribute to a healthier environment and bring about a brighter future for everyone. Simply put, the more science-literate individuals are, the stronger the society. This is because the lessons and skills inculcated through science have positive effects for more responsible citizens, a stronger economy, a healthier environment and a brighter future for everyone.

Succinctly put scientific knowledge and skills promote sustainable development as follows:

i. Ensuring responsible citizens: Students who have learned to think critically and have a healthy dose of skepticism can better make informed decisions, which can make them more enlightened, informed voters and stronger consumers. Also, the sense of responsibility and caution that science provides - along with the understanding of how things work (be the chemical reactions, human development, or nutritional needs) - can help future parents to provide safe, healthy environments for their own children, and be more responsible pet owners and neighbors.
ii. Assisting in building strong economy: Scientific skills and knowledge help in producing a generation of individuals who are better prepared for any career and can make greater contributions to society. Similarly, students who have a solid knowledge base in science will later be more open to emerging technologies and ideas that boost businesses and stimulate the economy. In support of this, Adikwu (2008) affirmed that if

Nigeria must achieve sustainable development, there is the need for an effective science education that will flourish scientific ideas and technologies that are used and managed by Nigerians. Ochu (2007) observed that the difference between developed and developing countries is based on the quantity and quality of science and technology they possess.

iii. Basis for decisions about living things: Scientific reports emphasize and explain the dependency of living things on each other and on the physical environment. This fosters the kind of intelligent respect for nature and informs decisions on the use of technology to improve the world for human beings and all living things.

iv. Enhancing national health status: There is no doubt that scientific achievements have led to longer, healthier and better lives. A generation that keys into past achievements will embrace and channel ways for future discoveries including innovative ideas that will improve physical and mental health thereby contributing to health status and improving on national productivity.

v. Preparing for advancement of scientific research: A science-literate society provides the necessary support to ensure future generations continue to improve upon scientific and technological breakthrough that guarantees safe environment and economic well-being of citizenry.

II. CONCLUSION

Studies and findings about science education and sustainable development is inexhaustible with a single study. Efforts by scholars, researchers and educationists have shown the nexus between science education and sustainable development. This paper posits that Nigerians and indeed Nigeria require an effective science education in order to achieve the goals of sustainable development. This is based on the fact that development in the 21st century should be anchored on the scientific knowledge and skills in which science education plays a pivotal role. Therefore, the philosophy of science education has to be reviewed to promote modern scientific discoveries on local and national scale.

III. RECOMMENDATIONS

From the foregoing, the following recommendations are made:

- Stakeholders in education should put in a concerted efforts and resources towards attainment of the objectives of science education by engaging services of qualified and experienced science teachers.
- Non-Governmental Organizations should make modern teaching gadgets and necessary science research equipment available both in schools and researchinstitutes in order to encourage scientific discoveries by Nigerian scientists.
- It is imperative that institutions are provided with adequate well equipped and well-staffed science laboratories. This will motivate students to participate dedicatedly, in the study of science and the scientific process, leading to discoveries.
- The quality of science education be improved to the best practices in the world, and above all, it should be made affordable and available for all citizens.
- Finally, issues surrounding science teachers' welfare, conditions of service and remunerations should be prioritized by the government so that they can put in their best in teaching thestudents.

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