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Physics Education as a Tool for Achieving Sustainable Development in Nigeria

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ABSTRACT

This paper highlight the roles of physics education as a tool for achieving sustainable development in Nigeria. Accordingly, Physics education can provide the country with indispensable avenue through which it could address the myriads of problems it is facing relating to sustainable development. In view of this, this paper examined the ways in which Physics Education can function as a tool for achieving sustainable development in Nigeria. It asserts that effective teaching and learning of physics could influence the sustainability of technological development in Nigeria. By sanctioning so-called special centers, students of physics would learn to work hard for a merited success. In the same vein, Physics teachers should be recruited based on merit. They should be examined on both content and pedagogical knowledge before recruitment and it should be ensured that they are registered with the teacher registration council (TRCN) for quality assurance. Lastly, textbook developers should ensure that physics textbooks are up to the standard and written in simple and understandable language.

Keywords: **Physics, Education, Sustainable Development, Effective Teaching**

INTRODUCTION

Education as regarded by [1] is the transmission of cultural heritage through systematic change of human behavior that is acceptable to the society. [2] further sees education as the process of training in which an individual is actively involved with the view to bringing out latent talents that can be modified for their personal and societal benefits. It is the most singular powerful instrument of life, charged with the responsibility of shaping and refining of life [3]. Hence, education is a systematic process of training aimed at bringing about a lasting positive change in the behavior of an individual for the betterment of the society. The contribution of education, especially science education, in developing a nation cannot be overlooked. According to [4], science education is described 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. [5] went further to state that science education is the study of the interrelationship between science as a discipline and the application of educational principles to its understanding, teaching and learning. It involves an in-depth study of both science disciplines and educational disciplines (psychology, philosophy, sociology and curriculum). It is a pre-requisite for technological development which involve an in-depth study of science as well as verified educational knowledge and concepts. Science education therefore owes it as a duty to equip teachers, learners and the society with knowledge, skills and freedom to perform noble tasks useful for improving socio-economic standard by producing capable scientists who contribute meaningfully through the product of their researches to raise the economic level of a nations. One of the branches of science, physics, is particularly of immense value in bringing about developments

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needed in technological development of any nation. Hence, its effective teaching and learning are crucial issues for consideration.

Concept Clarification of Physics Education

Physics is the science subject that deals with the study of matter and energy and their interactions. Physics can be seen as a culture, a way of perceiving and doing things which inevitably affects the problem-solving capabilities of any society and this is what determines the extent of development such a society can attain. Knowledge of physics has contributed immensely to the production of instruments and devices of tremendous benefits to humanity, thus playing a very vital role in the development of any nation. Physics, being one of the core subjects offered in Nigerian secondary schools forms the basis for the nation's technological advancement and human resource development [6]. Some of the roles played by physics to development are in the areas of electronics, food processing, preservation and storage, information communications and technologies as well as fuel and electricity production. Physics education as defined by [7] is the theory and method of teaching physics in the curriculum. The aim of all the intellectual effort dissipated in effective teaching of physics is to improve the learning of physics at all levels of learning especially at the secondary school level.

For a sustainable development of any nation to be achieved, sound physics education cannot be neglected. Despite the importance of physics education to national development, Nigeria lacked sustainable physics education since independence in 1960. This is why physics education has not been able to move the country into industrialization and above poverty level. Following the view of [8], science (especially physics) education has failed to produce skilled human resources needed for transformation into national prosperity. Hence, Nigeria has been witnessing haphazard type of modernization leading to acquisition of obsolete technology which of course does not lead to sustainable development.

Overview of Sustainable Development

Sustainable development is a construct, which envisions development as meeting the need of the present generation without compromising the needs of the future generation [9] further stated that sustainable development is 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 later definition stresses sustainable development as the process that is equitable and sensitive to ecological and environmental issues. Hence, any developmental issue must, must be aimed at preserving the ecology and the environment, else, such development cannot be said to be sustainable [10]. The sustainable development goals (SDGs) which is a transformative action plan based on the millennium development goals (MDGs) was officially launched on January 1, 2016. Its purpose was to address urgent global challenges over the next 15 years after the MDGs target (by the year, 2030) so as to consolidate the MDGs and ensure sustainable social and economic progress worldwide. SDGs seek to eradicate extreme poverty and to integrate and balance the three dimensions of sustainable development namely: economy, social and environmental in a comprehensive global vision. According to [11], the latest data reveals that about 12.5 % of people all over the globe are still living in extreme poverty and nearly 800 million people suffered from hunger while the birth of nearly 25 % of children under five years had not been registered. Ban [11] further added that about one million people were living without electricity while more than two million still suffer from water scarcity globally.

To achieve sustainable development, a lot of issues are to be put in place; namely, human capital through education and technology advances; physical capital like machines, tools among others. Educational institutions and their programmes are therefore the tools with which development and its sustainability can be attained. Borrowing a leaf from UK panel for education for Sustainable development (1998), education for Sustainable development enables people to develop the knowledge, values and skills to participate in decisions about the way we do things, individually, collectively, locally and globally that will improve the quality of life now without damaging the planet in future. Sustainable development, therefore is a process in which the exploitation of resources, the direction of investments, orientation of technological development and institutional changes are all in harmony and enhance both present and future potential to meet human needs and aspirations [12]. Creative thinking is a sine qua non and a rapidly growing trend that promotes sustainable development projects. Through physics education, efforts are made to foster creative thinking in learners to ginger them to be innovative. The role of creative thinking as a strategy for development of human knowledge and in problem solving is undeniable.

Strategies for Achieving Sustainable Physics Education

To achieve sustainable physics education, the following strategies will be of great help:

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i. Curriculum review: The Physics curriculum should be reviewed to make it relevant for the needs of the society and to be in consonance with the signs of the time. Relevant competent skills should be emphasized and inculcated in students at all levels to make them functional contributors to the society on graduation. Such curriculum should also emphasize skills acquisition and development which will make learners competent and creative so as to be able to compete with their counterparts globally. It is in line with this that [13] asserted that a futuristic curriculum for this millennium should be introduced in the educational system. To [13], futuristic curriculum should ensure that before graduation, every student should be equipped with such skills in science and technology, especially in physics that will be needed for sustainable, technological and socio-economic development agenda of the nation in a period of globalization.

ii. Training/retraining of more physics teachers: The impact of the teacher in performance of students in general, but particularly in physics is germane. It has been reported by researchers [14], that most teachers teaching physics are ignorant of the curriculum content of the subject. Some of them do not even have the basic qualification in physics, while some others who have, are without teaching qualifications. For this reason, there is need to train more physics educators and to insist that those who do not qualify should go for in-service training to obtain needed qualification to practice as physics educators. This will make those teachers well-grounded both in the conceptual understanding of the subject as well as being acquitted with the best method of impacting the knowledge on the learners for proper comprehension [15]. This agrees with the submission of [16] that the success or failure of any educational programme rests mainly on the adequate availability of well qualified (professional) and dedicated teachers.

iii. Re-orientation of value system. The present society values more of those professions that will generate enough income, respect and popularity. Hence, many who are good in and could have opted for physics education, the bedrock of sustainable development, are discouraged on the ground that it will not yield them enough money. Orientation on value system therefore, should be reversed to give science, technology, engineering and mathematics (STEM) (especially physics) education its pride of place in the society. In similar manner, girls should be encouraged to go for physics to bridge the gender gap since it enables them gain higher status in life and enhanced sense of efficiency. Educated women, especially in physics create more equitable lives for their families, increase their participation in community decision making and work towards achieving sustainable development [17].

iv. Motivating physics students: Students who opt to study physics should be properly motivated through scholarship opportunities and other incentives to attract and encourage more students to offer physics. Efforts should also be made to lay solid foundation at the grass root during the basic science days in the junior secondary schools so as to make students love and appreciate the subject at higher levels of education. At this level too, proper orientation if given to students in the career choice will go a long way to developing their interest in the subject. More importantly, while teaching the various concepts in physics, their relationships in, and applications to real life situation should be highlighted.

Physics Education for Sustainable Development: the way forward

Physics education for sustainable development entails giving people knowledge and skills in terms of lifelong learning to help them find new solutions on their environment, economic and social issues [17]. However, it is imperative to find out if the present physics education programme of Nigerian Universities equip students with adequate skills that will lead to sustainable development. Accordingly, the performance of the products of most Nigerian Universities in the labour market shows that there is still plenty of gaps to be filled in our physics education programme to fit it for sustainable development. Physics education for sustainable development is a lifelong process that enables a scientifically informed and involved citizenry to have the creative problem-solving skills, scientific literacy and commitment to engage in responsible individual and cooperative action [17]. Physics education as a tool for sustainable development sharpens and extends students' ability to think for themselves and try their hands on novel activities that lead to innovation, discoveries and inventions.

To achieve sustainable development through physics education, it is expedient to concur with [18] that effective skills development for employability and sustainable livelihood is essential and this also provides a foundation for peace building through contributing to poverty alleviation and raising level of income. It

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is important to note that the more involved the people are in physics, the stronger the society can be since the lessons and skills have effects that help make for more responsible citizen, a strong economy, a healthy environment for their own children and create a brighter future for everyone and provide a better technologically-driven world. The communication, research, reporting and collaboration skills that science (especially physics) provide can produce generations of individuals who are better prepared for any career and can make greater contribution to the society. According to [19], students who have solid knowledge base in science (especially in physics) will later be more open to emerging technologies and ideas that can boost business and stimulate the economy.

LIMITATIONS AGAINST SUSTAINABLE DEVELOPMENT THROUGH PHYSICS EDUCATION IN NIGERIA

They are a number of challenges that affect the effective teaching and learning of physics; among these are the underlisted:

Scarcity of Competent Physics Teachers: The problem of finding physics teachers that are well equipped with the needed knowledge and competence to impact such knowledge is one of the major problems experienced in physic education presently. This is why it is difficult to achieve sustainable development through physics education. Most of the available physics educators lack the skills needed for the practical application of physics for sustainable development.

Examination Malpractice: The problem of students patronising special centers, also known as miracle centers where examination malpractices are freely conducted presents a major constraint to achieving sustainable development through physics education. This is because, these students are neither interested nor ready to go through the stress involved for the acquisition of quality knowledge that will equip them with the necessary skills required for technological development.

Inappropriate Learning Material: Most physics textbooks used both at secondary and tertiary levels of education are not written in line with our culture. They are often beyond the scope and conception of the students for whom they were written. Good textbooks should use demonstrations and illustrations from materials available in the locality and also should be written in simple language understandable to the students for whom they were written.

Inadequate Funding: The problem of funding affects every facet of human endeavour including the education sector. Fund is needed to train physics educators and physicists; to equip and maintain physics laboratories for meaningful research in physics; for on-going development of physics professionals and for proper remuneration of the serving physics educators and physicist in order to attract more serious-minded persons to study and practice in the area.

Physics Education Curriculum: Inadequate Physics education curriculum at all levels of education where physics is offered presents one of the major constraints to the teaching and learning of physics in Nigeria. Since the world is growing rapidly in technology, there is an urgent need to restructure and reform the science, especially the physics curriculum to be in line with the present need. In line with this, [20] suggested that national physics curriculum would give way to international physics curriculum. Learning would become a universal system. Nationalistic or regional curriculum orientation would be replaced by global focused curriculum.

CONCLUSION/RECOMMENDATION

This paper highlight the roles of physics education as a tool for achieving sustainable development in Nigeria. Accordingly, Physics education can provide the country with indispensable avenue through which it could address the myriads of problems it is facing relating to sustainable development. In view of this, effective teaching and learning of physics could influence the sustainability of technological development in Nigeria. By sanctioning so-called special centres, students of physics would learn to work hard for a merited success. In the same vein, Physics teachers should be recruited based on merit. They should be examined on both content and pedagogical knowledge before recruitment and it should be ensured that they are registered with the teacher registration council (TRCN) for quality assurance.. Lastly, textbook developers should ensure that physics textbooks are up to the standard and written in simple and understandable language.

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