

## THE ROLE OF PHYSICS IN THE SOCIO-ECONOMIC EMPOWERMENT OF SOCIETY: THE NIGERIAN EXPERIENCE

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### Abstract

*Physics is an enterprise school subject which plays a key role in the progress and socio-economic development of any society. Today, scientific knowledge and technology are growing at a spectacular rate and are having a dramatic impact on society. It is glaring now that the Nigerian society has become very dependent on technology for its housing, lighting, clothing, mobility, healthcare, safety and security. It is also obvious that without technology, most of our durable goods, public utilities, consumables and services would simply cease to exist. Physics is one of the most important science subjects that is responsible for these technological breakthrough. It is in this light that this paper discusses the subject, Physics and society, situation of Physics education in Nigeria and its consequences on the socio-economic development of the society, and devastating effects that Physics could have on society. The paper concluded by recommending among others, that government at all levels should establish centres where training of youths in Physics and technology as spelt out in the senior secondary school Physics curriculum would be put into practice to enhance maximum productivity.*

### Introduction

Today the world is changing as a result of scientific and technological development and Physics plays a key role in that. Physics is the salt of science and technology innovations because its principles, laws and theories are mostly used in technological development. It is clear that most of the technological gadgets we use today have their roots in Physics. That is why Ogunleye (2001) submits that the technological potentials of any nation could be more accurately gauged by the quality of its Physics education and that without Physics, the technological culture of citizens cannot be firmly rooted. In agreement with this, Atadoga (2010) admitted that Physics is the heart of science and the pillar of technological activities. The development of human society in today's world is hinged on development in science and technology and Physics plays a key role in that aspect. There is invariably no society the world over that is not using the technological inventions that are from the knowledge of Physics. That is why UNESCO (2009) reported that teaching Physics is currently a concern to every nation and that the future prospect for technical progress is determined primarily by achievements in the main direction of Physics. Indeed Physics play a fundamental role in advancing the ground work for technological growth and development of the society and nations in general. Supporting the relevance of Physics to society globally, Okoro (2003) opined that unless one understands the foundation of Physics and links it with applied knowledge, one cannot call oneself an educated person in countries like Russia. To catch up with developed nations like U.S.A, UK, France, Germany and so on, Nigeria needs functional science and technology particularly in Physics (Usman, 2011).

Physics is a subject which has some applications in other fields of human endeavour. For example, the ideas of Physics were used to explore the other disciplines of science such as Neuro Physics, Medical Physics, Agro Physics and Chemical Physics. The ideas of Physics are also applicable and useful to human society particularly in non- physical sciences such as Economics, Social Science and Psychology. For

example, ideas of Physics are used in Economics to develop a model dealing with poverty and its eradication or to study the fluctuations in share markets (Bendre, 2015). These ideas of Physics are needed by the Nigerian society now in order to come out from the current economic recession. There is no doubt that the Nigerian society of today live in abject poverty simply because the country is lagging behind in the directions of science and technology. No nation will be economically buoyant if its citizens lack the knowledge of physics. For example; a house wife must have the knowledge of Physics before she can make use of her electrical appliances; a carpenter cannot make use of hammer effectively to remove nails from wood without him being taught how to use it. Knowledge of Physics is also required by technicians, doctors, engineers, artisans, etc. to carry out their functions effectively. Physics indeed is the life wire of modern science and technology. In the light of this, the paper discusses the following:

### **Conceptual Framework on Physics and Society**

Physics as a subject of study has been viewed in different perspectives by science educators. Erinsho (2013) viewed Physics as that part of science which deals primarily with the inanimate world and which is concerned with trying to identify the most fundamental and unifying principles. It is a science subject that deals with the study of matter and energy and how they interact (Usman, 2016). It could also be seen as that aspect of science that tries to explain the cause and effect relationship about what is happening in the universe. Bendre (2015) sees Physics as an experimental science. Physics as a branch of science could be defined as the study of nature, properties of matter, energy and their interactions which answer questions about natural occurrence on earth and beyond.

Society, on the other hand, could be seen as an aggregate of people living together in a more or less ordered community. The Oxford English living dictionaries (online) define society as the community of people living in a particular country or region and having shared customs, laws, and organizations. It is a group of people involved in persistent social interaction, or a large social grouping sharing the same geographical or social territory, typically subject to the same political authority and dominant cultural expectations.

### **Situation of Physics Education in Nigeria and its Consequences on Socio-economic Development of the Society**

Physics is one of the science subjects taught at the senior secondary school level of the Nigerian educational system which offers the students an opportunity to think critically, to reason analytically and to acquire the spirit of enquiry and use the knowledge to solve pertinent problems in life. Because of its relevance to socio-economic empowerment of the society, the Federal Government of Nigeria (FRN, 2009) in its senior secondary school curriculum document outlined the objectives of teaching Physics as to: Provide basic literacy in Physics for functional living in society; acquire basic concept of Physics as preparation for further studies; acquire essential scientific skills and attitudes as a preparation for technological application of Physics and stimulate and enhance creativity. It is pertinent to also note that the federal government, in its bit to improve the state of Science, Technology and Mathematics (STM) in Nigeria, has been making concerted efforts to turn the Nigerian society into a more scientifically literate and technologically advanced entity. The establishment of universities of technology, polytechnics and technical colleges in addition to the creation of ministries of Science and Technology, Environment, National Mathematical Centre (NMC) and launching of the satellite in 2003 are some of the efforts. Nigeria Sat 1 primary function is to detect natural disasters like flood, earthquakes generate data and provide aerial pictures of Nigeria to be used for national population census and are all aimed at promoting Science Technology and Mathematics (STM). In addition to these, several organisations and agencies were established and new policies were promulgated by the Federal Government. These include National Board for Technical Education (NABTECH), the comparative study and Adaption Centre (CESAC), Nigerian Educational Research and Development Council (NERDC) National Universities Commission and 60:40 admission policy ratio into Nigerian tertiary institutions in favour of science and so on.

However, despite the efforts put in place by the Federal Government of Nigeria, the situation of Physics in Nigeria still leaves a lot to be desired. That is why Adeyemo (2010) remarked that despite the efforts of the Nigerian Government, the situation of Physics in our schools is worrisome to stakeholders most especially Physics educators and researchers. Considering the objectives stated by the Federal Government (FRN, 2009) in the Physics curriculum documents, one could assume that the situation of Physics teaching and learning should have improved. Unfortunately, the situation is more worrisome as enrolment and performance of students in the subject is still poor. This assertion is in line with that of Isola (2010), Adegoke (2011), Omosewo and Akanbi (2013) where they generally reported low and poor performance in Physics. The low enrolment and poor performance of students in Physics according to Akanbi, Omosewo, Muhammed and Abdulmalik (2016) is indicative of a serious variance between the expectations of the National policy on education (FRN, 2013) and the actual situation of Physics in our schools and calls for a critical look at the strategies for teaching and learning of Physics (WAEC, 2008).

The poor performance of students in Physics is as a result of many challenges. Some of the challenges, according to Federal Government of Nigeria (FRN, 2009) include dearth of qualified teachers, the use of ineffective teaching approaches, inadequate equipment in Physics laboratories, and the nature of the subject matter that appears to be difficult. These challenges have culminated in lack of interest in Physics by students, declining popularity, and poor performance in public examinations conducted by National Examinations Council (NECO) and the West African Examinations Council (WAEC). For example, the analysis of WAEC and NECO results of candidates as released by Chief Examiner's Reports of (2003, 2005, 2007, 2008 & 2009) shows a disturbing trend of poor performance of students in Physics. In these years the analysis of results shows that 50% and above of the candidates are without credit in Physics. This, by implication, means that 50% of the candidates were not qualified for admission into higher institutions to study Physics or Physics- related disciplines.

This picture of Physics education in Nigeria is not desirable, considering the quest of the nation for economic and technological development. The probable consequences of these challenges may be low rate of admission of students into science- based courses in Nigerian tertiary institutions and subsequently low manpower development of the country. This situation also affects negatively the desire by Nigeria to create wealth and improve the quality of life of the citizens. Going by this ugly situation, Nigeria would not be able to produce engineers, doctors and pharmacist that could help in addressing the numerous challenges which the country is currently facing and in dire need for the socio- economic empowerment of the society.

### **Physics and Socio-Economic Development of Society**

Physics has made many contributions to the socio- economic development and transformation of society. Most of the technology which mankind uses today is related to physics. For example, television uses electromagnets to direct electrons on a screen to produce pictures, a cell phone uses microwaves, cars are built on the mechanical principles of Physics and modern homes use electricity to power appliances. An understanding of electro magnetism enable individuals to build electrical circuits and computers, Newton's first and second laws of motion enable people to put satellite into orbit, and erect safe buildings without problem. The knowledge of nature of light enables astronomers to determine the composition of stars without having to visit them.

Physics is crucial for effective living in this modern age of science and technology. The effects of Physics can be felt in all areas of human activity. For example, the technological inventions like the scanning machines, the production of drugs, camera, radio, just to mention a few; are the many inventions and discoveries of man which requires the knowledge of Physics for their understanding. The Nigerian society now has become very dependent on technology; for its housing, lighting, clothing, mobility, health care, safety and security and Physics plays a significant role in these areas. This is why UNESCO (2009) reported that teaching of Physics is a current-concern to every nation and that the future prospect for

technical progress is determined primarily by achievements in the main direction of Physics. Presently, Nigeria is in dire need of energy supply to improve on its electricity supply. This energy demand can only be realizable if the country tailored its efforts towards the training of people in the direction of Physics. Energy, which is the power derived from the utilization of Physical and chemical resources especially to provide electricity, heat and run machines, serve as the basis for extraction of resources which individuals, communities and even the entire nation can depend on. Supporting this assertion, Bala and Pam (2012) noted that a nation's development is largely determined by its political and economic vision. While the latter is derived from the former, its attainment is by modern energy supply in the economy-electricity, fuel and heat all other things being equal. Similarly, Sambo (2009) reported that, energy is an essential ingredient for socio- economic growth of all nations. For a nation to maintain its position and improve the quality of life of its citizens in global stage, energy crisis has to be settled.

Any society that is deficient in manpower development in the direction of Physics, that society would also be deficient in scientific and technological advancement. The socio- economic empowerment of any society depends largely on its seriousness in science and technology development. Because of the role played by Physics in society, the subject is becoming increasingly interdisciplinary, as Physicists work with many experts in the field of science and technology to understand and solve a wide range of problems confronting society. This by implication means that Physics, being a cross-cutting discipline, has industrial applications in many sectors of the economy such as health, mining, energy and engineering. Among many of the application of Physics which benefits the society are: ultrasound wave's used in scanning machines to obtain the position and image of a foetus. In the petroleum sector, which Nigerian economy relies so much on, the geophysicist and seismic prospecting workers use sound waves to probe the earth's crust for oil to drill. This action is generating about 90% of the total economic income for Nigeria.

The laws of thermodynamics are very significant to society. This is because ordinary household utensils and appliances are designed in whole or in part by using the laws of thermodynamics. For instance, the heating and air conditioning systems, the refrigerator, the pressure cooker, the water heater and the pressing iron man uses at home, all have their bases from the thermodynamics aspect of Physics. Similarly, the law of thermodynamics plays a major role in the design and analysis of rockets, conventional and nuclear power plants, solar collectors, and the design of vehicles ranging from cars to aeroplanes. The study of radioactivity in Physics has contributed enormously towards national development of the society in the field of agriculture. This is used to study the uptake of fertilizer or minerals in plants, production of fertilizers and in food preservation. Furthermore, radioactive dating and carbon dating being the most familiar, has proved invaluable in the range of crime investigation in our society. Indeed, there is no part of societal development which physics has not played a role. Physics therefore is the life wire of any society since its roles has permeated virtually all aspects of human existence on earth.

### **Devastating Effects of Physics on Society**

Although Physics has played a significant impact on society by way of improving the quality of life through its socio-economic empowerment, the subject has its own damage on the generality of society including Nigerian society. It has been said over and over again that technology is the application of scientific knowledge to produce things that are beneficial to the society. If this is true, then technology could be said also to depend on Physics because it is one of the science subjects which its laws, principles and theories are used in technology to make innovations that are useful to the human development. The knowledge of Physics in Technology could be constructive and destructive in nature. The constructive ideas of Physics used in technology has been exhaustibly discussed elsewhere in this paper. The destructive nature of Physics has been recognized by scientists. For example, in medicine, where x-rays are used to detect the position of foetus in his mother womb but too much exposure of an individual to x-rays can cause cancer. In warfare, Physics knowledge has been used to cause havoc to man because during the second world war of 1945, the two Japanese cities, Hiroshima and Nagasaki, were completely destroyed

by the use of nuclear bomb. This devastating effect of nuclear bombing continued to be remembered in the world's history.

Radioactivity is an aspect of Physics that has its devastating effects on human beings. For example, too much exposure to ionizing radiation is dangerous to living organisms including human beings. It is believed that too much use of radioisotopes dosage can cause cancer. The knowledge of Physics is used in technology to manufacture cars which are today used for transportation with widespread effects on society. In recent times Nigeria has witnessed series of plane crashes which has led to the loss of many lives.

In the area of water transportation, the devastating effect of the use of Physics knowledge to construct ships that sail on water and use as means of transportation is becoming a global disturbing issue. This is because, the global society is continuing to record a lot of loss of lives everyday as a result of sea accidents. Indeed we can say that Physics is constructive as well as destructive because both are continuing to have effects on the lives of citizens.

### Conclusion

Based on what has been discussed in this paper, it is glaring that Physics has played and will continue to play a significant role in the life of society. Since Physics is the hallmark of any scientific and technological development, its teaching and learning should be accorded serious attention in our schools. The paper has x-rayed the contributions which Physics is continuing to play in the life of society, but the most disturbing picture is that its teaching and learning in our schools is still inadequate. This paper has also pinpoint some areas which Physics has played a major role such as in agriculture, health, communications, transportation et cetera. It has then become pertinent for Nigeria to brace up and inculcate the knowledge of Physics into her young people for national prosperity.

### Recommendations

In the light of what has been discussed in this paper, the following recommendations are put forward:

1. Nigerian government at all levels should provide enabling environment for the study of Physics in schools.
2. The worrisome situation of physics teaching and learning in Nigerian schools must be addressed if the country wants to develop scientifically and technologically.
3. For Nigeria to come out from the current economic recession, physics should be accorded serious attention by making it to be part and parcel of the society.
4. Developing manpower in the area of Physics education should be given priority as doing this would greatly help the country to acquire engineers, doctors, technicians and so on.
5. Governments should establish centres where training of youths in Physics and technology as spelt out in the SSS Physics curriculum would be made practicable.

### References

- Adegoke, B.A. (2011). Effect of multimedia instruction on senior secondary school students' achievement in Physics. *European Journal of Educational Studies*, 3(3), 537-550.
- Adeyemo, S.A. (2010). Student's ability level and the competence in problem solving task in Physics. *International Journal of Educational Research and Technology*, 1(2), 35-47.
- Akanbi, A.O., Omosewo, E.O., Muhammed, R.E. & Abdulmalik, O. A. (2016). Gender and School Type as predictors of performance of senior secondary school Physics students in Ilorin Kwara State. *Journal of Education in Developing Areas (JEDA)*, 24(1), 33-41.
- Atadoga, M.M. (2010). *Challenges of effective teaching and learning of Physics at the secondary school level. Improving educational standards in Nigeria perspectives, challenges & strategies.* In Timothy O. Oyetunde, Joseph S. Aliyu, Mary P. Haggai and Joseph M. Musa, 253-258.

- Bala, E.J. & Pam. G.Y. (2012). Energy sources and sustainable development of the North. A paper presented at conference on “The North and Strategies for Sustainable Development”, organized by Arewa House, Kaduna, 5<sup>th</sup> – 6<sup>th</sup> December.
- Bendre, B. (2015). Physics at the service of mankind. *International Journal of Current Research*, 7(10), 21680-21687.
- Erinosho, S.Y (2013). How do students perceive the difficulty of Physics in Secondary School? An exploratory study in Nigeria. *International Journal for Cross-Disciplinary subjects in Education (IJCDSE)*, 3(3), 23-24.
- Federal Government of Nigeria (FRN, 2013). *National policy on education*. NDERC Press: Lagos.
- Federal Government of Nigeria (FRN, 2009). *Senior secondary school physics curriculum*. NERDC Press, Abuja: Nigeria.
- Isola, O.M. (2010). Effects of standardized and improvised instructional materials on students’ academic achievement in secondary school Physics. Unpublished M.Ed. Thesis; University of Ibadan, Nigeria.
- Ogunleye, A.O. (2001). Girls’ Perceptions of Strategies for improving low enrolment, underachievement and attitudes of girls in Physics of the Senior Secondary Level. Science Teachers Association of Nigeria 44<sup>th</sup> Annual Conference Proceedings. Ibadan: Heinemann Books, Plc.
- Okoro, D. (2003). Physics Technology and Society: The Journey so far. Science Teachers Association of Nigeria. 44<sup>th</sup> Annual Conference Proceedings. Ibadan Heinemann Education Books, Plc.
- Omosewo, E.O. & Akanbi, A.O. (2013). Analysis of errors committed by Physics students in secondary schools in Ilorin metropolis, Nigeria. *Acta Didactica Napocensia*, 6(1), 55-60.
- Sambo, A.S. (2009). *The challenges of sustainable energy development in Nigeria*. A paper presented at Nigerian society of engineers forum at Shehu Musa Yar’adua centre, Abuja, Nigeria.
- UNESCO (2009). *Education for all, global monitoring report*. Paris: UNESCO.
- Usman, I.S. (2011). Educational Reforms and Physics Education in Nigeria: An Overview of areas of needs in Physics education. *UMMYU Journal of Educational Research*, 3(1), 1-9.
- Usman I.S. (2016). Effects of Concept Mapping Strategy on Secondary School Physics Students’ Achievement in Jos, Plateau State, Nigeria. Unpublished Ph.D Thesis, University of Jos, Nigeria.
- WAEC (2008). Executive summaries of entries, results and Chief Examiners report on West African Senior Secondary School Certificate Examination (WASSCE) conducted in Nigeria Lagos, Nigeria: Author.
- West African Examination Council (WAEC, 2003, 2005, 2007, 2008 & 2009). Chief examiner’s reports in Physics, Nigeria.
- Partnership on Measuring ICT for Development (2010). “Core ICT Indicators 2010”. Geneva: International Telecommunication Union.
- UNESCO (2011). *Transforming Education: The Power of ICT Policies*. Paris: UNESCO.