

PHYSICS EDUCATION IN NIGERIAN SECONDARY SCHOOLS: PROBLEMS AND PROSPECTS

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Abstract

This paper examines the problems and prospects of teaching and learning Physics in Nigerian secondary schools. The problems include the teaching method employed by teachers in teaching Physics and lack of well-equipped Physics laboratories. In spite of the existing problems, it is pertinent to bring to bare the ample career prospects that abound for graduates of Physics Education. Some of these prospects the paper has examined include gainful employment into the public sector as Physics and Mathematics teachers and being self-employed. Suggestions were proffered which when utilized, may improve the teaching and learning of Physics in Nigerian secondary schools; which in turn may lead to technological and socio-economic growth of the nation. The suggestions made include solving the problems hindering the smooth implementation of secondary school Physics curriculum so as to facilitate meaningful learning of Physics.

Introduction

Education is any act or experience that has a formative effect on the mind, character or physical ability of an individual. In a technical sense, education is the process by which society deliberately transmits its accumulated knowledge, skills and values from one generation to another. It is an incontestable fact that education is an important tool for wholesome development that no nation can afford to ignore. This is because education plays a key and leading role in the overall development of the individual and society at large. Hembra, Trisma, Kakmena & Josiah (2005) highlighted the importance of Physics to national development in the area of technology, industry, job opportunities and health.

Electrical generators used in power stations, radio and television developed from Physics theoretical ideas, nuclear power resulting from increasing knowledge about the structure of matter, and many more are clear indications of the importance of Physics to national development in the area of technology. In the industry, lasers are employed to remove tumours and correct vision. They are also used to weld metals with high precision, leading to high quality joints. Research in electronics, batteries, radio signals and detection systems has rendered cellular phones portable and affordable. In the health sector, particle accelerators are employed to treat cancerous tumours. Non-invasive techniques of diagnosis now enable doctors to obtain information about a patient's health without subjecting the patient to undue pains of surgery. These are but a few example of how Physics is beneficial to the society.

The significant role of Physics education in the development of Nigeria is enshrined in government's effort to improve science education in schools. The Federal Government of Nigeria (as cited in Kakmena, Tongjura, Zumyil, & Josiah, 2004) formulated a national policy on Science and Technology in 1980, after establishing a full-fledged Ministry of Science and Technology to promote and develop scientific and technological research in the country. It also put in place a 60:40 science to humanities admission policy to improve enrolment into science and science related courses in the tertiary institutions. These and many efforts the government of Nigeria attempted to put in place to facilitate the teaching and learning of Physics in schools.

Despite the relevance of Physics to national development and the steps taken by government of Nigeria to improve teaching and learning of Physics in schools, a lot of problems are still bedeviling the teaching and learning of Physics in the secondary schools. Josiah and Okooboh (2001) identified some of the problems as teachers' welfare and motivation, dearth of qualified manpower, ill-equipped laboratories, overcrowded classrooms and inadequate supply of teaching and learning materials. Other problems found in the teaching and learning of Physics in secondary schools include poor environmental conditions in schools, teacher stress, students' poor attitude towards the subject, inadequate infrastructure, poor funding, and industrial disputes (Akpan, 2001; Josiah, 2004; Dashe&Taukek, 2004).

The Nigerian Educational Research and Development Council (NERDC) (2008) highlights the objectives of studying Physics to include, among others, provision of basic literacy in Physics by students for functional living in the society and acquisition of essential scientific skills and attitudes as a preparation for the technological application of physics in the society. Thus, for national development in technology, basic concepts and principles of Physics in secondary schools is intended to provide for young scientists who would be able to design the technological devices that would make day-to-day

activities easier and living more comfortable (Ajayi, 2008). This implies that Physics is one of the pivotal subjects in technology. Therefore, the teaching and learning outcomes of this all-important subject need serious attention in order to enhance a sustainable technological development in Nigeria.

Physics Education in Nigeria

Science teaching started in Nigeria since 1859 in Nigerian secondary schools. It commenced with the teaching of nature study and afterwards it expanded to the separate science; that is Physics, Chemistry and Biology. Physics is a branch of science that deals with the study of the manifestations of the laws of nature. It is sometimes referred to as the science of measurement and its knowledge has contributed greatly to the production of instruments and devices of tremendous benefits to the human race. In Nigeria, Physics is being taught as one of the science subjects at the senior school level and its branches include mechanics, optics, electricity, atomic physics and physics of sub-atomic particles. The knowledge of Physics is important for the technological advancement of any nation. Its study can lead to several scientific fields and professions such as engineering, manufacturing, mining and construction industries. Apart from this, the knowledge of Physics plays a very significant role in the economic development of any nation. Josiah (2013) stated that the knowledge of Physics enables a man to repair electronic devices such as radio, television and calculators. Such knowledge can also lead man to producing solar panel, a computer for solar electricity generation, and laboratory equipment for use in schools. He can also construct laboratory equipment.

There may be no end to exhausting the significant role of Physics in uplifting the development of any nation. It embraced and utilized, Physics can facilitate the socio-economic status of Nigerians.

In realization of its numerous advantages of Physics to national development, Physics has been introduced in Nigerian secondary schools at senior level in order to achieve the following objectives (NERDC, 2008):

- i. Provide basic literacy in Physics for functional living in the society;
- ii. Acquire basic concepts and principles of Physics as a preparation for further studies.
- iii. Acquire essential scientific skills and attitudes as a preparation for the technological application of Physics and
- iv. Stimulate and enhance creativity.

Problems of Physics Education in Nigerian Secondary Schools

A careful analysis and appraisal of Physics education reveals some fundamental problems/challenges confronting Physics education in secondary schools in Nigeria. These are discussed below:

- a. **Teaching methods:** The teacher's methods of teaching may go a long way in enhancing effective learning by the students. The traditional method of teaching science (Physics inclusive) in the schools involves chalk and talk activities which is fully teacher-centred. In this case, the students are passive robots in the classrooms who regard the teacher as repertoire of knowledge.

There is agitation to inculcate the 21st century approaches to science teaching in Nigeria. These include inquiry method, collaborative teaching, discovery method and creativity. They are purely child-centered approaches. Here, the students are guided to discover facts and construct their own idea and understanding of the concepts of the study. Research report indicates that the traditional method of teaching Physics that has been identified as ineffective is still being used in Nigerian classroom (Boyo, 2010). The practical activities that could enhance creative thinking in the learners (as advocated for by NERDC, 2008) are given "lip service" in Nigerian schools.

- b. **Lack of well-equipped Physics laboratory:** Physics cannot be effectively taught without well-equipped laboratories, as laboratory work has long been regarded as an integral and necessary aspect of the learning experience in science courses. Most of the concepts in Physics will only be assimilated fully by the learners if laboratory work complements theoretical work. As such, the Physics laboratory is very essential in the teaching and learning of Physics. However, Anikweze and Sowande (as cited in Akpan, 2001) reported that most laboratories in Nigerian schools are either ill-equipped or inadequate for the student population.
- c. **Curriculum content:** Physics is crucial for effective living in the contemporary science and technology age. With the immense role Physics plays in the technological development of any nation and its importance in science and science-related endeavours, it is necessary that every science student be given the opportunity to acquire the concepts, principles, theories and skills. Unfortunately, problems have hindered the effective delivery of the teaching and learning of the subject Physics in schools. This is evident in the poor performance of students recorded in external Physics examinations such as the West African Examination Council (WAEC) Senior Schools Certificate Examination (SSCE). NERDC (2008) reports that the implementation of Physics

curriculum in secondary schools has fallen short of expectation because of lack of sufficient number of qualified Physics teachers, inadequate facilitating laboratory equipment and nature of the Physics which is apparently difficult. This is despite the plausible adjudgment of the philosophy, objectives and content of the Physics curriculum. Ajayi (2008) laments that Nigeria still lacks the technology that could satisfy her daily needs and comfort.

A careful study of the curriculum approach reveals a shift from the conceptual approach to content selection to the thematic approach. The spiral approach to content organization has been employed and the guided-discovery method of teaching, child centered method, has been recommended for the teaching and learning of Physics.

- d. **Teacher's quality:** The impact of the teacher in the performance of students in Physics is germane. The teacher is the facilitator who is to impact and put across into students' concepts expected to be learnt. Most teachers teaching Physics are ignorant of the curriculum content of the subject because they are unqualified. They lack the requisite of teaching skills. The students taught by this category of teachers would be invariably shallow in Physics concepts and principles. On another perspective, some Physics teachers who are masters of their subjects lack the technical knowhow of impacting the concepts to the students. One thing is to be well grounded in the conceptual understanding of a subject; another thing is to be well acquainted with the best method to pass the concepts across to the learners for proper comprehension. A professional teacher would be desirable in this regard. The results of a study by Adebayo (2010) showed that professional teachers affect the students' performance in Physics positively more than the non-professional teachers.

The need for professional teachers in science has been on stage in Nigeria for some decades now. The situation in most secondary schools in Nigeria is that Physics is taught by graduates in other fields of science such as B.Sc. Physics, B.Tech Engineering, B.Sc (Ed) Technology and Higher National Diploma(HND). This set of people lack the skills involved in teaching science since they were not trained for the job. Federal Republic of Nigeria (as cited in Josiah, 2008) defined teaching as a profession and sees a teacher as one that has graduated from any of the following institutions: Grade II Teachers' Colleges, Advanced Teachers' Colleges (now Colleges of Education), Institutes of Education (in Universities), National Teachers' Institutes, and Teachers' Centers. Josiah (2008) included Faculties of Education (in Universities) and Polytechnics

as teacher-training institutions. An individual who has graduated from, at least, one of the above mentioned institutions is qualified to be a professional teacher.

- e. **Negative attitudes of students towards Physics:** To the majority of the students in the secondary schools in Nigeria, Physics is perceived as a very difficult subject (Josiah, 2004). The cause of the negative perception of students towards Physics was identified by Josiah (2004) and Adebayo (2008) to include the fear of the mathematical skills involved, harsh teacher-student relationship, students' unreadiness to study, preconceived bad information that Physics is a difficult subject and poor method of teaching. This impression greatly affects students' readiness and interest to the study of Physics.

Career Prospects for Studying Physics Education

- a) **Public Sector:** Owolabi, Akintoye and Adeyemo (2011) carried out a research on career prospects in Physics Education and found out that graduates of Physics Education can be gainfully employed into the public service as teachers in secondary schools. They can teach Physics as well as Mathematics. Such graduate can also be employed in Ministries and Parastatals (other than Education) in the Civil Service. A good first degree result provides the platform to teach in higher institutions like the University.
- b) **Private Sector:** Graduates of Physics Education can work in the bank and private companies like Oil and Gas, and Construction Companies. Owolabi, Akintoye and Adeyemo (2011) reasoned that graduates of Physics Education can work in the private sector because that sector is not only concerned about the field of specialization of applicants but also about their quality. According to the trio, most private companies organize refresher training for freshly employed hands to acquaint them with the work. Physics Education graduates can fit in as senior technical staff and programming officers, amongst many other positions.
- c) **Self-Employment:** With the unemployment rate rising high in public sector, especially in the under-developed and developing countries like Nigeria, the clarion call and need for graduates of Physics Education to be self-employed can never be over-emphasized. NERDC (2008) introduced the theme "Physics in Technology" into the secondary school Physics curriculum to provide opportunity for equipping students with the necessary knowledge and skills for constructing and operating workable devices as well as acquainting them with some products of modern technology. Supplementing, Mallo, Kakmena and Josiah (2013) opined that teaching Physics such that students acquire the knowledge and skills

in the subject aids them in income generation. They can repair radio and television sets, calculators, hand phones, amongst other gadgets.

- d) **Postgraduate Studies:** Graduates of Physics Education can aspire to acquire higher degrees [M.Sc (Ed) and PhD (Physics Education)]. With PhD, they can be consultants in the field. A graduate of Physics Education can venture into Physics-related fields such as Engineering and Computer Science. Owolabi, Akintoye and Adeyemo (2011) stressed that a graduate of Physics Education can also sit for professional examinations such as Chartered Institute of Bankers (CIB) and Association of Certified Chartered Accountants (ACCA), given the interconnectedness between Physics and Mathematics.

Suggestions

The relevance of Physics Education in sustaining technological development makes it imperative to proffer urgent solutions to the myriad of problems befalling it. A few suggestions are offered here:

- a) **Curriculum Implementation:** Efforts should be made to solve the problems hindering the smooth implementation of secondary school Physics curriculum so as to enhance meaningful planning for technological development of Nigeria.
- b) **Teachers' roles:** The Physics teacher should use appropriate teaching methods that are relevant to his/her students. Obviously, no method is the best, but the teacher needs to study the students and identify the best teaching method for them. This calls for expertise in methodology, hence the need for skilled teachers. The 21st century approaches to teaching Physics emphasizes child-centered method (NERDC, 2008) where the teacher mainly facilitates creative thinking in the learners.
- c) **Teachers' Training Programme:** The teachers' training programme should be extensive enough to produce quality Physics teachers. More emphasis should be placed not only on the mastery of their subject matter but as well as on improvisation methods, methodology, practical skills and the like. Teachers' Registration Council of Nigeria (TRCN), a control and regulatory body of a teaching profession, must flush out these unwanted non-professionals for effective teaching and learning of Physics to be achieved.
- d) **Students' Encouragement:** The students are the focus of all activities involved in Physics education. The teacher has a skilful role of making Physics interesting and captivating for the students. The teacher's relationship with the students both inside and outside the classroom should

not scare them away but rather draw their interest towards the study of Physics. Physics must be presented to the students as a subject that deals with physical phenomena around them; this is a fact which has been eluding the students. Students should be sensitized as to the relevance of Physics in other fields of human endeavours such as medicine, pharmacy, and engineering. The awareness of the link between Physics and other fields of study would leave the students with desire and readiness to learn the subject. The use of ICT in the teaching and learning of Physics should be encouraged as this would serve as motivation to the learners and more importantly make learning interesting, involving and effective.

- e) **Provision of Resources/Materials:** Physics deals with practical concepts. Hence, it cannot be effectively taught and learnt without involving the practical activities. The school authority and government should make adequate provision for functioning equipment in Physics laboratory. Where the facilities are inadequate, the teacher should improvise. The teacher is also encouraged to make judicious use of the available materials for effective learning.

Conclusion

Physics is a powerful tool for achieving technological development. It drives economic growth, creates options for the future and is the key to global competitiveness. Educating Physics teachers is a step in the right direction to achieving the Nigeria of our dreams, a technologically developed Nigeria. This implies that effective teaching and learning of Physics would undoubtedly facilitate Nigeria's socio-economic growth.

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