



REFOCUSING THE TEACHING OF PHYSICS FOR THE TECHNOLOGICAL DEVELOPMENT OF NIGERIA

Bawan A. M.^a, Kamgba A. F.^b and Obi D. O.^c

^{a&c} Department of Physics, Cross River State College of Education, Akamkpa.

^bDepartment of Physics, University of Cross River State, Calabar, Cross River State, Nigeria.

Corresponding Author's Email: donbalism@yahoo.com; Tel.: 08066896698

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ABSTRACT: *The paper discusses the current condition of physics education in Nigerian secondary schools, and the challenges of teaching and learning physics in the country towards enhancing development in technology and further highlights some of the prospects of physics teacher education reform for Nigerian technology development. It also discusses the way forward to the current challenges for physics teacher education in Nigeria. Based on this, recommendations were made on the key reform issues; the use of innovative teaching methods in teaching Physics by physics teachers should be encouraged, government and the stakeholders should provide instructional material, training and retraining of physics teachers on information and communication technology, (ICT), government should ensure proper monitoring and implementation of the education reform, all level of education should be provided with adequate qualified physics teachers that would transform physics teacher education program and teaching/learning of physics towards refocusing physics education for technological development of Nigeria.*

KEYWORDS: Physics Education, Teacher Education, Technological Development, Nigeria.



INTRODUCTION

Physics is a very crucial subject for the technological development of any country, and as such its teaching and learning must be a matter of not just a national concern but a global one. There is a drastic drive in Nigeria towards technology, this is contained in her National Policy on Education (2004) chapter 5 section 39, sub-section 1; “a greater proportion of educational expenditure will be devoted to science and technology”. The development of any society is judged by the technological level and the category of people that inhabit it (Adegun, 2003), a society with a high level of technology will be then regarded as developed.

The National Education Scheme (1985), designed for secondary school physics has it that the objective of studying physics includes, among others:

- To provide basic literacy in physics for fundamental living in society.
- To acquire essential scientific skills and attitudes as a preparation for the technological application of physics.
- To stimulate and enhance creativity.

Unfortunately, despite the aforementioned national concern, there is an increasing low enrolment in physics in schools and tertiary institutions in Nigeria (Ladipo, 2009) and student performance has continued to witness a downward trend.

The ever-increasing decline in physics enrolment and achievement Ezeife, (1996) points to the fact that there are increasing conditions for underachievement and slow learning. The teaching of physics in secondary schools is intended to produce young scientists who would be able to design technological devices that will make day-to-day activities easier and living more comfortable (Ajayi, 2011). It thus implies that physics is one of the pivotal subjects in technology. The teaching and learning outcomes of this all-important subject need serious attention in order to enhance Nigeria’s technological development.

Teacher education is a programme that mentors and nurtures individuals to become professional teachers. It involves making teachers obtain requisite knowledge in their different subject areas and theories and principles that guide the practice of teaching through in-service training and retraining.

Omosewo (2009) noted that the revised version of the NPE (4th edition section 8 subsection 70(a)) stated that teacher education will continue to be given a major emphasis in all educational planning since no educational system can rise above the quality of its teachers. The policy also points out that if Nigerian universities are to make optimum contributions to national development in professional fields, the course contents should reflect the national requirements.

The same policy under higher education added that:

- a) Education of higher professionals will continue within the university system, and it will be rooted in a broad-based, strong scientific background;
- b) The curriculum will be geared towards producing practical people, and the course content will reflect our national needs, not just a hypothetical standard. Omotayo (2009) also



noted that nothing is as important to learning as the quality of the learner's teacher. Physics education is one of the teacher education programs of Faculties of Education in Nigerian higher institutions of learning.

Physics is one of the core science subjects taught at the senior secondary school level of the Nigerian educational system. Physics teacher education curricula which were developed in line with the criteria established by the NUC are meant to produce competent Physics teachers (NUC, 2007). The knowledge of Physics is usually required to pursue courses like Astronomy, Geology, Chemistry, Biology, and Engineering amongst others. Udo (2013) established that learning Physics offers the student an opportunity to think critically, reason analytically and acquire the spirit of enquiry. This is why he asserted that: Physics is crucial for effective living in the modern age of science and technology. Given its application in industry and many other professions, every student must be given an opportunity to acquire some of its concepts, principles, and skills.

Despite the importance of this subject, it is widely recognized that the teaching and learning of Physics has been fraught with challenges such as low enrolment both in secondary schools and in tertiary institutions in Nigeria (Daramola, 1982). Notable among the causes for low enrolment of students offering Physics in schools include: poor Science and Mathematics background of students at the junior secondary level of education, poorly equipped Physics laboratories, inadequate motivation of teachers, poor remuneration, inappropriate teaching strategies employed by the teachers and insufficient number of qualified Physics teachers (NERDC, 2009; Ajayi, 2021). These factors have equally added to the decline in the performance of students who enrolled for Physics at the Senior Secondary School Certificate Examinations (SSCE)

Problems of Physics Education Presently:

Physics education is a major factor in enhancing technological development for effective living in the modern age of science and technology. Given its application in industry and many other professions, it is necessary that every student be given an opportunity to acquire some of its concepts, principles and skills. Unfortunately, the teaching and learning of physics has been faced with a lot of challenges. These challenges prevent many students from performing well in formative and summative evaluations.

Edinyang (2008) and Bawan, (2013) listed the problem areas of senior secondary physics education to include:

❖ **Curriculum content and implementation:** the philosophy, objectives and concepts of the physics curriculum in line with the colonial orientation have been adjudged by professionals in the field to be satisfactory, but its implementation has fallen short of expectations because of the paucity of qualified physics teachers, inadequate equipment to ensure the performance of related students' activities which are aim at enhancing meaningful learning. (Bawan and Udo, 2019) remarked that the content of science and physics, in particular, taught in the school void of local environment and do not identify with the technological needs of society, in the 21st century. The curriculum does not take into consideration the cultural values and beliefs of the society for which it was designed. It is only recently that efforts have been geared towards reforming the curriculum to suit the needs of the society for which it is meant to serve, but the



curriculum still lacks the values and materials that connect it to the immediate environment. In such a case, the advocacy of technology as a means of satisfying society is likely to be a mirage.

❖ **The paucity of modern instructional and laboratory equipment:** No effective physics teaching can exist without learning materials, practical equipment and activities. It is therefore expedient that physics laboratories must be adequately stocked with the necessary modern equipment for effective teaching of the subject. However, educational researchers reported that most secondary schools in Nigeria have no physics laboratory and few that have are rather ill-equipped (Ibe, 2010; Ajayi, 2011 and Bawan, 2013;). Ibe (2010) while assessing the level of students' involvement in practical activities in physics laboratories concluded that only 22.23% of the schools allow their students to carry out practical activities. The neglect of the practical aspect of physics contradicts the objectives of physics education in senior secondary schools.

One would expect the teacher, who is the facilitator in the teaching-learning process, to improvise for materials where they are not available or are insufficient, but the attitudes of the teachers towards improvisation of teaching materials is negative

❖ **Lack of a sufficient number of professionally trained physics teachers:** the teacher is supposed to be vested with the principles, concepts and objectives of the subject, but research shows that about 65% of the teachers teaching physics in Nigeria secondary schools are not qualified and are ignorant of the concepts and curriculum content of the subject (Onu, 2007). The students taught by these rather incompetent teachers would be invariably shallow in physics concepts and principles. The teaching method is another thing that mitigates the realization of the objectives of physics education. The traditional method of teaching physics in schools involves board and talk activity which is fully teacher-centered. In this case, the students are passive “robots” in the classroom who regard the teacher as a 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 etc. Those approaches are purely child-centred which helps the learner to discover fact, construct his/her ideas and be creative.

❖ **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 schools involves “chalk and talk” activities which are fully teacher-centred. In this case, the students are passive “robots” in the classrooms who regard the teacher as the repertoire of knowledge (Ajayi, 2021).

Other challenges not highlighted here include: the lip-service attitude of

Government, inadequate funding, negative attitudes of students towards physics and students' ignorance of the relationship between physics and the environment.

From the afore-going, rather than achieve the general objectives of the senior secondary physics curriculum, physics education at the senior secondary levels is in a coma, needing urgent revival or refocusing.



Refocusing Physics Education and Physics Teacher Reform

The current abysmal performance of students in Nigeria's secondary and higher institutions of learning and a host of challenges mitigating the efficient teaching and learning of physics education calls for urgent refocusing of the practice and delivery of physics education in Nigeria. The Physics teacher education program in Nigeria needs urgent reform to provide solutions to the current marathon problems in physics teacher education in Nigeria. Based on the analysis of the situation, a few suggestions are offered here but the list is not exhausted:

- ✓ **Teacher training program:** The quality of the existing teaching force must be improved primarily through in-service programs, by professionals in physics education. More emphasis should be placed not only on the mastery of the concepts and the principles of physics but also on improvisation methods, methodology, practical skills, innovative teaching methods etc.
- ✓ **Curriculum innovation:** Efforts should be made to revisit the curriculum with the aim of catering for the needs of the society for which it is designed in line with the realities of the 21st century.
- ✓ **Admission and students' encouragement:** Admission of candidates into physics education program should be based on merit and interest, oral/written examination and interviews should be used to test candidates before admission. The teacher should build a good relationship with his students and develop skills aimed at motivating the students.
- ✓ **Teacher Registration Council:** The Teacher Registration Council of Nigeria, Nigeria Union of Teachers, and the government should ensure that only professionally trained teachers with adequate knowledge and skills in a particular subject should be registered and allowed to teach physics or practice the teaching profession.
- ✓ **Lecturer role:** The lecturer should use appropriate lecturing methods that are relevant to his/her students, switch from the prevalence board and talk traditional classroom setting to inquiry-based, constructive methods (such as guided discovery method) including online teaching, learning and research. More so the common practices of collecting money (sorting) from students to award unmerited grades in physics should be discouraged to stem the attendant effect of producing half-baked and unqualified graduates (teachers) by Nigerian tertiary institutions.
- ✓ **Government:** Apart from providing adequate relevant modern instructional materials and practical equipment for physics laboratories, the government should provide ICT facilities in our schools and training programs for teacher educators. This will provide easy access to the online library and also aid research. More so, motivational and incentive packages should be provided to the teachers.
- ✓ **Students:** Counseling services should be provided in our schools to reorient the students on the relevance and relation of physics to the environment. They should also be encouraged to take their physics studies seriously, scholarship should be given to outstanding physics students; this will help them develop their inherent creative skills to their full potential aiding the development of technological tools for the technological development of the country.



RECOMMENDATION

- Teachers should employ innovative teaching methods such as guided discovery, peer tutoring etc. in the teaching of physics to bring about needed scientific learning and innovation
- The government should ensure proper implementation and monitoring of the newly introduced curriculum
- Adequate training and retraining of teachers on ICT is very important for effectiveness.
- Government should provide good textbooks to the schools which should be in an understandable language for the students to understand the context very well. This means there is a need for the government to provide the students with e-library so that they can be able to access the books of their choice.
- The government also should review the curriculum of Physics education so that it will meet the present advancement
- Recruitment of Physics teachers should be based on merit, a set of both written and verbal interviews should be conducted by all screened applicants so as to reduce impersonation. For a Physics teacher to effectively teach in a way that will lead to the development of the desirable level of techno-scientific literacy he/she must be well groomed, be of sound knowledge in Physics and he/she must obtain the relevant professional teaching qualifications along with specialized knowledge of instruction. – Modern laboratory equipment that cannot be improvised should be imported to equip laboratories in the various schools. Well-trained laboratory technicians/technology should be employed in the Physics laboratories.
- Students should be counselled and guided properly in their career choice and should also be encouraged to study Physics by telling them the importance of Physics in the development of society. Proper measures should be taken to ensure that students from a younger age have the knowledge of Physics, therefore the government and stakeholders should find room for organising orientation/lectures from the primary school level to the higher school level.
- Political deception should be avoided in the education sector by all types of government. Proper funding should be given priority attention to cater for infrastructure, learning materials, laboratory equipment etc.
- Physics teachers and science teachers should be motivated by incentives, such as a special salary scale for science teachers to keep them comfortable in the classroom. Attractive scholarships based on merit (performance of the students), not political scholarship schemes should be formed and made available for science students in teachers training institutions.

CONCLUSION

Physics education programs need to be redesigned to incorporate, in real terms modern technologies of teaching/learning process and retrain the existing physics teachers in line with the realities of the 21st century.



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