

Physics Resource Availability and Utilization in Nigerian Secondary Schools

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Abstract

This paper dwelled on the availability and utilization of physics resources in Nigerian secondary schools. Worldwide, science education (Physics education inclusive) is recognized as a form of investment in human capital for socio-economic benefit. Given the vast application of Physics in most spheres of the economy, Physics education at the secondary school level must not be relegated to the background. Unfortunately, in Nigeria, the performance of secondary school students in external Physics examinations over the years has been dwindling. This poor performance of students in secondary school Physics leaves little or nothing to be desired of Physics education in Nigeria. Since the outcome of Physics curriculum depends on facilitating factors such as resources, this paper looked at the availability, utilization and effectiveness of resources in teaching Physics in Nigeria. Improving performance in Physics through the use of local material resources was advocated. Creation of enabling environment by the principals and stakeholders through workshops/seminars/conferences and financial support for improvising were also recommended.

Keywords:

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Background to the Study

Science education is globally recognized as a form of investment in human capital for socio-economic benefit of countries. It is worth noting that the government of any country is among agencies responsible for the education of its citizens and, in most instances, it is the sole controlling body. Josiah (2004) opined that affluent people and organizations in oversea countries that spend enormously on education so within the countries various governments' guidelines. The countries are confined to a boundary of government's rules and regulations or policy formulations. Here in Nigeria, educational institutions managed by some wealthy citizens and organizations have since taken off. This is commendable as it is a mere logic that the government of any country, its citizens and non-governmental agencies should work together for the maintenance of science and technology in the country.

Nigeria is noted for its ability to formulate wonderful educational policies which, if properly implemented, would lead to tremendous socio-economic development. Such policies include the National Policy on Education, National Policy on Science and Technology, and the Blueprint on Implementation Guidelines for the Universal Basic Education programme. Such policies led to the introduction of 9 years' Basic education (6 years primary school and 3 years Junior Secondary School), introduction of Basic Science in primary school, establishment of many government and non-governmental secondary schools, Colleges of Education (Technical), Universities of Science and Technology, and the purchase and distribution of science and technical equipment and machinery to schools. However, experience has indicated that the main hindrance to the growth of science and technology in Nigeria is the lack of implementation of the policies stemming mainly from poor planning and execution. Furthermore, science curriculum outcomes depend on facilitating factors such as resources, but unfortunately, the outcomes of physics teaching through the employment of these factors have been underscored by the turn out of students' poor performance in external physics examinations. Tables 1 and 2 provide information on the abysmal performance of Nigerian secondary school students in physics in West African Senior School Certificate Examination (WASSCE) organized by West African Examination Council (WAEC) over the past seven years.

Table 1: Trend of students' performance in physics in 2005-2011 May/June WASSCE

YEAR	NO. THAT SAT FOR EXAM	% CREDIT	% FAIL
2005	15970	31.60	68.40
2006	15947	39.57	60.43
2007	17308	28.10	71.90
2008	18239	31.58	68.42
2009	18546	26.30	73.70
2010	19440	30.28	69.72
2011	18770	28.38	71.62

Source: Ojediran, Oludipe and Ehindero (2014)

Table 2: Performance of students in physics in 2012-2013 May/June WASSCE

YEAR	NO. THAT FOR EXAM	% CREDIT	% FAIL
2012	624658	68.74	31.26
2013	636857	46.42	53.38

Source: WAEC (2015).

Although, the performance of students in 2012 improved as observed from table 2, there seem to be a return to the failure trend in 2013. This is worrisome and underscores the importance of secondary education opined by Konyango (2011) as investment in education which yields considerable social and private returns. Buabeng, Ossei-Anto and Ampiah (2014) later pointed out that physics is important for economic, scientist and technological growth of any nation. Indeed the opinions mentioned above are valid in the contemporary science and technology age. In the years 2014, 2015 and 2016, the respective percentages of students that passed the May/June WAEC WASSCE are 60.76, 59.40 and 79.55 (WAEC, 2016). Although these performances were encouraging, the pertinent question is 'What happens to the students who failed physics in those years?' Such students do not get the opportunity to study physics or physics-related courses in higher institutions of learning and this, of course, is worrisome.

Given the application of physics in industry and a vast number of professions (NERDC, 2008; Young & Freedman, 2008), it is necessary that every physics student is accorded the opportunity to acquire concepts, principles and skills of physics. Unfortunately, the teaching and learning of physics in secondary schools in Nigeria has been fraught with challenges that hinder many students from performing well in externally organized examinations. Although the objectives and content of secondary school physics curriculum have been adjusted as satisfactory, NERDC (2008) lamented that its implementation has fallen short of expectation. Factors adduced to the lack of proper implementation of the physics curriculum include lack of sufficient number of human resources and inadequate material resources. The unsatisfactory and disappointing outcome of physics learning at the secondary school level must be brought under searchlight if the objectives of physics curriculum are to be achieved.

The teaching/learning of physics in secondary schools in Nigeria is rather faced with lofty challenges, which include inadequate resources of both human and material. Josiah (2004) opined that when resources are provided and properly managed, physics learning can be effective. Konyango concurred with Josiah by stating that any system of education that does not provide adequate resources for its schools cannot achieve quality education. Resources provide necessary concrete experience in that skill and concepts that are hard and difficult to conceptualize are made clear. In Josiah's view, resources are objects of study, related to particular concepts, which enhance teaching and learning processes in the school system. These resources are usually utilized to attain the goals or objectives of teaching by teachers and learning by students.

Conceptual Framework

Konyango (2011) provided the correlates of Physics resources and school performance in physics (Fig 1)

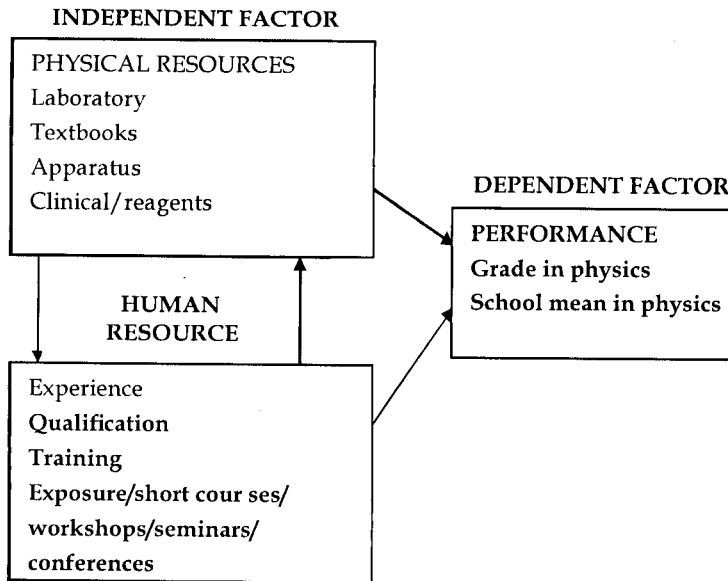


Fig. 1: Correlates of Physics resources and school performance in Physics.

Source: Konyango (2011)

Konyango viewed the school as a system with laboratories, library (textbooks) and teachers/technicians as sub-systems. The physics laboratory consists of apparatuses for utilization by teachers and the acquisition of skills by students. The library comprises physics textbooks and other instructional materials for use in the physics teaching-learning process. Physics teachers and laboratory technicians process the laboratory and library (inputs) into skills and knowledge passed on to the students.

The student receives the processed inputs and gives out outputs such as manipulative skills, observation skills and recording skills. Subsequently, these outputs will be converted into results (performance). The availability of physical resources such as well-equipped laboratories and libraries, when properly used by quality physics teachers, enhances students' performance in physics. Such teachers are teachers with working experience in-serviced by the likes of Strengthening Mathematics and Science in Secondary Education (SMASSE), a refresher course for science teachers. In addition, teachers are trained by WAEC and National Examination Council (NECO) as physics examiners who know the strategic areas where marks are awarded during marking in WAEC WASSCE and NECO SSCE. These teachers apply experiences and exposure in setting and marking of internal physics examinations, thereby instilling in students the best answering techniques which enhances good performance in the external examinations. The short courses, seminars, conferences and workshops update the

physics teachers on topical issues and emerging issues in physics curriculum implementation.

Availability of Laboratory Materials for Teaching Physics

Much as physics curriculum seems laudable, the fact still remains that the successful implementation of any education programme is, to a large extent, contingent on the availability of the appropriate laboratory resources. To ensure effective teaching and learning of physics in secondary schools, appropriate and sufficient material resources are needed for the implementation of physics curriculum. It is by so doing that students, who are the recipients of physics teachings, will be well-equipped with the knowledge, skills, motivation and attitude expected at the secondary education level. Stephen (2011) described material resources as information carriers designed specially to fulfill objectives in the teaching-learning situation and this connotes the importance of material resources in the teaching and learning of physics. Empirical studies have shown that physics students perform better in physics when exposed to learning using material resources (Azar & Sengulec, 2011; Musasia, Abacha & Biyoyo, 2012; Josiah, 2013; Ojediran, Oludipe & Ehindero, 2014; Awotua-Efebo, Williams & Aderonmu, 2015).

On the relationship between material resources and students' academic performance, Idiagbe (2004) had earlier inferred that teacher's qualification and adequate material resources are determinants of assessing academic performance of students in secondary schools. Therefore, the availability or non-availability of physics material resources in schools affects the academic performance of students. The school climate is determined by the resources such as well-equipped physics laboratory and library which the physics teachers and students use and which affects teaching and learning. Stephen (2011) in a study on the status of material resources for effective teaching of physics in secondary schools in Akwa Ibom state of Nigeria found out that only 51.3% average material resources for meaningful teaching and learning of physics were available in secondary schools. On whether those material resources are adequate, he found out that only 48.3% of the available physics material resources are adequate in the schools and this is not encouraging enough.

Utilization of Physics Material Resources

In 2004, Federal Republic of Nigeria (FRN) provided the objectives of the secondary school physics curriculum. These objectives which were re-echoed by Nigerian Educational Research and Development Council, NERDC (2008), are:

- i. Provision of basic literacy in physics for fundamental living in the society;
- ii. Acquisition of basic concepts and principles of physics as a preparation for further studies;
- iii. Acquisition of essential scientific skills and attitudes as a preparation for further technological application of physics; and
- iv. Stimulation and enhancement of creativity.

For these objectives to be realized, Asubiojo and Aladejana (2013) posited that physics teachers are in a position to:

- i. Select the appropriate learning experience (content) based on the use of the students;
- ii. Select the appropriate material resources to facilitate students' understanding of physics;
- iii. Select the appropriate teaching method; and
- iv. Select the mode of evaluation so as to determine whether or not the objectives have been achieved.

The implication is that physics teachers are saddled with the responsibility of effectively utilizing material resources in physics in order to facilitate student's learning and performance in physics. FRN (2004) concurred with the above implication by pointing out that the quality of a country's teachers determines the quality of its education system. No matter the availability of material resources for physics teaching and learning if the teacher does not utilize the material resources efficiently, the performance of students in physics will remain poor. Asubiojo and Aladejana concurred by noting that the quality of a teacher predicts students' achievement. Stephen (2011) found out that only 16.1% of the available physics material resources in secondary schools in Delta state, Nigeria are often used by physics teachers in teaching physics. This implies that secondary school physics teachers seldom use the available material resources to teach physics.

Effectiveness of Human Resource in teaching Physics

In the content of this study, human resource refers to the physics teachers and physics laboratory technicians found in schools. Williams and Nweke as cited in Josiah (2004), however, defined human resource as teachers, students and school leaders. Effectiveness of human resource in teaching physics is an area where physics teachers require to properly prepare themselves in lesson planning and subject-matter delivery. The laboratory technicians also need to be capable of preparing the physics experiments. There are instances, however, when experiments fail. Such instances lead to the belief by students that physics is difficult. Such attitude of students toward physics can lead them to poor performance in the subject. Therefore, for physics students to attain full potential in physics, it would be essential that physics teachers engage in effective teaching practices.

A study conducted by Omosewo (2009) revealed that 57% of physics teachers claimed inadequate exposure to the physics contents taught in schools. Furthermore, non-professional teachers such as holders of B.Sc Geology and B.Eng (Bachelor of Engineering), who are not equipped to teach physics, were found teaching the subject in secondary schools. These findings are in conflict with the role of the teacher who, according to Konyango (2011), is the keystone of quality. The role of the physics teacher is the most important because without a well-educated and well-equipped teacher the arch of excellence in secondary school physics collapse. Physics Education Research (PER) has continued to show that an effective physics teacher is the single most important factor of a

student learning physics. It is in that wise that United Nations' Education, Scientific and Cultural Organization (UNESCO) supports teacher upgrading (training and retraining) and innovative approaches in developing countries (Konyango, 2011).

Improving performance in Physics through use of Material Resources

The effective teaching of physics includes using strategies to promote constructivist learning, conceptual understanding of physics and to develop skills and methods for the physics student to understand the process of scientific inquiry. These strategies include the use of co-operative learning, technology tools, activities performed and managing local material resources, especially in developing countries like Nigeria.

Management of material resources in physics refers to the control or usage of material resources that facilitates teaching and learning of concepts in physics. Josiah (2004) acknowledged that material resources in most Nigerian schools are inadequate, partly because they are imported and partly because of high cost. Local material resources should, therefore, be resorted to by physics teachers because they are cheaper, being sourced from within. Local material resources are those materials that are readily obtainable within the physical learning environment and can be utilized for effective teaching and learning. This means that local material resources can be well-managed only if they are seen to:

- i. Be easily obtainable.
- ii. Enhance the required skills and attitudes in students just as the imported material resources;
- iii. Provide precise solutions to scientific problems; and
- iv. Motivate the students towards learning.

Along as cited in Josiah (2004) classified local material resources into three, namely:

- i. Household devices in use;
- ii. Discarded scraps or waste material resources such as dry cells and rods; and
- iii. Materials that occur easily and naturally.

An example of the concept to be taught and learned using local material resources is sound transmission through solids. The local material resources required is the 'local telephone', made up of two empty boxes of match sticks and hair-plaiting thread. The outer cover of boxes of match sticks is discarded and a tiny hole drilled at the middle of the base of each box. About 20m of the thread is then cut and each end of the thread is tied to the boxes, via the holes. Haven done that, two of the students can stretch the thread taut and one of the students should talk to the other through the box while the other listens through his box. Therefore, the observation in that sound is transmitted through the thread (Josiah, 2004).

Students will easily and willingly bring some of the local material resources to class for use, when called upon to do so. Therefore, the physics teacher can use the students to help source the local material resources required for teaching and learning of physics concepts.

Conclusion

Nigeria's development is better measured in terms of the growth of science and technology and can be sustained only if the quality of science and technology education is improved upon. The unsatisfactory approach to physics education, which leads to poor performance by secondary school students in the subject in external examinations, must undergo a rebirth. Once physics teachers see themselves as stakeholders in the policy of the nation, physics teachers would contribute desired quota to the enhancement of students' performance in Physics.

Recommendations

It is, therefore, recommended that as a matter of urgency

1. Physics teachers should utilize the available teaching and learning resources in schools for optimal performance.
2. Physics teachers should be encouraged to improvise material resources, where such are not available.
3. Principals and stakeholders in education should provide enabling environment for physics teachers through financial support and training in workshops/seminars/conferences.

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