

**IMPACT OF AVAILABILITY AND UTILIZATION OF FUNCTIONAL  
LABORATORIES ON STUDENTS ATTITUDE IN SECONDARY SCHOOL  
PHYSICS IN NIGERIA**

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***Abstract***

*This paper on availability and utilization of functional physics laboratories on students attitude in Nigeria is a discourse proposing the practical laboratory based component, which is intended to enable students undertake laboratory work necessary for explaining practically their understanding of the theories, ideas, principles and concepts of physics they were thought theoretically. Both the theory and the practical work are important in the overall study and assessment of students in physics because no one component is more important than the other. For Nigeria to develop into a nation that will be technologically independent and self-reliant, there must be available laboratories for the study of physics and those available must be used for practical activities. The paper explains the composition of the functional laboratories, the facilities that are classified into human and physical facilities is to promote and encourage inquiry and experimentation, these two processes are important in learning both the method and content of science. Access to adequate science equipment can impact students learning opportunities as well as affect their attitude. It has been concluded that the students' attitude to any subject has been proven to lead to good performance in that subject. Negative attitude towards a certain subject makes learning difficult, while positive attitude stimulates students to put more effort and leads to the high achievement in that subject.*

**Keywords:** availability, utilization, Physics laboratories, students and attitude

**Introduction**

Science and technology are responsible for the world's current development and advancement in all aspects. Science is a hands-on subject that entails numerous manipulations and verifications in order to arrive at a conclusion. Science is distinct from other subjects in that it has a distinct nature that necessitates a unique teaching method. Science is the foundation for long-term national development which prevents ignorance, illiteracy, disease, and poverty in human societies (Adeleye & Omotayo, 2020). It would have been difficult for man to explore the other planets of the cosmos without the use of science. Also, science has become an important tool that no nation, wishing to progress socially or economically can afford to replace its learning in schools. Science education is a service of creative, intellectual activities leading to unifying concepts, theories and laws about human natural environment and the application of these concepts, theories and laws to control the environment for the benefits of human being (Zaman, 2007).

Also, science had been of great importance locally, nationally and internationally for sustainable and socio-economic development as well as for technological advancement of every nation. This expectation is very high in developing nations that are still putting more effort towards sustained scientific, technological, economic and political developments. Most developing nations, especially African countries are facing a number of challenges with their educational systems. Consequently, upon this, curriculum reforms have become a regular feature of their system of education. Talking about the importance of education, particularly science education, Pollyn (2012) explained science education as a bedrock on which every nation rests to build an established self-reliant manpower base for sustainable development.

Science education of today is expected to produce and develop a scientifically literate people that can operate in a scientific and technology changing world. The much desired technology of our nation can be achieved if students acquire the basic knowledge in science before leaving the school. The knowledge of science is used in the production of materials that reduces stress, protect people as well as makes life easier which is therefore a necessary factor for economic development of a nation (Olagunju, Adesoji, Iroegbu & Ige 2003). Through the application of science, longevity of existence is ensured and so it is the fundamental upon which teachers' logical breakthrough is built. The rapid change in the world of technology is achieved from the knowledge of science especially in physics as a subject. Physics is a core subject in science subjects since it studies the essence of natural phenomena and helps people to understand the rapidly technological changing society. It is an important subject that has positive impact on human's life and nation's economy. According to Rudraiah (2011), he stated that physics is a pure science. It can be defined as man's systematic effort to understand natural phenomenon. The principles of physics have been widely used for various scientific and technological advancement such as in satellites and computers, which has reduced the world into global village. Also, the knowledge of physics had led to sustainable development in the area of industrialization for improvement of materials useful for the well-being of human race. Discussing physics as a science subject is not complete without fixing the idea of practical with theory. Physics is a double edge sword of practical and theory.

The teaching of physics has two components. The theoretical component which is meant to train the students properly in the concepts, theories and principles of physics. There is also the practical laboratory based component, which is intended to enable students undertake laboratory work necessary for explaining practically their understanding of the theories, ideas, principles and concepts of physics they were thought theoretically. Both the theory and the practical work are important in the overall study and assessment of students in physics because no one component is more important than the other. For Nigeria to develop into a nation that will be technologically independent and self-reliant, there must be available laboratories for the study of physics and those available must be used for practical activities. Availability of laboratories is the degree to which the laboratories are available and accessible.

Obviously, adequate laboratory equipment is very important for successful achievement of science programmes. Facilities and materials should be designed in such a way as to achieve the purpose of impacting ideas in the mind of students and provide actual experiences in practical science. These facilities are classified into human facilities and physical facilities. The human facilities include the teacher, the laboratory assistants/ attendants and the students, while the physical facilities include the laboratories and the equipment in the laboratory. The basic purpose of science facilities and materials is to promote and encourage inquiry and experimentation, these two processes are important in learning both the method and content of science.

Access to adequate science equipment can impact students learning opportunities as well as affect their attitude. Students' attitude to any subject has been proven to lead to good performance in that subject. Negative attitude towards a certain subject makes learning difficult, while positive attitude stimulates students to do effort and leads to the high achievement in that subject. Relative to Physics, Godwin and Okoron-ka (2015) showed that a significant relationship exists between students' attitude and their corresponding academic performance in physics. Determining students' attitude towards a subject is therefore a useful task if one wishes to improve the performance of students in that subject. The estimation of students' attitude towards natural sciences has been carried out by many researchers. Many of them (Akinbobola, 2009; Alimen, 2009; Mekonnen, 2014) came to the same conclusion that the decrease in Physics academic achievement is alarming. The outstanding factor that caused this is the students' attitude towards Physics (George, 2000).

Adequate availability of teaching resources positively affects teachers and student's efficacy. The poor attitude appears to be a reflection of their poor foundation in laboratory activities at both primary and secondary levels due to insufficient science equipment. Subsequently, the poor performance of the science students does not stop on school program alone but also affects in their job performances after their graduation. In Nigeria, some employers lament the poor practical exposure and knowledge of science students as many of them fail to perform up to expectation in their respective working places. Uneven distribution of science equipment appears to exist among secondary schools in urban and rural settlements. Researcher observed that students in the rural schools are denied of modern science facilities such as laboratory equipment and workshops and where such exist, they are characterized with obsolete equipment and poor utilization. The poor utilization of the little available science equipment in rural school may not be connected to inadequate practical oriented physics teachers. Meanwhile, urban schools have adequate supply of science equipment on the advantage of education planning based rate of approach. Also, students in urban schools are adequately exposed to the use of science equipment as there are more supporting factors in carrying out science practical such as regular supply of electricity and adequate science teachers.

Utilization of the laboratory is the way by which the available laboratories are being put into use. Making use of a well-equipped laboratory that contains all relevant equipment and apparatuses for the purpose of teaching and learning improves the efficiency of the teachers as well as that of the students, as it enables the students to have a deeper and practical understanding of what he has been taught (Makolo, 2014). Laboratories are places or work places where scientific experiments are systematically carried out. Activities in the laboratory are of two types: structured and unstructured activities. In a structured activity, the students are given instructions that lead them through a procedure designed to produce certain results, but in an unstructured activity, a problem is posed and students are allowed complete freedom to device their own procedure, organize their own data and arrive at their own generalizations (Seweje & Jegede, 2005). The students must be pioneers in their work and draw conclusion from their experimental results. A Laboratory is a place which provides controlled conditions in which scientific research, experiments and measurement may be performed. Learning by inquiry is a challenge for teachers and learners (Bransford, Brown and Cocking, 2000). Inquiries are diverse ways in which scientist study the natural world, propose ideas, explain and justify the assertions based upon evidence derived from scientific work. It could also be described as learning science in classrooms and laboratories, through which the students and their teachers explore and discuss science in a narrative of enquiry context (Seweje & Jegede, 2005).

Teaching Physics is challenging, but the practical activities in the laboratory have peculiar challenges that make it a demanding task, as it calls for advanced skills. Felder and Brent (2004) opined that the method of teaching Physics should change from the lecture to a more active and investigative practical approach. When students are presented with such approach through laboratory activities, they tend to develop traits such as curiosity, problem solving, creativity and perseverance, which are essential in science. According to Duyilemi (2000), laboratory practical and field work have all been stressed as the basis for teaching and learning of Physics. He stressed further that a good science course must be laboratory-based. In his opinion, laboratory activities help Physics students to stimulate the desire to learn Physics, make those things they learn theoretically clearer to them and enable them to reason more critically and to be able to apply the information acquired throughout their lives. Laboratory activities enable students to carry out experiment by themselves and this helps in facilitating proper and efficient teaching and learning. Physics laboratories, if available in the secondary schools and are well utilized, will improve the teaching and learning of Physics, and more specially, will improve the level of imagination, creativity skills and cognitive aspect of the learners.

The quality of education at any level depends largely on the qualification and commitment of the teacher, and Physics is not an exception. The teacher engages in interactive and psychomotor changes in them. The Physics teacher engineers the teaching and learning of Physics by selecting the instructional objectives, contents, method and experiences and as well, organizes the experience with respect to the stated objectives. The teacher's personality, behavior and attitude therefore have importance on the mind of the students to carry out the instructions (Fabayo, 2001). Many schools across the country have recently changed from primary observational laboratory exercises to more investigative, hypothesis-testing experiments. The shift in the nature of laboratory activities has dramatically alter the laboratory reports; what was once a descriptive report that could be successfully written outside of class theoretically have become written exercises that help the student synthesize and interpret their experiments after their observations (Njoku, 2000).

Goubeaud (2009) emphasized that the principal focus of laboratory activities should not be limited to learning specific scientific methods or particular laboratory techniques; instead students in the laboratory should use methods and procedure of science to investigate the phenomena, solve problems and pursue inquiry and interest. Laboratory work involves experiment, science laboratory activities are learning experiences in which students interact with materials and/or with models to observe and understand the natural world. Laboratory activities appeal as a way of allowing students to learn with understanding, and, at the same time, engage in a process of constructing knowledge by doing science (Tobin, 2000). For a correct use of manipulative skills such as measurement of weight, volume, setting up of apparatus, setting of microscope, cleaning and care of apparatus, there should be skillful manipulation which makes the difference between hazardous and safety chemicals during laboratory work (Tanner & Allen, 2004). The display of knowledge attained or skills developed in school subjects designated by test and examination scores or marks assigned by the subject teachers in the performance of the students. One of the aspect of organizing the skills is teacher's ability to organize his students to learn science through activities in the laboratory, his activities to organize a pleasant classroom atmosphere, the way through which the apparatus and equipment are arranged during demonstration, giving instructions for laboratory activities, demonstration, recording of readings, observation of experimental result, keeping of the table neat and arrangement of equipment on shelves and store which are of immense importance for

proper utilization of available laboratory and contribute to the adequacy and effectiveness of the laboratory officials (Hofstein, Shore & Kipnis, 2003).

One of the most outstanding sources of this development could be traced to the ways and manners in which sciences subjects are badly taught in schools. If Nigeria is to develop into a nation that will be technologically independent and self-reliant, the study of Physics at secondary school level should be handled by qualified teachers who have a good mastery of the subject matter.

### **Justification for Functional Physics Laboratories**

There have been various studies on the poor performance of students in science subjects among which physics is one and the factors prompting the lowly performance ranging from non- hominid factors such as lack of adequate laboratories materials, instructional materials, library and text books, time limitations in teaching science and the human factors such as teachers, students, parents, school factor and lack of equipped Physics laboratories. Concept difficulty in various science subjects to be the contributing factors to the students' poor performance in science. National policy on education (1998; 2013) anticipated on new innovations within the Nigeria school settings and thus recognized the need for teachers to be kept abreast of new and emerging development which may impact on the school system or the work of the teachers.

### **Physics Practical**

It has been demonstrated that a student's attitude toward one or more subjects correlates with strong achievement in that subject. A negative attitude toward a topic makes learning difficult, whereas a good attitude motivates pupils to put out extra effort and results in excellent accomplishment in that subject (Veloo, Nor, & Khalid, 2015). In the case of physics, Godwin and Okoronka (2015) discovered that there is a link between students' attitudes and their academic achievement in the subject. In the study of Usman and Yakubu, (2020) on the effect of physics practical on students attitude making use of 70 students, the mean score of male students is 59.35 and the female 60.19, a mean score difference of 0.86 which is too low and not significant was achieved hence, they concluded that both male and female students were of the same attitude to physics practical.

Usman and Yakubu, (2020) also discovered that students taught physics practical making use of laboratory equipment developed a positive attitude towards physics than does taught abstractly. The absence of proper apparatus and instructors' incapacity to improvise, impede successful scientific education. Many Physics teachers or instructors prefer to teach the topic theoretically, ignoring the practical approach, which results in students having unfavorable impressions and attitudes about the subject, and therefore disliking it. Many scientific instructors in impoverished countries are primarily trained on theoretical content issues, resulting in poor management of Physics practical classes. As viewed by Motswiri (2014), practical work plays an important role in teaching and learning of physics. Apart from helping students to gain insights into scientific knowledge, it also help them to acquire a number of scientific skills, namely cognitive and manipulative, and not to mention motivational factors it creates in the students. The attainment of these goals, however, depends on the way practical work is organized. Mafnmiko (2006) argued that practical work forms essential component of science education provision in secondary schools in Nigeria. Ideally (in the official curriculum) every class at both junior and senior classes is supposed to do practical work. In terms of assessment, it constitutes 40 percent of final examination grade.

### **Availability of Physics Equipment in secondary schools**

Bello (2012) found that the Physics Laboratory Equipment (PLE) offered differs depending on the kind of institution. In mechanics (37.5%), heat energy (42.0%), current/electricity (34.4%), waves and sound (47.6%), and magnetism (43.4%), federal schools had the highest number of PLE, followed by private schools, which had the same number as public schools in light and optics (33.7%), mechanics (33.4%), heat energy (36.4%), current electricity (33.7), waves and sound (31.0%), and magnetism (35.5 percent). With the exception of light and optics and an appreciable amount in current/electricity (31.9 percent), public schools have the fewest accessible PLE. In addition, all schools have the largest number of PLE in the mechanics option (34.1%), followed by current electricity (25.0%), waves and sound (04.8%), and magnetism (04.8%). (04.4). In a similar vein, the aggregate result revealed that federal schools (37.4 percent) had the most PLE, followed by private schools (34.0 percent), and public schools (28.6 percent). Students' performance in physics as a subject in Nigeria's Senior Secondary School Certificate Examinations (SSSCE) has been abysmal and discouraging over the year, and this could be due to students' attitudes toward the subject, as a positive approach to the subject correlates with high performance, and vice versa.

The percentage of pupils passing credit-level physics (A1-C6) had continuously been less than 50%. (West African Examination Council [WAEC] Report, 2012). This is due to poor performance in the physics practical, which accounts for 40% of the total points in the SSCE physics examination. Among the primary practical notions that are troublesome are electricity, simple pendulum, momentum, mass of spring, and geometric optics. These topics are among the abstract and complicated parts of physics that students find difficult to understand and some professors find difficult to teach, according to research findings (WAEC, 2015, 2016, 2017, 2018 & 2019). Students require practical experiences in order to grasp some abstract physics ideas; hence, efficient utilization of laboratory equipment and facilities will increase students' comprehension of physics concepts, as well as their attitudes and performance. However, most Nigerian public secondary schools lack appropriate laboratory and equipment, limiting teachers to do just basic laboratory activities. Due to a lack of equipment, facilities, and other logistic issues, physical tests are rarely conducted in several Nigerian public secondary schools (Adekunle & Hussaini, 2010).

### **Utilization of Physics Equipment and students' Attitude towards physics subject in secondary schools**

The use of laboratory provides easy access to science. Through the use of the Physics laboratory for practical, students can understand the physical concept better because they will have access to the real object, they carry-out their tests, write their observations and draw their inferences at their own pace. Okoronkwo (2008) observed that many science teachers do not utilize or manage the unique environment of the school laboratory effectively. Oyalegan (2013) observed some factors that affect the use of Physics laboratories in teaching. He identified the following factors among others: Availability- Non-availability of Physics laboratories and apparatus by most of the schools has contributed immensely to its under-utilization. There are no better stores for schools that have some of the apparatus and hence they are packed under lock in the principals' offices. Also, accessibility- most secondary school teachers do not have access to the apparatus. Time is constraint to the utilization of the Physics laboratories because carrying out practical is time consuming. Some teachers feel that taking the students to the

laboratories will waste most of their time and hence embark on the theoretical aspect of teaching Physics.

Students' attitudes toward certain subjects have an impact on their learning and accomplishment in that discipline. Inherent attitudes such as interests, beliefs, confidence, and self-efficacy, according to Partin and Haney (2012), may influence how students approach learning, such as problem-solving techniques, study habits, and critical thinking with that discipline. Science practical exercises have been praised for their role in fostering good student attitudes toward science and boosting students' interest in science as well as their competence to operate equipment. Practical work, according to Kim and Chin (2011), is an important instrument for strengthening students' scientific knowledge and habits of mind.

### **Conclusion**

This paper has established the fact that availability and effective utilization of functional physics laboratories has positive influence on the academic achievement of students in physics. Poor state of performance as well as mass failure of physics in senior secondary schools is linked to the level of availability and utilization physics laboratories in Nigeria senior secondary schools. The paper concluded that science laboratory is a critical variable in determining the quality of output from secondary schools.

### **Suggestions**

This paper therefore suggested that physics teachers should be encouraged to make use of the laboratory facilities provided for teaching of physics practical in secondary schools in Nigeria. Federal and states educational agencies should set up laboratory facilities maintenance agencies to be saddled with the responsibility of providing and maintaining broken down laboratory equipment

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