AN ASSESSMENT OF PRACTICAL MATERIALS IN SENIOR SECONDARY SCHOOL PHYSICS EDUCATION

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ABSTRACT

For meaningful teaching/learning to take place, there must be available materials to picture what is to be taught/learnt. This paper highlighted what physics practical is all about, identified the equipment required for secondary school physics practical under the topics; electricity, optics and mechanics, in three selected secondary schools and compared those equipment available to the students in the respective schools. It was aimed at assessing the availability of practical tools as they affect student's achievement in physics. The paper further discussed the effects of practical on student's achievement and recommended some steps to be taken to improve student's achievement in physics.

Introduction

Robert (1975) defined science as involving the investigation of natural phenomena through scientific process and attitude. Abdulahi (1982) defined science as an activity culminating into testable, falsifiable and verifiable body of knowledge. one cannot talk of science without talking of physics. Neither can one talk of the contribution of science without the contribution of physics, since physics is one of the science subjects. Physics, according to Daintith (1976), is a science subject which studies matter and energy without reference to chemical change. The definitions above reveal that science is not just a collection of facts, neither is it an essay of sterilized body of knowledge. Rather, it involves engaging in certain activities by which scientific knowledge is generated.

Science has contributed to national development in areas like:- Agriculture, Industry, health, education and man power development as well as technological competence. The capacity to absorb improved technology depends on the general level of skills, a balance distribution of scientific and technological personnel and adequate supply of managerial and inter-personal talent. That is why Nanchen and Emmanuel (2004) pointed out that Science Education should be designed to develop skills and habit of minds among the members of the community to prepare them for any change in life. They further pointed out that "this firm conceptual base and essential skills in science education must be a focus for every Nigerian for the future development of the country.

It is on this note that the broad aim of the National Policy on Education (2004) is to equip students to live effectively in the media age of science and technology and contribute

to the development of their society in line with these objectives. Science subjects are among the core subjects that are taught in primary and secondary schools in the Nigerian system of education. Even at the university level, comparatively few narrow specialists will be required and the major need is a broad scientific and technological training including related science studies which aim at technical competence in wide settings. Emphasis in physics education has been centered on developing teaching strategies that have potential for enhancing student's achievement in physics. This cannot be done without the teaching materials. Habekhai (2001) advanced that instructional and learning materials make learning task more participatory and self- directional. Though the materials are divided into books and non-books, where the books used are scanty and complicated for student's comprehension, it will lead to student's failure in the subject. The non-books materials include the physical laboratory as well as the apparatus essential for physics practicals/experiments. Due to non challant attitude towards physics education, some schools have no physical laboratory and the tools are in short supply. For the few tools available, some are obsolete.

In most schools, practical work is done at the last form of the sixth year. Consequently, students missed their visual or practical experience which should reinforce the theory required for the understanding of the practical work. This has contributed to student's failure in examination. Ogunyemi (1986) has shown that secondary school physics students are unfamiliar with more than half of the laboratory apparatus and are unable to know what experiments they are used for. This has shown to us the importance of practicals in student's achievement in education and should be a matter of concern to all educationists.

What Is Physics Practical About?

The Oxford Advanced Learner's Dictionary (2000) defines practical knowledge as that which is connected with real situation rather than with ideas and theories. This clearly reveals that practical knowledge supercedes reading and writing a text as knowledge has to be seen, felt and touched. If this is so, then it must require the use of hand, pen and other tools around. It is on this note that Brethaupt and Dunn (1995) pointed out that practical knowledge is acquired through performing laboratory practice and the students must use all the tools found in the laboratory to acquire practical knowledge and this knowledge acquired must be concrete and real and must be used to solve societal problems. The laboratory tools are not used all at a time. The nature and the extent of the tools to be used at a particular time depends on the topic under consideration.

Practical knowledge precedes theoretical knowledge. The two are interrelated and depend solely on one another for the achievement of a stated goal. Learning becomes meaningless when the knowledge acquired is not applied to real life situations. That is, when the knowledge acquired is not used to solve societal problems.

Practical knowledge is categorized into short experiment, investigations and projects.

i. **Short-experiment**:- This type of experiment is performed with a specific aim in mind like finding out the relationship between two concepts.

ii. **Investigation:-** This normally has specified aims. After identifying the problem terms, a hypothesis is formulated.

iii. **Project:-** This refers to a piece of planned work or activity which is completed over a period of time intended to achieve a particular aim. (Cambridge International Dictionary of English).

This shows that the type of practical one performs depends on what the problem on ground is and the step or steps taken to solve the problem.

The Effects of practical on students' achievement

Laboratory practical is an essential part of the physics curriculum/course. It is on the basis of the practical that the structure of physics has been formed. It plays vital role in the teaching and learning process by way of giving learners the opportunity to acquire basic experimental skills/techniques as well as exposing them to the various fields of knowledge. Practical knowledge is essential for students in the following ways:

1. **It helps students to explain laws and principles:** Nelkon and Ogbaru (1998) pointed out that "good knowledge of practical physics will enable students to perform experiments on the fundamental laws and principles encountered in the theoretical work". This will help them to relate theory and practicals hence they understand clearly what they have been taught. For example when a student learnt ohms law which says "the current flowing in a metallic conductor is directly proportional to the potential difference" such student can proof this in the laboratory when he/she performs practicals in laboratory. The student will also get to know that the more the resistance offered, the less the amount of current and vice verse when he connects potentiometer wire to a circuit. The student will understand that increasing the length of the resistance wire reduces the current in the circuit and reducing the length of the resisting wire increases the amount of current in the circuit.

   Another example is given when a student learns that "extension of an elastic body is proportional to the load". (Hooks law). The student can find out this in the laboratory by attaching mass to a spiral spring suspended on a retort stand. The student will observe that increasing the mass increases the extension of the spiral spring and Vice - versa, provided the elastic limit is not exceeded.

2. **Explain Natural Phenomenon:** Natural phenomena such as the formation of rainbow, lighting and eclipse can be explained by the students when they perform experiment in the laboratory. For example, formation of rainbow can be explained from refraction of light. When a student learns, in theory, that light is made up of seven colours (Red, orange, yellow, green, blue, indigo and violet), and that the speed of light changes as it passes from one medium to another the student can verify this by passing light rays through triangular prism. The seven colours of light will be observed. The student will get to know that each colour of light travels with its own speed when in glass or water. The student will use this to understand that the formation of rainbow is as a result of the separation of the colours of light when it passes through molecules of water suspended in air. Eclipse of the sun can be

explained when a student performs experiment on the rectilinear propagation of light.

3. **Expose students to practical materials and skills**: Frequent use of the laboratory equipment helps students to be exposed to different equipment and to acquire more practical science in their field of study. That is why Tyler (1970) noted that laboratory practical brings the students in contact with the physical materials and apparatus with which they can learn to produce accurate and precise results. He further pointed out that this gives them strength, skills and courage to device and design their own experiment. The more the students use the practical tools around them the more they understand the uses of each tool and how it is being used.
4. **Arouse Students Interest**: Students become interested in learning physics when they perform simple experiments that are meaningful to their life. For example when a student connects, a torch bulb to a 1.5v battery cell, he/she will find out that light is produced, he/she will be very happy and become curios in the subject.
5. **Developed Problem Solving Attitude**: Verification of theories and principles by the students helps them to develop problem-solving attitude, which is a good quality of a scientist. When a battery cell is used to produce light in a circuit such questions like how is the light produced? what produced the light? how does it reach the bulb? will come to the mind of the students. The students will try to find answers to those questions themselves. This will facilitate their learning abilities hence they think independently and use their own ingenuity and initiatives in carrying out investigation to its meaningful conclusion.
6. **Retention of Memory**: Above all students hardly forget when they are actively involve in the teaching and learning process.Reneheart as cited in Cirfat (2006) maintained that after two weeks of classroom interaction, we remember.
    1. 10% of what we read
    2. 20% of what we hear
    3. 30% of what we see
    4. 50% of what we see and hear
    5. 70% of what we say
    6. 90% of what we say and do

    When students perform experiment the knowledge they acquire in that process remains in them permanently because of their active participation. The students some times formulate questions for themselves and try to find out the answer to the questions. It is in this regard that Breithaupt and Dunn (1995) advice that students should be involved in practical activities throughout their secondary school work in physics.

Assessment of available equipment for electricity, optics and mechanics in some secondary schools.

SCHOOL	NO OF STUDENS	TOPIC									
A	551- 79 552- 86 553- 47 Total 212	Electricity	Potentio Meter 5	Meter bridge -	resistor variable - 7 1R-3 2R-4 3R-4	Resistor Variable - 7	Galvan oumet er 5	Jockey 5	Accumm u- lator -	Key 6	Voltimeter 7
		Optics	Rectan gular glassblo ck 17	Triangul ar glass Prism 9	Eurve mirror Con Cause 4 Convex 6	Lens Concave - 3 Convex- 10	Plane Mirror 7	Screen 8	Pins Optical - 100 Thumb - 50	Drawing Board 7	Ray box 5
		Mechanics	Rule 8	Pendulu m bob 10	Retort stand 10	Masses Log-10 Rog-15 Jog-4	Stop watch 3	Knive Edge 5	Spiral Spring 10	Spring/ beam Balance -	
B	551- 42 552- 23 553- 20 Total 85	Electricity	Potetiom e- ter -	Meterbri ge -	Resistor Variable - 4	Ammeter 3	Galvan omete r 3	Jockey -	Accumu -lator -	Key -	Voltumete r 2
		Optics	Rectang u-	Triangul ar glass	Curve mirror	Lens	Plane Mirror	Screen -	Pins	Drawing board	Ray box 1

			lar glass block	prism	-	Cancave 5 Convox -	4		Optical - 12 Thumb -	5	
		Mechances	Rule 4	Pendula n bob 10	Retort Stand 4	Masses 10g-50 20g-15 50g-5	Stop watch 2	Knive Edge 5	Spiral Spry -	Spring/b eam Balance -	
C	551-200g 552-46 553-16 Total 262	Electricity 5	Potentio meter 3	Meter bridge 3	Resistor Variable 17 1,R- 2 5R- -	Ammeter 12	Galvan omete r 3	Jockey 5	Accumul ator 6	Key 4	Voltmeter 11
		Optics	Rectang ular glass block 14	Triangul ar glass prism 11	Curve mirror Concave 1 Convex 1	Lens Concave 5 Convex 3	Plane Mirror 5	Screen 5	Pins Optical - 20 Thums - 100	Drawing Board 5	Pay box 10
		Mechanics	Rule 4	Pendulu m bob 8	Retort Stand 16	Masses 5g-10 20g-10 50g-20 100g-7	Stop watch 12	Knive edge 7	Spiral spring 3	Spring/b ean Balance 8	

The data in the table above show the total number of students in the three schools. School A has a total of 212 students with SS2 having the highest population of 86 students. SS1 and SS3 have 79 and 47 students respectively. For effective learning to take place, each student is entitled to a complete set of apparatus (1:1) in an experiment so that every student should be actively involved. Where the students are grouped, some will depend on others hence they may not acquire the knowledge they are supposed to acquire.

School A is deficient in all the practical equipment. There are only five complete sets of apparatus for electricity (17 students per set of apparatus) two complete sets of tools for practical involving lens and mirrors (optics) (43 students per set of apparatus) and three complete sets of practical tools for (28 people per group) for experiment in simple or compound pendulum (optics).

School B cannot perform experiment involving potentiometer,/meter bridge, jockey, accumulators, keys, glass block, triangular prism, curve mirrors, screen and thumb pins since these tools are completely absent.

In school C, only three complete sets of practical tools are available for experiment in electricity, one complete set for experiment involving curved mirror and four complete sets for experiment in mechanics.

The table clearly shows that less than ¼ of the students actively participate in practical physics in these schools while more than ¾ of the students do not actively participate but depend on others. This affects their understanding of physics concept most especially in the explanation of laws and principles as well as their performance in the course.

Conclusion:

This research work has revealed that insufficient practical equipment is a major problem affecting the student's performance/achievement in physics in these three selected secondary schools. There could be other problems like insufficient teachers, libraries, student's attitude and administrative problems. Interest should therefore be given to science courses, especially physics, to effect positive change in the life of the students since the development of any nation depends solely on its scientific growth and development.

Recommendations

In view of the outlined problems in this research work, the researcher wishes to give the following recommendation.

i. Management of schools should supply enough physics equipment for effective teaching and learning to take place.

ii. Government should aid in the provision of science equipment to schools.

iii. Government should emphasis supervision in all schools to ensure that the science laboratories are well equipped. Where they are not and are not ready to do so, then government should ban the offer of science in this school.

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