Practical Teaching Resources to Teach Physics in Rural and Urban Secondary Schools: Implications

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Abstract
The study surveyed practical teaching resources to teach Physics in rural and urban secondary schools in Osun East Senatorial District of Osun State, Nigeria and the implications. Descriptive survey research design was used for the study. The target population of this study is made up of all practical teaching resources for teaching Physics, Senior Secondary School SSS (3) Physics students and 42 Physics teachers. Random selection of 210 Physics students, 20 Physics teachers and fundamental practical teaching resources formed the sample size. The instruments for data collection are one for the teachers requested for the availability and the sufficiency of practical teaching resources to teach Physics while the instrument for the students elicited responses to ascertain teachers' usage of practical resources. The two instruments were validated, the students' instrument had with reliability coefficient 0.82.Results showed that greater numbers of practical teaching resources are not available nor sufficiency in the schools. Rural students' responses showed that they were not taught with practical resources compared with urban students. The study concluded that practical resources are not sufficiently available in the schools.

Keywords: Practical teaching resources; teaching; Physics; rural and urban secondary schools; implications

1. Introduction

Science educators in recent times have called for constructive teachings where students can concretize what they have learnt. Constructive learning demystified the importance of learning with practical teaching resources as this was outlined from teachers' and students' activities in science curriculum. The general consensus to science teaching is that it should be taught to articulate science processes which draw inevitability to the use of practical teaching resources. Science process skills are needed skills to help students adept at comprehending to new concepts and help them to create the necessary knowledge and values (Prince, 2004; Yang & Heh, 2007). Science process skills are enabled in the classroom through practical teaching resources. According to Adebisi and Otun (2022), science process skills engenders through practical teaching resources.

The use of practical teaching resources is not limited to the four walls of laboratory but are materials that are used for teaching concepts during class interactions. Practical teaching resources according to Yahya and Shamsudeen (2019), has a critical role in determining the level of learners' acquisition of science process skills and competency in science ideas. Practical teaching resources are equipment meant not only for students' engagement but also allow for real-time activities that promote collaboration and enquiry teaching phenomenon.

Practical teaching resources in Physics are worth examining for the fact that the subject has dreaded many students over numbers of years at the secondary schools and its knowledge is vitalto developments. From many researchers' contributions, Physics is considered very important to the scientific and technological development of nations(Bello.2012), Physics provides the foundational knowledge required for future technological advancements that will continue to power the world's economic engines (Shedrack & Omeodu, 2022). Also, the knowledge of physics has advanced computer world which has led to improvement of man powers and human developments. With all these benefits, more students should be encouraged to be attracted in doing Physics through the use of practical resources at the secondary schools for them to pursue sciences, engineering, medicine, at higher levels of education.

Practical teaching resources aid educational activity which students learn through observation and experimentations. The presentation of Physics concepts can be easily comprehended in the classroom if it is taught with sufficient practical teaching resources to arose

students' attention (Adebisi & Ogunmola, 2023).Physics is a central and unique science subjects. It studies the essence of natural phenomena through meta cognitive skills which demands practical teaching resources to make principles and concepts obvious to students view.

It is further asserted by Okonkwo, Achufusi and Onuh (2018) that the extensive use of Physics teaching resources makes Physics thought-provoking, stimulating and reasonable to the learners and the success of students in Physics largely depends on the adequacy of the provision and effective use of the available practical teaching resources.

In factstudents' inability to familiarize with some basic measuring instruments such as micrometer screw gauge, spring balance, stop watch, chemical balance, ammeter, voltmeter, may make them not to fully understood some concepts emanating from the usage of such instruments both in practical class as well as in principles. Given the application of Physics knowledge to a wide variety of life activities and a vast number of professions it is necessary that every Physics student is accorded the opportunity to get used with learning practical resources in the class.

The nature of physics is such that the development of physical theories often requires creativity at every stage of learning and is often seen as a two-way process that commences with observation in which the students need to be taught through practical resources (Usman, Simyyap, & Fasanya, 2019).To guarantee that teachers had effectively taught the contents of Physics as stipulated in the curriculum, appropriate and sufficient material resources must have been brought to the class. It is by so doing that students, who are the recipients of physics teachings, will be well-furnished with the adequate knowledge, skills, enthusiasm and attitude expected at the secondary education level (Macmillan & Celina 2019)

1.1 Statement of the problem

The teaching of science demands concretization of presentable facts to make the students comprehend the trends of processes which cannot be done in the classroom without practical resources. For long the teaching of physical sciences has been repeatedly researched on that students learn better with the aids of resources. Physics as a subject in secondary schools has been considered very difficult by many students and few are found enrolling for the subject compared with other sciences. Besides, researches have been carried out on the implications of practical resources to promote students learning in Physics. However, few studies on availability of practical resources do not capture the sufficiency of practical resources in Physics and as well

as getting the feedback from students in rural and urban schools to ascertain teachers' usage, therefore the study was carried out.

1.2 Purpose of the Study

Practical teaching resources to teach physics in rural and urban secondary schools: a question to ask Specifically the study sought to:

(1) Assess availability and sufficiency of practical resources to teach Physics in secondary schools.

(2) ascertain Physics teachers' usage of practical resources in rural and urban secondary schools through students' responses.

1.3 Research Questions

The following research questions were raised in line with the objectives of the study:

(1) Are practical resources available and sufficient to teach Physics in secondary schools?

(2) What are the responses of Physics students in rural and urban secondary schools to ascertain teachers' usage of practical resources?

2. Methodology

This study adopted the descriptive survey research design. The target population of this study is made up of all Practical teaching resources for teaching Physics, Senior Secondary SchoolSSS (3) Physics students and42 Physics teachers at secondary schools in Osun East Senatorial District. From the population, 210 Physics students, 20 Physics teachers and fundamental practical teaching resources for the five major themes in the curriculum made up the sample size. From 10 local governments in Osun East Senatorial District, seven local governments, two schools from each local government,15 students from each school were each selected by simple random sampling technique in that order.

The characteristics of the sample students are: males were 142 and constitute 67.6 % of the sample while females were 68 which is 32.4% of the sample. Two instruments were used for this study, the first instrument was meant for Physics teachers which elicited practical teaching resources availability and sufficiency in their schools. The second instrument was designed to get feedback from the students if practical resources were being used to teach them in Physics class.

The two instruments have face and content validity through two experts'judgment and suggestions. The students' instrument has likert-type four point scale of measurement of Strongly Agree (SA) = 4points; Agree (A)= 3 points; Disagree (D)= 2 points and Strongly Disagree (SD) =1 point to elicit information on agreement of Physics students if they have been taught with practical resources. The reliability of students' instrument was established on 20 students outside the study areas using cronbach alpha and the value obtained was 0.82 which is good for the study.

3. Results

This section presents the analysis of data collected for the study according to the research questions raised.

Research Question 1: Are practical resources available and sufficient to teach Physics in secondary schools?

Table 1: **Availability and Sufficiency of Practical Resources to Teach Physics in Secondary**

S/N	Branches of Physics	Laboratory facilities	Available	Available and Sufficient	Available not Sufficient	Not Available
1	MECHANICS	Micrometer Screw Gauge	0 (0.00%)	4 (20.0%)	6(30.0%)	10(50.0%)
		Spring Balance	2(10.0%)	2 (10.0%)	10(50.0%)	6(30.0%)
		Stop Watch	6(30.0 %)	6 (30.0%)	6(30.0%)	2(10.0%)
		Pendulum Bob	4(20.0 %)	4 (20.0 %)	8(40.0%)	4(20.0 %)
2	Light Waves	Rectangular Glass Block	2 (10.0%)	4(20.0%)	8(40.0%)	6 (30.0%)
		Plane Mirror	4 (20.0%)	4(20.0%)	10(50.0%)	2(10.0%)
		Concave Mirror	-	2(10.0%)	8 (40.0%)	10(50.0%)
		Convex Mirror	2(10.0%)	2(10.0%)	6(30.0%)	10(50.0%)
		Convex Lens	2(10.0%)	2(10.0%)	6(30.0%)	10(50.0%)
		Concave Lens	2(10.0%)	-	6(30.0%)	12(60.0%)

		Triangular Prism	6(30.0%)	-	4(20.0%)	10(50.0%)
3	Heat	Liquid in GlassThermometer	2(10.0%)	8(40.0%)	8(40.0%)	2(10.0%)
		Bunsen Burner	-	2(10.0%)	6(30.0%)	12(60.0%)
		Beaker	8(40.0%)	6(30.0%)	6(30.0%)	-
		Chemical Balance	2(10.0%)	4(20.0%)	4(20.0%)	10(50.0%)
		Copper Calorimeter	2(10.0%)	-	6(30.0%)	12(60.0%)
4	Sound Wave	Tuning Forks	-	4(20.0%)	4(20.0%)	12(60.0%)
		Vacuum Pump	-	4(20.0%)	4(20.0%)	12(60.0%)
		Glass Jar	4(20.0%)	4(20.0%)	6(30.0%)	6(30.0%)
		Sonometer	-	-	2(10.0%)	18(90.0%)
5	Electricity	Rheostat	4(20.0%)	-	4(20.0%)	12(60.0%)
		Galvanometer	2(10.0%)	4(20.0%)	8(40.0%)	6(30.0%)
		Ammeter	10(50.0%)	2(10.0%)	8(40.0%)	--
		Voltmeter	10(50.0%)	2(10.0%)	8(40.0%)	
		Potentiometer	10(50.0%)	-	4(20.0%)	6(30.0%)
		Meter Bridge	6(30.0%)	-	2(10.0%)	12(60.0%)

Table one above answer the availability and sufficiency of practical teaching resources. For Mechanics practical resources, 10 schools represented by 50.0% indicated that Micrometer Screw Gauge is not available while 6represented by 30.0% indicated that Micrometer Screw Gauge is available but not sufficient. 6 represented by 30.0% indicated that spring balance is not available while 10 schools represented by 50.0% indicated that spring balance is available but not sufficient. 4 schools represented by 20 % indicated that Stop watch is not available while 6 represented by 30.0% indicated that is available but not sufficient. 6 represented by 30.0%

indicated that Pendulum Bob is not available while 8 represented by 40.0% indicated that Pendulum Bob available but not sufficient.

For Light Waves practical resources, high percentages of teachers indicated the non-availability and insufficiency of practical resources to teach the concept. 6 represented 30.0% while 8 represented 40.0% indicated non-availability and insufficiency of Rectangular Glass Block respectively. 2 schools represented 10.0% while 10 represented 50.0% indicated non-availability and insufficiency of Plane Mirror respectively. 10 represented 50.0% and 8 represented 40.0% indicated non-availability and insufficiency of Concave Mirror respectively. 10 represented 50.0% and 6 represented 30.0% indicated non-availability and insufficiency of Convex Mirror respectively. 10 represented 50.0% and 6 represented 30.0% indicated non-availability and insufficiency of Convex Lens respectively. 12 represented 6 0.0% and 6 represented 30.0% indicated non-availability and insufficiency of Concave Lens respectively. 10 represented 50.0% and 4 represented2.0% indicated non-availability and insufficiency of Triangular Prism respectively.

For Heat practical resources, 2 represented 10.0% while 8 represented 40.0% indicated non-availability and insufficiency of Thermometer, 12 represented 60.0% and 6 represented 30.0% indicated non-availability and insufficiency of Bunsen Burner respectively, 10 represented 50.0% and 4 represented 20.0% indicated non-availability and insufficiency of Copper Calorimeter.

For Sound Wave practical resources, 12 represented 60.0% and 4 represented 20.0% indicated non-availability and insufficiency of Vacuum Pump respectively. 6 represented 30.0% and 6 represented 30.0% indicated non-availability and insufficiency of Glass Jar respectively. 18 represented 90.0% and 2 represented 10.0% indicated non-availability and insufficiency of Sonometer respectively

For Electricity practical resources, 12 represented 60.0% and 4 represented 20.0% indicated non-availability and insufficiency of Rheostatrespectively.8 represented 40.0% indicated insufficiency of Ammeter. 8 represented 40.0% indicated insufficiency of Voltmeter.6 represented 30.0% while 4 represented 20.0% indicated non-availability and insufficiency of Potentiometer, 12 represented 60.0% and 2 represented 10.0% indicated non-availability and insufficiency of Meter Bridge respectively.

Research Question 2: What are the responsesof Physics students in rural and urban secondary schools to ascertain teachers' usage of practical resources?

Table 2: Responses of Physics Students in Rural and Urban secondary schools to ascertain teachers' usage of practical resources

S/N	ITEMS	SCHOOL TYPES	N	MEAN	STANDARD DEVIATION	DECISION
1	I have been taught Physics with Micrometer Screw Gauge	RURAL	66	2.30	1.067	Disagreed
		URBAN	144	3.04	0.978	Agreed
2	Hooke's Law lesson was taught with the use of Spring Balance	RURAL	66	2.48	1.011	Disagreed
		URBAN	144	2.83	1.051	Agreed
3	The following were used to teach Machines: Crowbar, Claw, Lever and Pulleys	RURAL	66	2.13	0.820	Disagreed
		URBAN	144	2.63	0.792	Agreed
4	Refraction of Light was taught with Rectangular prisms	RURAL	66	1.73	0.452	Disagreed
		URBAN	144	3.00	0.964	Agreed
5	My teacher has taught friction with two surfaces and the Lubricants	RURAL	66	2.56	1.040	Agreed
		URBAN	144	2.81	0.970	Agreed
6	My teacher has used iron fillings and magnets to demonstrate magnet field	RURAL	31	2.45	1.091	Disagreed
		URBAN	69	2.57	1.014	Agreed
7	Glass jar, tuning fork and sonometer were used to teach to teach sound waves	RURAL	31	2.18	0.875	Disagreed
		URBAN	69	2.47	1.018	Disagreed
8	I have received lesson of Upthrust with the use of measuring cylinders and liquids before	RURAL	31	2.35	0.987	Disagreed
		URBAN	69	2.89	0.947	Agreed

9	Thermometers have been used to demonstrated temperature rise in Physics class	RURAL	31	2.70	1.037	Agreed
		URBAN	69	3.02	0.993	Agreed
10	Bunsen burner, Copper calorimeter and water were used to teach us Specific Heat Capacity	RURAL	31	1.58	0.068	Disagreed
		URBAN	69	2.88	0.967	Agreed
Grand Mean (Rural)=2.25 Grand Mean (Urban)=2.82						

Table 2above showsthat Physics students in rural schools responded that they have not being taught with practical resources using micrometer screw gauge, spring balance, rectangular prisms, iron filling tuning fork, measuring cylinders and liquids before, Copper calorimeter in Physics class with mean value less than 2.50 in items 1, 2, 3, 4, 6, 7, 8, 10, while they responded to being taught with taught friction with two surfaces and the Lubricants and temperature rise using Thermometers.

Physics students in urban schools responded of being taught with practical resources of micrometer screw gauge, spring balance, rectangular prisms, iron filling tuning fork, measuring cylinders and liquids before, Copper calorimeter in Physics class with mean value greater than 2.50 in the corresponding items except the use of tuning fork with mean value less than 2.50. The grand mean for rural is 2.25 indicating that practical resources are not use used to teach practical resources while grand mean for urban is 2.81 indicating that practical resources are use used to teach practical resources in the schools

4. Discussion of the findings

From the research question raised on the availability and sufficiency of practical teaching resources for Mechanics, Heat, Sound Wave, and Electricity themes in the curriculum. The results of the finding indicated that greater percentages of practical teaching resources of the

themes are notavailable nor sufficiency in the schools. The findings of this research are in support of Macmillan and Celina (2019)that there is a lofty challenge of inadequate practical resources to teach Physics at Nigeria secondary schools.

The results is also in line with the findings of Olajide, **Adebisi** and Tewogbade (2017) that basic practical resources such as beakers, boiling tubes, conical flask and measuring cylinder, Ammeters, Resistance box , Meter Rule, Rheostats, Connecting wires are not available in schools. Muhammad (2017) also raised the alarm that schools have poor practical teaching resources and the supplies of equipment for experiments are quiet low in schools.

The research question on the responses of rural and urban students revealed that rural students' responses are not taught with practical resources compared with urban students. This study is support of the findings of Ovansa (2017) that schools in urban areas had more practical teaching resources for teaching and learning of science than those schools in rural areas. This was also supported by research conducted by Udayaruban (2022) that high percentage of students in rural areas affirmed that their learning process is affected by shortage of practical learning resources

5. Implications

Practical resources have been considered to be potent tools for quantitative science learning. Empirical studies conducted by Ovansa (2017) have supported there that there is a significant difference in the performance of students in external examination in urban and rural schools with students in urban performed better than the rural in sciences.

The effective use of Physics apparatus helps in learning physics appropriately, in their studies there is positive and a significant relationship between school practical teaching resources and students' academic achievement in Physics(Babajide & Peter, 2021)Practical teaching resources serve as the major components of both direct and indirect elements in providing diversity of thought for observation and inquiry for development of scientific attitudes and skills in students. Usman and Yakubu, (2020) also discovered that students taught physics practical resources developed a positive attitude towards Physics than does taught abstractly.

6. Conclusion

Practical teaching resources are germane to effective teaching of science. Among science subjects in secondary schools the demand to teach Physics with practical resources is inevitable to make the subject real to the students. Empirical studies have shown that teaching Physics with the aids of practical resources have enhanced the performance, attitude and processes skills of students. With these benefits the study ascertained availability and sufficiency of practical resources to teach mechanics, light waves, sound waves, heat and electricity. The study concluded that practical resources are not sufficiently available in the schools. From the findings, it was observed that students in rural schools are not being taught with practical resources compared with their counterparts in urban schools.

7. Recommendations

Based on the results of the study the following are suggested:

(i) Physics teachers should be encouraged to attend regular seminar and workshop to keep them informed on the importance of teaching with practical resources in the class.

(ii) Research of this kind should be made available to Government and Ministry of Education to make them see the necessity of providing sufficient Physics practical resources to schools.

(iii) Further studies could be carried out in different states of the country toascertain the consistency of the findings.

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