

Relationship Between Physics Laboratory Facilities and Achievement in Senior Secondary Physics

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Abstract

The study investigated the relationship between physics laboratory facilities and achievement in Physics in selected secondary schools in Mainland Local Government Area of Lagos State. The study adopted a descriptive survey research design. The sample consisted of 400 Physics students selected randomly from 20 Senior Secondary School in the local government. A self-developed checklist of Physics laboratory facilities and Physics Achievement Test (PAT) of $r=0.78$ using KR-20 were the instruments used in collecting data. Three research questions guided the study and two research hypotheses were tested at 0.05 level of significance. The data collected were analyzed using descriptive statistics of mean and standard deviation to answer the research questions and Pearson correlation statistics and Independent t-test were used to test the hypotheses at 0.05 level of significance. The result shows that mechanics' apparatus is the predominant apparatus available in Physics laboratory, gender influences physics achievement, and physics laboratory facilities made a positive correlation with achievement in physics. Based on the findings, it is recommended that the Physics laboratory should be properly equipped with all apparatus in all the sections of senior secondary school physics and strategies that would eliminate gender difference in Physics achievement should be adopted by physics teachers.

Keywords: *School facilities, Students' Academic Performance, Maintenance Culture, Senior Secondary Schools, Lagos State*

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Background to the Study

Education, in every human community is an indispensable instrument for human progress, empowerment and effecting national development. This suggests that a nation that lacks a sound educational culture and philosophy stands the risk of decay whereas a nation that sees to the development of its education is bound to achieve great success (Ekundayo, 2012). The educational system is undoubtedly a system of production and could be viewed as a factory that requires men, money and material resources to aid production (Torupere and Koroye, 2016). Each factory has its peculiar environment that depicts or suggests the type of production that goes on there. The School plant, which refers to the physical facilities available in the School such as the School site, the buildings, equipment, machinery, furniture, electrical and water supply infrastructure could simply be likened to the capital in an industrial setting. They're very necessary to ensure the effectiveness of the system. Schools are established for the purpose of teaching and learning. It is also more important that teachers and learners are properly accommodated to facilitate teaching and learning process. This is the essence of School plant and facilities (Alimi 2004). Therefore, School facilities are the space interpretation and physical expression of the school curriculum.

The National Policy on Education (2014), stipulates that the school environment especially the physical environment should be well constructed and spacious and all types of physical facilities such as instructional materials, library, laboratory and its apparatus, playing ground, toilets and staff rooms should be provided for effective teaching and learning process. Adams (2004) submitted that a quiet, cool, clean and beautiful physical environment makes the teachers and students happy and enhances their performance and productivity.

Wilson (2013), Okunuga (2015) and Ijaduola (2018) continued that with poor physical working condition, there are usually mental fatigue, truancy, frustration, discomfort, and poor health; all of these consequently reduce students' academic performance. Excellent school facilities and dedicated teachers are basic fiber upon which hangs the whole educational edifice. There's a realization that the transfer of knowledge does not only take place in the four walls of the classroom from the teacher to the students, rather an overall atmosphere that guarantees effective teaching and learning process (Asiabaka, 2008).

Bandele (2003) and Orodho (2013), reiterate that the importance of physical facilities cannot be relegated. Facilities like modern laboratories, libraries and classrooms are to be put in place in our schools. Adesola (2005) found out that the level of available resources is indeed a plus to the teachers and goes to show the level of ingenuity and commitment of teachers towards effective lesson delivery. There's need for renovation of old buildings, chairs, desks, cabinets and acquisition of modern classrooms as earlier recommended by Alimi (2007).

Akinfolarin (2008), identified facilities as a major factor contributing to academic performance in the school system. These include classroom furniture's, recreational equipment amongst others. The study of Owoeye and Olatunde (2011), equally

established that school facilities were the most potent determinant of academic achievement. They alluded that achievement is a function of the availability of facilities to students in unity schools compared to public schools.

Cynthia and Megan (2008) also confirmed a strong relationship between quality of school facilities and student achievement. In Nigeria, it is the general opinion of people that private schools are better in terms of the availability of human and physical facilities and consequently students' performance than public schools. This situation has made many parents enroll their children in private secondary schools.

Physical facilities strive to give students a comfortable learning environment in which they work and learn. In developing countries, low quality of learning amongst students can partly be attributed to poor or physical facilities of the schools (Bijaya and Maharjan, 2015). They alluded that all physical facilities must be provided to the schools for the students' better concrete and real experiences. The child learns through concrete rather than abstract experiences.

Whilst factors such as students' socio-economic status and parental involvement are amongst the most important predictors of student's academic performance at secondary school level, improving the quality of school facilities offers a feasible opportunity for an improvement in the academic performance of students. Poor academic performance is more often than not a function of inadequate school facilities. Okeke (2009), acknowledged the situation when he asserted that with the expansion of secondary schools in Nigeria, there has been a general cry about the falling and failing standard of education in the country. Over the years, the performance of students has fallen in examinations due to variety of reasons. Chief amongst these factors is inadequate provision of school facilities (Anchurian and Steward 2006).

It can be inferred from this literature that school facilities have a positive relationship with school effectiveness. It was against this backdrop that the present study found out the relationship between school facilities and students' academic performance in public secondary schools in Mainland LGA of Lagos State.

Statement of the Problem

In this 21st century, there has been a tremendous growth in student's population without a corresponding growth in the number of facilities as a result of economic depression and corresponding rise in cost (Osuji, 2016). The researcher asserted that for any school to function effectively, the facilities must be available, good condition and usable. The absence of these facilities often leave a doubt in the minds of stakeholders, parents, students and the general society as to what type of teaching and learning that could take place in such situation. Adeyemo (2018) found out that lack of adequate facilities such as equipment, classrooms, laboratories, workshops and libraries are amongst the probable cause of students' poor performance in Physics examination. To ascertain this fact this study sought to determine the relationship between school facilities and students' academic achievement in Physics in public secondary schools in Mainland Local Government Area of Lagos state.

Purpose of the Study

The main purpose of the study is the need to investigate the relationship between physics laboratory facilities and achievement in senior secondary school physics.

Specifically the study determined;

- i. The predominant laboratory facilities available in physics laboratory
- ii. The relationship between physics laboratory facilities and achievement of students in physics
- iii. The effect of gender on achievement of students in physics

Research Questions

The following research questions were raised and guided the study

1. What is the predominant laboratory facility available in physics laboratory?
2. What is the relationship between physics laboratory facilities and achievement of students in physics?
3. What is the influence gender on achievement of students in physics?

Research Hypotheses

Ho1: There is no significant relationship between physics laboratory facilities and achievement in physics.

Ho2: There is significantly influence of gender on achievement in physics.

Theoretical Framework

The study is based on theory propounded by Millar, Le Maréchal (2004). He stated that practical works helps students to make links between the domain of objects and observable properties and events, and domain of ideas. Hence, the consistent use of practical works to teach physics student helps in linking the abstract nature of physics to the real world. They were able to apply the learnt physics concept in solving real life scientific problems.

Methodology

The study adopted a survey research design in form of descriptive approach. The targeted population for this study comprises of ninety-four (94) senior public secondary schools, in Education District IV which consist three local governments; Mainland, Surulere and Apapa Local Government Areas (Lagos Schools online, 2018). A sample size of 400 physics students were selected randomly from twenty (20) senior secondary schools out of 24 schools in Mainland Local Government Area in Education District IV of Lagos. The instruments used in the study were Checklist and 30 items Physics Achievement Test (PAT) with $r = 0.78$ The mean and standard deviation were used to answer the research questions while Pearson Product Moment Correlation and Independent Sample t-test were used to test the hypotheses at 0.05 level of significance.

Table 1: A test blueprint was drawn up for the PAT, this is presented below;

Content	SHM	Frictional force	Moment	Equilibrium	Projectile	Total
Level of Objective						
Knowledge	2	2	2	2	2	10
Comprehension	1	2	1	1	1	6
Application	1	1	1	1	1	5
Analysis	1	-	1	1	1	4
Synthesis	-	-	-	-	-	-
Evaluation	1	1	1	1	1	5
Total	6	6	6	6	6	30

The research study was discussed with the school principals and vice principals. In some schools where the principals were not available, the vice principals and senior tutor were met. The essence of meeting school heads was to obtain permission from them and discuss the purpose of the research study. Then, after permission were granted, copies of the instruments were directly and personally administered to the selected respondents by one of the researchers. At the end of the exercise, the instruments were collected for data analysis.**Result**

Research Questions 1:What is the predominant laboratory facility available in physics laboratory?

Table 2: Descriptive Statistics on Availability of Apparatus for Teaching and Learning of Physics

S/N	Mechanics Apparatus	Quantity	Functioning	Not- Functioning
1.	Pendulum bob	50.00	50.00	-
2.	Retort stand	45.00	45.00	-
3.	Spring	60.00	59.00	-
4.	Meter rule	315.00	302.00	-
5.	Stop watch	215.00	195.00	8.00
6.	Vaniercallipers	200.00	151.00	49.00
7.	Micrometre screw gauge	155.00	150.00	5.00
8.	Protractor	137.00	131.00	6.00
9.	Divider	89.00	85.00	4.00
10.	Flat surface/lab table	400.00	387	13.00
11.	Incline plane	50.00	43.00	7.00
12.	Thread (Bundle)	316.00	316.00	-
13.	Mass hanger	260.00	256.00	4.00
14.	Standard Masses	457.00	457.00	-
15.	Digital stop watch	198.00	151.00	47.00
	Electricity Apparatus			
16.	Battery	50.00	40.00	10.00
17.	Connecting wire	503.00	503.00	-
18.	Light bulb	41.00	35.00	6.00
19.	Potentiometer (Variable Resistor)	17.00	6.00	-
20.	Wheatstone bridge	15.00	13.00	2.00
21.	Resistant box	49.00	41.00	8.00
22.	Constantine wire	27.00	27.00	-
23.	Resistors	266.00	250.00	16.00
24.	Rheostat	64.00	60.00	4.00
25.	Voltmeter	213.00	200.00	13.00
26.	Ammeter	215.00	199.00	16.00
27.	Galvanometer	216.00	202.00	14.00
28.	Capacitors	88.00	80.00	8.00
29.	Diode	10.00	6.00	4.00
30.	Transistors	8.00	5.00	3.00
31.	Breadboard (Connecting Boards)	15.00	10.00	5.00
32.	Induction coil (Bundle)	206.00	206.00	-
33.	Switch	251.00	251.00	-
34.	Gold-leaf	6.00	3.00	3.00
35.	Carbon electrode	10.00	7.00	3.00
	Optics (WAVES) Apparatus			
36.	Concave lens	213.00	200.00	13.00
37.	Convex lens	215.00	199.00	16.00
38.	Pins	216.00	202.00	14.00
39.	Screen	200.00	193.00	7.00
40.	Rectangular prism	299.00	299.00	-
41.	Triangular prism	303.00	303.00	-
42.	Concave mirror	101.00	99.00	2.00
43.	Convex mirror	122.00	119.00	3.00
44.	Turning fork	15.00	13.00	2.00
45.	Polarizer	147.00	101.00	46.00
46.	Ripple tank	-	-	-
47.	Ray box/touch light	50.00	45.00	5.00
48.	Pinhole camera	-	-	-
49.	Protractor	96.00	90.00	6.00
50.	Ruler and other measuring instruments	370.00	366.00	4.00

Table 2 show that the mechanics apparatus has the highest total number of physics apparatus available in Mainland Local Government Area of Lagos State. Thus, the mechanics apparatus is the predominant apparatus available in teaching and learning of physics in the Local Government Area of Lagos State.

Research Questions 2: What is the relationship between physics laboratory facilities and achievement of students in physics?

Table 3: Pearson Product Moment Correlation Statistics on School Facilities and Physics Students' Academic Performance

		SCHOOL FACILITIES	PAT	
SCHOOL FACILITIES	Pearson Correlation		1	.801
	Sig. (2-tailed)			.000
	N		400	400
PAT	Pearson Correlation	.801		1
	Sig. (2-tailed)	.000		
	N	400		400

The table 3 shows that the Pearson Product Moment Correlation value between school facilities and academic achievement of physics students is 0.801. This implies that there is positive relationship between physics laboratory facilities and students' academic achievement in physics.

Research Question 3: What is the influence gender on achievement of students in physics?

Table 4: Descriptive Statistics on Influence of Gender on Physics Students' Academic Performance

GENDER		N	Mean	Mean Difference	Std. Deviation	Std. Error Mean
PAT	MALE	216	22.3462	8.3450	1.34536	.34562
	FEMALE	184	14.0012		1.44261	.36721

The table 4 shows that male and female physics mean scores and standard deviations are 22.3462, 14.0012 and 1.34536, 1.44261 respectively. There is a mean difference of 8.3450 between the two groups. This implies that gender has influence on the physics students' academic achievement at the senior secondary schools in Lagos State.

Testing of Hypotheses

Ho1: There is no significant relationship between school facilities and students' academic achievement in Physics.

Table 5: Pearson Product Moment Correlation Statistics on School Facilities and Physics Students' Academic Performance

		SCHOOL FACILITIES	PAT
SCHOOL FACILITIES	Pearson Correlation	1	.801
	Sig. (2-tailed)		.000
	N	400	400
PAT	Pearson Correlation	.801	1
	Sig. (2-tailed)	.000	
	N	400	400

The table 5 shows that the Pearson Product Moment Correlation value between school facilities and academic achievement of physics students is 0.801 which is significant at 0.05 level of significance. This implies that there is a significance relationship between school facilities and students' academic achievement in physics at the senior secondary schools in Mainland Local Government Area of Lagos State. Thus, reject Ho1

Ho2: There is significantly influence of gender on achievement in physics.

Table 6: Independent Sample t-test on the significantly Influence of Gender on Achievement in Physics

GENDER		N	Mean	Std. Deviation	Std. Error Mean	T	df	Sig.
PAT	MALE	216	22.3462	1.34536	.34562	23.034	398	.000
	FEMALE	184	14.0012	1.44261	.36721			

Table 6 shows that male and female physics mean scores and standard deviations are 22.3462, 14.0012 and 1.34536, 1.44261 respectively with t - value of 23.034 which is significant at 0.05 level of significance. This implies that there is significant influence of gender on physics students' academic achievement in Lagos State. Thus, reject Ho2.

Summary of Findings

1. The mechanics apparatus is the predominant apparatus available in teaching and learning of physics in Mainland Local Government Area of Lagos state secondary schools
2. There is positive and a significant relationship between physics laboratory facilities and students' academic achievement in physics.

3. There is significant influence of gender on the physics students' academic achievement.

Discussion of Findings

The study revealed that there is positive and a significant relationship between school facilities and students' academic achievement in physics. Therefore, there is a significant relationship between school facilities and students' academic performance. The two variables are related in the sense that, one has a greater chance of influencing the other. The availability and functionality of facilities to teach physics in secondary schools predicts how well student perform in Physics. The effective use of physics apparatus helps in learning physics appropriately. This finding is in line with (Mc Growen, 2017) who observed that school facilities are the essential materials that must be put in place and considered so that the objectives of the school system can be achieved; the availability of those facilities determines the quality of instruction and performance of the students in the school. Asiabaka, (2018) observes that, school facilities constitute the major components of both direct and indirect elements in the environment of learning. According to him, the school plant and facilities are materials designed to serve specific purposes. She suggested the followings as the need for facilities in schools, to provide opportunity for the firsthand experience, for experimentation and demonstration; for specific investigation, to provide diversity of thought; for observation and inquiry for development of scientific attitudes and skills, to protect the individual, provide comfort and to illustrate concepts. Like Ogunleye (2014) and Adeyemo (2016) is in line with is findings.

Adeogun, (2001) discovered that, a very positive relationship between instructional resources and students' academic performance exists. He asserted that, schools endowed with more resources performed better than schools that are less endowed. Collaborating this, Babayomi, (1999) asserted that, private schools, because of the availability and adequacy of teaching and learning resources performed better than public schools. Many studies have shown that adequacy of school plant and facilities positively correlate with increase academic performance, for instance, Ayorinde, (1986) and Adeogun, (2001) asserted that, schools endowed with more resources performed better than schools that are less endowed. The result is also in collaboration with Hopland, (2013) studies, "School Facilities and Student Achievement in Industrial Countries". He studied the link between school facilities and student achievement in eight countries. The results indicated a negative relationship, but the estimated coefficients are mainly insignificant. Interestingly, the coefficients differ heavily across countries. Whereas there seem to be adverse consequences from poor facilities in Australia, the Netherlands and Japan, there is no significant effect in the remaining five countries, (Hopland2013).

Lastly, there is significant influence of gender on physics students' academic performance. Raimi & Adeoye (2002) investigated the difference between the male and the female students' achievement in physics and revealed that there is a significant difference between the male and the female students' achievement in physics. Likewise,

This finding of Njoku and Atanga (2011), Ukozo (2011) Ogunneye and Lasisi (2008), Ogunleye (2003) also revealed a significance difference in the academic achievement in physics based on gender. The gender effect on school science cannot be over stressed as reported by Bello (2002) that gender difference is characterized by female under representation and under achievement in physics. Oludipe (2012) Iroegbu and Babajide (2010) and Adegoke (2009) also studied the difference between the male and the female students' achievement in physics and reported a no significant difference in the achievement of male and female students in physics.

Conclusion

The study concluded that mechanics apparatus is the predominant apparatus available in teaching and learning of physics in Mainland Local Government Area of Lagos state secondary schools, there is positive relationship between physics laboratory facilities and students' academic achievement in physics, and there is significant influence of gender on the physics students' academic achievement.

Recommendation

From the findings of the study, it is hereby recommended that:

1. Laboratory facilities and all sections of physics should be made available and functional at the secondary schools in Lagos state.
2. Teachers should adopt strategies that motivate the female physics students in learning physics so as to eliminate the gender difference in physics classroom.
3. The academic institutions should be aware of the physics laboratory facilities that is crucial and most important all the sections of physics in achieving academic excellence.

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