

Availability and Utilization of Physics Laboratory Equipment on Academic Achievement of Students in Public Day Secondary Schools

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Abstract:-The purpose of paper was to investigate the correlation between availability and utilization of physics laboratory equipment and the academic achievement of students in Public day secondary schools. The study was necessitated by the continuous decline in students' academic achievement in public day secondary schools in Kisii County, Kenya. The objective of the study was to establish the level of availability and utilization of physics laboratory equipment and how it relates to students' academic achievement in public day secondary schools. Correlational research design was used in this study which involved students and teachers from the 246 public day secondary schools in the county. Non-proportionate sampling, systematic random sampling and purposive sampling techniques were used to select the sample unit size of schools and sample size of students and teachers. Non-proportionate sampling technique was used to sample schools, systematic random sampling technique was used to sample students while teachers were sampled using purposive sampling technique. Student questionnaire (SQ) and Teachers Interview Schedule (TIS) were used to collect data. The study yielded both quantitative and qualitative data. Quantitative data were analyzed using inferential statistics, Pearson's Product Moment Correlational Coefficient analysis and multiple regression. The findings from the study revealed that availability and utilization of physics laboratory equipment had a relationship with students' academic achievement. It was concluded that the relationship was statistically significant [$F(4, 372) = 39.203$, $R^2 = .297$, sig. $< .05$]. A respectable variability ($\approx 30\%$) in student academic achievement was explained by the physics laboratory equipment.

Key Words: Laboratory Equipment, Academic Achievement, Availability and Utilization

I. INTRODUCTION

According to Akçayir et al. (2016), when science laboratories equipment are utilized effectively in the teaching and learning process, they instil in students skills and abilities to pose scientifically oriented questions, design experiments, perform practical science activities, articulate and rescript scientific enlightenments, converse and defend scientific arguments. Therefore, a science laboratory as a learning resource, plays a very crucial role in the teaching of science subjects and has a significant relationship to students' academic achievement. However, Glewwe et al. (2013), contend that availability of school resources on their own cannot bring much meaning as pertains to students' academic performance unless the same resources are utilized effectively

in the teaching and learning process. These arguments are in consonance with those of Dahar and Faize (2011), who argue that, although availability of materials used in teaching and learning is key, proper utilization of these resources is needed to realise better students' academic achievement. The current study was on availability and utilization of school resources on students' academic achievement in public day secondary schools. The study therefore filled the gap on whether it is the availability of school resources, utilization of school resources or both that influence students' academic achievement in public day secondary schools.

Tekalign (2016), undertook a study on science laboratory equipment in the teaching of science subjects in Ethiopia. The findings of the study disclosed that, 33.33% of the high schools involved in the study did not have science laboratories completely despite them forming a compulsory component for teaching practical activities. The rest of the high schools in the zone under study were poorly-equipped. The findings disclosed further that, only two (16.67%) of the high schools in Ilu Abba Bora Zone were sufficiently equipped with science laboratory resources required in the teaching of biology practical lessons. In the same study, only five high schools under study had adequate chemistry laboratory equipment while only three of the high schools had adequate physics laboratory equipment as the rest were poorly equipped. The unavailability and inadequacy of science laboratory resources in the schools makes it difficult for teachers and students to cover areas that require practical activities which leads to non-attainment of the curriculum objectives. Science laboratory equipment are crucial in the teaching of science subjects such as; physics, chemistry and biology without which the subjects loses their value, a preventive implication from pursuing Physics, Chemistry and Biology and allied courses in higher institutions. It is therefore very crucial to teach basic science practically to promote critical thinking, objectivity and rationality which science entails. The laboratory practical is one of the most effective experiences geared towards the development of scientific skills in students (Tekalign 2016).

In South Africa, Zenda (2016) carried out a study to investigate the factors associated with low grade achievement in Physical Sciences among secondary school students in the

rural area of Limpopo. In this study, both qualitative and quantitative survey design approaches were employed. At the same time, interview schedules for physical science teachers, school heads, parents and curriculum support officers were conducted for an in depth prop to address various research questions. Focus group discussions were also used to collect data from physical science students. Participants were selected through purposive sampling technique. According to the results of the findings, the following revelations were prominent; Inadequacy of teaching and learning resources, low student motivation, high pupil teacher ratio and high teaching workload. According to the study all these contributed to the low students' achievement grades. The current study upholds that since the study by Zenda (2016) employed interview schedule and focus group discussions as the only data collection instrument, the results were only possible with a small sample. The current study on the contrary employed questionnaires which provided the researcher access to a large number of subjects for data collection.

Utilization of science laboratory equipment refers to the number of time that the available science laboratory equipment are used during classes or laboratory practical lessons. According to Lawal (2013), laboratory equipment influences practical learning, making the classroom real, lively and more meaningful. They have the potential of making the content learnt permanent and consequently increase students' performance. Utilization of science laboratory equipment increases the chances of learners' concentration and acquisition of practical skills. In effect, acquisition of such skills enables students to be innovative, discover new ideas and capable of combating unemployment and poverty. Students should therefore make maximum use of such equipment so as to reap their immense benefits.

Oluwasegun, Ohwofosirai and Emagbetere (2015) examined the impact of physics laboratory equipment on students taking physics in Ethiopie West local government area. From the study it was discovered that students' performance in physics was greatly improved by availability of physics laboratory equipment. These arguments are in consonance with those of Olufunke (2012) that, high levels of availability and utilization of physics laboratory equipment has a significant relationship with students' academic performance. In his study, Olufunke(2012) revealed that schools with the highest utilization frequency of laboratory equipment recorded high mean scores in students' academic performance and vice versa. At the same time average mean scores in students' academic performance were recorded in schools with average utilization frequency of science laboratory equipment. This can therefore be concluded that high student mean scores in science subjects is attributed by high frequencies in utilization of science laboratory equipment during the teaching and learning process.

According to Oluwasegun et al. (2015), proper and effective use of physics laboratory apparatus improves students learning outcomes in physics subject, inculcates, scientific

reasoning and increases students' achievement grades in the subject. The study continues to argue that, teaching learners with laboratory equipment reduces abstraction of the concept learned. The more the learners get involved in the laboratory activities, the more they manipulate the equipment, conduct experiments, record scientific observation and retain what they have learnt. The use of laboratory equipment enables students to acquire basic scientific skills and attitudes that will help them in academic performance and in future application of concepts in everyday life. Hence the finding corroborates with those of Nwagbo and Uzoma (2014) in Abuja whose findings revealed that laboratory practical activities enable students to acquire scientific skills and attitudes. The implication is that teachers who utilize science laboratory equipment in biology teaching produces graduates who will be useful to the society since the skills acquired leads to creation of wealth and eradication of poverty.

According to Adebisi (2014), basic Science subjects which are mainly; Physics, Chemistry and Biology in secondary schools should not be taught without the required laboratory resources for this undermines the value of science subjects. This makes the subjects look complicated which hinder students from pursuing Physics, Chemistry and Biology in the senior secondary schools and allied courses in higher institutions. It is therefore very necessary to use practical activities in the teaching of science subjects. The laboratory practical is one of the most effective experiences geared towards the development of scientific skills in students. It is on this platform that the society and the nation can benefit from science and technology (Adebisi 2014).

II. METHODOLOGY

A correlational research design was employed for the study. Salkind (2011), argues that a correlational research design describes a linear relationship between variables and that it does not imply a cause-and-effect relationship. It expresses the degree of linear relatedness between variables and shows the strength of relatedness. In this correlational research design, the study adopted an Expost facto research method. According to Cohen et al (2003), Ex post facto research is a method of teasing out possible antecedents of events that have happened and cannot, therefore, be manipulated by the investigator. Ex post facto research method denies a researcher direct manipulation of the independent variables since they have already taken effect.

III. RESULTS

Availability and Utilization of Physics Laboratory Equipment

Table 1 presents the findings on availability and utilization of Basic Physics Laboratory Equipment summarized in mean and standard deviation.

Table 1: Basic Physics Lab Equipment Availability and Utilization

Text Books	Availability		Utilization		Overall	
	Mean	SD	Mean	SD	Mean	SD
Crocodile clip	4.14	0.99	3.80	1.32	3.97	1.16
Ammeters	4.08	1.05	3.67	0.86	3.88	0.96
Galvanometer	4.02	1.09	3.70	0.88	3.86	0.99
Dry cell holders	4.12	1.05	3.72	0.90	3.92	0.98
Connecting wires	4.02	1.12	3.70	0.91	3.86	1.02
Bulb holders	4.12	1.10	3.80	0.93	3.96	1.02
Meter rule	4.58	0.65	4.09	0.51	4.34	0.58
Optical pins	4.34	0.90	3.96	0.73	4.15	0.82
Soft boards	4.24	0.99	3.86	0.80	4.05	0.90
Stop watch	3.89	1.28	3.58	1.09	3.74	1.19
Beam balance	3.35	1.51	3.12	1.31	3.24	1.41
Overall mean availability	3.96	1.03	3.68	0.87	3.82	0.95

Source: Survey data (2018)

The results of the survey revealed that, on average, basic physics laboratory equipment are generally not adequate to the students. This was reflected by an overall mean availability of 3.96 (1.03) on the scale of 1 to 5, implying that only under four-fifth of the students have one to one access to basic physics laboratory equipment during their physics practical lessons. However, the level of availability differed from one equipment to the other. For instance, most of the schools have a meter rule, as reflected by a mean of 4.58 (SD=0.65) indicating that more than nine out of ten (91.6%) of the students in day secondary schools in Kisii County have access to a meter rule as a physics laboratory equipment. On the contrary, a beam balance is the least available basic physics laboratory equipment as reflected by a mean of 3.35 with a standard deviation of 1.51, implying that only 67.0% of the students get access to a beam balance during their physics practical lessons. However, a standard deviation of 1.51 which is relatively large shows that there is a wide variation in the level of availability of a beam balance among the schools which took part in the survey.

Relationship between availability and utilization of Physics Laboratory Equipment and students' academic achievement

H₀2: *There is no statistical significant relationship between availability of physics laboratory equipment and students' academic achievement in public day secondary schools in Kisii County*

To investigate whether there was any statistical significant relationship between availability and utilization of laboratory equipment and student's academic achievement, the null hypothesis was tested. Pearson Product Moment Correlation Coefficient was used, with scores on availability and utilization of laboratory equipment as the independent variable and student's academic achievement academic

achievement scores as dependent variable. The level of availability and utilization of laboratory equipment was computed from frequency of responses and converted into continuous scale (1.00-5.00), where high scale ratings implied high perceived level of availability and utilization of laboratory equipment and vice-versa.

Table 2: Relationship between Availability and Utilization of Laboratory Equipment and Student's Academic Achievement

		Laboratory Equipment Availability & Utilization	Academic Achievement
Lab. Equipment Availability & Utilization	Pearson Correlation	1	.170**
	Sig. (2-tailed)		.001
	N	377	377
Academic Achievement	Pearson Correlation	.170**	1
	Sig. (2-tailed)	.001	
	N	377	377
**. Correlation is significant at the 0.01 level (2-tailed).			

The finding of the study shows that there was a statistically significant positive correlation ($r=.170$, $n=377$, $p=.001$) between availability and utilization of laboratory equipment and student's academic achievement with a high level of availability and utilization of laboratory equipment associated to higher academic achievement among the students and vice-versa. Given that the relationship was statistically significant, the hypothesis that, "there is no statistically significant relationship between availability and utilization of laboratory equipment and student's academic achievement" was rejected. Therefore, it was concluded that there is a statistically significant positive relationship between availability and utilization of laboratory equipment and student's academic achievement.

These findings are in agreement with Konyango (2011) who carried out a study on the impact of resource utilization on the performance of physics in KCSE in public secondary schools in Ugunja/Ugenya districts in Kenya. The results from his findings showed that, availability of laboratories was over 90% but there was still poor performance in physics. According to Konyango (2011), this could be an attitude problem by both teachers and students. It was also noted that not many students take the subject up to form four. Adequate apparatus were available at the ratio of 1:2 but very few were operational due to lack of maintenance. Therefore demonstrations and group experiments were common. At the same time, Akçayir et al. (2016) supports the findings by noting that, students' skills and abilities are improved through effective utilization of science laboratories equipment in the teaching and learning process. They therefore concur with the finding of this study by reporting that, science laboratory equipment plays an important role in the teaching and

learning process and a key predictor of students' academic achievement.

IV. CONCLUSION

The study revealed that most public day secondary schools in the County have not attained a 1:1 ratio in access to basic physics laboratory equipment during their practical lessons. On the relationship between availability and utilization of laboratory equipment and students' academic achievement, it was established that physics laboratory equipment have a statistically significant positive relationship. However, it was established that although a majority of the public day secondary schools have the basic laboratory equipment, their utilization by students is somewhat low in physics. This could be a possible contributing factor in the low students' academic achievement in physics in public day secondary schools in Kisii County.

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