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Influence of Organization and Coordination of Laboratory Facilities on Students' Achievement in Physics in Secondary Schools of Njoro Sub County, Nakuru County, Kenya

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Abstract
Physics is a science subject that provides the foundation of industrial, technological and economic development of any country. Despite this, student's achievement in the Kenya Certificate of Secondary Examination (KCSE) physics in Njoro Sub County has been poor over the years. The unsatisfactory performance may perhaps be due to Management of Laboratory Facilities (MLF). This study examined the influence of organizing and coordination of Laboratory Facilities on students' achievement in physics in public secondary schools in Njoro Sub County. The study adopted the descriptive survey research design. The target population of the study comprised of all the 8229 students and 60 physics teachers in public secondary schools in Njoro Sub County. The accessible population was all the 60 physics teachers and 2385 form two students in the 35 public schools in sub county schools. A sample of 53 physics teachers and 343 form two students who participated in the study were selected using purposive, stratified, proportionate and simple random sampling techniques. A student's physics practical achievement test (SPPAT), laboratory facility checklist (LFC) and physics teacher laboratory facilities management questionnaire (PTMLFQ) were used to collect data. Data was analysed with the aid of the Statistical Package for Social Sciences (SPSS) version 24. The study established that organization of laboratory facilities has statistically significant influence on students' achievement in physics. The study also revealed that coordination of laboratory facilities has statistically significant influence on students' achievement in physics. The study recommends that the Ministry of Education through its various agents, to review its laboratory organisation and coordination policies. The Teacher Service Commission (TSC) should emphasise on the Teacher Performance Appraisal and Development (TPAD) to ensure students' performance is monitored across all classes.
Keywords: Organization, Coordination, Management of Laboratory Facilities, Student's Achievement

1. Introduction

1.1 Background of the Study

Physics is one of the science subjects besides biology and chemistry that are taught in secondary schools. The aims of teaching secondary school physics are to equip leaners with basic knowledge on scientific enquiry, foster problem solving skills and enhance their career development (Kapting'ei & Rutto, 2014). It also aims at equipping leaners with knowledge; skills that would enable them accurately predict outcomes of natural phenomena such as effects of gravity and engage in industrial activities (Zhaoyao, 2002). A learner with physics background is expected to think both deductively and inductively and approach situations with a high degree of precision (Munene, 2014).

The Ministry of Education in Kenya has recognized physics as one of the important subjects and has thus emphasized its teaching and learning in high schools. However, it is not attractive to most students as they tend to avoid it when provided with an alternative (Olufunke, Awolowo & Blessing, 2014). In addition, students' academic performance in the subject has generally been low. The students' performance in physics at the Kenya Certificate of Secondary Education (KCSE) for the year 2013-2017 were below average mean points of six given that the means were out of a maximum of 12 required by the Kenya National Examination Council (KNEC). The student's poor achievement in physics in the country is further reflected in Nakuru County. The mean points ranged between 4.26 and 5.57 out of a maximum of 12 for the year 2013-2017. The Students low mean points in physics in the county is further indicated by their performance at the sub county level. In Njoro Sub County, the KCSE physics mean grades for the years 2013 to 2017 were below the 50% (below a mean grade of 6) mark (DQASO-Njoro Sub-County, 2018).

Literature shows that there are many factors that affect students' achievement. Adeyemo (2012) noted that teacher related factors such as qualification, experience, instructional leadership, commitment to work and ability to cover the syllabus and management of students; homework and assignments were key determinants of academic achievement. Olufunke, Awolowo and Blessing (2014) noted that teaching method is a significant determinant of achievement in physics as presentation is key to acquisition and retention of content. Attitudes has been found to significantly affect students' choice and achievement in physics (Glore, 2013). This is so because attitudes determine the amount of time and effort dedicated to the subject and this ultimately improves

students' performance in the subject. Likoko, Mutsotso and Nasongo (2013) and Dessarollo (2008) observed that facilities significantly affects the teaching and learning of physics which in turn influences students' achievement in physics.

Management of school facilities has also been found to influence students' academic achievement. Management of Laboratory Facilities (MLF) is considered as one of the major driving force behind the teaching, learning and achievement in physics (UNESCO, 2010). Uko and Ayuk, (2015) assert that management of facilities enhances achievement since effective learning only takes place when the required teaching-learning materials are provided in adequate quality and quantity and at appropriate times. According to Akweya, Twoli, and Waweru (2015) facility management revolves around organizing and coordinating facilities. Organizing ensures that a laboratory has adequate staff with clearly defined roles. Coordination enables scheduling of activities such that teachers can carry out demonstrations and students have the opportunity to carryout 'hands on' activities in class without collision (Mekonnen, 2004). Based on the foregoing, it was hypothesized that the poor performance in physics in Njoro Sub County was due to organization and coordination of laboratory facilities.

1.2 Statement of Problem

The Ministry of Education in Kenya has recognized physics as one of the important subjects and has thus emphasized its teaching and learning in high schools. The ministry has also equipped schools with laboratory facilities that are essential for the teaching and learning of the subject through FSE. Despite this, student's achievement in physics has been below average in public secondary schools in Njoro Sub County. For example, students KCSE physics mean points for the years 2013 – 2017 were in the range of 3.32 and 5.92 out of a maximum of 12. The low achievement in the subject may perhaps be due to the organization and coordination of laboratory facilities given that laboratories play a significant role in physics achievement. This study therefore, sought to investigate the influence of organization and coordination on pupils' achievement in physics in Njoro sub county, Kenya. Several studies have been carried out on achievement in physics but their focus has been on influence of other determinants such as teaching methods and learning facilities. There is no empirical evidence relating organization and coordination and students' academic achievement in physics in Njoro Sub County thus the need for a study to fill the gap.

1.3 Purpose of the Study

The purpose of this study was to investigate the influence of organization and coordination on students' academic achievement in physics in public secondary schools of Njoro Sub County.

1.4 Objectives of the study

1. To determine the influence of organizing laboratory facilities on students' achievement in physics in public secondary schools of Njoro Sub County.
2. To establish the influence of coordination of laboratory facilities on students' achievement in physics in public secondary schools of Njoro Sub County.

1.5 Research Hypotheses

H_{01}: Organization of laboratory facilities has no statistically significant influence on students' achievement in physics in public secondary schools of Njoro Sub County.

H_{02}: Coordination of laboratory facilities has no statistically significant influence on students' achievement in physics in public secondary schools of Njoro Sub County.

1.6 Significance of the Study

The findings were expected to contribute towards improvement of students achievement in physics through: reviewing its laboratory organisation and coordination policies, come up with training programmes for enhancing the managerial skills of physics teachers, strengthen ongoing programmes like Strengthening of Mathematics and Science in Secondary Education (SMASSE),Training of Kenya National Examination Council Examiners (KNEC Examiners), and National Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA). The Teachers Service Commission (TSC) will utilize the findings of this study on the Teacher Performance Appraisal and Development (TPAD) in ensuring students' performance is monitored across all classes.

2. Literature Review

The study aimed at determining the influence of organizing laboratory facilities on students' achievement in physics. Organizing refers to the management structure of the laboratory facilities and personnel. It involves the school principal, head of science department, subject heads, physics teachers and finally to the laboratory technicians and the students (WHO, 2010). School principals have the overall responsibility of ensuring effective

management of school resources, curriculum and co-curriculum activities in order to prevent wastages and ensure achievement of educational objectives (Kabugi, 2013). The head of science departments keep financial estimates for the department, maintain quality teaching on the subject and exercise close supervision on teacher. The management of the laboratory facilities is the responsibility of science subject teachers with the assistance of support technical staff.

Physics teachers are expected to request apparatus to be used by students early enough to avoid any inconveniences. Laboratory technicians are required to provide the facilities to the students before class experiments or teacher demonstrations starts. Laboratory technicians should collect the apparatus immediately students are through with the class experiment to ensure order. Any breakages should be communicated immediately to the teacher and head of department for replacement the technicians should also provide annual report on laboratory equipment and materials. It is management's responsibility to ensure that laboratory technicians and physics teachers are competent in their work at all times. School managers can ensure this by organizing in-service courses and workshops for teachers regularly to get them acquainted with new developments in laboratory based teaching and management (Sharifah, 1999).

The study further sought to establish the influence of coordination of laboratory facilities on students' achievement in physics. Coordination refers to the students' performance of class experiments without clashing. It is achieved by systematic provision of the equipment to students for class experiments, collection and storage of the equipment after the practical. Amuka, Olel, Frederick and Gravenir (2010) argue that practical work in science subjects must be organized in a systematic manner. Dahar and Faize (2011) assert that laboratories facilitate meaningful learning only when the activities are in harmony with the learning objectives of that particular session. Only then can they be able to construct their knowledge of phenomena and related scientific concepts.

Past studies have revealed that the performance of students in secondary school physics has consistently remained poor over the years. Lawrenz, Wood, Kirchhoff, Kim and Eisenkraft's (2009) study conducted in the United States of America revealed that high school students' achievement in physics was below expectation. Mangaoang-Boado (2012) noted that high school student's performance in physics in Phillipines was relatively low. Isola (2010) and Adeyemo (2012) also observed that high school students in Nigeria achievement in the subject was below average. Students performance in physics in Kenya has also been poor over the years (Makanda, 2015; Akweya,Twoli & Waweru, 2015; KNEC, 2014).

Students' academic achievement in physics has related to many factors. McGuffin (2011) observed that schools with principals and subject teachers who have the ability to set pace, lead and motivate students to perform to their highest potential perform better. Lydiah and Nasongo (2009), argue that schools require good leaders to organize the process of teaching and learning to ensure that the mission of the school is achieved. Thakur (2004) assert that leadership is a major determining factor of the quality of education and school performance. Shamim, Rashid and Rashid (2013) conducted a study on influence of teacher factors on students' academic performance in physics in secondary schools of Jammu and Kashmir states in India. The study observed that teachers play an important role in students' achievement because it is their responsibility to shape student's academic achievement.

Kibett and Kathuri (2005) found that students who were taught using project based learning out performed their counterparts in regular teaching approach. Orora, Wachanga and Keraro (2005) found out that the cooperative concept mapping approach teaching method enhanced the teaching and achievement in secondary school science. Bello (2011) demonstrated that using small group cooperative teaching method enhanced learning in Physics. Oladejo, Olosunde, Ojebisi and Isola (2011) examined the effect of instructional materials and students' academic achievement in physics. They found out that students who were taught with adequate instructional material obtained higher mean scores than those who were not. Olufunke (2012) established that availability and effective utilization of instructional facilities had a positive influence on the academic achievement of students in Physics. The study concluded that facilities is a critical variable in determining quality of output of secondary schools.

A study by Oladejo et al (2011) indicates that resources do matter and are the single most important input to learning. The authors further noted that schools endowed with teaching facilities perform better than those that are less endowed. Adeyemo (2012) established that availability of a well-equipped laboratory contribute significantly to students' academic achievement like chemistry, biology and physics. A study by Uwezo Kenya (2010) also showed that private schools performed better than public schools because of the availability and adequacy of teaching and learning facilities. Okoth (2012) in a study conducted in public secondary schools in Ugunja and Ugenya districts, Kenya, found out that use of facilities provide an appropriate introduction and learning of new and complex concepts. The study further found out that facilities also motivates students to learning thus increasing their participation and concentration.

3. Methodology

This study adopted the descriptive survey research design. The target population of the study comprised of all the 8229 secondary school students and 60 physics teachers in Njoro Sub County. The accessible population was all the 60 physics teachers and 2385 form two students in the 35 public schools in sub county (DQASO Njoro Sub-County, 2016). The number of physics teachers and students who participated in the study was determined using Slovin's formula and whereby a sample of 53 physics teachers and 343 students were sampled. The number of teachers and students from each division was determined using proportionate sampling techniques. At the division level, teachers who participated in the study were selected using simple random sampling. Purposive and simple random sampling techniques were used to select intact physics classes in sub county schools with 53 teachers. Sub county schools were purposively selected as a way of ensuring that they are comparable in terms of facilities. Three research instruments namely; Students Physics Practical Achievement Test (SPPAT), Physics Teachers Laboratory Facilities Management questionnaire (PTLFMQ) and Laboratory Facilities Checklists (LFC) were used to collect data. Statistical Package for Social Sciences (SPSS) version was used in data analysis. Frequencies, percentages, standard deviations and simple linear regression tested the five study hypotheses at the 0.05 level.

4. Results and Discussions

4.1 Influence of Organizing Laboratory Facilities on Students Achievement in Physics

The second objective of the study sought to examine the influence of organizing laboratory facilities on student's achievement in physics. The influence of organizing laboratory facilities on students' performance in the physics practical test was determined using simple linear regression. Organizing laboratory facilities as measured by its index was regressed on the students' scores in the physics practical test. Table 1 shows the summary of the regression model between organizing laboratory facilities and students' achievement in physics practical test.

Table 1: Model summary for Organization of Laboratory Facilities

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.706[a]	0.498	0.496	0.26039

a. Predictors: (Constant), Organizing Laboratory Facilities

As shown in Table 1, R-value is 0.706, R Square value is 0.498, adjusted R-Square value is 0.496 and standard error of estimate is 0.26039. It implies there was an average correlation between the observed values and the predicted values of the students' performance in the physics practical test. R Square value of 0.498 implies that 49.8% of the variation in students' achievement in physics practical test is attributable to the organization of laboratory facilities. A low standard error of estimate of 0.26039 shows that the regression model is accurate in predicting the students' achievement in physics practical test using the organization of laboratory facilities. Table 2 shows the significance of the model as a whole tested using analysis of variance (ANOVA).

Table 2: ANOVA for Organizing Laboratory Facilities Model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.783	1	12.783	188.524	0.000
	Residual	22.037	291	0.068		
	Total	34.819	292			

a. Dependent Variable: Students' Achievement in Physics Practical Test

b. Predictors: (Constant), Organizing Laboratory Facilities

Table 2 indicates that the F-test results are that $F(1,291)= 188.524$ and p-value less than 0.05. This implies that the regression model has statistically significant capacity to predict the students' achievement in physics practical test. Table 3 shows the influence of organizing laboratory facilities on students' achievement in physics practical test.

Table 3: Regression Coefficient for Organizing Laboratory Facilities

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.205	0.073		16.441	0.000
	Organizing Laboratory Facilities	0.445	0.032	0.706	13.730	0.000

a. Dependent Variable: Students' Achievement in Physics Practical Test

Results in Table 3 implies that for every one unit increase in organizing laboratory facilities, students' achievement in physics practical test increases by 0.445 units with other factors held constant. This is revealed by unstandardized beta coefficient of 0.445. The p-value for the t-statistic is less than 0.05 and therefore organizing laboratory facilities is a statistically significant predictor of students' achievement in physics practical test. In respect to this, the second research hypothesis stating that the organization of laboratory facilities has no

statistically significant influence on students' achievement in physics was rejected. This led to the following simple linear regression equation;

Students' achievement in physics practical test = 1.205 + 0.445 (Organizing Laboratory Facilities) + 0.26039

The results agree with Adeyemo (2012) who found out that where there are adequately furnished laboratories and the teachers are not available to teach, effective learning cannot take place. Abdulkadir and Ma'aji (2014) agreed that personnel must be fully trained in all the tasks they are authorized to carry out. Training must be supported by up-to-date training records, which must also identify training needs. According to WHO (2005), careful adherence to these programmes will allow staff to take on a wider range of activities in the laboratory, and enable promotion, when opportunities arise. All staff in the laboratory will impact on the quality of the data generated, and must therefore have clear and agreed job descriptions. These must cover all the accountabilities that the job holder takes on, together with a clear description of the purpose of each one.

4.2 Influence of Coordination of Laboratory Facilities on Students Achievement in Physics Practicals

The third objective of the study sought to find out the influence of coordination of laboratory facilities on students achievement in physics practicals. The influence of coordination of laboratory facilities on students' performance in physics practicals was determined using simple linear regression. The link between the two variables was established by regressing coordination of laboratory facilities index on students practical physics test scores. The model summary is as shown in Table 4.

Table 4: Model summary for Coordination of Laboratory Facilities

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.720[a]	0.518	0.516	0.22729

a. Predictors: (Constant), Coordination of Laboratory Facilities

Table 4 depicts that R-value is 0.720, R-Square value is 0.518, adjusted R-Square value is 0.516 and standard error of estimate is 0.22729. It implies there was a strong correlation between the observed values and the predicted values of the students' performance in the physics practical test. R-Square value of 0.518 implies that 51.8% of the variation in students' achievement in physics practical test is due to the variation in coordination of laboratory facilities. A low standard error of estimate of 0.22729 shows that the regression model is accurate in predicting the students' achievement in physics practical test using the coordination of laboratory facilities as the predictor variable. Table 5 shows the ANOVA for coordination of laboratory facilities model that test the overall significance of the model.

Table 5: ANOVA for Coordination of Laboratory Facilities Model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.030	1	18.030	349.027	0.000
	Residual	16.789	291	0.052		
	Total	34.819	292			

a. Dependent Variable: Students' Achievement in Physics Practical Test

b. Predictors: (Constant), Coordination of Laboratory Facilities

As depicted in Table 5, the results of F-test are that $F(1,291) = 349.027$ with a p-value less than 0.05. This implies that the regression model has statistically significant capacity to predict the students' achievement in physics practical test. Table 6 shows the influence of coordination of laboratory facilities on students' achievement in physics practical test.

Table 6: Regression Coefficient for Coordinating Laboratory Facilities

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
1 (Constant)	1.074	0.061		17.586	0.000
Coordinating Laboratory Facilities	0.473	0.025	0.720	18.682	0.000

a. Dependent Variable: Students' Achievement in Physics Practical Test

Results in Table 6 implies that for every one unit increase in coordination of laboratory facilities, students' achievement in physics practical test increases by 0.473 units with other factors held constant. This is shown by unstandardized beta coefficient of 0.473. The p-value for the t-statistic is less than 0.05 and therefore coordination of laboratory facilities statistically and significantly influences students' achievement in physics practical test. The third research hypothesis stating that the coordination of laboratory facilities has no statistically significant influence on students' achievement in physics was therefore rejected. In respect to this, the following equation was arrived at;

Students' achievement in physics practical test = 1.074 + 0.473 (Coordination of Laboratory Facilities) + 0.22729

The study findings are in line with findings by Amuka, Olel, Frederick and Gravenir (2010) who found out that

coordination of class experiments without clashing through systematic provision of the equipment to students for class experiments, collection and storage of the equipment after the practical boost student performance in practical work in science subjects.

5. Conclusions and Recommendations

The study concluded that organization and coordination of laboratory facilities significantly influences students' performance in physics practicals in public secondary schools of Njoro Sub County. These findings have significant implications in the teaching, learning and performance in physics given that they show the aspects of management that affect academic performance in the subject. It implies that student's performance in physics practical and the subject in general can be enhanced by ensuring that teachers have laboratory management skills. This can be accomplished through in-service programmes, workshops, seminars and conferences. Efforts to improve the management of laboratory facilities must also be accompanied by improvements in other factors that enhance performance in physics such as facilities, motivation, teaching methods, and a conducive environment at both school and home. The study recommends that the Ministry of Education through its various agents, to review its laboratory organisation and coordination policies. In order to enhance organization and coordination of laboratory facilities, school administrators should organize for the training of physics teachers.

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