Influence of Availability of Equipment, Learning Aids and Facilities on Practical Abilities of Learners in Physics in Sirisia Division, Bungoma West Sub-County, Kenya

Mang'eni G. Nasambu
School of Education, University of Eldoret, P.O. BOX 1125, Eldoret

Email Address: gladysmangeni@yahoo.com

Abstract

Physics plays an important role in the development of the scientific base necessary for Kenya's industrialization as envisaged in Vision 2030, but the students' performance in the subject has been on a downward trend in recent years. This study set out to investigate influence of availability of equipment, learning aids and facilities on the practical skill abilities of the learners in physics during classroom interaction in selected schools in Sirisia Division, Bungoma West Sub-County, Kenya. The research design adopted for the study was descriptive survey. Questionnaires and observation schedules were used to collect the data. The target population for the study was 14 secondary schools, 30 teachers of physics, and form 3 students. One hundred and forty form three students and twelve teachers were selected to fill in the questionnaire. Two physics teachers were observed while teaching a form three class in each of the six schools selected. Data was analyzed using descriptive and inferential statistics, results were presented in tables and percentages and checked off using chi-square. The findings showed that available physics teaching resources influenced learners' development of practical physics. The study also found out that there was no significant difference between availability of equipments, teaching aids and other facilities and learners' ability to develop practical physics skills. The study concluded that students who are exposed to inquiry-based learning, in which the teachers' role is that of a facilitator with the learner playing an active participatory role, develop proficiency in manipulative skills. By making equipment and apparatus available to the learner, the student acquires speed and skill for further education in science and technological field. The study recommends that secondary schools should be empowered to receive more allocation from CDF funds, well-wishers and parents to be able to build standard laboratory (especially the state owned public schools) in which improvised and other concrete materials such as models and specimens could be stored for the purpose of physics teaching through demonstrations, class experiments and project learning. Inspections should be routinely carried out on schools' laboratories and worn out equipment replaced with new ones.

Keywords: Availability of Equipment, Learning Aids, Facilities, Practical Skill, Learners Physics, Classroom

INTRODUCTION

Physics, which is the study of matter, energy and their interactions, is an international enterprise, which plays a key role in the future progress of mankind (Chen et al., 2001; Brodskyet al., 2013). The principles of Physics have been widely used for economic, scientific and technological advancement. Despite the undisputed significance of Physics, many students perceive it to be a difficult subject (Erinosho, 2013).

These students' learning challenges in Physics in public secondary schools is more pronounced in Africa. In Nigeria, a study on problems and prospects of teaching and learning of Physics in Senior science secondary schools in Sokoto state of Nigeria of 2014, revealed that the major challenges affecting student's learning in Physics have been inadequate facilities, poor administration, inadequate training of teachers, overcrowded classrooms and laboratory as well as a poor attitude of students towards the Physics as a subject (Anka et al., (2014).

More often than not, unavailability or inadequacy of suitable teaching facilities is blamed for the poor performance among other factors such as the teacher competency, teaching methodology and the attitude of the students towards the subject. Using adequate and suitable laboratory equipment to teach Physics in secondary schools will help to improve the academic achievement of learners (Olufunke, 2012).

Practical work may be considered as engaging the learner in observing or manipulating real or virtual objects and materials. Appropriate practical work enhances pupils" experience, understanding, skills and enjoyment of science. Practical work enables the students to think and act in a scientific manner. The scientific method is thus emphasized. Practical work induces scientific attitudes, develops problem solving skills and improves conceptual understanding Practical work in physics helps develop familiarity with apparatus, instruments and equipment. Manipulative skills are acquired by the learners (Millar, 2004: Musasia et al., 2012).

Innumerable efforts in trying to improve the performance of science subjects have been witnessed since independence. The main problem was whether resources could have critical causes of this trend in Bungoma County, Kenya.

KNEC results of 2012, 2013 and 2014 of Sirisia Division revealed that the best student in physics in the Division scored a mean grade of B+. According to the Kenyan grading system, a candidate cannot raise a mean grade of B- in physics unless he/she scores at least a grade of D+ in physics practical paper (KNEC Report, 2014). This, however, indicates that majority of students in the said Division could be performing dismally in the practical paper; an issue that must be addressed to possibly improve performance and enhance enrolment in the subject.

Although research has been done to address factors that could be contributing to poor performance in Physics in some parts of the country, no similar research has been conducted to investigate the influence of availability of equipment, learning aids and facilities on the practical skill abilities of the learners in physics during classroom interaction in Sirisia Division. It was in this respect that the researcher wished to find out whether the availability of equipment, learning aids and facilities could affect the practical skill abilities of the learners in physics during classroom interaction processes.

Objective of the Study

The specific objective that guided this study was to determine whether the availability of equipment, learning aids and facilities affect the practical skills of the leaners in Physics

Hypothesis

The null hypothesis formulated at 0.05 alpha level of significance which guided the study was:

Availability of equipment, learning aids and facilities in practical physics does not significantly predict development of learners' practical skills in physics

METHODOLOGY

The study was conducted in Sirisia Division of Bungoma West Sub-County, Kenya. Descriptive survey research design and inferential statistics were utilized during this study and the target population was 14 secondary schools, 30 teachers of physics and form three students. Purposive and disproportional stratified random sampling techniques were used to select the 6 secondary schools. This sampling was based on gender, setting and type of schools, whether single sex or mixed. Lecompte and Preissle (1993) observed that stratified sampling required the population be divided into relevant subjects and that individuals are selected from each subject. The sample of the study comprised of six schools, form three students in each school and twelve teachers of physics from a selection of boys, and girls and mixed secondary schools in the division. One hundred and forty form three students and twelve teachers were selected to fill in the questionnaire. Two physics teachers were observed while teaching a form three class in each of the six schools selected. The three types of schools were deemed important because they represent both the single sex and co-educational institutions.

Data Collection Procedures/Techniques

The researcher proceeded to the six selected schools under study for familiarization and sought permission of head teachers and teachers of physics to conduct research. Two days were used for these visits, which were also meant to help the researcher disclose the intention of the study to the subjects and create a rapport with them in order to avoid suspicion. Timetables were collected from the teachers concerned during the visit with the aim of making a visiting schedule. This was necessary in order to know which teacher to observe and what time.

Teachers were given specific appointments. The days of observation depended on the teacher's timetable. Teachers were made aware that they were to be observed on any day that they were having a lesson on the timetable. This was meant to avoid special preparation on the part of the teacher. Formal visits were made to the schools by the researcher for data collection after familiarization visits. During the lesson observations, the researcher checked off observable behaviors on the lesson observation guide during classroom interaction processes. Students were given questionnaires to fill in by the researcher, after which teachers filled in theirs. The researcher was able to collect the learners end of term marks from the teachers' mark books (for those learners who took part in the research) as the teachers filled their questionnaires.

Table 1: Sampling grid for sample population

Gender	Total number of schools	Sample schools	Number of teachers	Numbers of teachers to be observed	Number of learners
Boys	2	2	4	2	40
Girls	2	2	4	2	40
Mixed	10	2	4	4	60
Total	14	6	12	8	140

Data Analysis

The information from lesson observation guides, questionnaire and learners' end of term physics marks were coded and analyzed qualitatively and quantitatively using basic descriptive statistics like percentages and frequency counts and variable relationships were checked using chi-square. All the responses were organized into various themes and sub-themes based on the variables under study. Research findings and conclusions were drawn from information obtained from the data collection instruments. Recommendations were drawn from research findings and conclusions made.

RESULTS AND DISCUSSION

Questionnaire return rate

The study was interested in establishing response return rate since the return rate determines the quality of data collected and significance of the study findings to an existing population. This was presented as in Table 2.

Table 2: Sample population and response rate

Category	Dispatched	Returned	Percentage
Students	140	128	91.42
Teachers	12	12	100.0
Total	152	140	92.11

Results from Table 2 revealed that there was a return rate of 92.11%. This is majorly attributed to the researcher's accurate timing of scheduled meetings that were organized by the principals in the study schools. In this way the instruments were collected from the respondents well after they were through with them. The few cases of non-return were present as regards the wider target study area, where during the rainy season, muddy road hindered transportation and therefore late receipt of the instruments.

Demographic characteristics of respondents

Demographic characteristics of the respondents include; respondents gender, age bracket, level of education and teachers' qualification respectively.

Gender of Respondents

The study sought to determine the gender of respondents since gender was likely to influence learners' ability in development of practical skills during physics practical lessons and the findings are shown in Table 2.

Table 2: Respondents Gender

Description		Frequency	Percentage
Students	Male	64	50
	Female	64	50
Teachers	Male	7	58.3
	Female	5	41.5

Results from Table 2 revealed that equal number of male students 64 (50%) and female students 64 (50%) participated in the study and that majority of teachers were male as shown by 7 (58.3%) respectively, the findings therefore indicated that both male and female respondents participated in the study.

Age of Respondents

Thereafter the study investigated age brackets of the respondents involved in physics practical lessons in the study area and respondents were asked to indicate the bracket they belonged and results were as follows in Table 3.

Table 3: Ages of respondent

Description	No. of Years	Frequency	Percentage
Students	14-16	40	31.3
	17-19	64	50.0
	20-22	20	15.6
	23 & above	4	3.1
Teachers	20-30	2	16.7
	31-40	3	25.0
	41-50	4	33.0
	51 & above	3	25.0

Results from Table 3 revealed that majority of student respondents in the study were aged from between 17 – 19 years, 64 (50.0%), followed by those within 14 – 16 years, 40 (31.3%), 20 – 22 years, 20 (15.6%), and lastly those aged 23 and above years, 4 (3.1%). This implied that most of the students' participants in physics practical lessons were aged from between 17 – 19 years. Majority of teacher respondents were aged between 41 – 50 years and this implied that most have taught for long hence have more years of experience in the teaching of practical physics lessons.

Learners End of Term Physics Marks

The study moreover sought to establish as a factor, the end of term physic marks scored by the learners as this would likely indicate their practical skills development in physics practical lessons and the results were as shown in Table 4.

Table 4: Learners end of term physics marks

Marks	Frequency	Percentage
20-30	8	6.3
31-40	20	15.6
41-50	60	46.9
51-60	25	19.5
61 & above	15	11.7
Total	128	100.00

Results from Table 4 revealed that majority of participants in the study had scored 41-50 marks in the end of term examination in physics 60 (46.9%) followed 51-60 marks at 25 (19.5%), 31-40 marks had 20 (15.6%), 61 and above marks were 15 (11.7%) and lastly 20-30 marks at 8 (6.3%) respectively. Therefore, majority of learners had scored fairly well in the end of term physics examinations.

Teachers Qualifications
The study lastly sought to determine the qualification of physics teachers as this would likely influence learners' development of practical skills in the practical physics lessons and the results are presented in Table 5.

Table 5: Academic qualification of teachers

Category	Frequency	Percentage
Masters	2	16.7
BED (Science)	4	33.3
B. Science	3	25.0
PGDE	2	16.7
Diploma	1	8.3
	100	12

The results in Table 5 shows that majority of teachers 4 (33.3%) had a BED science qualification, 3 (25%) had B. Science qualification, 2 (16.7%) had both PGDE and Masters Qualification while 1 (8.3%) had diploma qualification. The findings showed that the physics teachers in the study area were qualified to impart quality physics practical lessons to enhance learners' skill development in physics.

Availability of Equipments, Learning Aid and Teaching Facilities on Development of Learners Practical Skills in Physics

This objective sought to determine the availability of equipments, learning aid and teaching facilities on development of learners' practical skills in physics and the findings were presented under the following sub themes;

Lesson allocation in a week for the following areas
As an indicator within availability of teaching/learning facilities, the study sought to ascertain lesson allocation per week in various area and the results obtained from respondents were as presented in Table 6.

Table 6: Lesson allocation in a week for the following areas

Category	Lessons per week	Frequency	Percentage
Demonstration or Desk Experiments	4	66	51.6
Standard Exercise Experiments	2	20	15.6
Discovery/Research type Experiments	3	36	28.1
Project Work	1	6	4.7
Total		128	100

From Table 6 it can be deduced that majority of learners 66 (51.6%) asserted that lesson allocation for demonstration or desk experiments were four per week, 36 (28.1%) cited that discovery/ research type experiments were lesson planned three times per week, 20 (15.6%) indicated two standard exercise experiments per week and lastly 6 (4.7%) asserted one project work allocated per week. This was also similar with physic teachers who asserted that they employed the use of demonstration and desk experiments in the teaching of physics practical's in the study schools.

Availability of practical physics equipments, learning aids and facilities and development of learner's practical skills in physics

The study further sought to determine the relationship between availability of practical physics equipments, learning aids and facilities and learners' ability to develop practical skills in physics. To answer this sub theme, the respondents were asked to tick against their level of agreement using a Likert scale of **SA** = Strongly Agree, **A** = Agree, **U**= Undecided **D** = Disagree and **SD** = Strongly Disagree. Table 7 shows the study finding.

Table 7: Relationship between demonstrations, class experiments and project learning and Learners' ability to develop practical skills in physics

Category	SA		A		U		D		SD		TOTAL	
	f_o	f_e	f_o	f_e	f_o	f_e	f_o	f_e	f_o	f_e	N	χ^2
School provide sufficient apparatus and equipments needed for physics practical's	45	48	60	55	00	00	23	25	00	00	128	.739
Apparatus are shared among students conveniently /in the right ratio	40	48	60	55	00	00	28	25	00	00	128	1.147
The school has adequate laboratory facilities for physics practical lessons	45	48	55	55	00	00	28	25	00	00	128	.485
The laboratory space is adequate for effective practical experiments lessons for all students	50	48	60	55	00	00	18	25	00	00	128	2.496
Total												4.887

χ^2 (6, N=128) = 4.887, p<.05

As portrayed from Table 7, the result indicates that there was no significant difference between availability of equipments, teaching aids and other facilities and learners ability to develop practical physics skills Sirisia Division of Bungoma West Sub County had a [χ^2 (6, N=128) = 4.887, p<.05]; the difference between observed and expected values under the null hypothesis were consistent and therefore a smaller discrepancy resulted in a smaller value for chi-square thus data did fit the null hypothesis and the hypothesis was retained in favour of the alternative hypothesis because there was no statistically significance difference between availability of equipments, teaching aids and other facilities and learners ability to develop practical physics skills. Studies reveal that students who are exposed to inquiry-based learning in which the teachers' primary role is that of a facilitator, providing guidance and support through the learning process; with the learner playing an active and participatory role (i.e. student-centred approach of teaching and learning); develop proficiency in manipulative skills than those who are not exposed to this approach (Anderson 2002).

Good learning environment which help promote students' involvement in deciding some of the features of the practical task they are engaged in (the question it addresses, the apparatus and equipment that they will use, the data that they will collect, how they will analyze and interpret these) need to be emphasized. Thus practical work will become a means to an end, and not an end to itself. Only by making equipment and apparatus available to the learner for practical work in physics can the student acquire the speed and skill required when s/he leaves school. In society, professional competence and further education depends on the quality and efficiency of practical skills an individual acquires in their field of specialization.

CONCLUSION

The study assessed investigate influence of availability of equipment, learning aids and facilities on the practical skill abilities of the learners in physics during classroom interaction in selected schools in Sirisia Division, Bungoma West Sub-County, Kenya. It was noted that majority of learners asserted that lesson allocation for demonstration or desk experiments was four per week. This was also similar with physics teachers who asserted that they employed the use of demonstration and desk experiments in the teaching of physics practical's in the study schools. Studies reveal that students who are exposed to inquiry-based learning in which the teachers' primary role is that of a facilitator, providing guidance and support through the learning process; with the learner playing an active and participatory role (i.e. student-centered approach of teaching and learning); develop proficiency in manipulative skills than those who are not exposed to this approach (Anderson, 2002). Good learning environment which help promote students' involvement in deciding some of the features of the practical task they are engaged in (the question it addresses, the apparatus and equipment that they will use, the data that they will collect, how they will analyze and interpret these) need to be emphasized. Thus practical work will become a means to an end, and not an end to itself. Only by making equipment and apparatus available to the learner for practical work in physics can the student acquire the speed and skill required when s/he leaves school. In society, professional competence and further education depends on the quality and efficiency of practical skills an individual acquires in their field of specialization.

RECOMMENDATIONS

On the basis of the findings and conclusions above, this section presents the recommendations of the study.

- The secondary schools should be empowered to receive more allocation from CDF funds, well-wishers and parents to be able to build standard laboratory (especially the state owned public schools) in which improvised and other concrete materials such as models and specimens could be stored for the purpose of physics teaching through demonstrations, class experiments and project learning.
- High priority should be placed on good management of physics laboratories in order to appraise the technology of physics practical instruction in the schools which enables both learners' and teachers to develop within the limits of human and material resources, a system that enhances understanding, thinking, production and problem solving. Inspections should be routinely carried out on schools' laboratories and worn out equipment replaced with new ones.

REFERENCES

Anderson, R. (2002). Reforming Science Teaching: What research says about inquiry. Journal os Science Teacher Education, 13, 1-2.

Anka, D. L. M., Anka, A., & Anka, S. (2014). Problems and Prospects of Teaching and Learning of Physics in Senior Secondary Schools in Sokoto State, Nigeria. *Nigeria (September 8, 2014*

Brodsky, S. J., Fleuret, F., Hadjidakis, C., & Lansberg, J. P. (2013). Physics opportunities of a fixed-target experiment using LHC beams. *Physics Reports*, *522*(4), 239-255.

Chen, L. M., Zhang, J., Dong, Q. L., Teng, H., Liang, T. J., Zhao, L. Z., & Wei, Z. Y. (2001). Hot electron generation via vacuum heating process in femtosecond laser–solid interactions. *Physics of Plasmas*, *8*(6), 2925-2929.

Erinosho, S. Y. (2013). How do students perceive the difficulty of physics in secondary school? An exploratory study in Nigeria. *International Journal for Cross-disciplinary Subjects in Education (IJCDSE)*, *3*(3), 1510-1515.

Kenya National E xamination Council; (2014). The year 2013 KCSE Examination Report with question papers and marking Schemes. Vol. 2: mathematics and science report. Nairobi

Kenya National Examinations Council. (2015). The Performance of Students in KCSE in selected

Lecompte, M., & Pressle, J. (1993). Ethnography and Qualitative Design inEducational Research, San Diego: Academia Press.

Millar R., (2004), The Role of Practical work in the teaching and learning of Science, Paper prepared for the Committee: High School Science Laboratories: Role and Vision, *National Academy of Sciences*, Washington, DC

Musasia, A. M., Abacha, O. A., & Biyoyo, M. E. (2012). Effect of Practical Work in Physics on Girls' Performance, Attitude change and Skills acquisition in the form two-form three Secondary Schools' transition in Kenya. *International Journal of Humanities and Social Science*, *2*(23), 151-166.

Olufunke, B. T. (2012). Effect of Availability and Utilization of Physics Laboratory Equipment on Students' Academic Achievement in Senior Secondary School Physics. *World Journal of Education*, *2*(5), 1-7.

Williams C., stanisstreet M., Spall K., Boyes E., And Dickson D. (2003): Why aren't Secondary students interested in physics? Physics Education 38(4), 324-329.