INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Students and Teachers Perceptions of Physics Practical Work in Secondary Schools in Kakamega East Sub – County, Kenya

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Abstract:
In the last ten years, the Kenya national examination council (KNEC) has reported unsatisfactory performance in the physics practical paper 232/3 despite the enthusiasm for practical work among the teachers of physics. In its recent annual report (KNEC, 2011), the national mean scores in practical papers for years 2007,2008,2009, 2010 and 2011 were 25.85, 23.92, 22.37,22.24, and 15.22 respectively. The figures listed above are a clear indication that practical work in physics is not yielding the much anticipated results. It is in view of this observation that the present study was initiated in Kakamega east Sub County to establish the reasons for the current trends in the use of practical work in the teaching and learning of physics. The purpose of this study was to assemble, organize, scrutinize, analyze and interpret the students and teachers perceptions of physics practical work. In this study, a sample of 100 students and 20 teachers of physics drawn from fifteen public secondary schools by simple random method were used. A questionnaire was used to collect the raw data for this study. A pilot study for this study was conducted in two public secondary schools to establish the reliability of the research tool. The reliability of the tool was calculated using cronbach's alpha formula and found to be 0.73. The information collected in the study was presented by use of frequency tables and analysed using percentages. The findings of the study indicated that the majority of the students and teachers viewed practical work as a series of investigations that requires good organization and familiarizes students with apparatus and enables them to learn by doing. It is hoped that the findings of this study will go along way in informing teachers of physics and curriculum developers. The findings of this study will be used by curriculum developers to review the current curriculum and make the necessary changes in line with the best practices.

Keywords: *Perceptions, physics practical work, gender, tacit knowledge, life - style*

1. Introduction

The ability of school administrators to understand and manage students and teachers perceptions effectively is a vital skill in the overall success of the school programs. In the recent years, studies conducted by psychologists, sociologists, teachers and administrators into the students and teachers perceptions of physics practical work have shown that many of the schools in developing countries are experiencing very serious challenges in the execution of practical work.

The term 'challenge' in this study is used to refer to an obstacle or goal needing to be met. According to Kerr (1964), Woolnough and Allsorps (1985), Hodson (1990) Tamir (1981), white (1994),Gott and Duggan (1995), wellington (1998) Hofstein and Lunetta (2000), Bakalo and Wilford (2001), Twoli (2006), Lunetta (2007) ,Kasanda (2008) and Millar (2014) some of the challenges experienced by secondary schools students and teachers in doing practical work include; poor working conditions, insufficient equipment, long working hours, poorly qualified teachers, lack of equipment and facilities, the attitude and interests of students , inefficient teaching strategies and poor achievement in physics examinations.

It is against this backdrop that the researcher initiated this study to delve into finding out how secondary students and teachers perceive physics practical work with a view to managing the students and teachers perceptions of physics practical work.

2. Methodology

This study adopted a survey design to enable the researcher to investigate the research problems. The approach consisted of identification of the research problems, formulation of research questions, and designing of a written questionnaire to answer the research questions. The study then proceeded to pilot the research instruments on24 students Kakamega high school to establish its validity. The letters authorizing the study were applied for and obtained from the university administration and national commission of science and technology.

The study targeted all the form three students taking physics in all the secondary schools in Kakamega east Sub County. However the researcher employed the simple random sampling method to select 15 secondary schools from a total of 46 schools in Kakamega east Sub County. A total of one hundred (100) students and twenty (20) teachers of physics participated in the study.

Table showing the Number of students and teachers involved in the study

	Female	**Male**	**Total**
Students	48	52	100
Teachers	3	17	20
Total	51	69	120

Table 1

The study used a written questionnaire whose reliability was found to be 0.77 using miles and Huberman formulae and 0.73 using cronbach's alpha's formulae.

$$\mathbf{R}= \frac{C}{C+D}$$

Where;

C – Is the symbol of consensus?

D – Is the symbol of differences?

The validity of the questionnaire was established using a panel of experts from Masinde Muliro University of Science and Technology and post graduate students in the department of Science and Mathematics Education.

The data collected in the study was analysed and discussed using relative frequencies and percentages.

3. Area of the Study

Kakamega-East sub-county lies between longitudes 34^0 38'' and $34^0$47" East of the prime meridian and latitudes 0^0 03" and 0^0 02"North of the Equator. It covers a total area of 410.3 km^2 (Republic of Kenya, 2009) with a population of 212,358 persons.

4. Results and Discussions

One of the four objectives of this study was to determine, analyze and discuss the student's perceptions of the meaning of physics practical work, its requirements, reasons for doing it, its functions, significance, impact, weaknesses and the barriers to effective physics practical work. The findings of the study are presented in tables labeled 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, and 4.8 as follows:

	Meaning	**Students Perceptions**		**Totals**
		Yes-f (%)	**No- f (%)**	
A.	Practical work in Physics is a Series of exercises	04(04%)	96(96%)	100(100%)
	Practical work in Physics is a Series of investigations	62(62%)	38(38%)	100(100%)
B.	Practical work in Physics is a Series of experiments	29(29%)	71(71%)	100(100%)
C.	Practical work is a series of tasks	05(05%)	95(95%)	100(100%)

Table 2: Students perceptions of the meaning of practical work
(Field data, 2014)

As shown in Table 2 above, 62.0 of the students in the YES category were of the opinion that practical work is a series of investigations, 29(29%) of the student indicted that practical work in physics is a series of experiments, 5(5%) of the students felt that practical work is physics is a series of tasks, while 4.0% held the opinion that practical work in physics is a series of exercises.

Similarly, 96.0% of the students in the NO category strongly disagreed with the statements that practical work in physics is a series of exercise, 9.5% were convinced that practical work is not a series of tasks 71.0% did not believe that practical work in physics is a series of experiments, while 38.0% of those in the NO category opposed that the assertion that practical could be to series of investigations. Indeed many of the students didn't seem to be very clean what the meaning of a similar study conducted in United Kingdom (2007) by the Science Community Representing Education (SCORE), it emerged that practical work has a variety of

existing definitions many of which are frequently used with little clarification. This study therefore attempted to define practical work as learning experiences in which students interact with materials or with secondary sources of data to observe and understand the natural world. In this study the concept of practical work in physics was considered to be any science teaching and learning activities in which students working individually or in small handle or observe the object or materials they are studying. Investigations exercise, experiments and tasks are all kinds of practical work.

	Requirements	**Students Perceptions**		
		Yes-f (%)	**No- f (%)**	**Total**
A.	Practical work in Physics Requires adequate apparatus.	20(20%)	80(80%)	100(100%)
B.	Practical work in Physics requires Careful preparation before hand	25(25%)	75(75%)	100(100%)
C.	Practical work in Physics requires Good organization throughout.	45(45%)	55(55%)	100(100%)
D.	Practical work requires well Trained teachers.	10(10%)	90(90%)	100(100%)

Table 3: Students perception of the requirements of practical work in physics
(Field data, 2014)

The data presented in Table 3 above shows that 45.0% of the responses in the YES category were of the opinion that practical work requires good organization throughout. Another 25.0% of the YES responses indicated that practical work in physics requires careful preparation beforehand. About 2.0% others believe that practical work in physics requires adequate apparatus while small percentage of 10.0% of the students in the YES category were convinced that practical work requires well trained teachers.

I a sharp contrast 90.0% of the students in the NO category indicted that practical work does not necessarily require well trained teachers. Another 80.0% did not figure out why physics practical will require adequate apparatus. Another 75.0% of the students in YES category did not feel that practical work in physics requires careful preparations before hand, while a 50.0% of the student responses felt. Practical work does not necessarily require good organization. However the findings of the study conducted in United Kingdom (2007) by SCORE it were apparatus trained teachers. This study does the sentiments of the summary given by SCORE (2007).

	Reasons	**Students Perceptions**		
		Yes-f (%)	**No- f (%)**	**Total**
A.	To enable students acquire a feel Of phenomena they are studying.	20(20%)	80(80%)	100(100%)
B.	To prepare students for K.C.S.E. Practical examinations.	07(07%)	93(93%)	100(100%)
C.	To develop in the students the Habit of working as a scientist.	23(23%)	77(77%)	100(100%)
D.	Develop a range of practical skills And techniques.	50(50%)	50(50%)	100(100%)

Table 4: Students perceptions of the reasons for doing practical work in physics
(Field data, 2014)

The data in Table 4 above shows that 50.0% of the YES responses indicated that practical work helps develop a range of practical skills and techniques. Another 20.0% felt that the reasons for doing practical work were to require a feel of phenomena being in students. A small percentage. Of 23% of students were convinced that practical helps the learners to develop the habit of working as a scientist and a smaller percentage of 7.0% submitted that the reason for doing practical work is meanly to prepare the students for K.C.S.E. practical examinations. In the NO category, 93.0% of the students responses dismissed the argument that practical work is meant to prepare the learners for K.C.S.E. practical examination. Another 80.0% of the student's responses rubbished the assertion that physics practical work enables students acquire a feel of the phenomena under study. Another 77.0% of the student's responses did not believe that practical work helps the learners develop the habit of working as a scientist. A smaller percentage of 50.0% opposed the allegation that practical skills and techniques. However in a special article written by Mark Sundew in 1983 and published by Thomas Nelson and Sons Limited, practical work was considered to help students develop management skills develop the ability to record assessment accurately and make accurate deduction. However this study is convinced that practical work enables students to develop a range of practical skills and techniques.

Function for practical work	Students Perceptions		
	Yes-f (%)	No- f (%)	Total
A. It demonstrates theoretical ideas	11(11%)	89(89%)	100(100%)
B. It provides familiarities with the Apparatus.	50(50%)	50(50%)	100(100%)
C. It provides training on how to do Experiments.	24(24%)	76(76%)	100(100%)
D. It trains students how to use instruments	15(15%)	85(85%)	100(100%)

Table 5: Students perceptions of the functions of practical work in physics
(Field data, 2014)

The data in the table shows 50(50%) of the students believe that practical work provides familiarities with the apparatus. The data presented in Table 5 above shows that a large percentage of students (50.0%) believe that practical work familiarizes the students with the apparatus. Another 24.0% have the opinion that practical work provides some training on how to do experiments. A smaller percentage of 15.0% in the YES category held the view that practical work trains the students how to use instruments, while a smaller percentage of 11.0% believes that practical work demonstrates theoretical ideas.
On the other hand 89.0% of the responses in the No category don't believe practical work demonstrates theoretical ideas. Another 85.0% of the response in NO category opposes the assertion that practical work trains students on how to use instruments as another 76.0% dismiss the argument that practical work trains students is how to conduct experiments. An average Percentage of 50.0% is reported to have opposed the assertion that practical work familiarizes the learners with apparatus. In a similar study conducted by SCORE (2007) practical work was reported to demonstrate theoretical ideas, trains the students on how to do experiment and trains the learner on how to use various instrument in the laboratories in the researcher in the study echoes the same sentiments.

Significance of practical work	Students Perceptions		
	Yes-f (%)	No- f (%)	Total
A. It enables students to do physics Rather than merely learning it	38(38%)	62(62%)	100(100%)
B. It provides the measuring skills In physics.	20(20%)	80(80%)	100(100%)
C. It prepares students for practical Examinations.	27(27%)	73(73%)	100(100%)
D. It improves the skill of observing Nature with alertness	15(15%)	85(85%)	100(100%)

Table 6: Students perceptions of the Significance of practical work in physics
(Field data, 2014)

A look at the data presented in Table 6 above (38.0) of the students the YES category hinted that practical work enables students to do physics (27.0%) of the students were of the opinion that practical work prepares students for examinations another (20.0%) of the responses conducted that practical work provides the learners with measuring skills in physics and a small percentage (15.0%) improves the students ability to observe nature with alertness. On the other hand, 85.0% of the responses are the NO category made it clear that practical work does not improve the skills of observing nature with alertness. Another 80.0% is not convinced that practical work provides the learners with measuring skills, and 73.0% of the responses find it difficult to believe that practical work prepares learners for practical examination, while a smaller percentage of 62.0% opposes the assertion that practical work enables students to do physics. In a similar study conducted by Stoma (2006) practical work was observed to provide a means of directly obtaining facts about nature phenomena. According top Tsuma (2006) practical work also enables students to do science rather than merely learning about it. In addition Tsuma considers practical work as a refiner of theory learned in class.

Impact of practical work	Students Perceptions		
	Yes-f(%)	No- f(%)	Total
A. It sharpens students skill in reading and writing	06(06%)	94(94%)	100(100%)
B. It help students to learn to think Independently	30(30%)	70(70%)	100(100%)
C. It provides the opportunity for Students to handle instruments	09(09%)	91(91%)	100(100%)
D. It familiarizes student with proper Methods of observation and experimentation	55(55%)	45(45%)	100(100%)

Table 7: Students perceptions of the impact of practical work in physics
(Field data, 2014)

The data presented in Table 7 above shows that in the YES category, 55.0% of the students believe that practical work familiarizes students with proper methods of observation and experimentation 30.0% and of the opinion that product work helps the students learn to think independently while the percentage of 9.0% and 6.0% believe that product work provides opportunity for students to handle apparatus and sharpens the students skills in reading and writing. On the other hand the table shows that in the NO category 94.0% disagree with the assertion that practical work sharpens students skills in ready and writing, 94.0% of other believe practical work provides an opportunity for student to handle instruments, 79.0% disagree with the allegation that practical work helps the learners to think independently and a smaller percentage of 45.0% doubted whether practical work familiarizes the students with proper methods of observation and experimentation. In a similar study conducted by Lunetta (2007) in the UK practical work was believed to increases students sense of ownership and can NESTA survey in 199% of the sample of the science teachers believed the practical work had an 83.0% impact on student performance and attainment.

	Place of practical work	**Students Perceptions**		
		Yes-f (%)	**No- f (%)**	**Total**
A.	It is closed, convergent and Dull	11(11%)	89(89%)	100(100%)
B.	It assumes that scientific knowledge is subjective and detached.	50(50%)	50(50%)	100(100%)
C.	It is much more a series of Restrictive exercises.	24(24%)	76(76%)	100(100%)
D.	It has very little to do scientific activities	15(15%)	85(85%)	100(100%)

Table 8: Students perceptions of the weaknesses of practical work in physics
(Field data, 2014)

The data presented in Table 8 above shows that that in the YES category 50.0% believe that practical work in physics assures that scientific knowledge is subjective and detached while a smaller percentage of 24% are of the opinion that practical work is much more a series of restrictive exercises. An even smaller percentage of 15.0% believes that practical work has very little to do with scientific activities. An even small percentage of 11.0% affirms that practical work is closed, convergent and dull. In the NO category, 89.0% was not convinced that practical work is closed, convergent ad dull while another 85.0% dismisses the argument that practical work has very little to do with scientific activities. Another 76.0% in the NO category does not think that practical work is much more a series of restrictive exercises. An average percentage of 50.0% argues that practical work does not assume that scientific knowledge is subjective and detached.

However findings of study conducted in the United Kingdom by SCORE (2007) identified the lack of support from government and slum management Team pupils behaviour, content of curriculum, health and safety lack of resources and facilities in most secondary school, cultural belief and practices, negative attitudes an d the inability to improvise apparatus among other weakness. This study concerns with SCORE in its findings.

Barriers to effective practical work	**Students Perceptions**		
	Yes f (%)	**No.f(%)**	**Total**
a) Too many students in practical class and associated behaviour problem	94(95%)	6(6%)	100(100%)
b) In appropriate assessment of practical Work.	70(70%)	30(30%)	100(100%)
c) Insufficient funding being devolved to Science department	91(91%)	9 (9%)	100(100%)
d) Under resourced and old fashioned laboratories	55(55%)	45(45%)	100(100%)

Table 9: The Students Perception of the Barriers to effective to Practical Work in Physics
(Field data, 2014)

The data presented in Table 9 above shows that 55.0% of the responses in the YES category indicted that many of the laboratories for conducting experiments and under resources and old fashioned. A large percentage of the students (91.0%) strongly felt that insufficient funding being devolved to science is a major barrier to effective practical work. Another 94.0% of the students on the YES category felt that too many students in a practical class and associated behaviour is major barrier to series practical work. An average percentage 70.0% of the responses in the YES category were reported to have lamented that practical work is not assessed appropriately. In the NO category 45.0% of the students did believe that practical work is under resources and performed in old fashioned laboratories. Another 30.0% didn't agree with the assertion that the barrier to effective practical work is appropriate assessment. A smaller percentage 9.0% of the students were of the opinion that insufficient funding to the science department is a barrier to effective practical work in physics. An even smaller percentage of 6.0% is reported to have disagreed with those convinced that too many students in a class as a barrier to effective practical work. A similar study conducted by the Institute of physics and

reported to House of Lords (2007), five barriers to effective practical work were indentified. Too many students in practical classes, inappropriate assessment of practical work, insufficient funding, old fashioned laboratories that are under resources and teachers who are not confident teaching physics.

5. Conclusion

The analysis of the findings of the study have revealed that the majority of the secondary school students believe that physics practical work is a series of investigations, requires good organization throughout, helps teachers develop a range of practical skills, demonstrates theory, helps students to do physics , familiarizes teachers with proper methods of observation and experimentation, helps students to learn to think Independently , has very little to do with scientific activities , is ineffective because of too many students in a practical class and is assessed inappropriately.

6. Recommendations

In any school setup perceptions of students, teachers, workers and administrators shape the climate and effectiveness of the working environment. It is therefore imperative that all effort have to be met to understand and manage perceptions. It is against the backdrop of the findings of this study that the researcher makes the following recommendations; continuous research into the students and teachers perceptions of the subjects perceived hard to study, curriculum developers have to make it easier for teachers by preparing suitable guides for teachers and technicians to enhance the teaching and learning of physics through practical work, ensuring that school laboratories are well equipped, employing ICT to supplement but not replace hands on activities, and finally to emphasize free flow of information between science educators.

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