**EVALUATING THE EFFECTIVENESS OF THE SEDP TRAINING ON PHYSICS LABORATORY WORK: THE CASE OF SELECTED SCHOOLS IN ILALA MUNICIPALITY**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN MONITORING AND EVALUATION OF THE OPEN UNIVERSITY OF TANZANIA**

**2017**

**CERTIFICATION**

The undersigned certifies that he has read and recommends for acceptance by the Open University of Tanzania a dissertation with the title “Evaluating the Effectiveness of the SEDP Training on Physics Laboratory Work: The case of Selected Schools in Ilala Municipality” in partial fulfillment of the requirements for the Degree of Master of Arts, Monitoring and Evaluation of the Open University of Tanzania.

……………………….……………….

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…………………..…………

Date

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**DECLARATION**

I, Charles William Philemon, declare that this dissertation is my own organized work and that it has not and will not be presented to any other university for a similar or any other degree.

………………………………

Signature

………………………

Date

**DEDICATION**

This work is dedicated to all those who, though advanced in age, do still seek to learn more and are ready to be guided through the path of new knowledge.

**ACKNOWLEDGEMENT**

This work is the result of inputs from several people including my family; thus I acknowledge their timely support which formed a conducive environment for my studies. A special mention is on Mr. Deogratias Ntukamazina who challenged me many years back to pursue this course. I will always thank him for putting this dream in me. Moreover, my Supervisor, Dr. Christopher Awinia who supported me tirelessly during the entire course deserves a special tribute. Likewise, is the Course Coordinator, Henry Tumaini for providing the necessary links?

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Finally, let it suffice to conclude that, By God’s grace we have come this far. Glory and honour is His, always.

**ABSTRACT**

The general objective of this study was to evaluate the status of practically-based teaching and learning in schools and its impact on the students’ performance in Physics at the Certificate of Secondary Education Examination (CSEE). Heads of school, heads of Physics Department, trained teachers and students fifteen secondary schools in Ilala Municipality, from were selected for the study. Questionnaires, interviews, observations and documentary surveys were used to collect information on frequency of practical work and reasons for failure to do the same. Also, students’ perception on practical work status in their schools was assessed. Secondary data from NECTA documents provided schools’ performance of the subject at CSEE. As per findings of the study, many physics teachers do not have in-service training, much as heads of school and students appreciated the role of practical work. Setbacks raised for lack of practical work in schools were ill-equipped and poorly organized laboratories. It could be concluded that the SEDP training for physics teachers gave them adequate knowledge and skills. However, it was not concluded whether the status of practical work in schools affected the performance in the CSEE significantly. All in all, more monitoring and follow-up to ensure teachers comply to their training is pertinent, apart from the need to upgrade physics laboratories in terms of quantity, apparatus materials and organization.

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**LIST OF ABBREVIATIONS**

BEST Basic Education Statistics in Tanzania

CSEE Certificate of Secondary Education Examination

DAS District Administrative Secretary

ETP Education and Training Policy

GPA Grade Point Average

HoD Head of Department

HoS Head of School

IFRC International Federation of Red Cross and Red Crescent Societies

INSET In Service Education and Training

JICA Japan International Cooperation Agency

KAP Knowledge, Attitude and Practice

MAME Master of Arts, Monitoring and Evaluation

MoEC Ministry of Education and Culture

Moet Ministry of Education and Vocational Training

NECTA National Examination Council of Tanzania

OECD/DAC Organization of Economic Cooperation Development/Development

 Assistance

OECD Organization of Economic Cooperation Development

OUT Open University of Tanzania

PLCA Project Life Cycle Approach

PR Pass Rate

RAS Regional Administrative Secretary

SAMDI The South African Management Development Institute

SEDP Secondary Education Development Programme

SIDA Sweden International Development Agency

SPSS Statistical Package for Social Science

STIP Science Teacher Improvement Project

TEAMS Teacher Education Assistance in Mathematics and Science

UNESCO United Nations Education at Scientific and Cultural Organization

URT United Republic of Tanzania

**CHAPTER ONE**

**1.0 INTRODUCTION**

**1.1 Background to the Problem**

The non-performance in basic science subjects and mathematics has been an issue of concern all over the world. Many countries, even in the developed world, are also experiencing more students’ failures in the basic (or natural) science than in the other subjects. (Mafumiko, 1998)

The International stakeholders including the World Bank, UNESCO and SIDA have done many interventions in African countries in the area of basic science and mathematics. (World Bank documents, 2006) These interventions include supporting international and national conferences to discuss the possible improvements in the performance of the subjects. Also they have been involved in financing specific projects such as supply of text books as well as laboratory equipment and materials apart from training of teachers.

**Table 1.1: Pass Rates for Science and Mathematics Subjects at CSEE, 2009-2015**

|  |  |
| --- | --- |
| **SUBJECT** | **PASS RATES IN %** |
| **YEAR** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** |
| PHYSICS | 55.5 | 44.6 | 43.2 | 42.52 | 44.1 | 46.7 | 44.3 |
| BIOLOGY | 48.2 | 30.5 | 43.4 | 30.55 | 37.1 | 48.3 | 53.7 |
| CHEMISTRY | 57.1 | 43.9 | 48.3 | 46.0 | 50.2 | 56.7 | 60.1 |
| BASIC MATHS | 17.8 | 16.1 | 14.6 | 11.34 | 17.8 | 19.6 | 16.8 |

**Source:** Basic Education Statistics in Tanzania, BEST (2016)

In Tanzania, close monitoring of performance in the basic science subjects and mathematics has been recorded by stakeholders for many years. (Osaki, 2009). The National Examination Council (NECTA) records of pass rates at CSEE for recent years; 2009 – 2015 is shown in Table 1.1.

The pass rate given here includes passes at grade A to D. (that means passes even of the lowest quality/grade which according to NECTA is 30%). The general observation from this is that Pass rates are weakest in Mathematics, Physics and Biology. However, there is some improvement of pass rates in Biology in 2014 and 2015; whereas pass rates in physics have not shown improvements since 2010. Table 1.2 below is specific on physics alone.

 **Table 1.2: Failure Rates in Physics at CSEE, 2006 – 2015**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **YEAR** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** |
| **FAILURE (%)** | 39.1 | 38.5 | 46.4 | 44.5 | 55.4 | 56.8 | 57.5 | 55.9 | 53.3 | 55.7 |

**Source:** Basic Education Statistics in Tanzania, BEST (2016)

The poor performance has prompted the government and scholars carry out a range of studies on the teaching and learning of basic science subjects. One such study (Mafumiko, 1998) concludes that, provision of quality science education has been affected by shortage of qualified science teachers, laboratories, laboratory technicians, overloaded science syllabus and shortage of laboratory and learning materials. Moreover, scholars had voiced concern on the teaching and learning of science. Osaki, (1995) had made important observations in his paper. “Issues in teaching and learning of science in Tanzania.” His concern was on the place of a qualified teacher in effective learning as well as hands-on experience for students.

This concern was also voiced by Chonjo, Osaki, Possi, and Mrutu (1996) in their paper “Improving science education at secondary schools: A situation analysis of selected secondary schools in Mainland Tanzania” who established by the observations that the teaching of science and mathematics had seriously deteriorated and has been reduced to copying and memorization. Hammond (2012) in Kileo (2015) noted that in teaching and learning process, teachers are an important ingredient. For teachers to play their roles well, they must be trained and qualified. Meena (1978), argues that new approaches to science education should stress activity methods, enquiry or discovery approaches at all levels.

In response to the studies, the government initiated several projects/programmes) including the Science Education in Secondary Schools, (SESS), in 1997 through funds from the German Government. Selected schools in Dodoma, Iringa and Pwani regions were supplied with books and laboratory equipment through the SESS project. Additionally, SESS carried out in-service training for teachers. (Budget speech, URT-MoEC, 2001/2002, 2002/2003, 2003/2004).

The same activities were being done under the Education II Project funded by the African Development Bank. The latter project focused on 36 earmarked governments and community built secondary schools. Through it, laboratories were built in all the 36 schools in three phases (Budget speech, URT-MoEC, 2004/2005). Books were provided whereas training of teachers was done to more than the 36 schools

Performance in the basic science subjects and mathematics was one of the key issues in the Secondary Education Development Plan (SEDP). In its first phase launched by the government in 2004, SEDP planned to build more laboratories to facilitate science practical work in those schools. More than 7000 laboratories were to be built in the under the five-year SEDP-I Programme (URT-SEDP, 2004). In the same backdrop, emphasis was laid on training of science teachers to manage laboratory practice in their schools (URT- MoEC, 2003, 2004, 2005, URT–Moet, 2006).

Likewise, SEDP II from 2010 to 2015 put a lot of emphasis on in-science education and training, IN-SET. SEDP initiatives were not the first response towards the science and mathematics teaching and learning in Tanzania. In early 1995 the government was more emphatic on Science and Technology as featured in the Education System (URT-ETP, 1995:53). In addition, Education II and SESS project/activities were mainstreamed into the bigger programme. Another intervention focusing on training science and mathematics teachers was launched in 2009. It was a technical cooperation between the governments of Tanzania and the Japan International Cooperation Agency (JICA) aimed at training secondary school science and mathematics teachers. Its first phase ran from 2009 to 2012 and the second one ran from 2013 to 2016.

The project was designed to cover teachers of Physics, Chemistry, Biology and Mathematics in Tanzania. At the national level 60 facilitators were to be trained and at the regional level, whereas 336 regional trainers were to be prepared through several Training of Trainers (TOT) workshops. The overall goal was to have 10,080 mathematics and science teachers trained per year. (MoEVT, 2009) The project was structured to be monitored by a well-selected team and each year a report was to be given to the funding agency. (Project document, MoEVT, 2009)

So far a substantial number of interventions has been made to address non-performance in the basic science subjects especially at the Certificate of Secondary Education Examinations, (CSEE). It is worth noting that most interventions were not adequately evaluated as also observed by Coppard (2004) and Osaki, (1999) whereas Government initiatives assume bigger improvement in performance due to efforts taken (Budget speech URT-MoEC, 2003/2004). This study attempts to evaluate practical work status in schools and how it is beneficial to students in the selected schools. Studies by Chonjo, (2001) Mafumiko, (1998) and Mafumiko, (2006), showed that the situation in schools remained unchanged in relation to practical work, quality and quantity of teachers.

Kalagho (2003), doing a study on the SESS Project concluded that teachers were not effective and efficient despite their participation in INSET conducted by SESS. The scholars echoed that performance in the science subjects’ demands more from the teachers. Chonjo and Osaki who have done a lot of analysis on teaching and learning of sciences concurred. Kabuje (2009), through a study on the Impact of Education II on the teaching and learning science in Tanzania, concluded that biology teachers who attended Education II project INSET programmes minimally implemented necessary knowledge and skills acquired from INSET.

To sum up, documents and studies cited above and many others have established that there is problem in the teaching and learning of the science subjects based on the following argument:

1. Interventions made so far do not seem to be effective.
2. Failure rates in physics subject are increasing,
3. Physics teachers need to add more knowledge and skills in their teaching methods,
4. Lack of laboratories and apparatus impacts upon the quality of the teaching and learning of the subject,
	1. **Statement of the Research Problem**

This study is an attempt to do further evaluation of government educational interventions. The general evaluation questions are on efficiency, effectiveness, impact, sustainability and relevance. The study will place more focus on effectiveness and impact of a particular intervention. It is essential at this stage to address some degree of sustainability of the project`s achievements. The findings, ought to answer questions on effectiveness and impact.

The MoEVT-JICA training project stated in 1.1 above included giving the trainees (science teachers) hands-on experience. The SEDP strategy has been to train science teachers adequately. The training was done at well equipped centres. Given the non-improving doubts are casted on the following aspects:

1. Did these trained teachers acquire the required competence to transfer to their students?
2. Was the school “environment” conducive enough for the teachers to practice what they acquired in training?

Given the cloud above, these are some of the questions this study wants to answer by linking the training of physics teachers on laboratory practice to, the actual practice in their schools and performance at CSEE. This demand is shared by Osaki (1999), who observed that, “…… though these projects had inspiring activities, little had been done to evaluate their impact”. The study also will establish whether the teacher training impacted upon the teaching and learning process at the schools and the performance at large.

* 1. **Research Objectives**

The general objective of this study is to evaluate how Practically-based teaching and learning is practiced in schools and how it affects the students’ performance in Physics at CSEE.

* + 1. **Specific Objectives are**

Specific objectives were as enlisted hereunder:

1. Assess if physics teachers trained under SEDP initiatives conduct practical work with their students in their teaching.
2. Explore students’ assessment of the practical work situation in their school
3. Examine the linkage between practice of Laboratory work and students pass rates, in their final examinations, the CSEE
4. Find out challenges faced by the SEDP-trained teachers in doing practical work in their school.
	1. **Research Questions**

This study is expected to give answers to the main question: how effective is the SEDP training on laboratory work to physics teachers when linked to students CSEE performance. Specific research questions to guide the conduct of this study were as enlisted hereunder;

1. Do teachers with training on laboratory work incorporate practical work in their day to day teaching?
2. How do students assess the practical work situation in their school?
3. What improvements have been made in students’ performance at CSEE as a result of doing practical work in their school?
4. What could be the reasons for the SEDP trained teachers failure to do practical work?

**1.5 Significance of the Research**

Many interventions have been made the component of training of teachers to improve the learning and teaching of basic science subjects for effective teaching.. It may be pursued as evaluation of the Moet-JICA joint cooperation to train physics teachers. In his Impact Evaluation notes, Dr. Mwisomba (2016) argues that little formal evaluations have been done on projects/programmes carried out by the government. This study will be a little contribution to this evaluation work. And the results are anticipated tol influence the manner of carrying out in-service training for science (physics in particular) teachers. The results from this research will reveal how the trained teachers managed to transfer the practical skills to their students. SAMDI (2007), suggests that this process can assist the government in evaluating its performance and identifying the factors which contribute such abnomarlies.

Furthermore, the findings may expedite the governments’ effort to build laboratories, equip them and provide them with necessary apparatus and materials. Also, policy makers may give some evidence-based directions and directives to pre-service teacher training and also facilitate results-based budgeting as well as helping relevant authorities to tackle the challenges that restrain successful implementation at school of training packages. Finally, more students might be motivated to pursue sciences at school.

**1.6 Scope and Delimitation of the Study**

Many projects targeting in-Service training for science teachers in secondary school have been done in the past but this study will only focus on physics teachers who were trained from the years 2010-2015 under the Moet-JICA Technical Cooperation. The study is meant to trace effects of the INSET on laboratory work on the teaching and learning processes and performance of students in 15 selected secondary schools in Ilala District, Dar es Salaam. The key concern is on frequencies of actual laboratory work done.

**CHAPTER TWO**

**2.0 LITERATURE REVIEW**

**2.1 Overview**

This chapter is on literature review for better understanding of the research problem. Studies that are closely related to performance in basic science subjects and efforts that have been made to improve the performance are reviewed and presented. Both primary and secondary sources of literature have been consulted. The conceptual and the theoretical framework are also presented in this chapter. Furthermore, terms used in this study are defined as part of the preliminary information.

**2.2 Conceptual Definitions**

Basic science principally refers to the scientific disciplines of physics; chemistry, biology and mathematics (https//www.quora.com).These are disciplines which describe natural phenomena, that is something that has not been created by man thus they are also referred to as natural sciences. In this study, basic science subjects are physics, chemistry and biology which are taught in Tanzanian secondary schools and examined as separate subjects at the Certificate of Secondary Education Examinations. (CSEE)

Certificate of Secondary Education Examination is an examination administered by the National Examination Council of Tanzania (NECTA) to all students completing the first level (also called the Ordinary Level) of secondary education in Tanzania. This is the level attained by a successful school candidate who has done four years of post-primary formal education designed to give him/her a certificate in secondary education.

Evaluation is an assessment that identifies, reflects upon and judges the worth of the effects of what has been done (OECD/DAC 2002). One of the objectives of evaluation is providing findings, conclusions and recommendations with respect to a specific programme. This study is expected to do just that with respect to the Moet-JICA intervention on training in practical work.

Evaluation of a project can be carried out during the implementation stage as formative evaluation or at the end of a project as summative evaluation. In Summative Evaluation effectiveness and impact are judged (assessed). In this study an assessment will be made on how the training of physics teachers has been worthwhile in that the planned objectives have been arrived at and how the practice of the trained teachers has impacted on the results of examination of the students.

Effectivenessaccording to IFRC (2011) is the extent to which an intervention has or is likely to achieve its intended immediate results. In this study it is primarily the positive change in performance at CSEE as a result of the initiatives taken for the improvement of the same. NECTA results on the Physics show that more than 50% have failed in the CSEE in the years of 2010 to 2015. This trend should be reversed and the quality of the passes should move from grade D towards grade A, that is less D’s, more C’s, B’s, and A’s. Effectiveness is also one of the foci of the fourth stage of the Project Life Cycle Approach, PLCA, which is, Evaluation. In the Evaluation stage of the Project Life Cycle Analysis, effect of what has been done is assessed. Output of the intervention is assessed if it is leading to intended outcome. Questions of Effectiveness are to compare the objectives of an intervention and its results. It is an outcome of an intervention.

Laboratory***:*** According to Dictionary.com a laboratory is a building or part of a building or other place equipped to conduct scientific experiments, tests, investigations. In this study a laboratory is a special room where practical work is done in the subjects of Physics, Chemistry and Biology. It is special because it has to be of a defined size, defined layout and certain equipment, apparatus and materials being found in it.

Laboratory Practice:in this research these refer to regular use of the laboratory to give students hands-on experience and familiarize with laboratory arrangements and apparatus. Laboratory practice takes the teaching and learning of the science subjects from the classroom to the laboratory.

Learning: Generally learning is the acquisition of knowledge or skill through study. Learning may also be defined as a measurable and relatively permanent change in behavior through experience or instruction. In this study, learning refers to that which the student acquires through the classroom or laboratory experience whether aided or not aided by the teacher and which is measured through examinations.

Outcomes: The IFRC (2011) defines outcome as the primary results that lead to the achievement of the goal (most commonly in terms of knowledge, attitudes or practices of the target group). The project we are evaluating ended up with a number of trained physics teachers who had the necessary skills to perform practicals with their students. This study seeks to find out whether the trained teachers practiced what they were trained on as an outcome of the project.

Performance:The key issue in this research is poor performance in the science and specifically in the physics subjects. Most Candidates at CSEE score grade F in the physics subject examination that is they score below 29%. The grading system in the National Examinations is a score of grade A, ranging from 75% to 100%. Grade B, 65- 74% grade C, 45-64%, grade D, 30-44% and grade F which is 29% and below. According to BEST (2016) more than half of those who did physics at CSEE in the years 2010 to 2015 scored grade F (that is a pass mark of less than 29%), and those who are said to have passed the majority got a score of D that is their score was between 30 and 44%. Performance in this study refer to the grades the candidates got in the physics subject at CSEE and so its corresponding pass rate and the Grade Point Average (GPA) in the subject each year of the examinations.

Practicals or Practical works are mainly laboratory work done by students. According to Woolnough (1991), this is performance of experiments or practical exercises with science apparatus in a laboratory setting. It is meant to give students hands-on experience and a better grasp of the subject matter which in turn will improve performance at examinations. In practical work, students are involved in the teaching and learning process. Teachers are expected to give practical work to students according to what is in the syllabus. A similar terminology used in schools is “Experiment.” This study seeks to find how many experiments the students have done in a given time (month or school term).

SEDP Teacher Training: The Government’s macro-intervention called the Secondary Education Development Programme, SEDP, had a component of training science teachers so as to improve performance in Physics, Chemistry, Biology and Mathematics. The governments secure funds to implement these initiatives from different Partners including the Japanese government through JICA. The project was to extend this kind of training to the whole country. Teachers were trained on laboratory work. It is this specific intervention done between 2009 and 2016, which is the focus of evaluation in this study.

Teaching: According to [www.merriam-webster.com](http://www.merriam-webster.com/) to teach is to impart information or skill so that others may learn. Teaching is essentially giving knowledge to a specific group of people in a manner they will be expected to take and make that knowledge their own. In this study teachers who have been trained under SEDP initiatives are expected to improve their teaching and this should be seen in the students’ performances.

**2.3 Impact of Practical Work on Students Learning**

According to Ngaruko (2016), literature review is for defining and understanding the problem better. Literature reviewed in this chapter will focus on areas which broaden understanding of research questions given in section 1.4 above. In the formal education sector, students learn because they are taught effectively using the right resources, in other words teaching and learning materials.

Kileo, (2015), asserts that teaching and learning materials contribute to the achievement of quality education. They create conducive environment for teaching and learning processes. Kileo quotes Mosha (2012) who hints that teaching and learning materials encompass all essentials that are acted upon to facilitate quality outcome in teaching and learning. For many years back, the book: student ratio especially in science subjects. has been very low in government schools. Edward (2014), conducted a study on the relationship between availability and usage of school textbooks and students’ performance and quotes several scholars on the issue.

Heynemann, Farrell and Suardo (1978), say that students do better in tests when there are text books in the classroom. He also quotes the Standard (2005) stating that in the learning process, teaching and learning materials rank above uniforms. He concludes that schools with good book: student ratio and good knowledge of usage of textbooks to both teachers and students come out with higher performance in CSEE compared to those with poor book: student ratio. Teaching and Learning materials is more than books. Mafumiko (1998), says that the level of resources (quality and quantity) is another crucial factor in achieving excellence in teaching and learning of science. He includes in resources things like adequate equipment and consumables, space to store them and published resources.

In the sciences, hands-on experience is needed above books. Students have to do experiments and other investigative activities using science apparatus and materials. The value of practical work in the learning process has been underscored by many scholars. Mafumiko (1998), affirms that practical work is an integral part in the study of secondary school science in Tanzania as in many other countries. He continues to assert that practical work provides an opportunity for students to learn how to conduct a scientific enquiry. Woolnough and Allsop (1991) summarize the goals of practical work as to gain experiences and to do exercises and investigations. Hodson (1998), expounds that the purpose of practical work is to help students to learn science, learn about science and enable them to do science. That is why the government introduced projects like SESS and Education II to give students practical work experience in their schools.

Assorted studies have been done to assess the effects of some of these projects. Assessing the effect of SESS on the trained science teachers, Kalagho (2003), reveals that teachers did not keep students actively involved in lessons. They did not assign appropriate tasks to students and were not effective and efficient. These are strong allegations which imply that the training did not meet its objective as far as these teachers are concerned.

This conclusion by Kalagho is quite opposite to what Osaki (2008) expected of another of the governments` project on In SET for science teachers. Focusing on Education II project, Osaki expected trained teachers to attain knowledge, skills and strategies to make them operate more effectively and efficiently in their classes. Kabuje (2009), who did a study on the impact of Education II Project on Teaching and Learning of Science in Tanzania, concluded that although students’ participation in learning activities was encouraging, their positive attitudes were suppressed by teachers not providing enough learning activities such as experiments, demonstration, and study tours.

Kibga, (2004), underscored the importance of assessing the knowledge of students in physics through practical work. Kibga observed that practical work had virtually been stopped and an alternative to practical examination which was introduced since mid-1980s had been perceived that there was no need for practical science anymore. The alternative to practical paper at CSEE was introduced because many schools had no laboratories or if any they were under-equipped.

Putting practical work aside defeats the purpose to develop students’ enquiring mind as a result very little learning is achieved. The role of practical work in science teaching is to engage students with investigations, discoveries, enquiring and problem solving activities as suggested by Hofstein (1991). He noted that when properly coached and given the right environment, a student doing laboratory work will develop skills in investigation, discover relationships between variables and confirms what she//he has heard from the teacher in the classroom. Ausubel (1968:45), argues that the laboratory gives the student appreciation of the spirit and method of science. He goes a step further that it provides students with some understanding of the nature of science.

In his concluding remark, Kibga (2004), says that there is a problem with the physics teachers themselves because they had stayed for a long time before attending any in-service training. Even during their pre-service training, there was lack of practical training. His study revealed 70% of the practical work required by the O-Level secondary education syllabus was not covered.

Mafumiko (1998) who did a study on the role of practical work in chemistry education in Tanzania observes that even in schools where practicals are offered, they are done only on a few topics. Reiterating the important place of the teacher in the learning process, he quotes Lazarowits and Tamir (1994) that teachers’ attitudes, skills ad behavior affect whether learning in the students laboratory attains its objective.

The findings by Kibga and Mafumiko confirm the need to train science teachers on practical work and put in place a mechanism to ensure that they practice what they have been trained on. Failure to comply will lead to continued under-performanca in physics at CSEE On the other hand the practical component can only be of use when given by properly–trained teachers.

**2.4 Student Input in the Teaching and learning Situation**

Performance of students is also a result of how much the student her//himself has done to merit good performance. Haimowits (2011), indicated that the cause of most failure in school might not be due to inadequate instructions but by learners themselves. According to Mabula (2012),, student performance in science subjects was affected by poor quality of science classroom teaching and decline in interest of students towards science subjects. The National Research Council (2003), found out that when students are authentically engaged in a meaningful, quality work, the likelihood increases that they will learn something new and remember what they learned.

The part played by the student in determining her//his performance is attributed to one’s attitude to learn. The famous statement by Mwalimu Nyerere may also be applied here that: “It can be done, play your part.” Mwalimu is also quoted by Lema et al (2004), that every learner is ultimately a volunteer. Boa (2014), in her dissertation on determination of high academic performance in secondary school concluded it to hard work, self-confidence, diligence and motivation.However,. Mafumiko (2006), observes that for many students laboratory work tends to be interpreted as following instructions to manipulate the equipment or get the right answer but not manipulating the reasoning behind the answers. When this is the case, practical work may not add much value in the complete learning process.

**2.5 Linkage between Teaching and Learning Methods and Pass Rates**

Most studies have shown that the teacher plays a key role in facilitation to the learner to perform. King’aru, (2014), concludes in his dissertation on “Factors contributing to poor performance of science subjects” that the science performance in secondary schools can be improved if students are involved in practical lessons under the guidance of well trained and qualified personnel”. Ogbonna (2014), quote Alebiasu and Ifanayiwa, (2008) that in selecting the methodology for a science lesson the science teacher should consider among other things innovative teaching strategies to enhance pupils academic performance in the subject.

This idea of teaching strategies is also voiced by Asikhia (2010) cited in Kitti (2014), arguing that teachers methods of teaching influence poor academic performance. Mtitu (2014) argues that for effective and efficient teaching, learner-centred methods that require teachers to actively involve students must be applied. In practical work, students are actively involved. The teacher is expected to have more knowledge and skills to incorporate more activities for giving students manipulative skills. Zazaguli (1999), in Mafumiko (2006) reports that limited knowledge of alternative practical activities, lack of improvisation skills and apparent negative attitudes towards practical work are among the barriers to successful laboratory teaching.

Effective teaching or appropriate teaching methods is the basis for In-Service Education and Training (INSET) which has been the goal of many projects tied to teaching and learning. To address the issue of poor performance in the sciences at CSEE many stakeholders have advocated appropriate in-Service training of teachers to improve their approaches and hence their effectiveness to learning. One of the areas where deficiencies were noted was in teachers doing practical work as part of their teaching, Kibga (2004).

The argument that you learn more by doing has been underscored in many educational reports. It is also a common saying that practice makes perfect according to Lema et al (2004). He quotes Nyerere that “Man’s consciousness is developed in the process of thinking and deciding and of acting. His capacity is developed in the process of doing things”. In this context, practical work in the basic science subjects gives the student an opportunity to learn by doing and hence develop her/his capacity to perform better. Oludipe (2004), concurs and expounds that “lack of practical work is the proof behind students’ poor academic achievement in basic sciences” Practical work stimulates students` imagination.

**2.6 Challenges Teachers Face in Conducting Practicals**

In order to do practical work successfully, there is need for students to have well-equipped laboratories and properly trained teachers. Through many projects and programmes, the government of Tanzania has managed to build laboratories in schools, provide appropriate apparatus and materials, and train teachers to use the laboratories effectively as elaborated in the chapter above: The Science Education in Secondary School (SESS) through which laboratory equipment was supplied to schools and science and mathematics teachers trained testifies (Budget speech, URT-MOEC 2001/2002).

Moreover, the Education II project focused on strengthening of science teaching in 36 government and community-built secondary schools in selected districts. Through the project, 108 laboratories were built and equipment supplied. (MoEC, Budget Speech 2001/2002), SEDP Phase I and II had components of in-service teacher training together with building and equipping laboratories (URT, SEDP 2004, 2010).

According to Mafumiko (2006), impediments to the success of practical work in schools are teachers’ competence in and the poor situation of equipments and consumables. Muwanga-Zake (1998), notes that apart from limited equipment, chemicals and other material resources studies show that most teachers do not do practical work because they are not clear on what to do, when and where. The need for in-service education and training is obvious. Chonjo et al (1996) concur arguing that shortages of regular in-service education activities is common in many countries. Osaki and Chonjo (2002) rightly put it, effective teaching of science requires a teacher who is well-equipped with subject matter, knowledge and skills such as instructional planning, questioning techniques, classroom management, teaching methods and assessment of students’ learning progress.

**2.7 Research Gap**

Students’ performance in science and mathematics has been researched on by many scholars. (Hainowitz, 1989 and Punch, 2000 in Kileo, 2015), submit that factors which contribute to poor performance in these subjects have been identified. These include lack of laboratories and equipment, erratic training of teachers as summarized in table 1.1 in Chapter 1. However, less has been said on the linkage between laboratory works as a factor to improve performance in science subjects. Moreover, having three science laboratories in a school to cater for each subject is not easy, leave alone that physics laboratory is the most expensive to equip. This may lead to limitation in its use even where there is one. Also, many schools do not have science laboratories to date, hence the nation-wide campaign to build school laboratories in 2014. This study is in effort to explore what impact proper handling of practical work has on performance of physics subject at CSEE. It further links special in-service training of physics teachers, with the anticipated improvement in their schools and its impact on students’ performance.

**2.8 Conceptual Framework**

Miles and Huberman (1994) in Mnyasenga (2010) defines Conceptual Frame work as a framework explaining graphically or in a narrative form, the main variables of the study including the key factors and the presumed relationships among them. In this study, the IFRC model on Evaluation is adopted. IFRC adopts the OECD/DAC definition of Evaluation and gives the aims to be determination of the relevance and fulfillment of objectives. (IFRC, 2011). In Evaluation also efficiency, effectiveness, impact and sustainability of a project are determined.

Figure 2.1 giving the conceptual framework below is adopted from the figure on evaluation questions as they relate to the log frame objectives given in IFRC. The key questions on the five areas of evaluation (efficiency, effectiveness, impact, sustainability and relevance) are highlighted and their correspondence to the Log frame objectives/stages, shown. This study focuses primarily on Effectiveness and Impact. It also presumes that if the training (intervention) is effective; there is great likelihood of attaining sustainability of outcomes.

The basic questions on effectiveness and impact, which also are part of the main research questions, are shown in the appropriate boxes of the figure.

|  |
| --- |
|  Project Implementation Output: An army of Trained teachers On practical work  |

|  |
| --- |
|  EvaluationHave the objectives of the interventionBeen achieved |

|  |
| --- |
| SustainabilityWill effective practical work continue at school? |

|  |
| --- |
| Effectiveness at Outcome level |

|  |
| --- |
| Impact at Goal level |

|  |
| --- |
| Is there Improvement in students’ performance? |

|  |
| --- |
| Effectiveness Questions:* Are the outputs leading to the intended outcome?
* Do we have practical work now in school
 |

**Figure 2.1: Conceptual Framework**

**Source:** Adapted from IFRC guide for monitoring and Evaluation (ifrc, 2011)

The figure above starts at the end of the intervention where trained teachers are the output shown at the first box. Evaluation follows the completion of the project by asking the chief evaluation question of whether the objectives have been achieved. Though evaluation questions address mainly five areas, this study focuses only on Effectiveness and Impact. However, when these are maintained in the targeted schools it will most likely result in sustainability. Hence addition of the box on sustainability which asks whether the benefits of an intervention are likely to remain for an extended period after its implementation. The figure shows what questions will show effectiveness and impact of the training at school level. These questions form the backbone of this research. They answer key objectives of the study. A critical question on sustainability is also added to the picture to give more value to effectiveness of the training.

Thus the IFRCC guide the framework for the study. Attention is given to the student whether she/he receives the benefits of the intervention. The field work will determine the answers to whether students are doing practical work and to what extent. Also if the students’ performance at the CSEE, has been affected by their actual practice of laboratory work.

**CHAPTER THREE**

**3.0 RESEARCH DESIGN AND METHODS**

**3.1 Overview**

This chapter discusses the strategies to the field work. In this chapter the research design is given, the population and area of the research identified. Also data collection techniques and how data will be processed and analyzed are spelt out.

* 1. **Research Design**

Claire Selltiz et al (1962), in Kothari (2004) describe research design as “the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure”. According to Kothari, (2004), adds that research design constitutes the blue print for the collection, measurement and analysis of data. Generally, it is the conceptual structure within which research is conducted. On the other hand, it is in the research design that foundation of the necessary field work are laid to fulfill the objectives of the study. Cohen et al (2000), argues that it is a plan showing the approach and strategy of investigation conceived by a researcher. The design will show the approach to obtain relevant data which fulfill research objectives and answers the set of research questions or tasks.

Most studies agree that there are three common types of research design enlisted hereunder:

1. Exploratory research design to generate basic knowledge, clarify relevant issues, uncover variables associated with a problem.
2. Descriptive research design to provide further insight into the research problem by describing the variables of interest.
3. Causal research design to provide information on potential cause and effect relationships (OUT, OEC699, 2016)

These types sometimes carry different names but Cohen et al (2000), sum up that there is no single blue print for planning research. This study is about evaluating the effect of training on a teacher and judging the measure of this effect by the performance of the student taught/ by this trained teacher. Of the three types of design mentioned above, this one will be mostly descriptive in that it provides further insight into the effective teaching and learning, by describing laboratory practical work as an input to teaching and its impact on examination performance in the physics subject at CSEE. Qualitative and quantitative data will be collected with a view to adequately answer the study questions given in chapter one.

**3.3 Survey Population and Area of Research**

The key players in this study are teachers who were trained on physics practicals through the Secondary Education Development Programme, SEDP and their students. According to the Completion report for In-service training of secondary school science and mathematics teachers’ project phase II (Moet, 2016), 10,820 sciences and mathematics teachers picked from over 3,000 secondary schools country-wide completed training. After this the teachers were expected to teach better, facilitating practical work, hence improving performance in the targeted subjects. It is from among these teachers the survey population is drawn. This study will confine itself to Ilala Municipality which has 49 secondary schools, six of which are government-built whereas 43 are community-built. It has the largest concentration of government-built secondary schools of all districts in the country. These have well-established laboratories and hopefully rich experience in using them. All the selected schools are easily accessible.

**3.4 Population Sample and Sampling Design**

Cohen et al (2000), in Kabuje (2009), defines a sample as a selected portion of the population that represents an aggregate of the target population for the study. The sample in this study will include 15 secondary schools in the municipality. This large sample is chosen to make the conclusions more accurate. The selected government-built schools are likely to have a laboratory for each of the science subjects and hence a separate laboratory for physics. A laboratory will be a necessary facility to achieve their goal. However, (Giddings, Hofstein and Lunetta (1991) in Mafumiko (1998) cast doubts that most schools have only a few physics teachers.

This choice of the population sample will include teachers with training at different levels and those without any training (if any). This will also include teachers who are doing practical work with their students and those who are not for whatever reasons. On students, this study will focus on one class stream per form Form III and IV. These students will testify on the implementation of the training package from the trained teachers. As beneficiaries, they will be in a good position to assess the teaching situation.

School management will also give some information on study objectives whereas the head of school will provide information to verify the status of environment for the trained teachers to practice their skills. They will also provide information on the knowledge and attitude of the targeted teachers. The physics head of department will provide information on the day to day activities of the physics teachers. This head will also give results of CSEE in the school as required by the researcher. The sampling design used in this study is non-random coupled with stratified. Best and Khan (2006), describe that purposeful sampling refers to one in which individual items are selected deliberately by the researcher. All the selected secondary schools in Ilala Municipality will be sampled. So long as there are SEDP trained teachers. Summary of the selected sample is given in the table hereunder:

**Table 3.1: Summary of Selected Sample**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TYPE OF SCHOOL | HEAD OF SCHOOL | HEAD OF DEPT. | PHYSICS TEACHERS | FORM 4 | FORM 3 | FORM 2 |
| GOVERNMENT-BUILT | 6 | 6 | 12 + | 40x6=240 | 30x6=180 | 20x6=120 |
| COMMUNITY-BUILT | 9 | 9 | 9 + | 40x9=360 | 30x9=270 | - |

(At least 2 teachers per school in government-built and at least 1 in community–built school)

**3.5 Variables and Measurement Procedures**

Boa (2014), says that academic performance, which is measured by the examination results, is one of the major goals of a school. Boa quotes Hoyles (1986), that schools are established with the aim of imparting knowledge and skills to those who go through them and behind all this are the idea of enhancing good academic performance. This study is on academic performance in the physics subject at the CSEE. The study picks on this variable (performance) to establish how practical work in the subject influences performance. Fairbrother (1991), argues that performance measures what students have learned and how they are able to use what they have learned.

But this study starts where the teachers leading students to perform better at CSEE. The said teachers participated in a training that was designed to give them more skills in practical work and a “push” to make them use these skills with theirs students. The attempt is to establish whether the project met its objectives. This study is a participatory evaluation exercise: the beneficiaries of the training and other key stakeholders (students and school authorities) are being involved to assess the effect of the project (the teachers training) on the direct (and indirect) beneficiaries.

Questions on effectiveness, impact and relevance will be employed. The study findings will highlight the extent to which the objectives of the training have been achieved. The variables here are the actual doing of practicals in schools as an outcome. The SEDP training becomes the independent variable and the actual practice (the doing of practical) the dependent variable. At another stage the doing of practical is the independent variable and the corresponding performance at CSEE the dependent variable. Teachers who have done the training will inform through prepared instrument about the training. The school authority, teachers and students will inform about the implementation of the training and NECTA or school records will inform about performance as required by the researcher.

**3.6 Types of Data and Data Collection Methods**

This study calls for both primary sources and secondary sources of data. The researcher use well designed instruments to collect information on the actual situation with regard to doing of practical work and how the stakeholders assess that situation. Primary sources were used for soliciting information on the level of knowledge and skills the teachers have and their attitudes to work, whereas secondary sources were used in getting examination results and other relevant information from appropriate documents.

The research has come out with both quantitative and qualitative data. Much of the secondary data is quantitative, while quantitative data have come from the primary sources like the frequency of doing practical work. Most of the data collected through the primary sources is qualitative such as likes and dislikes of both the teachers and students or their assessment of specific issues. The main methods used for data collection in this study were questionnaire, interview, observation and documentary review.

**Questionnaires:** These are carefully constructed questions which are usually close-ended to avoid multiple answers which may be difficult to analyze/ or organize. This method was used to collect data from teachers, students and school management. Cohen (2000), notes that questionnaires have the advantage of eliciting the most appropriate kind of data to answer the research purpose as well as sub-questions. Questionnaires are also useful on a large number of respondents. However, questionnaires have little opportunity to check the truthfulness of the responses (SAMDI 2007).

**An Interview**: Basically, it is a technique for questioning that allows the interviewer to probe and pursue topics of interest in depth. ([www.ifrc.org](http://www.ifrc.org/)). Data is collected through direct verbal interaction. It can be structured or semi-structured. Best and Khan (1986), says interviews can have immediate feedback allowing the interviewer to follow up by asking probing questions, thus obtaining more in–depth data. This technique was used in getting appropriate data from heads of school and heads of department. The semi-structured interviews had the advantage that some of the planned questions were left out in some cases and others were added as the situation dictated.

**Observation:** In this study we used observational techniques to collect data on the situation of the laboratories and the size of the classes. Cohen (2000) puts it that observational data provides an opportunity for a ‘live’ situation. Summary of issues and what instruments used to collect information on them is shown in table 3.2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  **Issue/Theme** | **HoS Qns** | **HoD Qns** | **Teacher Qns** | **St.Qns** | **Interview** | **Observation** | **Document** |
| School and Teacher profile |  |  |  |  |  |  |  |
| Practice of laboratory work |  |  |  |  |  |  |  |
| Students assessment of practical work situation |  |  |  |  |  |  |  |
| Link between practical work and performance |  |  |  |  |  |  |  |
| Laboratory situation |  |  |  |  |  |  |  |
| Hindrances to practice of practical work |  |  |  |  |  |  |  |

**Table 3.2: Issues and What Instruments was Used to Explore it**

**Documentary Review:** This is essentially secondary data found in the appropriate documents at school or at the NECTA. The researcher also wished to solicit students’ exercise books where they record practical work done and any logbooks keeping the required data. However this was not very successful. The questionnaires and interview questions used in the study are attached as appendices A, B, C, D, E, and F

**3.7 Data Analysis**

Data analysis is the process of converting collected (raw) data into usable information. (www.ifrc.org). Bogdan and Buklen (1992) in Lushinge (2009) describe data analysis as a process of systematically working with data or applying statistical and logical technique to describe, organize, summarize, compare collected data, and divide them into small manageable portions.

It is worth noting that both qualitative and quantitative data were collected from the different respondents. This data was collected through questionnaires, interviews, observation and review of documents. Data analysis followed the key stages of organizing the collected data, describing and/or interpreting the key findings and presenting data in a clear and simple manner so that the users will easily understand. Data from interview and observations was grouped into themes before making appropriate analysis. Moreover, data from questionnaires were tallied and totaled. Frequencies were found and percentages calculated. SPSS was not used in the analysis. Frequencies of respondents in the required information were the basis for certain conclusion.

**3.8 Expected Results of the Study**

This study was expected to link the implementation of a project (ie. doing the training) with one of its outcomes that of trained teachers doing practical work in schools and its impact on student performance. Through the findings, KAP knowledge, attitude, and practicals of the trained teachers can be established. It is possible that students continue to under-perform in physics because they don’t compliment their theory (class) work with practicals. It may be the case because teachers though trained, they are still not competent enough to do practical or though they have the necessary skill they are not ready to do the practical work. Also, there could be external hindrances and challenges.

**3.9 Ethical Issues**

The researcher observed all the ethical issues associated with his work. After the required letter from OUT was given, the researcher followed the required path to get the permission to collect data from schools. The university letter was taken to the office of the Regional Administrative Secretary (RAS), where another form was issued to the District Administrative Secretary (DAS). This office issued a letter to the Municipal Director, who in turn gave another letter to be taken to introduce the researcher to the Education Officer who finally issued a letter to schools which the researcher had asked to collect data from. The researcher also took time with the heads of the schools to get their good will for collecting the required data from their schools.

**CHAPTER FOUR**

**4.0 DATA PRESENTATION, ANALYSIS AND DISCUSSION**

**4.1 Overview**

This chapter presents data collected as per the design in the previous chapter. It also presents the analysis and discussion of the findings from the research work. The presentation, analysis and discussion are organized according to the research questions narrated in chapter one.

* 1. **Conduction of Practical Work as a Day to Day activity of the Physics**

 **Teachers**

This objective was meant to measure the extent to which the trained physics teachers are practicing what they had been trained on. In the project`s log frame, the training physics teachers on practical work should lead to having an army of trained teachers as an output (or the immediate result) of the project and the actual doing of the practical work as its outcome. IFRC (2011), defines outcomes as the primary results that lead to the achievement of the goal (most commonly in terms of the knowledge, attitudes or practices of the target group).

According to IFRC (2011), the effectiveness of an operation is measured by the extent its outputs have led to the intended outcomes. To measure this effectiveness, the study asked heads of schools, heads of physics department, physics teachers and students about the frequency of laboratory work before and after training. This question was directed to all the 15 schools of the sample and the results are given according to categories of respondents.

**4.2.1 Head of School Assessment of Actual Practice of Laboratory Work**

The head of school may not have all the details in regard to laboratory work but as the chief executive of the school she/he has a general knowledge of what is happening in every building under her/his care. Regarding the practical work done by the physics teachers, the head was asked if any of the teachers consult her/him on issues concerned with laboratory work and on the regularity of the use of the laboratory. Results to these questions are given on table 4.1 below. According to this table, 13 Heads of school (93%) agreed that the Physics teachers were consulting them on laboratory work.

**Table 4.1: Heads of School Assessment of Teachers’ Performance**

|  |  |
| --- | --- |
| Assessment Area | HoS Assessment Score |
| Good/V. Good | Average /Somehow | Unsatisfactory |
| Freq | % | Freq | % | Freq | % |
| Attendance to class | 11 | 85 | 2 | 15 | - | - |
| Regularity in the use of laboratories | 11 | 79 | 2 | 14 | 1 | 7 |
| Consultation with the head on practical work issues | 13 | 93 | 1 | 7 | - | - |
| Demonstration of knowledge and skills | 14 | 100 | - | - | - | - |

**Source:** Field data (2017)

All the 14 heads admitted through a question on the questionnaire that their physics teachers demonstrate knowledge and skills in handling practical work. On the regularity of the use of the laboratory, 11 (79%) said Physics teachers were using the laboratory regularly, 02 (14%) only somehow and 01 (7%) scarcely used. Of these 14 heads of schools, only 2 (14%) are themselves physics teachers. It appears that heads of school are comfortable with the regularity of the use of the laboratory. In the interview question, these heads of school admitted that the frequency to doing laboratory work has increased in recent years. The table 4.1 shows how heads of schools assessed their teachers on issues of attendance to class, use of Labs, consulting the head and their knowledge and skills. Heads of School commented further that:

1. SEDP training has empowered teachers to do practical work with confidence,
2. SEDP training has changed the attitudes of teachers and students towards basic science subjects and made the subject of physics interesting
3. SEDP training has helped teachers to use competence-based teaching methods and prepare standard examinations.
4. It has motivated teachers and enabled them to improvise for effective teaching.
	* 1. **The Heads of Physics Department Assessment of the Actual Practice of**

 **Laboratory Work**

The head of department is expected to be closer to her/his teachers than the head of schools. Many a time, it is her/him who arranges the timetable for the use of laboratories and receives the laboratory requirements from teachers. To gauge the assessment of the head of department on actual laboratory practice, the following issues or questions were asked through a questionnaire and interview:

1. The competence of the physics teachers on laboratory work
2. The actual organization of laboratory work at school by the trained teachers,
3. The average number of experiments done by a class per month,
4. The main reasons why teachers would not do practical work.

The table 4.2 shows how heads of department assessed their teachers on issues of competence in conducting laboratory work, actual doing of practicals and their attitudes to using the skills they have. 13 Heads of department (HOD) participated.

**Table 4.2: Heads of Department Assessment of Teachers Performance**

|  |  |
| --- | --- |
|  **ASSESSMENT AREA** | **HOD ASSESSMENT SCORE** |
| Very satisfactorily | JUST SATISFACTORY | POOR |
| FREQUENCY |  % | FREQUENCY | % | FREQUENCY | % |
| Competence in conducting laboratory work |  13 |  100 |  - |  - |  - |  - |
| Actual organization of laboratory work |  11 |  85 |  2 |  15 |  - |  - |
| Apparent attitude to doing laboratory work |  7 |  64 |  3 |  27 |  1 |  9 |

**Source:** Field work (2017)

According to table 4.2 above, all the 13 heads of department (100%) who participated in assessing their teachers agreed that these teachers are competent in laboratory work. The questionnaire did not spell out what exactly is expected to demonstrate this competency, but some of the heads of department when interviewed said that the teachers can arrange for their students to successfully perform planned experiments. Eleven of the 13 heads of department (85%) added that their teachers generally organize practical work for their students. Only 15% of the heads said that the teachers seldom organized practical work. This means that most schools carry out practical work.

It was established from most heads that four average practicals are done in the laboratory per month. Regarding the attitude of the trained teachers towards implementing their training, the table 4.2 shows that seven of the 11 heads of department (64%) said that these teachers have more skills in practical work and they actually do the practicals with their students while three (27%) said the teachers have the skills but they do not do practical work often.

Hence, the heads of the department are saying that generally the teachers at their school conduct practical work regularly and that this is a result of the SEDP Training. However, the heads of departments said, teachers sometimes fail to do practical work because of the following reasons:

1. Laboratories are not enough for the number of science classes in the school. (7 responses out of 11, or 64%)
2. Lack of enough apparatus and materials (11 responses, 100%)
3. Teachers are overloaded with many classes and students to teach (11 responses, 100%)
4. There are no laboratory technicians to arrange for practicals (8 responses, 73%)

Most heads of school and heads of department agreed that their teachers practice what they had been trained on through SEDP (See analysis in 4.2). This was very true in some schools but we should have expected some reservation in other schools for the frequency of doing practicals in those schools was very low. Some responses indicated management issues influenced the frequency of doing practical work. There was also indication that some of the teachers had no confidence in organizing and conducting practical work.

The response on frequencies of practical work was also influenced by their understanding of practical work. Practical work may be defined as performance of experiments or practical exercises with science apparatus in a laboratory setting. (Woolnough,1991). With this definition in the mind, it is possible that respondents to this item wanted to see an elaborative experiment where students worked individually (or in pairs) on science apparatus. Millar, Le Marechal and Tiberghien (1999), in Mafumiko (2006) offered a broader definition of practical work to include all those teaching and learning activities in science that involve students at some point in handling or observing the objects they are studying. It is possible that most of the respondents did not have this definition in mind.

**4.2.3 Physics Teachers Assessment of the Actual Practice of Laboratory Work**

Questionnaires were given to all physics teachers who were available for the exercise. The idea was for these teachers to make self-evaluation of their work at the school particularly with regard to practical work. 25 teachers filled in the questionnaire. Of these, ten were diploma holders and 15 degree holders. five of the teachers had done the Alternative to Practical paper at CSEE that is they did not do actual practical exams themselves at that stage of their education. (See Appendix H)

This factor could influence their readiness for practical work. It was found out that of the 25 teachers who responded, 13 of them (52%) had not attended any of the SEDP training on laboratory work. In regard to actual doing of practical work, teachers were asked the questions hereunder:

1. If they enjoy teaching (that is whether they are comfortable with their work)
2. How confident they are in practical work as a result of the SEDP training,
3. The number of experiments (practical work) they do with their students per month,
4. Their general assessment of the SEDP training

Answering the core question of regularity of practical work for the SEDP teachers, ten teachers out of 11 (91%) said that they do at least two experiments per month with their students. Eight of these teachers (73%) said that they have more confidence in practical work now. Looking back at the training they attended, nine teachers (82%) said they have more skills in practical work, seven out of eight (88%) are able to organize students for practical work, and eight out of ten (80%) enjoy physics. Even those who are not SEDP trainees joined their fellow in agreeing that they enjoy teaching (17 out of 21 teachers, which is 81%), though they also confessed that teaching physics is too demanding (14/16 teachers which is 87%). Hence, Physics teachers who were asked about the actual practice of laboratory work in their schools have said that practical work is now being done and SEDP training has contributed to it.

**4.2.4 Assessment of Students on actual Practice of Laboratory Work**

Students as recipients of services given by their teachers are also in a good position to tell the facts surrounding the practice of laboratory work in their schools. Through a questionnaire students were asked to speak about the frequency at which they were doing laboratory work. The following questions were asked:

1. Number of practical per week, per month, per term.
2. Number of expected experiments which have been done,
3. Use of locally available materials in their practical work.

As Kibga (2004) noted, there is a tendency to do more practical work with the examination class. Hence the responses were categorized as per form: Form 4s, Form 3s, for all schools and Form 2s in the government–built secondary schools. It was anticipated that, where teachers are determined to do practical work, they will use even locally available materials to fulfill their plans, hence the inclusion of this item to see teachers’ efforts to do practical work.

Findings from 15 schools of the sample whereby over 800 students participated established that only one school did practical work every week for their Form 4s and Form 3s. Furthermore, in seven schools (47%), reported that they had two practicals per month for Form 4s but it was not the case for Form 3. Based on the findings, 48% of the Form 4s had practical work in their schools at least twice per month, whereas for Form 3s it was 20% only. (see appendix J) The possible interpretation of these results is that students do not keep a record (even in their minds) of the times they are in a laboratory working with the apparatus and materials therein.

It is also possible that some students did not read the given item properly and so they ticked off an option without knowing what it implied. With these results however, we can still say that there is practical work in schools but not that often. As observed in table 4.3, even Form 4s, its only half of the students who agree to do practical work twice per month. It can also be said that the quality of the practical work aimed at improved students performance was done.

**Table 4.3: Students Assessment of Frequency of Practical Work**

|  |  |  |
| --- | --- | --- |
|  |  **FORM 4**  |  **FORM 3** |
|  A |  D |  % A |  A |  D |  % A |
| Doing practical work every week | 106 |  355 |  23 |  27 |  313 |  8 |
| Doing practical work at most twice per month |  226 |  244 |  48 |  67 |  271 |  20 |

Key: A= Agreed, D= Disagree

**Source:** Field Work (2017)

**4.3 Students Evaluation of the Place of Practical Work Situation in their School**

The student is a primary stakeholder in the teaching and learning equation. She/he holds the key to what and how much she/he will learn. Because of the student’s centrality in the learning process, this study involved her/him in the evaluation exercise. It was expected that the student will give their views which will help to determine how useful the physics teachers training has been. Students’ views focused on the following areas:

1. The adequacy of laboratories and how well-organized and equipped they are
2. The frequency of doing practical work,
3. The performance of their teachers and
4. What benefits they have or expect to receive from practical work.

Answers to these issues were meant to contribute to the evaluation of the SEDP training of physics teachers on practical work. But also this would answer monitoring questions such as how beneficiaries feel about the intervention. The question of output lead to achievement of the outcomes (IFRC 2011). Indeed, students can be used to track effects and impacts of the teachers training project.

**4.3.1 The Adequacy of Laboratories and how Organized and Equipped they are**

Students were asked three questions with a view to assess the adequacy and quality of their laboratories. To distinguish the situation of the laboratories from government-built schools and the relatively new community-built school the results were arranged into two independent categories as shown hereunder:

**Table 4.4: Students Assessment of Adequacy of Laboratories**

|  |  |  |
| --- | --- | --- |
| **Issue** | **Government-Built** | **Community-Built** |
| A | D | % A | A | D | % A |
| The number of Labs in the school is enough | 121 | 61 | 68 | 242 | 121 | 67 |
| Our Lab is well-organized | 104 | 89 | 54 | 104 | 125 | 45 |
| Our Lab is well-equipped | 77 | 102 | 43 | 83 | 142 | 37 |

Key: A= Agree, D= Disagree and % A= the percentage of those who agreed

**Source:** Field Data (2017)

The results on table 4.4 show that two-thirds (67%) of the students in both the government-built and the community-built schools are happy with the number of laboratories in place. This high percentage raises some questions on students` understanding of adequacy of labs. It is possible that these students have been able to do the work that was planned to be done in the laboratory without excuses as admitted through interviews and open ended questionnaire questions that laboratories were overcrowded. The remaining one third of the students may have had different interpretation of the word adequacy.

With regard to organization of the laboratories it is apparent that many laboratories are not well-organized. The table 4.4 shows 54% of students in the sampled government-built schools agreed that their laboratories are well-organized, unlike 45% in the community-built schools. These results also indicate that organization of school laboratories is more of a problem in community-built schools than it is in government-built schools.

Laboratory equipment still lack in schools and more so in the community-built schools where only 37% of the students agreed that their laboratories are well-equipped. That means two in three students in community-built schools see that their physics laboratories are not well-equipped. In general, students in the sampled schools find that the number of laboratories is enough for the required (or practiced) practical work, but are not adequately organized or equipped.

**4.3.2 The Performance of Teachers in the Selected Schools**

There is no doubt that the teacher plays a key role in the learning process. Maganga (2013) claims that teachers should be able to teach their students to enable them to practically do what they are taught. This study wanted to know students assessment on their teacher’s performance in practical work. Questions asked were on the following areas:

1. The doing of demonstrations using laboratory apparatus even in the normal classrooms,
2. Demonstration of knowledge and skills in the conduction of laboratory work,
3. If and how well does the teacher guide students in doing class experiments,
4. The use of locally-available materials in practical work when the known laboratory apparatus cannot be found.

The results of these questions were recorded separately for government-built schools and community-built schools.

**Table 4.5: Students Assessment of the Performance of their Teachers in the**

**Selected Schools**

|  |  |  |
| --- | --- | --- |
| **ISSUE** | **G`MENT-BUILT** | **COMMUNITY-****BUILT** |
| A | D | % A | A | D | % A |
| Our teacher makes practical demonstrations even in the classroom | 127 | 63 | 67 | 189 | 94 | 67 |
| Our teacher is competent in conducting practicals | 130 | 54 | 71 | 210 | 62 | 77 |
| Our teacher guides us well in doing practical work | 157 | 45 | 78 | 253 | 42 | 86 |
| Our teacher sometimes uses locally-available materials in doing practical work | 124 | 72 | 63 | 149 | 115 | 56 |

Key: A = Agree, D = Disagree, % A = The percentage of those who agreed

**Source:** Field Data (2017)

The results on Table 4.5 shows great appreciation on what teachers are doing, whereby 67% of students in both government-built and community-built schools agree that their teachers hold practical demonstrations in the classrooms. About three quarters of the students said that their teachers have the knowledge and skills to conduct practical work. There is also good use of locally-available materials in practical work at 63% and 56% respectively for government-built and community-built schools. Thus, the general assessment of the students on their teachers work is that they are competent in the practical work and they are doing their work satisfactorily.

**4.3.3 Benefits Students have Received from Practical Work**

Ali et al (2010) in Michael (2015) claimed that problem solving methods of teaching and learning exposed students to take responsibility of their own with the teachers acting as a facilitator. This study wished to obtain students assessment on the benefits from teachers’ fulfillment of their responsibilities as summarized hereunder:

1. If the students are enjoying the practical work they are doing,
2. If students are able to link what they do in the laboratory with what is taught in the classroom,
3. What is the place of practical work regularly done at school in the final exit examination, the CSEE.

Results from Form 4 students selected from 3 government-built schools and 4 community-built schools are given in the table 4.6:

**Table 4.6: Students Assessment of Practical Work Benefits**

|  |  |  |  |
| --- | --- | --- | --- |
|  | A | D | % A |
| Most students enjoy practical sessions | 205 | 39 | 84 |
| Most students are able to link what they do in the lab with what is taught in the classroom | 158 | 88 | 64 |
| Doing practicals helps to perform better in CSEE | 247 | 4 | 98 |

Key: A = Agree, D = Disagree, %A = Percentage of those who agree

**Source:** Field data, (2017)

Table 4.6 reveals that 84% of students enjoy practical and almost all agreed that doing practicals at school will help them to perform better at CSEE. This is in the line with. Kingaru (2014), who concludes that science performance, can be improved if students are involved in practical lessons. Ausubel (1968) expounds that the laboratory gives student spirit and method of science. Ndabi and Idea (1996) in Kibga (2004), state that the lack of practical exercises was among factors that contributed to poor performance in CSEE for physics held in 1992. The student is so sure that regular practical work improves their performance in the subject in other words they have seen it working.

The students also agree that practical work is complementary to what is taught in the classroom. If a student can link what she/he has discovered through practicals and the theory work done in the classroom, she/he will have mastered the lesson-well. The project monitoring and evaluation (M&E) guide of the International Federation of Red Cross and Red Crescent, IFRC (2011) advocates involving key stakeholders as much as possible in the evaluation process. Students have been brought in because they are in a position to see the outcome of their teachers training.

All the school selected for this study indicated that they had at least one physics laboratory in line with the goal set by the government. However, interviews and observational results by the researcher show that in some schools there are no standard laboratories whereas in one of the schools it was under construction. But it is also possible that if the frequency of practical work is low, the place where to do this practical work may not be of great concern. The little in place is good enough. Findings reveal that majority of students are satisfied with their teacher’s performance in practical work. This assessment demonstrates good relationship between them and their teachers, which can be used to facilitate learning. If students accept and have confidence in their teacher, they will be ready to listen to her/him and be guided by her/him

**4.4 The Linkage between Practices of Laboratory Work and Student’s Performance**

This objective was meant to find out if there are any improvements in the performance of students at CSEE, as an outcome of the training of teachers. Evaluation questions probes to find the effectiveness of an operation. Some of the questions in this area include if the objectives of the operation were achieved, or whether the outputs led to the intended outcomes. Ministry of Education documents, Moet (2009) give the number of science and mathematics teachers targeted for the operation to be 10,800. This means an output (among other outputs) of 2,520 physics teachers at the end of the project was expected. Evaluation questions also ask if there are any changes that the project brought, or what impact the project has caused.

This study assumes that change to the performance of students at CSEE is a result of trained teachers using the knowledge and skills gained through the training to improve their teaching and so effect students learning. Though other inputs may have contributed to the changes in performance. Studies in the impact assessment caution that changes observed in the target population may be a result of contributions from some unintended forces. (Mwisomba, 2016) The change in performance is observed at two levels: the pass rate which compares those who have scored 30% and above (grade D to A) with all those who did the exam at any of the sampled school, and also at the level of the Grade Point Average (GPA) which gives the quality of the pass.

If all the candidates scored A, the GPA will be 1.000, but if they all passed with a D, the GPA = 4.000. On the other hand if all the candidates scores F (Failed), the GPA = 5.000. Table 4.7 gives the pass rate and GPA for all selected 15 secondary schools in Ilala municipality in CSEE 2009, 2010, 2011, 2012 and 2015, 2016. (Results for the years 2013 and 2014 were left out because a different system of grading was used in those two years)

**Table 4.7: Performance in the Physics Subject for Selected Schools, CSEE 2009 – 2012, 2015 and 2016**

Key: Schools 1 – 6 are Government-Built schools and 7 – 15 are Community-Built school, GPA = Grade Point Average

**Source:** NECTA Documents (2010 - 2017)

The results as shown in table 4.6 show that the pass rates for the selected schools have been fluctuating in the years under study: they do not establish a firm growth or decline for most schools. For example Azania had pass rates which were (chronologically) 75, 76, 79, 77, 47, and 57, over the years of study. The pass rate was improving very slightly in the first three years, but went down, down again and picked up in 2016. Kisutu had a pass rate of 56, 78, 65, 83, 76, 64, rising, falling, rising again, and then falling again. Similarly Gerezani, whose first form 4 in 2010 had a trend of pass rates 46, 75, 39, 52, 37 respectively.

Likewise, the results do not establish firmly if the pass rate of the later years are better **than** those of the earlier years. The pass rates in 2016 are lower than that of 2015 for 8 of the 15 schools (53%) with some of the changes being significant (for example Mnazi Mmoja dropped from 72% in 2015 to 37% in 2016). However whereas the pass rates of Jangwani for the last two years (2015 and 2016) are lower than those of the recorded previous four years (2009 – 2016), pass rate of Pugu are better in the last two years than the other four years. Of the selected 15 schools in the study, seven (47%) have shown some improvement in the pass rates (taking the average pass rate for the last two years, 2015 and 2016 and comparing it with the first two years of 2009 and 2010) the remaining 8 schools had the average of their pass rate lower in the last two years.There are also other significant issues to be noticed from these results:

1. Though in some cases the pass rate is high, the GPA which shows the quality of the pass is low. Take Zanaki whose pass rate was 81% in 2016 but the corresponding GPA is 3.64. This shows that the average grade was between C and D. Dar es Salaam Secondary school had a pass rate of 88% in the same year, and a GPA of 3.73. Only once in the recorded six years do the results show a GPA of less than 3. This was in 2016 where Pugu had a pass rate of 96% and GPA of 2.94 which indicates an average of grade C.
2. There are community-built secondary schools that are performing better in the physics subject than the old, government-built schools. In the six years included in the study, Dar es Salaam school had a pass rate of above 80%. Ilala the average pass rate was 75%. Kinyerezi scored a pass rate of 92% in 2015. All the three schools above are community-built. The average pass rate for BW Mkapa High School was 63% for the recorded six years of the study. Kisutu had an average of 72%, Azania 69%. Community-built schools also did well in the mock Examinations conducted in May 2017 (see table below)
3. Generally these schools (except for one) have had a pass rate in the physics subject above the national average (See table 1 in Chapter 1). 55.5 (2009), 44.6 (2010), 43.2 (2011), 42.5 (2012), 44.3 (2015). This is to say that there are schools in the country that are doing much worse and so pulling down the high pass rates of other schools. It can also be assumed that Dar es Salaam schools are generally doing better in the performance of Physics subject at CSEE than is the case with most other schools.
4. The general performance in Mock Examinations done in May 2017 shows good performance for all schools except one as shown in the table below:

**Table 4.8: Physics Mock Results for Sampled Schools: July 2017**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  Grade Scored |  |  |  |
| Name of School | A | B | C | D | F | GPA | Pass rate: % |
| Azania | 11 | 22 | 66 | 11 | 03 | 2.76 | 97.3 |
| BW Mkapa | 06 | 10 | 72 | 51 | 33 | 3.58 | 80.8 |
| Jangwani | 1 | 15 | 77 | 47 | 36 | 3.58 | 79.5 |
| Kisutu | 1 | 2 | 30 | 33 | 11 | 3.70 | 85.7 |
| Pugu | 0 | 3 | 23 | 19 | 10 | 3.70 | 81.8 |
| Zanaki | 0 | 5 | 55 | 26 | 2 | 3.28 | 97.7 |
| Dar es Salaam | 3 | 17 | 47 | 22 | 1 | 3.01 | 98.9 |
| Gerezani | 0 | 0 | 10 | 9 | 15 | 4.15 | 40.0 |
| Ilala | 0 | 8 | 18 | 19 | 3 | 3.35 | 93.7 |
| Jamhuri | 1 | 5 | 37 | 23 | 5 | 3.37 | 93.0 |
| Juhudi | 1 | 14 | 67 | 17 | 1 | 3.03 | 99.0 |
| Kinyerezi | 3 | 1 | 11 | 14 | 6 | 3.54 | 82.9 |
| Majani ya Chai | 0 | 5 | 30 | 19 | 1 | 3.29 | 98.2 |

**Source:** School files for Mock Examinations

Success in examinations is a crucial indicator that a student has benefited from a course of study. (Wiseman, (1961, Fishman, (1962), shows that teachers were trained in laboratory work so that they will do laboratory work effectively in their schools. This was expected to lead to increased interest in the physics subject coupled with actual doing of practical work in schools increased, resulting in improved learning of the subject. The outcome of having more practice in practical work and improved learning of the subject will be better performance in both the theory and practical paper at the final examination. Scholars have linked science performance with laboratory (practical) work for many year

According to (Kingaru, 2014, Alebiasu and Ifanuyiwa, 2008, Oludipe, 2014), if the performance at CSEE as recorded in this study has not shown improvements, it could be an indication that there is something was not right in the practice of laboratory work in the said schools. However, the results from this study alone cannot make accurate conclusions on the issue. In the absence of conclusive evidence from the study, further probing into the issue is required.

* 1. **Hindrances to Actual Implementation of Practical Work**

This objective was meant to find out reasons behind any under-achievements in the implementation of practical work in the selected schools. Focus was put on the following areas:

1. Adequacy of the SEDP training itself. Can we say that the training gave an output of the expected standard?
2. Adequacy and quality of infrastructures and resources. Do we have enough labs? How are they organized? How about the human resources required?
3. The trained teacher readiness to work

Head of school, head of physics department, physics teachers and students were involved in this assessment. Questionnaires, interviews and observations were used as instruments to collect the required data.

**4.5.1 Adequacy of the SEDP Training**

The assumption made was, if the training met its objectives the trained teachers will have the required knowledge and skills to conduct practical work and they will put that to good use at their school. 14 heads of school were asked if their physics teachers are demonstrating knowledge and skills in handling practical work and all (100%) said yes. Among these heads, two are physics teachers themselves. However only 8 of the 14 (57%) agreed that the training the physics teachers received under SEDP had been put to good use in the school.

When heads of physics department in 11 of the 14 selected schools were asked to assess the teachers’ skills in practical work as a result of the SEDP training, 7 of them, (64%) said that the teachers have the required skills and they are doing the expected work. 8 out of 11 Teachers (73%) themselves said that they are now more confident in organizing practical work for their students. 71% of the 130 students who were asked to assess their teachers’ competence in handling practical work agreed that teachers are competent. The results show that SEDP training imparted to the teachers the necessary knowledge and skills to conduct practical work in their schools. Teachers’ skills for the work are not a hindrance to the actual implementation of the practical work.

**4.5.2 Adequacy and Quality of the Infrastructures**

Heads of school assessed this area by giving the number of laboratories in their school and also the number of physics teachers and their qualifications. (See Appendix G) 11 of the 14 schools (78.6) who gave this information had one physics laboratory for the school. Three schools (21.4%) had two physics laboratories. The 14 schools had a total of 39 teachers, 26 of them (67%) with degrees. The minimum number of streams taking physics in these schools was eight, but some schools had up to 18 streams taking physics at the O-level.

The heads of physics departments who were expected to be more eloquent on the issue of practical work made the following observations; seven out of 13 (53.8%) observed that laboratories are not enough for the number of classes in the school. 11 out of 13 (84.6%) observed that apparatus and materials were not enough for the kind and number of experiments required. In regard to availability of required human resources, 8 (61.5%) wished they had a laboratory technician at the school to handle most of the laboratory work. 11 heads (84.6%) pointed out that teachers were overloaded with many classes to teach. Of the 25 teachers who responded to the issues of infrastructures and resources, 12 (48%) said they could have done more practical work but apparatus and materials limited them. 11 teachers (44%) said they will need the assistance of a laboratory technician to do more practical work.

Of the 190 students in government-built schools who responded on the issue of adequacy and quality of infrastructures, 61 (32%) were of the opinion that laboratories were not enough. 102 (56%) also said that their laboratory were not well-equipped. In the community-built schools 121 out of 363 students (33%) also said the number of laboratories is not enough and 63%, observed that they did not have enough equipment/apparatus for practical work. The students also noted that there were no enough physics teachers both in the government-built and the community-built schools

**4.5.3 Readiness of the Trained Teachers to Carry Out the Required Practical Work**

Readiness could mean different things to different people. In this context, the head of school was asked to judge the teachers readiness through the following:

1. Her/his attendance to class. Does he/she need to be pushed every time!
2. Her/his willingness to consult the head to assist her achieve her goals in practical work,
3. Her/his availability to students to assist them do practical work.

According to appendix I, 11 out of 13, (84.6%) heads of school commended their teachers for good attendance to class (more than 70% of the periods allocated them on the timetable). 13 out of 14 (92.8%) admitted that their teachers come to them to seek assistance, an indication that they want to achieve what they have planned. 11 out of 13 (84.6%) saw their teachers helping their students prepare well for examinations. On whether they enjoy teaching, 17 out of 21 (81%) said yes. One teacher (4.8%) said no, and three (14.2%) said somehow. There were three teachers who responded that their students will understand them even without practical work.

Heads of schools, teachers and students gave information through questionnaires and interviews which pointed out some of the possible hindrances to the actual implementation of practical work. As he analysis was done in section 4.5 above the adequacy and quality of infrastructure was leading as a hindrance to practicing practical work. Teachers and students were of the opinion that more laboratories were needed to meet the desired standard. Most times the laboratories were over crowded during practical sessions. It was hard for teachers to attend to the learning needs of their students.

Coupled to the problem of space, most laboratories did not have enough of the required apparatus and materials. You could see this shortage immediately you went into the laboratory: it looked empty. With just one or two cupboards to keep apparatus, not much could have been hidden. In some schools there were a few apparatus kept in the office of the head of school. It was said that they were kept there for their safety. It was argued that it is easy for the apparatus to disappear or be destroyed if they are kept in the laboratory.

Lack of adequate number (and type) of apparatus meant large groups of students when they were doing practical work. This in turn hindered students from proper hands- on experience and gave room for the disinterested student not to participate. Students were asked if their teachers were sometimes using locally – available materials to continue with their practical work. More than 50% of students agreed that their teachers do use locally – available materials in practical work. Using locally – available materials means the teacher is being proactive and innovative. It means that the teachers are ready to work and they would go round the obstacles likely to draw them back from achieving their goal. This would indicate that their attitude to practicing practical work at school is not a hindrance to actual implementation of practical work. They have positive attitude towards this work.

Most schools have found out that the four physics periods per week are not enough to do practical work comfortably. A laboratory session will need at least 2 double periods. In the open ended questions asked in the questionnaire to students, there are several students who pointed out that the school time table is a challenge to doing practical work after class hours. This is a challenge to both teacher and student but some schools have agreed to do practical work after the official class hours on the time table. The result of this is that many times the teacher is not available and many students also miss these sessions. Hence we can conclude that laboratory work is not carried out in schools as required because of the in adequacy and quality of the laboratories. Also the availability of resources, apparatus/ materials and administrative challenges like fitting laboratory work in the timetable contribute to practical work not being done.

**CHAPTER FIVE**

**5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS**

**5.1 Overview**

**5.1 Overview**

This chapter presents the summary of the major findings and the conclusion derived from the presented findings. The chapter also presents some recommendations from the study including recommendations for further study.

**5.2 Summary of major findings**

This study aimed at assessing the extent to which the SEDP science teachers training has been beneficial to the trained teachers and to their students. The study wanted to know the regularity of doing practical work and how skillful and confident the teachers are. The major findings from this can be summarized as

1. Practical work is being done in most schools. The frequency of doing practical work is not as high as desirable for different reasons (highlighted in part iv below). On the average, there are two sessions of laboratory work per month. Classes other than the Form 4 are having laboratory work less frequently. Heads of school seem to be satisfied with this frequency of practical work and happy with the practical skills of their teachers.
2. Students are happy with the competence of their teachers on practical work. They also think the number of laboratories in their school is adequate for the amount of practical work being practiced but they are not too happy with how the laboratories are organized and the amount of apparati and materials in the laboratory. Students have also shown that they do not do practical work as often as required.
3. Performance in Physics subject at CSEE has not improved significantly. Though the pass rate for the selected schools is high, the quality of the passes as seen from the GPA is still low. The performance at Mock Examinations done in May 2017 is very promising. It was also found that there are many relatively new, community-built schools who are performing better than the old government-built schools.
4. Ill-equipped laboratories, lack of apparatus and materials are leading hindrances to practical work in schools. It was also found that there are very few physics teachers in schools, which forces schools to overcrowd students into few classes. Big classes de-motivate teachers from doing practical work. There are also challenges on fitting laboratory work in the available periods on the school time table.

**5.3 Conclusion**

On the basis of these findings it can be concluded that:

1. The training project has imparted the necessary skills to the teachers to conduct practical work successfully but for different reasons teachers are not conducting enough practical work to make a significant contribution in the learning process of their students.
2. Students generally appreciate the work of their teachers. They have rated them positively in many aspects. This apparent good relationship between teachers and students can be used for the advantage of both. The findings also pointed to the fact that students are aware of the practical work situation at their schools and hence they can give good information on monitoring of the teachers work.
3. Though scholars agree that practical work improves performance in examinations, this study could not establish how much of the performance in the selected years is a result of practical work done at school. This is not to say that the training has had no positive effect, because there are many factors that will need to be looked into to come to that conclusion. Each year has different examinations, different students and this may lead to different results pattern. However mock results in May 2017 show big improvements in the performance of the subject for almost all schools. Further research is needed to make accurate conclusions.
4. With regard to hindrances to actual implementation of practical work in schools, the study findings lead to conclusion that availability of laboratory apparatus and materials is still posing a big hiccup in the teaching and learning of basic science subjects especially physics. Students noted the absence of relevant apparatus for experiments.. Teachers lamented that they could have done more if laboratory apparatus was available. Hence more laboratories are needed and they should be well-equipped.

**5.4 Recommendations**

In the light of the findings and conclusion drawn thereon, it is recommended as stated hereunder:

1. Physics in-service training should continue targeting all teachers, having established the substantial achievement from the SEDP Teachers In-Service Training. However, emphasis should be laid on how the fruits of the training can be sustained.
2. M & E practices should be strengthened at school level to assure regular and effective practical work. Doing of practical work should be closely monitored by Head of Department and Head of school through log books or report forms filled regularly to show what practical work was done, when, where, with what apparatus and materials. Students should have exercise books for practicals which are periodically checked by some school authority.
3. There is urgent need to ensure scarcity of apparatus and materials is fully addressed as well as mobilization of available resources to clear existing gaps. It is also recommended that available apparatus and material be kept safely and neatly in the laboratories and be used regularly.
4. Discussions and even debates should be encouraged at school and inter-school on the value of practical work in the performance of physics at the final examinations. If well-arranged this will stimulate students morale to do practical work efficiently and effectively. Past examination results should be used to motivate students to do better.

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**APPENDICIES**

**APPENDIX A: Questionnaire to Heads of School**

This questionnaire is to seek from the head of school some general information about the school and how friendly it is to the teaching of physics with practicals. The head of school is also asked her/his views on teacher’s readiness to take practical work in physics as part of their day to day teaching. It is expected that the head of school as the overall leader will have a broader view of the issue at hand but also he/she is the key to any specific information from any member of the school. The information will be confidential.

**Part 1: Brief Profile of the School**

* 1. Name of school……………………………………….
	2. O-level only [ ] or O-and A-level [ ]
	3. Number of science streams: Form 4 [ ]

 Form 3 [ ]

 Form 2 [ ]

* 1. Science combination at A-level where the School has A-level science combinations.(tick v)

 PCM [ ] PCB [ ] PGM [ ] CBA [ ] CBN [ ] CBG [ ]

* 1. Total number of Laboratories [ ]
	2. Number of laboratories for physics subject [ ]
	3. Number of physics teachers [ ]
	4. Qualifications of physics teachers

 Number of degree holders [ ]

 Number of diploma holders [ ]

 Others?............................................

* 1. Is the head of school a physics teacher? (tick v)

Yes [ ] No [ ]

**Part 2: Head’s Assessment of Teacher Performance**

2.1 Attendance to classroom of the physics teachers. (tick) [ ]

 Attendance is good (More than 70% of the period [ ]

 Attendance is average (Between 40%-70% of the period) [ ]

 Attendance is poor (Below 40%) [ ]

2.2 Physics laboratory is being used by teachers (v)

 Regularly [ ]

 Somehow [ ]

 Scarcely
2.3 Physics teacher demonstrate knowledge and skills in handling practical work.

 Yes [ ] Somehow [ ] Unsatisfactory [ ]

2.4 There are complaints by Physics teacher which seem to draw them back from doing practical work.

 Yes [ ] No [ ]

**Part 3: Head’s Assessment of Students Performance**

3.1 General assessment of student’s performance in physics at CSEE is

 Average [ ] below average [ ] above average [ ]

* 1. Student could have performed better in physics if they had done more practical work

 Yes [ ] don’t know [ ]

The training that Physics teachers have had under SEDP has been put to good use in my school (tick v)

 Yes [ ] Somehow [ ] No [ ]

* 1. Give some comments with regard to the effect of the SEDP Training on your physics teachers ………………………………………………………………………………..

……………………………………………………………………………..

**APPENDIX B: Questionnaire to heads of Physics Department**

This questionnaire seeks to get from the head of department information on the actual happening in the physics laboratory. The department head is assumed to be closer to the teachers and so she/he knows better the actual laboratory work being implemented at school. Honest answers will make the whole exercise more useful to many stakeholders. Your responses will remain confidential

Name of School……………………………………………

**Part 1: Observing the Physics Teacher at Work in the Laboratory**

* 1. How do you assess the competence in laboratory work of the physics teachers under your leadership?(please tick V)

Satisfactorily competent

Unsatisfactory

 In between…………………………………………………………..

1.2 Do teachers under you generally organize practicals for their students (tick v) Yes they do

Only seldom

No, they don’t

* 1. What is the average number of experiments a class is doing Per month? Per term
	2. What would be the main reasons for teachers not to conduct practical lesson! (tick as many)
1. Laboratories are not enough for the number of classes in the school
2. Lack of enough or/and appropriate apparatus and material
3. There are no laboratory technicians to arrange for practical’s
4. Teachers are overloaded with many classes to teach
5. Teachers draw back from practical work because they are not competent enough
6. Teachers are just not ready or willing to conduct practical
7. Teachers not confident on their capability to organize practicals
	1. What would you say of teachers who have received practical training under SEDP? (tick v)
8. They have more skills in practical work and they are conducting experiments for their students
9. They have skills but they don’t often do experiments with their students
10. Many of them are not good enough

1.6 Any further comment……………………………………………………

 ……………………………………………………………………….

**Part 2: Assessing Students**

* 1. Students show satisfaction with how their teachers are teaching them yes [ ] no [ ] somehow [ ]
	2. Students are generally not careful enough careless when they are in the laboratories

 Yes [ ] No [ ] Somehow [ ]

2.3 Students are enthusiastic and a source of encouragement to their teachers when it comes to doing/organizing practical classes Yes [ ] somehow [ ]

**Part 3: Examination Results**

* 1. Please give a summary of physics results for your schools at CSEE in the table below;

|  |  |  |
| --- | --- | --- |
| Year  | no. of students (physics) | Scores |
|  A | B | C | D | F | GPA | %PASS  |
| 2015 |  |  |  |  |  |  |  |  |
| 2016 |  |  |  |  |  |  |  |  |
| Mock2017 |  |  |  |  |  |  |  |  |

3.2 How, do you think, these results can be improved?

………………………………………………………………………………

……………………………………………………………………………………..……………………………………………………………………………………..……………………………………………………………………

**APPENDIX C: Questionnaire for Physics Teachers**

This Questionnaire is for collecting information from Physics Teachers on how they are including practical work as part of their teaching. The aim is to see the frequency of actual practical’s being done and the ‘comfort’ with which teachers are doing the practicals. Please be honest in your responses. They will be kept confidential. True and honest answers will make the results of the study more valid and so more useful.

Name of School…………………………………………..

**Part 1: Teachers Profile**

1.1 Academic Qualification; Diploma [ ], Degree [ ]

1.2 Experience in the teaching work

 Less than 3 years [ ]

 Between 3 and 8 years [ ]

 Above 8 years [ ]

1.3 How long have you been teaching in this school ……………………..

1.4 How many other schools have you taught?

 Only here [ ] Two other schools [ ] More than 2 [ ]

1.5 In-Service Training attendance;

 Have not attended even once [ ]

 Have attended only one session of training [ ]

 Have attended two sessions of training [ ]

 Have attended more than two sessions [ ]

**Part 2: Own Assessment of the Teaching Work**

2.1 Having attended the In-Service Teacher Training organized under SEDP, and others (tick √)

* I now have more confidence in doing practicals [ ]
* I still do not feel confident in organizing practical work for my students [ ]

2.2 Having attended the In-Service Teacher Training, now;

* I do……………experiments/demonstrations per……………
* I still cannot do even one experiment in a month [ ]

2.3 Looking back at the In-Service Training that I attended, (tick the appropriate answer)

* I now have the skills to do practical work myself;

Yes [ ], No [ ]

* I can see that it has helped me to be able to organize students for practical work; Yes [ ], No [ ]
* It has made me to enjoy physics; Yes [ ], No [ ]

2.4 Tick those only you agree with;

* I want to do more practicals but the Labs are overused [ ]
* I could have done more practicals but there is lack of apparatus and materials [ ]
* I want to do more practicals but I will need the assistance of a lab technician [ ]
* There is not much push from above to do practicals [ ]
* My students will understand me even without practicals [ ]
	1. Give a statement on the relevance/effectiveness or impact of the In-Service Training you attended………………………………………………………

…………………………………………………………………………

**Part 3; Teachers Assessment of the students work**

3.1 Rate the general performance of your students in the Physics Subject at CSEE (tick)

 Highly satisfactory [ ], Satisfactory [ ], Unsatisfactory [ ]

3.2 How do you think doing practicals regularly would affect performance of the subject at CSEE?

 Will bring big improvement [ ]

Will bring small improvement [ ]

Do not know [ ]

3.3 What are your strategies to improve performance of your class in the Physics Subject?

………………………………………………………………………………

………………………………………………………………………………

**APPENDIX D: Questionnaire for Students**

This questionnaire is aimed at getting students feelings and assessment of the teaching and learning situation of the Physics subject at their school and particularly practical work situation. By filling in this questionnaire honestly, you will have played a part in improving the teaching and learning of the subject.

**Part 1: General Information**

* 1. Name of school………………………………..
	2. Your Form/Class …………………..

**Part 2: Student’s Assessment of the Teaching and Learning environment at school**

Put a tick ( ) in the appropriate column of your answer to the given statement. You have three options: Agree (A), Disagree (D), Not decided (N)

|  |  |  |  |
| --- | --- | --- | --- |
|  | A | D | N |
| Our Laboratory is well organized |  |  |  |
| Our Physics Laboratory is well- equipped |  |  |  |
| We do practicals once every week |  |  |  |
| We do practicals at most twice every month |  |  |  |
| We do practicals on the average less than five times per term |  |  |  |
| Our teacher makes some practical demonstrations even in the classroom |  |  |  |
| Our teacher is competent in conducting practicals |  |  |  |
| Our teacher sometimes uses locally available materials to do practical work |  |  |  |
| Our teachers sometimes team up to arrange practicals for students |  |  |  |
| Most students can handle well Laboratory apparatus |  |  |  |
| Students learn better through practical work  |  |  |  |
| Most students are able to link what we do in the Lab with what is taught in the classroom |  |  |  |
| Doing practicals helps students to perform better at CSEE |  |  |  |

**Part 3: General Comments**

3.1 Give a general comment on how the school is handling the issue of practical work for

 Students

…………………………………………………………………………………………

…………………………………………………………………………………………

3.2 Give a general comment on how students appreciate the opportunity to do physics practical

 …………………………………………………………………………………………

**APPENDIX E: Interview Guiding Questions to the Head of School**

 (Almost the same questions were directed to head of department)

1. Do you have Physics Teachers who have been trained under the SEDP-Organized In-Service Education and Training for Science Teachers?
2. Can you see any changes in their teaching? Do they show any significant improvement in the way they carry out their teaching work?
3. How regular and how often are Physics teachers doing practical work? What kind of practical work do they do?
4. How would you describe your science/physics laboratories especially in terms of its adequacy for carrying out laboratory work?
5. Do you think the performance in Physics at CSEE has been affected by the way practical work in the subject is being carried out?
6. Are your students reporting of how their teachers are being serious (or not serious) on practical work?

 .

**APPENDIX F: Observational Areas**

1. The laboratory:
* Its size (is it standard?!)
* The benches: (are they standard, how many students can work on them at one time)
* How are the apparatus and laboratory materials kept?
* Are there side cupboards to store apparatus?
* Cleanliness: (is the ‘room’ kept clean? Are apparatus well-arranged)
* Is the laboratory being used? Is it full of dust and cobwebs?
1. Students Practical Exercise book:
* Do they have one?
* How many practicals have been recorded?
* Do they follow standard record keeping?

**APPENDIX G: General Information on Sampled Schools**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name of School |  School Level | Total no. of Labs | Physics Laboratories | Physics Teachers Qualifications |
|  |  O-level only | O & A-level |  |  | Deg | Dipl. | Total |
| Azania |  |  | 6 | 2 | 3 | 1 | 4 |
| BW Mkapa |  |  | 6 | 2 | 3 | 0 | 3 |
| Jangwani |  |  | 4 | 1 | 3 | 1 | 4 |
| Kisutu |  |  | 3 | 1 | 2 | 0 | 2 |
| Pugu |  |  | 5 | 2 | 5 | 1 | 6 |
| Zanaki |  |  | 3 | 1 | 0 | 2 | 2 |
| Dar es Salaam |  |  | 3 | 1 | 1 | 1 | 2 |
| Gerezani |  |  | 2 | 1 | 2 | 2 | 3 |
| Ilala |  |  | 3 | 1 | 1 | 0 | 2 |
| Jamhuri |  |  | 3 |  | 2 | 1 | 1 |
| Juhudi |  |  | 3 | 1 | 0 | 2 | 4 |
| Kinyerezi |  |  | 3 | 1 | 1 | 0 | 1 |
| Majaniya Chai |  |  |  |  |  |  |  |
| Mchikichini |  |  | 3 | 1 | 1 | 1 | 2 |
| Mnazi Mmoja |  |  | 3 | 1 | 2 | 1 | 3 |

**APPENDIX H: General Information on Physics Teachers in the Sampled Schools**

1. Academic Qualifications: Degree holders [ 15 ] Diploma holders [ 10 ]
2. Experience in the teaching work:

 Less than 3years [ 02 ] = 8%

 Between 3 and 8 years [ 03 ] =12%

 Above 8 years [ 20 ] = 80%

1. Stay at the present school

 0 to 5 years [ 10 ], 6 – 10 years [ 5 ], Above 10 years [ 10 ]= 40%

1. Practical Examination done by these teachers:

 Number who did Alternative to Practical [ 5 ]= 20%

 Number who did actual practicals[ 20 ]= 80%

1. Attendance to In-Service Training:

 Number of teachers who have not attended even once [ 13 ] =52%

 Number who have attended more than twice [ 12 ] = 48%

1. Number of those who enjoy and are comfortable with teaching physics: [ 17 ] ( out of 21 respondents = 81%
2. Effects of SEDP Training:
3. More confidence in doing practical work [ 8 out of 11 = 72.7% ]
4. Doing at least 2 experiments per month [ 10 out of 11 =90.9%]
5. Able to organize students for practical work [ 7 out of 8 =87.5%]

**APPENDIX I: Head of School’s Assessment of Teachers Performance**

1. Attendance to class: Good (attends more than 70% of periods)

 : Average (attends 40 – 70% of periods)

 : Poor (Below 40%)

1. Use of the physics laboratory by Teachers

 : Regular [ 11 ]

 : Somehow [ 2 ]

1. Teachers consult HOS on issues of practical work

 : Regularly [ 13 ]

 : Rarely [ 1 ]

1. Physics Teachers demonstrating knowledge and skills in handling Practical work

 : Yes [ 14 ] Somehow [ 0 ]

1. There are no complaints from Physics Teachers which draw them back from doing practical work: Yes [ 6 ] No [ 8 ]

**HOS assessment of Effect of SEDP Training on Physics Teachers**

The following statements were common from heads of schools assessing the usefulness of the training

1. Teachers can now use competence-based teaching
2. Teachers can now prepare standard examinations/Tests
3. Teachers have more positive attitude towards the subject
4. They can now improvise T/L materials
5. They are more motivated in their work
6. Physics is now an interesting subject
7. Teachers are more confident in their work

**APPENDIX J: Table: Frequency of Laboratory work as assessed/observed by Students**

|  |  |  |  |
| --- | --- | --- | --- |
| No | Name of School | Practicals Every Week |  At Most Twice Per Month |
|  |  |  FORM 4 |  FORM 3 |  |  FORM 4 |  |  FORM 3  |
|  |  | A | D | % A | A | D | %A | A | D | %A | A | D | %A |
| 1 | Azania | 16 | 26 | 38 | 3 | 30 | 9 | 23 | 16 | 59 | 8 | 22 | 27 |
| 2 | BWMkapa | 2 | 18 | 10 | 2 | 48 | 4 | 10 | 15 | 40 | 2 | 48 | 4 |
| 3 | Jangwani | 0 | 45 | 0 | 0 | 53 | 0 | 8 | 35 | 19 | 0 | 52 | 0 |
| 4 | Kisutu | 2 | 36 | 5 | 0 | 11 | 0 | 24 | 13 | 65 | 11 | 1 | 92 |
| 5 | Pugu | 3 | 9 | 25 | 1 | 33 | 3 | 9 | 2 | 82 | 1 | 31 | 3 |
| 6 | Zanaki | 1 | 35 | 3 | 1 | 6 | 14 | 11 | 24 | 31 | 2 | 5 | 29 |
| 7 | Dar es Salaam | 6 | 27 | 18 | 7 | 28 | 20 | 20 | 13 | 61 | 18 | 18 | 50 |
| 8 | Gerezani | 3 | 22 | 12 | 0 | 14 | 0 | 5 | 20 | 20 | 9 | 6 | 60 |
| 9 | Ilala | 17 | 16 | 52 | 2 | 7 | 22 | 20 | 16 | 56 | 1 | 10 | 9 |
| 10 | Jamhuri | 5 | 38 | 12 | 0 | 11 | 0 | 11 | 26 | 30 | 2 | 10 | 17 |
| 11 | Juhudi | 1 | 33 | 3 | - | - | - | 29 | 8 | 78 | 2 | 10 | 17 |
| 12 | Kinyerezi | 4 | 22 | 15 | 1 | 10 | 9 | 19 | 8 | 70 | 3 | 4 | 43 |
| 13 | Majaniya Chai | 30 | 4 | 88 | 0 | 15 | 0 | 13 | 17 | 43 | 0 | 16 | 0 |
| 14 | Mchikichini | 5 | 23 | 18 | 0 | 25 | 0 | 14 | 18 | 44 | 1 | 23 | 4 |
| 15 | MnaziMmoja | 11 | 11 | 50 | 10 | 22 | 31 | 10 | 13 | 43 | 9 | 25 | 26 |
|  | Total | 106 | 355 | 23 | 27 | 313 | 8 | 226 | 244 | 48 | 67 | 271 | 20 |

Key: A = Agree to proposed frequency D = Disagree proposed frequency

**Source:** Field work (2017)