

**INTENSIVE PRACTICAL TEACHING AND ACADEMIC PERFORMANCE OF
BIOLOGY AT 'O' LEVEL IN SELECTED SECONDARY SCHOOLS IN KWEEN
DISTRICT**

SUSAN CHEROTWO

M16/BUW/MED/003

**A DISSERTATION SUBMITTED TO SCHOOL OF EDUCATION IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A DEGREE OF MASTER
OF EDUCATION ADMINISTRATION AND PLANNING OF UGANDA CHRISTIAN UNIVERSITY**

November, 2024

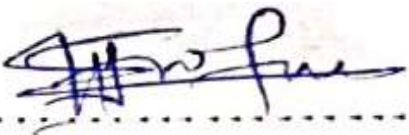


**UGANDA CHRISTIAN
UNIVERSITY**

A Centre of Excellence in the Heart of Africa

Declaration

I, Susan Cherotwo declare that this work is mine and has never been presented by any one for any award to any institution of learning.

Sign: 
.....

Date: 16/11/2024

Approval

This dissertation was written under my supervision as the University Supervisor

Sign:

A photograph of a handwritten signature in blue ink on a document. The signature is stylized and appears to be 'A. Mulyanyuma'. The document has horizontal lines and some faint text in the background.

Date: 16/11/2024

Name: Dr. Aaron Ayeta Mulyanyuma

Supervisor

Dedication

I dedicate this work to the Almighty God, to my beloved parents and my family at large

Acknowledgement

My gratitude goes to the highest God who is supplying me with knowledge in doing this study, May He take the glory, praise and honor for ever more. Amen

Special thanks go to my supervisors; Dr.Christine Okurut Ibore, Dr Okurut David and Dr. Aaron Mulyanyuma for the guidance and support, may the Almighty God bless you abundantly.

Special thanks go to my lecturers and all other lecturers of Uganda Christian University and my colleagues, Mbale University College for the information, all other support they rendered to me.

List of Acronyms

UK:	United Kingdom
CSTC:	Commons Science and Technology Committee
ORF:	Oral Reading Fluency
MoES:	Ministry of Education and Sports
TRCs:	Teacher Resource Centers
ICT:	Information Communication and Technology
CVI:	Content Validity Index
SPSS:	Statistical Package for Social Sciences

List of Tables

Table 1.1: Table showing performance in Olevel Biology	24
Table 4.1: Demographic Information of the Participants	22
Table 4.2: Distribution of Participants in Groups	23
Table 4.5: Gender Comparison for Post-test Performance Results	24
Table 4.6: Analysis of Variance of the Post-test Scores on Performance	25

List of Figures

Figure 1.1 Conceptual frameworks

Table of Contents

Declaration	i
Approval	ii
Dedication	iii
Acknowledgement	iv
List of Acronyms	v
List of Tables	vi
List of Figures	vii
Abstract.....	xi
Chapter One: Introduction	1
1.0 Background of the study	1
Table 1.1: The statistic evidence of Academic performance.....	4
1.2 Statement of the problem.....	4
1.3 The general objective of the Study	5
1.4 Specific objectives	5
1.5 Research Questions	5
1.6 Scope of the study.....	6
1.6.1 Time Scope	6
1.6.2 Content scope.....	6
1.6.3 Geographical scope	6
1.7 Significance of the study	6
1.8 Assumptions of the Study	7
1.8 Conceptual framework.....	7
Chapter Two: Literature Review.....	9
2.0 Introduction	9
2.1 Theoretical Review.....	9
2.2 Experimental lessons and academic performance in Biology.....	9

2.3 The gaps identified in the existing literature.....	10
Chapter Three: Methodology	13
3.0 Introduction	13
3.1 Research Design	13
3.2 PopulationSize.....	13
3.3 Sample size	14
3.4 Sampling procedures	14
3.4.1 Purposive Sampling	14
3.4.2 Simple random sampling	14
3.5 Data collection Methods	15
3.5.1 Survey method.....	15
3.5.2 Interview method	15
3.6 Research instruments	16
3.6.2 Questionnaire	17
3.7 Data collection procedures.....	17
3.8 Data Quality Control	18
3.8.1 Validity of Instrument.....	18
3.8.2 Reliability.....	18
3.9 Data analysis and presentation	19
3.9.1 Quantitative data analysis	19
3.9.2 Qualitative data analysis	20
3.10 Ethical considerations	20
3.11 Limitation of the Study.....	20
Chapter Four: Data Presentation, Results and Discussion	21
4.0 Introduction	21
4.1 Demographic data	21
Table 4:1: Demographic Information of the Participants	21

Table 4:2: Distribution of Participants in Groups	22
4.4 Objective Two: Gender Consideration for Post test Performance.....	23
Chapter Five: Discussion of Results.....	26
5.0 Introduction	26
Chapter Six: Summary, Conclusions and Recommendations.....	29
6.0 Introduction	29
6.1 Summary of findings.....	29
6.2 Conclusions	30
6. 3 Recommendations.....	31
6.4 Suggestion for further research.....	31
References.....	32

Abstract

The purpose of this study was to establish the effect of Biology practicals on students' performance in Biology in secondary schools in Kween district. It was guided by the following objectives; to establish whether students learning biology using intensive biology practicals perform better than those learning without, to determine the effect of frequency of Biology practicals on students' performance in Biology in Kween district, and to find out whether boys and girls exposed and those not exposed to Biology practicals differ significantly in their average score. The study adopted a quasi-experimental pretest-post-test design. This is because the performance in Biology of the group of students taught with methods integrating biology practicals (experimental group) were compared to the performance in biology of the group taught without biology practicals (control group). It used both quantitative and qualitative research approaches while focusing on schools. The targeted population was 300 from which 140 respondents were selected. Questionnaires, documentary reviews and interview guides were used to collect data. The data was analyzed using Statistical Package for Social Scientists (SPSS). It is hoped that the findings of this study will help the stake holders to come up with policies on the best methods of teaching biology at the 'O' level and gender inclusiveness. The findings indicate that the mean score of the experimental group was slightly above that of the control group. The post-test results show that experimental group performed better than their counterpart control group by having a higher mean gain of 24.0 compared to 2.2 respectively. It further indicated that boys performed slightly better than girls exposed to the same conditions. The study recommended that teachers intensify the teaching and learning of Biology using practicals as opposed to the conventional method.

Chapter One: Introduction

1.0 Background of the study

Throughout the years, numerous individuals have contended that for students to find value in science, it is essential to incorporate meaningful practical experiences or laboratory work within the educational framework (Hofstein and Mamlok-Naaman, 2007). Generally, the concept of practicals refers to experiences in educational environments where students actively engage with materials in order to observe and comprehend the natural world. Practicals are structured and carried out to involve students either on an individual basis or in small groups, a technique known as class experiments, or in larger groups through teacher demonstrations. Engaging in practical work serves to motivate students by igniting their curiosity and enjoyment (Leana, 2011). A student's performance during practical activities is expected to reflect the skills they have internalized. A key concern is how teachers can facilitate the acquisition of these skills among students. While students may replicate example diagrams in practical exams taken from textbooks, they often overlook guidelines that advise drawing from actual specimens. The ability to create biological illustrations can separate those skilled from those less adept at drawing, although a student may excel in memorization and be capable of reproducing from memory. By memorizing anticipated outcomes in scientific experiments, students may describe and justify expected results without providing the actual findings. Engaging in practical work is a critical component of secondary science education (Abrahams & Millar, 2008), leading to a substantial portion of Biology lesson time in secondary schools being devoted to practical work, under the assumption that this fosters higher achievement in the subject for students. Similar to other sciences, the teaching and learning of biology benefits from laboratory practicals. Biology is defined as the study of life and living organisms, encompassing their structure, function, growth, evolution, distribution, and classification. The term biology has its roots in Greek: bios translates to life, and logos refers to science or study. Therefore, Biology is essentially the science of living entities, which is why it is often referred to as Life Science (Raghad, 2018).

Globally, teaching methods like experimental and demonstration lessons have played a significant role in enhancing biology performance in Western Europe (Berland & Hammer, 2012). In North America and Japan, science subjects account for 42.4% of the growth in the education sector, while Western Europe contributes 46.8%, Asia 38.5%, and Africa 30.1% (Sithulisiwe, 2017). The laboratory method used in science education traces its roots back to ideas proposed by early scientists in the 17th century. The influence of experimental science began around 1590 when scientists started conducting deliberately designed experiments (Kind et al., 2011). A report by the House of Commons Science and Technology Committee (UK, 2002) asserted that practical work in science is essential for education. It helps students enhance their comprehension of science, recognize that it relies on evidence, and develop hands-on skills necessary for improving performance and progress in the subject. Students should have opportunities to engage in exciting and diverse experimental and investigative activities. The (UK, 2002) report emphasizes the quality of school science practicals and laboratories as major concerns. The report contends that practical experiences are crucial for students' learning journeys and should significantly contribute to better performance in science. Various sectors of the science community, as well as industry and business, have raised concerns that schools are generally insufficiently incorporating practical work and that the quality varies (Abrahams and Millar, 2008). Dillon (2008) notes that despite curriculum reforms in the UK aimed at enhancing biology practical experiences, students often spend excessive time following "recipes" and, as a result, engage in lower-level skills. Many authors have identified strategies to elevate the quality of biology practicals. For instance, Millar (2004) indicated that effective tasks engage students as both "hands-on" and "minds-on," allowing them to fully benefit from the learning experience. Millar believes that improving the quality of practical activities involves helping teachers clarify the learning objectives associated with the practical tasks they employ. High-quality science practical work fosters student engagement and interest, while also building a variety of skills, scientific knowledge, and conceptual understanding.

According to Keshnee (2017), education equips individuals with advanced skills that enhance productivity and elevate quality of life (UNDP, 2012). Nonetheless, the practical instruction of science subjects in Sub-Saharan Africa remains significantly lower compared to that in developed nations (Adu, 2016). Enhancing academic performance in biology presents a considerable challenge for African nations such as Kenya, Madagascar, Mauritius, Mali, Mauritania, Niger, and Uganda, among others (Adukaite et al., 2017). As noted by Karuku & Tennant (2016), science subjects in the East African region, similar to many other areas worldwide, encounter numerous obstacles that contribute to diminished academic performance in the context of population growth, technological advancements, regional interdependence, and globalization. Since gaining independence, various curricular reforms in science subjects have been suggested and enacted within the region. The most recent initiative aims to establish a unified curriculum across the member states of the East African Community, which is intended to improve practical education in science subjects. Despite efforts by the East African Community member states—Kenya, Rwanda, Tanzania, and Uganda—to standardize the secondary school science curriculum to accommodate all learners, performance in these subjects continues to be subpar.

The Ugandan policy on science subjects and its implications has not yet fulfilled its purpose. The rationale behind this policy was to build capacity in the field of science in Uganda. Consequently, science subjects were made compulsory in 2005 in secondary schools (O'level only) (Kagolo, 2010). Many districts in Uganda such as Lira, Gulu, Hoima, Moroto, Mbale, Kapchorwa, Bukwo and Kween still under perform in science subjects including biology (Ochwa-Echel, 2011). In Kween district, its performance has consistently remained poor as evidenced in the table 1.1 below.

Table 1.1: The statistic evidence of Academic performance

Biology	Years	2016	2017	2018	2019	2020
	Mean score (in %)	16.8%	23.2%	25.5%	31.6%	20.5%
Chemistry	Years	2016	2017	2018	2019	2020
	Mean score (in %)	14.3%	19.4%	30%	34.2%	26.1%
Physics	Years	2016	2017	2018	2019	2020
	Mean score (in %)	18.3%	24%	28.3%	32.4%	28.3%
Mathematics	Years	2016	2017	2018	2019	2020
	Mean score (in %)	28.3%	30%	36.3%	37%	29.6%

Source: District reports, (2020)

Performance in Biology has frequently been below 50% (average) despite the fact that the ministry of education and sports in corporation of other bodies has come up with stringent strategies to improve the teaching and learning of science. To this end a notable intervention has been the Secondary Science and Mathematics Science (SESMAT) program. SESEMAT was started by the Ministry of Education (MOE) in conjunction with Japan international Corporation agencies (JICA) as in-service training sessions which are held during breaks in the school calendar to address challenges in teaching and learning of sciences and mathematics but the performance in Biology is still poor. It is against this background that the researcher seeks to undertake a study to establish the effect of Biology practicals on academic performance of secondary schools in Kween district.

1.2 Statement of the problem

Biology is one of the seven compulsory subjects in Ordinary level (O'level) in Ugandan Secondary schools and has a crucial role in the rapid developments in science and technology. Since the Uganda "Vision 2030" emphasizes the role of science, technology and innovation in modern economy, then, good performance in the subject and other sciences is crucial. Teaching science with the help of practicals makes it more enjoyable and stimulating to students than when teaching the same subject matter only through lecture. Students have a lot of benefits from biology practicals which may include increasing students' interests and abilities in the subject as well as their achievement

in science (Hofstein, 2004). In Uganda, biology practicals are given a central and distinctive place in teaching and learning at the secondary school level. Biology teaching and learning essentially involves biology practicals and has been a long tradition in schools, however, questions have been raised about the appropriate role and the reality of what is actually achieved by the biology practicals (Barton, 2004), especially with continued decline in performance in the subject. Furthermore, Abimbola (1994) reports that, reviews of research in this area concluded that science education researchers have failed to provide conclusive evidence to support the view that using the laboratory method of teaching science is superior to other methods. Therefore, this study sought to find out the effect of Biology practicals on students' performance in Biology in secondary schools in Kween secondary schools in a bid to improve the academic achievement in the subject.

1.3 The general objective of the Study

The general objective of the study is to establish the effect of Biology intensive practicals on students' performance in Biology in O'level in secondary schools in Kween district.

1.4 Specific objectives

- (i) Establish whether students learning Biology using Biology practicals perform better than those learning without.
- (ii) Determine the effect of frequency of Biology practicals on students' performance in Biology in Kween district.
- (iii) Find out whether boys and girls exposed and those not exposed to Biology practicals differ significantly in their average score.

1.5 Research Questions

1. Is there a significant difference in academic performance in Biology between those taught using practicals and those taught without in Kween district?

2. What is the effect of frequency of Biology practicals on students' performance in Biology in Kween district?

3. Do boys and girls exposed and those not exposed to Biology practicals differ significantly in their average score?

1.6 Scope of the study

1.6.1 Time Scope

The study was based on the period of five years ranging from 2015 to 2020. This is because there is available data on performance of Biology in Kaptoyoyo sub-county, Kween district. The research is expected to take three months from August to November, 2020.

1.6.2 Content scope

The study focused on the relationship between practical teaching of science subjects and academic performance in Kween district. The investigator's attention was to understand whether Practical teaching has direct contribution to academic performance academic performance in Biology in Kween district

1.6.3 Geographical scope

The study was conducted in Kween District, Kaptoyoyo sub-county which is bordered by Benet sub-county to the north, Kapchorwa district to the east, Njenje to the south, and Binying to the west. Kaptoyoyo sub-county will be mainly selected as the case study of the research because it is still experiencing performance challenges in Biology which is associated with poor academic performance.

1.7 Significance of the study

The study attempted to provide evidence on the effects of biology practicals on learners' performance in biology in Kaptoyoyo sub-county secondary schools. By so

doing, the findings of this study will add to the existing body of knowledge about the role and effects of biology practicals on learners' performance in biology. Using this knowledge, the teachers of biology, science teacher trainers and science educators will be able to maximize the benefits of using the chemistry practicals as a teaching and learning strategy. The findings will also give some necessary feedback to tutors in science teachers training colleges, which will probably improve on the training of biology teachers. Furthermore, Curriculum developers will have to change their approach in designing the curriculum and incorporate more practical aspects in the curriculum. The inspectors of schools may find the findings useful in designing approaches for inspection so that they can inspect the practical and skill acquisition processes.

1.8 Assumptions of the Study

In undertaking this study, several assumptions were taken into consideration.

- i) The schools selected had the necessary equipment to perform the practical work.
- ii) It was assumed that the nature and quality of biology practicals has effect on performance in biology in Kween secondary schools.
- iii) Another assumption was that students were not be affected by the experiment itself, that is, there will be no Hawthorn Effect.
- iv) The teachers administering the treatment are all qualified in biology Education

1.8 Conceptual framework

A conceptual framework refers to a research tool which helps the researcher to develop awareness and understanding the situation under study (Kombo and Tromp, 2006). It is researcher's own understanding of the problem and gives direction to the study, showing the relationships of the different issues that a researcher wants to investigate (Neumann, 2000).

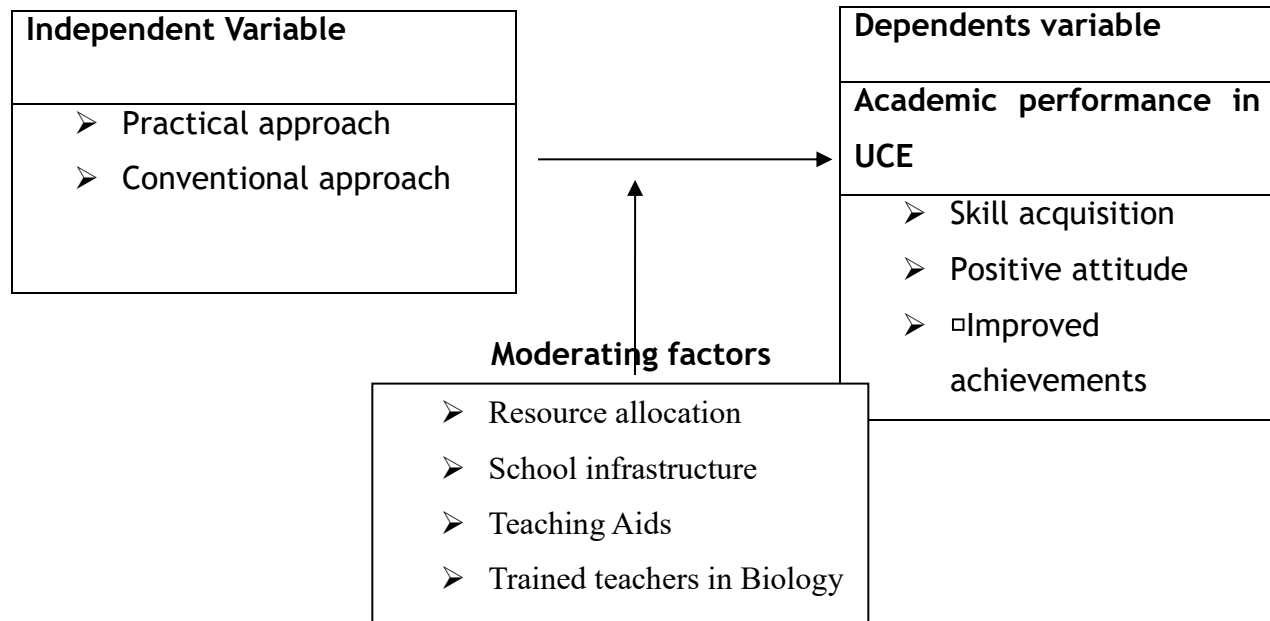


Figure 1.1 Conceptual framework. Source: Modified from Segrado et al, (2016)

Figure 1.1 above illustrated a conceptual framework that modeled a unilateral relationship between the independent variable of “Practice teaching of science both conventionally and practically and its relationship with academic performance in terms of skills acquisition and improved performance.

Chapter Two: Literature Review

2.0 Introduction

This chapter reviews research done by many scholars and how they are related to this study. And it will be reviewed according to objectives of the study as to: Establish whether students learning Biology using Biology practicals perform better than those learning without. To determine the effect of frequency of Biology practicals on students' performance in Biology in, Kween district. To find out whether boys and girls exposed and those not exposed to Biology practicals differ significantly in their average score. In this literature review the topic explained in sections and sub-section before the specific objective of the study that elaborated more about the purpose of this study in secondary schools in Kween district.

2.1 Theoretical Review

This research was informed by the constructivist learning theory as outlined by John Dewey, who suggested that individuals create knowledge and meaning from their experiences (Dewey, 1938 & Bruner, 1960). The constructivist approach indicates that learners build their ideas and comprehension based on a sequence of personal experiences (Barton, 2004). Providing personal experiences during biology practicals can offer valuable opportunities for biology students. Miha (2006) states that constructivism presents a framework for teaching and learning science in classrooms, aiming to enhance the effectiveness of science instruction in improving student learning. Furthermore, as noted by Tobin (1990) and Ikeobi (2004), significant learning can occur from laboratory experiments if students are given sufficient chances to use equipment and materials that aid them in constructing their understanding of phenomena and associated scientific concepts, leading to better performance in the subject. The second theoretical foundation for this study is Jerome Bruner's Cognitive Development Theory (1962). He argued that the objective of education should focus on intellectual growth rather than rote memorization. Bruner emphasized that learning should involve acquiring knowledge processes instead of simply memorizing facts.

Consequently, instruction should guide learners on how to engage in the processes that facilitate the formation of knowledge. The goal of teaching any subject is to involve learners in the knowledge-building process. According to him, gaining knowledge is a journey rather than a final outcome. Bruner promoted the organization of concepts and the concept of learning through discovery. He believed that learners could construct knowledge through interaction with their environment. He established three stages of cognitive development: enactive, iconic, and symbolic representations. This study will emphasize the evaluation of science process skills because it is through these processes that learners gain knowledge rather than just focusing on the end product—the results.

2.2 Experimental lessons and academic performance in Biology

According to James & McMillan (2016), people primarily learn about the world in three significant ways: by discovering information through personal observations and interactions with their surroundings; by receiving knowledge shared directly from others; or by creating personal understanding through the meaningful transformation of discovered and acquired information. Knowledge emerges from the integration of understanding and modifying experiences (Worth, 2010). Learning science involves more than merely acquiring facts and comprehension about a specific phenomenon. This is why engaging in hands-on experiments is recognized as an effective method, as it motivates students to learn through observation or feelings and enhances their academic success. Experiential lessons encourage students to enjoy the learning process and develop a keen interest; they prompt active involvement in the classroom. Although student interest in studying science remained at 56.9%, both with and without hands-on experiments, classroom observations indicate greater active participation when practical experiments are incorporated. Experimental activities foster critical thinking, effective reasoning, and comprehension of scientific concepts while assisting students in developing their knowledge production skills (Kawu et al., 2017). Numerous researchers have explored the influence of practical teaching on biology academic performance, including: Evelyn (2014) claimed that experimental lessons positively affect students' performance in biology subjects. The challenges of balancing a

demanding curriculum, the struggle to find time for specialized professional development, and the focus on examination success rather than pursuing the broader educational goals are significant hurdles. However, Mei Chi Lee (2017) noted that while practical lessons contribute positively to biology academic performance, some students, particularly in developing countries like Uganda, face challenges due to insufficient materials and resources allocated by the national government. Gorard (2014) asserted that teachers can enhance academic performance beyond the use of experimental lessons. Science fundamentally revolves around knowledge, with practical activities that translate theoretical concepts into tangible realities. El-Rabadi (2013) emphasized that the effective teaching of science subjects is essential for imparting practical skills that may be valuable in future career opportunities. One response referenced the importance of practical skills, but this focus was more related to university rather than employment prospects. In reality, very few science lessons utilize student-centered methods, such as hands-on experiments; most are delivered through a teacher-centered approach. This is partly due to teachers' beliefs and past experiences in education, which have led them to adopt this traditional method (Jones and Wyse, 2014). While practical teaching methods have been implemented in various regions worldwide, there is limited information regarding the impact of frequent practical sessions on biology education in Kween district.

2.3 The gaps identified in the existing literature

Many researchers such as Komakech & Robert (2014), Evelyn, (2014) among others have identified poor methods of teaching of science subjects, as the leading cause of poor academic performance. Scholars such as Odom & Bell, (2015) and Stewart, (2014) focused on lack of resource/funds and gender inequality as one of the factors that hinder academic performance in science subjects. Mei Chi Lee, (2017) focused on health and safety as some of the factors that lead to poor performance in science subjects. And lastly, Busemeyer & Rieskamp, (2014) focused on traditional mathematics instruction as one of the factors contributing to poor academic performance in developing countries. Therefore this study will establish the extent to which practical teaching

contributes to performance in Biology at UCE in Kaptoyoyo sub-county secondary schools.

Chapter Three: Methodology

3.0 Introduction

This chapter includes a complete description of the study methodology that will be used in the research process. It includes the research design, study population, sample size, sampling techniques, research methods, research instruments, data collection procedure, data processing and analysis, quality control methods that is validity and reliability, ethical considerations and limitation to the study.

3.1 Research Design

The research employed a quasi-experimental design with pretests and posttests. This approach was utilized to compare the biology performance of students taught using methods that incorporated biology practicals (experimental group) with those instructed without these practicals (control group) (Kumar, 2005). The study involved four schools divided into two categories: A and B. Each category included two schools, one serving as the experimental group and the other as the control group, resulting in a total of four groups. All groups participated in a pre-test achievement assessment at the beginning of the study. The experimental groups received instruction through a practical approach, while the control groups were taught through traditional methods. This instructional period spanned two months. Both groups underwent a pre-test and a post-test to evaluate their performance before and after the instructional treatment. Student Achievement Tests (SAT) were utilized to assess learner performance in biology. To reduce the Hawthorne Effect, an equal number of schools were pre-tested for both the control and experimental groups, although all groups also completed the post-test.

3.2 Population Size

Target population or universe of a study is all the members or objects involved in the study (Kothari, 2004). The population of the study consisted of all biology students from four secondary schools in Kween district in Uganda. The schools included Kapkoch S.S, Kween modern, Toswo S.S and Chemanga Seed S,S. This study involved majorly S.3

students. The senior three (S.3) class will be chosen because at this point the students have been introduced to biology as a subject and practicals. Also, because the senior three (S.3) students were not be preparing for national examination as it happens in candidate classes. The target population involved the Head teachers, Biology Teachers, and 'O' level students offering Biology in Kween district. There were four secondary schools within the locality of the researcher; therefore, all the four schools took part in the research. The study selected (4) Head teachers, (12) Biology teachers and (16) students from each of the four schools school. The population of study will be 80 targets.

3.3 Sample size

The researcher choose a sample because a sample is practical, smaller and therefore manageable than the whole population (Andreas & Jejena 2014). The study selected (4) Head teachers, (12) Biology teachers and (16) students from each of the four schools school. The population of study will be 80 targets.

3.4 Sampling procedures

According to Andreas & Jejena (2014), sampling is a process of selecting elements from the population in such a way that the sampled elements represent the population under study. This research therefore will use both purposive and simple random sampling techniques. The details of how each technique will be used are discussed below:

3.4.1 Purposive Sampling

This is a non-probability sampling method whereby a researcher selects a number of objects that have features of interest from the given population to form part of the sample (Kothari, 2004). This research purposively selected head teachers, from Kween Modern, Toswo S.S and Kapkach S.S, using this purposive sampling technique to collect the interview data that was appearing in a narrative format to support the questionnaires.

3.4.2 Simple random sampling

This is a probability technique of sampling whereby every component of the population has an equal chance and independent chance of being selected for the sample (Kothari, 2005). The 'O' level students offering Biology subject, lab attendant and Biology Teachers in selected schools in Kaptoyoyo sub-county, Kween district using this technique, because it is too difficult for the researcher to use the whole population.

3.5 Data collection Methods

Data collection is the process of gathering and measuring information on targeted variables in an established systematic fashion which enables one to answer relevant questions and evaluate outcomes while methods vary by discipline. The researcher employed the following data collection methods

3.5.1 Survey method

The researcher used a survey method to collect data from 'O' level students offering Biology lab attendants and Biology Teachers in selected schools in Kaptoyoyo sub-county, Kween district using a questionnaire instruments. This method was used because survey methods ensure that all respondents are asked the same questions and are exposed to the same response options for each question. Since questions are preset and organized in a particular arrangement, the researcher is assured that every respondent was confronted with questions that address the complete variety of information objectives driving the research study. This tool was used to collect quantitative data for analysis.

3.5.2 Interview method

The researcher used an interview method to collect qualitative data from respondents. The interview method involved presentation of oral-verbal stimuli and reply in terms of oral-verbal responses (Kothari, 2004). It involved face-to-face verbal exchanges between the researcher and the respondents. The researcher will ask specific questions concerning the research objectives and will ensure that the respondents restrict their answers to those questions. This method used to collect data from Head teachers of Kween Modern, Toswo S.S and Kapkach S.S in Kaptoyoyo sub-county, Kween district. The

answers to the questions posed during the interview will be written down during the interview. This method used by the researcher because it offers the opportunity to restructure questions which can generate data on aspects that could have been left out in the interview guide through probing.

3.6 Research instruments

The data for this study was collected using student achievement tests (SAT) - through the Pre-test and the Post test results and questionnaires for students and for the biology teachers.

3.6.1 Student Achievement Tests (SAT)

Student academic achievement in both the experimental and control groups in the study were evaluated using the researcher created biology student achievement tests (SAT). Two student achievement tests: a pre-test and a post test, were constructed and used by the researcher. A pre-test was administered to the respondents in the first week of the study to assess student pre-treatment biology academic abilities. Pre-tests will be administered as formative evaluations to assess student pre-treatment biology academic levels (Creswell, 2005). The pre-test will consist of five structured questions which will test the entry behavior (pre-requisite knowledge) of the students before learning the study topic. The pre-test will items from the sub-topics: flowering plants, human body and food tests. The pre-test was planned for one hour and consisted of questions that were of knowledge, comprehension and application levels while a few will be of the analysis level in Blooms taxonomy of objectives.

After the five weeks of teaching a new topic, a post test was administered to both the control and the experimental groups. A post test was administered as summative assessment after every treatment period to measure student academic gain in biology (Ormrod, 2003). The topic was conveniently so as to cause little inconvenience to teachers during their planning process and also the learners were not aware of their involvement in the study. The post test consisted of structured questions and were planned to take place for one hour. It consisted of questions that will be of knowledge,

comprehension and application levels while a few were of the analysis level in Blooms taxonomy of objectives. Performance of the students were based on the scores attained after marking the achievement tests.

3.6.2 Questionnaire

This is an instrument that the investigator used to collect data 'O' level students offering Biology subject and Biology teachers of Kween Modern S.S, Toswo S.S, Chemanga seed S.S and Kapkoch S.S in Kween district. Two sets of questionnaires were used in the study: questionnaire for biology teachers and students. The questionnaires was used to solicit information on the teaching and learning experiences during secondary school biology lessons involving biology practicals. They were structured to capture information required in helping to elucidate the relationship between biology practicals and performance in secondary school biology. Students' and teachers' views were sought on several areas that affect the use of biology practicals in the study of biology. The questionnaires consisted of closed ended questions and were divided into two sections: Section A sought information about the schools and the students. Such information included: county where school is located, type of school (government aided or private), discipline, attitude towards biology subject and its activities, academic and general ability in biology and in science activities. Section B solicited information about the teaching and learning practices in biology such as: the teaching and learning resources in schools such as laboratories, apparatus and reagents, teachers, biology textbooks and time allocation for theory and biology practicals, quality and frequency of use of the various teaching and learning strategies in biology and information about perceptions on the value of biology practicals on learning of biology. The format used the simple-multiple-choice by which respondents choose one from among the given alternatives (Sato, 2003). The required responses will be based on a five - point Likert scale with 5 intervals: (1 = Strongly Disagree, 2 = Disagree 3 = Neutral, 4 = Agree, and 5 = Strongly Agree).

3.7 Data collection procedures

The researcher acquired an introductory letter from the Uganda Christian University Mbale University College addressed to Kaptoyoyo sub-county authorities seeking permission to conduct research in the area. The researcher then presented his qualifications to the authorities explaining the purpose of the study. This section describes in detail how the data was obtained and the timelines involved in collecting the data in Kween district, Kaptoyoyo sub-county secondary schools.

3.8 Data Quality Control

Reliability and validity are important qualities of research and must always be taken into account for effective data quality control.

3.8.1 Validity of Instrument

Validity is the extent to which the instruments was used during the study measure the issues they will be intended to measure (Orodho, 2009). To ensure validity of instruments, the instruments will be developed under close guidance of the supervisor. After the questions were designed, they will be pre-tested to a tenth of students and teachers in the sample. This helped to identify ambiguous questions in the instruments and be able to re-align them to the objectives. The average Content Validity Index (CVI) formula was used to gauge the content validity of items on an empirical measure. It will be applied using the formula shown below;

$$\text{Content Validity Index (CVI)} = \frac{\text{Number of items declared valid}}{\text{Total number of items}}$$

When it was calculated for the work under study, using SPSS it gave 0.81 (76%), which was good and acceptable according to George & Mallery, (2003)

3.8.2 Reliability

Kothari (2005) defines reliability as the extent to which studies or findings can be replicated, that is, the accuracy or consistency of the research instrument in measuring whatever it measures, therefore, a measuring instrument is reliable if it provides consistent results (Kothari, 2004. Pilot study will be carried out. The results from piloting

will be used to determine the level of the reliability of the instruments. To determine the reliability of the test item, the researcher will use the test-retest method. According to Trochim (2000), the test-retest reliability is estimated by administering the same test to the same sample on two different occasions. The test items will be administered to the respective respondents on two different occasions within an interval of one week (Muijs, 2004). The results will be scored and a comparison will be made on the score of the first test and the scores of the second test to provide a reliability coefficient. The Pearson product-moment correlation coefficient will be used to compute the reliability coefficient of the test item. The Cronbach's Alpha correlation will be used to analyze the data on the reliability of the instrument (Kasomo, 2015). The Pearson correlation coefficient, r , can take a range of values from +1 to -1. A value of 0 indicates that there is no association between the two variables. A value greater than 0 indicates a positive association; that is, as the value of one variable increases, so does the value of the other variable. A value less than 0 indicates a negative association; that is, as the value of one variable increases, the value of the other variable decreases. The positive (increase, increase) correlation coefficient can range from 0.00 to 1.00. The closer the r value is to 1.00, the stronger the reliability (Muijs, 2004). In this study, the alpha was 0.78 was good and acceptable according to George & Mallery, (2003).

3.9 Data analysis and presentation

3.9.1 Quantitative data analysis

Quantitative data analysis entailed categorizing and summarizing data in order to find answers to the research questions. Quantitative data will be analyzed using statistical tools to reduce the data, summarize it and make the most important facts and relationships apparent. Quantitative data from the SATs, questionnaires and interviews will be subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS). Questionnaires will be checked and edited in the evenings after each day's work to check for consistency and accuracy. Responses will then be entered into the computer after all the fieldwork and will be edited and coded. Answers for close-ended questions will be listed and assigned numbers through developing categories and

assigning corresponding value labels to each question which information will then be coded. This will be used because it will enable simultaneous testing of a large number of variables. The data will then be presented using percentages and frequencies. The graphs and tables will be used to facilitate report writing.

3.9.2 Qualitative data analysis

The qualitative data in this study will be analyzed through data reduction, editing and categorizing into narrative that are in line with the objectives of the study.

3.10 Ethical considerations

Permission will be sought from the principals of the selected secondary schools involved in the study. The researcher will explain to the school principals and chemistry teachers, the purpose of the study and the methods to be used to carry out the study. In this case respondents will be permitted the right to or not to participate in the interview. Respondents will be informed that their honest opinions were welcome and confidentiality will be maintained where they will not be quoted without their permission. This will help to create confidence between the respondents and the interviewer who will try, as much as possible, to use friendly language.

3.11 Limitation of the Study

This study like many other studies of its kind will be faced by a number of limitations in terms of geographical location, content and time scope. Due to time and financial constraints, the study only will cover four secondary schools in Kaptoyoyo sub-county. Due to the length of the study, a significant number of respondents may not be available or unwilling to participate in the final stage of data collection.

Chapter Four: Data Presentation, Results and Discussion

4.0 Introduction

This study was carried out with the aim to assess the effects of biology practical activities on students' academic performance in senior secondary schools in Kween district. This was achieved by examining 128 students, split into treatment group (71) and control group (57). The students were given pre-test and post-test which were subjected to statistical analysis using appropriate tools and procedure in Microsoft Excel. The results are presented as follows:

4.1 Demographic data

Table 4:1: Demographic Information of the Participants

Gender	Frequency	Percentage
Male	72	56.3
Female	56	43.7
Total	128	100

Table 4 shows the distribution of students by gender. The sampled schools have 56.3% males and 43.7% females. This depicts that there was fair representation of participants by gender, to avoid any form of bias.

4.2 Distribution of Participants in Groups

Table 4:2: Distribution of Participants in Groups

Groups	Frequency	Percentage
Experimental	71	55. 5
Control	57	45. 5
Total	160	100

Table 4;2 indicated that 71 participants (55.5%) belonged to the experimental group and 57 representing (45.5%) of the 128 respondents were in the control group. They may not have had equal representation, but the distribution for both control and experimental groups was fairly done in the study, and any form of subjectivity that could have been attributed to group sentiments was eliminated.

4. 3 Objective One: To Establish whether overall Results for Experimental and Control Groups on Pre-test and Post-test defer.

An analysis of the pre-test outcomes revealed that the average scores for the experimental and control groups were only marginally different (0.3). The experimental group scored slightly higher than the control group. The post-test results indicate that the experimental group outperformed the control group, achieving a mean gain of 24.0 compared to 2.2, respectively. The results from both the experimental and control groups on the pre-tests and post-tests are presented in Table 4:3 below.

Table 4:3: Overall Results for Experimental and Control Groups on Pre-test and Post-test.

Group	Pre-test Mean	Post test Mean	Mean Gain
Experimental	28.0	52.0	24.0
Control	27.6	29.8	2.2

The post test results for both experimental and control groups were further compiled and expressed in terms of mean scores and standard deviation. The t-test was used to determine significance of difference of the means from the groups. Table 4:4 shows the post test results in terms of means, standard deviations and t-test.

Table 4:4: Comparative Post test Results for Experimental group and Control Group.

Group	Mean Score	Standard Deviation	t-test
Experimental	52.0	7.9	
Control	29.8	9.5	3.13

$$\alpha = 0.05; t = 1.93$$

According to table 3, the average score for the experimental group was 52.0, while the average score for the control group was 29.8. The t-test value was 3.13, which exceeded the critical t-value of 1.93. This suggests that there was a significant difference in performance between the experimental group and the control group. The standard deviation for the experimental group was 7.8, whereas the standard deviation for the control group was 9.4. This implies that the experimental group had a more uniform understanding of the topics, in contrast to the control group, which exhibited a wider variation in their comprehension.

4.4 Objective Two: Gender Consideration for Post test Performance

Both mean scores and standard deviations were used to compare the experimental group and the control group in terms of gender. This is represented in Table 4 below.

Table 4.5: Gender Comparison for Post test Performance Results

Group	Boys		Girls	
	Mean Score	Standard Deviation	Mean Score	Standard Deviation
Experimental	55.9	9.4	48.8	9.0
Control	28.6	10.7	29.5	9.7

The experimental group displayed a higher average score of 55.9 for boys and 48.8 for girls, in contrast to the control group's lower averages of 28.6 for boys and 29.5 for

girls. The standard deviations for boys in the experimental group were 9.4, while in the control group they were 10.7. For girls, the standard deviations were 9.0 in the experimental group and 9.7 in the control group. The variation indicates that there were significant statistical differences between the two groups. The mean scores for the experimental group surpassed those of the control group, suggesting that the teaching methods applied to the experimental group were more effective than those utilized in the control group. In both groups, boys achieved higher mean scores compared to girls, indicating that boys have a better understanding of Biology concepts than their female counterparts. To illustrate the effectiveness of intensive practical activities in teaching and learning physics versus traditional methods, a one-way ANOVA was conducted on the post-test results. The outcomes of the ANOVA test are detailed in table 5 below.

Table 4.6: Analysis of Variance of the Post test Scores on Performance

	Sum of Square	Df	Mean Square	F	Sig.
Between Groups	4672.38	30.0	108.66	4.21	0.016
Within Groups	4754.75	98	27.17		
Total	9427.13	128			

Significant at $P < 0.05$; Critical Value = 2.65

The results in table 4.6 indicates that the F-Value of 4.21 exceeds the critical value of 2.65 at $\alpha = 0.05$. This shows that both experimental group and control group were statistically different at post test. The p- value (0.016) was also less than α -value (0.05).

4.5 Objective Three: To establish whether Mean performance of students taught biology more frequently with Practicals and those taught with practicals but not frequently differ.

Table 4.7: Mean performance of students taught biology more frequently with Practicals and those taught with practicals but not frequently

Variable	N	Mean	SD
Frequent Practical Lessons	47	51	10.96
Non frequent Practical Lessons	36	30.63	9.24

Source: Primary data

Table 4.7 shows the results of students taught biology practical activities frequently and those taught with practical but unfrequently. It was observed that students taught biology practical using frequently had a mean score of 51 and standard deviation of 10.96 while those taught with practicals but unfrequently had a mean value of 30.63 and a standard deviation of 9.24. This implied that teaching with frequent practical sessions has a greater advantage than teaching with practicals but on rare occasions.

Chapter Five: Discussion of Results

5.0 Introduction

This chapter discusses the results of the findings of the study. The discussion is done according to the study objectives. Related results from other researchers and theoretical propositions have also been included to ensure that the discussion of findings is comprehensive. The discussions were done according to the objectives of the study, which were; to establish whether students learning Biology using Biology practicals perform better than those learning without, determine the effect of frequency of Biology practicals on students' performance in Biology in Kween district and finally to find out whether boys and girls exposed and those not exposed to Biology practicals differ significantly in their average score.

Objective One: To establish whether students learning Biology using Biology practicals perform better than those learning without

The researcher sought to find out whether teaching using practical sessions was had a better effect on academic performance than using convention methods of teaching Biology. The findings indicate that the mean score of the experimental group was slightly above that of control group. The post test results show that experimental group performed better than their counterpart control group by having a higher mean gain of 24.0 compared to 2.2 respectively.

The results from the current research concur with UNEB (2022) which determined that in the national examinations, those students who performed well in practical work also performed well in the final physics examination. Morris (2019) found a statistically significant relationship between theory and practical scores on all science subjects. A similar correlation was also found between understanding science subjects and practical work which lead to improvement in achievement tests (Wasanga, 2009). Practical work makes the students take science learning seriously as demonstrated by Amunga, et al (2011). The determination to meet physics objectives requirements of practical task leads the student to take charge of the

learning situation and develop an insight in the requirements of the task involved. Lunetta et al (2007) suggested that engaging in science practical work provides simulation experiences which situate students' learning in states of inquiry which needs high mental and physical engagement.

Objective Two: find out whether boys and girls exposed and those not exposed to Biology practicals differ significantly in their average score.

Further more, the research sought to establish whether girls and boys exposed to same conditions had the same performance or not. The findings indicated that the experimental with higher mean score of 55.9 and 48.8 for boys and girls respectively. The control group had lower mean scores of 28.6 and 29.5 for boys and girls respectively. The standard deviations for boys were 9.4 and 10.7 in experimental group and control group respectively. The standard deviations for girls were 9.0 and 9.7 in experimental group and control group respectively. The spread shows that the two groups were statistically different. The mean score in experimental groups was larger than that of control groups showing that the instructional method used in teaching experimental group was more effective than that used in the control group. In both groups the mean scores for boys were higher than that of the girls. This shows that boys grasp Biology concepts better than their counterpart girls.

The results are in tandem with those of Amadalo 2012 who opined that Gender-wise practical activities have been found to benefit girls tremendously. The performance in physics achievement tests for the girls improved when practical work was incorporated in the teaching routine of the girls. Benson and Nkiruka (2013), Nduru (2014) and Abungu et al (2014) have also found similar results when working with girls in Nigerian and Kenyan girls secondary schools respectively

Objective 3: To determine the effect of frequency of Biology practical on students' performance in Biology in Kween district.

The results indicated that, that students taught biology practical using frequently had a mean score of 51 and standard deviation of 10.96 while those taught with

practicals but unfrequently had a mean value of 30.63 and a standard deviation of 9.24. This implied that teaching with frequent practical sessions has a greater advantage than teaching with practicals but on rare occasions. This finding is supported by Mari (2010), who stated that students who see the organism they are studying physically and often and even in its natural location remember and understand better than when they are taught only theoretically.

Chapter Six: Summary, Conclusions and Recommendations

6.0 Introduction

This chapter presents the summary, conclusions and recommendations to the study. It further presents the areas of further research basing on the study findings. The chapter was written basing on then objectives of the study.

6.1 Summary of findings

The purpose of this study was analyze the effect of intensive teaching of Biology using Using Practicals on academic performance of Selected secondary schools in Kween district. The study was guided by they following research questions which were formulated from the research objectives.

- (i) to establish whether students learning Biology using Biology practicals perform better than those learning without,
- (ii) to determine the effect of frequency of Biology practicals on students' performance in Biology in Kween district
- (iii) to find out whether boys and girls exposed and those not exposed to Biology practicals differ significantly in their average score.

The results generally indicate that teaching students with practical intensively had a greater effect on their understanding of Biology, hence academic performance.

6.1.1 Objective one: To establish whether students learning Biology using Biology practicals perform better than those learning without

The findings indicate that the mean score of the experimental group was slightly above that of control group. The post test results show that experimental group performed better than their counterpart control group by having a higher mean gain of 24.0 compared to 2.2 respectively.

6.1.2 Objective Two: find out whether boys and girls exposed and those not exposed to Biology practicals differ significantly in their average score.

The findings indicated that the experimental with higher mean score of 55.9 and 48.8 for boys and girls respectively. The control group had lower mean scores of 28.6 and 29.5 for boys and girls respectively. The standard deviations for boys were 9.4 and 10.7 in experimental group and control group respectively. The standard deviations for girls were 9.0 and 9.7 in experimental group and control group respectively. The spread shows that the two groups were statistically different. The mean score in experimental groups was larger than that of control groups showing that the instructional method used in teaching experimental group was more effective than that used in the control group. In both groups the mean scores for boys were higher than that of the girls. This shows that boys grasp Biology concepts better than their counterpart girls.

6.1.3 Objective 3: To determine the effect of frequency of Biology practical on students' performance in Biology in Kween district.

The results indicated that, that students taught biology practical using frequently had a mean score of 51 and standard deviation of 10.96 while those taught with practicals but unfrequently had a mean value of 30.63 and a standard deviation of 9.24. This implied that teaching with frequent practical sessions has a greater advantage than teaching with practicals but on rare occasions.

6.2 Conclusions

From the study first it was found out those intensive practical activities have a positive influence on student's achievements in physics. It improves physics academic performance of the learner. This can be achieved if the learners are fully involved in the practical learning process. This was confirmed from post-test results in both experimental and control group. At the beginning of the study respondents from both groups scored low grades. By the end of the study experimental group improved by more than half while the control group improved by less than a tenth. Boys performed better than girls both in the two tests.

There was a bigger improvement within experiment group for boys than for the girls. Therefore there was magnified difference in achievement by students taught using intensive practical activities.

6. 3 Recommendations

The study recommends as follows

1. The use of practical activities in teaching biology should be encouraged to enhance students' performance in senior secondary schools.
2. The use of real specimens among biology teachers should be encouraged than the use of charts in teaching of Biology

6.4 Suggestion for further research

1. The study to be repeated based on expanded sample of schools in the county, regional and national categories in secondary schools.
2. With technological advancement similar research to be carried out by involving learners in Biology learning practical through electronic work bench.
3. A similar study should be done in other classes in secondary school Biology

References

- Abimbola, I. O. (1994). A critical appraisal of the role of laboratory chemistry practicals in science teaching in Nigeria. *Journal of Curriculum and Instruction*, 4 (1&2), pp.59-65.
- Abrahams, I. & Millar, R. (2008). Does chemistry practicals really work? A study of the effectiveness of chemistry practicals as a teaching and learning method in school science. *International Journal of Science Education*. 30.14: 1945-1969.
- Adu, E. O. (2016). *E-Learning facilities usage assessment by Economic and Management Science (EMS) teachers in Eastern Cape Province, South Africa*. In *Ed Media: World Conference on Educational Media and Technology* (pp. 1738-1744). Association for the Advancement of
- Adukaite, A., van Zyl, I., Er, S., & Cantoni, L. (2017) *Teacher perceptions on the use of*
- Andreas Ahrens, Jeļena Zaščerinska (2015). Principles of Sampling in Educational Research in Higher Education. *Journal of Society, Integration and Education* (I). <http://dx.doi.org/10.17770/sie2015vol1.310>
- Barton, R. (2004). *Teaching secondary science with ICT*. Berkshire, England: Open University Press.
- Bennett, J. (2013). *Teaching and learning science: A guide to recent research and its applications*. London: Continuum.
- Busemeyer, J. R., & Rieskamp, J. (2014). *Psychological research and theories on preferential choice*. In S. Hess & A. Daly (Eds.), *Handbook of choice modelling* (pp. 49-72).
- Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (2nd ed.). Columbus, OH: Pearson - Merrill Prentice Hall.
- El-rabadi, E. G. S. (2013). *The Effect of Laboratory Experiments on the Upper Basic Stage Students Achievement in physics*. *Journal of Education and Practice*, 4(8), 62-71.

- Evelyn Wan Zi Shan, (2014) *The effectiveness of hands-on experiments in learning science among year 4 students*, published in Taylors University, Malaysia.
- Glöckner, A., Hilbig, B. E., & Jekel, M. (2014). *What is adaptive about adaptive decision making? A parallel constraint satisfaction account. Cognition, 133*, 641-666.
- Gorard, G. (2014). *Combining methods in educational and social research*. Berkshire: Open University Press.
- Govender, N. & Govender, D. (2014,). *Change of science teachers' use of Information and*
- Grose, K. & Strachan, J. (2016). In demonstration classrooms, it's show-and-tell every day. *Journal of Staff Development, 32*(5), 24-29.
- Hirschfeld, D. (2012). *Interest in science careers wanes in Latin America*. Retrieved November 10, 2016, from <http://www.scidev.net/global/capacity-building/news/interest-in-science-careers-wanes-in-latin-america.html#>
- Hofstein, A. (2004). The laboratory in chemistry education: Thirty years of experience with developments, implementation, and research. *Chemistry Education: Research and Practice*, Vol. 5, No. 3, pp. 247-264. Published Online.
- Hofstein, A., & Mamlok-Naaman, R. (2007).The laboratory in science education: The state of the art. *Chemistry Education Research and Practice*, 8: 105-107.
- House of Commons Science and Technology Committee, (2012). *Practical experiments in school science lessons and science field trips*, published in Stationery Office Limited, London.
- Ian Abrahams, (2012), *Practical work: Its effectiveness in primary and secondary schools in England*, published in the University of Lincoln
- Kagolo, F. (2010, Monday 10th May). Boys Top University Scholarships. *New Vision*.
- Karp, A., Opolot-Okurut, C., & Schubring, G. (2014). *Mathematics education in Africa*.
- Karuku Simon and Geoff Tennant, (2016). *Towards a Harmonized Curriculum in East Africa: A Comparative Perspective of the Intended Secondary School Mathematics Curriculum in Kenya, Rwanda, Tanzania and Uganda*.
- Kasomo, D. (2015) *Research Methods in Humanities and Education*. Nairobi: The Jomo Kenyatta Foundation.

- Kawu, W., Kikkas, R., Violet, H., (2017). *The future of education and skills Education 2030*, published in the University of Pennsylvania, United States.
- Kaya, H., & Büyük, U. (2011). Attitudes Towards Physics Lessons and Physical Experiments of the High School Students. *European Journal of Physics Education*, 2(1), 16-22.
- Keshnee Padayachee, (2017). A snapshot Survey of ICT Integration, published in the University of South Africa.
- Kibirige, I., & Tsamago, H. (2013). *Learners ' Performance in Physical Sciences Using Laboratory Investigations*. International Journal of Educational Sciences, 5(4), 425-432.
- Kimago, H. R. (2011). *Study Guide for Med APPS Course*. Dar es Salaam: University of Dar es Salaam.
- Kind, P. M., Kind, V., Hofstein, A., & Wilson, J. (2011) *Peer argumentation in the school science laboratory - Exploring effects of task features*. International Journal of
- Kirui Kipyegon Kosgei, (2016) *Challenges facing staff development and training: A survey of secondary schools in Kericho County*, published in *Kenyatta University. literacy*. Science Education, 87(2), 224-240.
- Kombo, D., and Tromp, D. (2006). *Proposal and Thesis Writing: An introduction*. Nairobi: Pauline's publications Africa.
- Kothari, C.R. (2004). *Research methodology: Methods and Techniques*. 2nd Edition, New Delhi, India: New Age International Publishers.
- Kothari, C.R. (2005). *Research methodology: Methods and Techniques*. 3rd Edition, New Delhi, India: New Age International Publishers.
- Kumar, R. (2005). *Research methodology: A step by step guide for beginners*. 2nd Edition, London, UK: Sage Publications Ltd.
- Kween district local government report, (2016). Annual report 2016, Kampala, Uganda.
- Leana, C. R. & Pil, F. (2016). Social capital and organizational performance: Evidence from urban public schools. *Organization Science*, 17, 1-14.

- Leana, C. R. (2011). *The missing link in school reform*. *Stanford Social Innovation Review*, 9(4), 30-35.
- Lorenz, B., Banister, S. I., & Kikkas, K. (2015). *Impacting the digital divide on a global scale-six case studies from three continents*. In International Conference on Learning and Collaboration Technologies (pp. 687-696).
- Manizheh, D.H. (2016). *Putting Constructivist Teaching into Practice in Undergraduate Introductory Science*. *Electronic Journal of Science Education*, 3(2), 1-12.
- Mei Chi Lee, (2017). *The Effectiveness of Practical Work on Students' Interest towards Learning Physics*, published in the University of Malaysia Sabah.
- Millar, R. (2004, June 3). The role of practical work in the teaching and learning of science. Paper presented at the *High School Science Laboratories: Role and Vision* Meeting
- Ministry of Education and Sports, report, (2018) building confidence in teaching subjects, published in Uganda, Kampala.
- Muijs, D. (2004). *Doing quantitative research in education with SPSS*. London: Sage Publications
- Neumann, W. (2000). *Social Research Methods: Qualitative and quantitative Approaches*. Boston: Allyn and Bacon.
- Ochwa-Echel, J. (2011). *Exploring the gender gap in computer science education in Uganda*. *International journal of gender, science and technology*, 3(2), 273-292.
- Ormrod, J. E. (2003). *Educational psychology. Developing learners* (4th ed.). Columbus, OH: Merrill Prentice Hall.
- Orodho, J.A (2009), *Techniques of Writing Research Proposals and Reports in Education and Social science method*, Kenya, Kaneja publishers.
- Robert Agwot Komakech & John Robert Osuu, (2014). *Uganda SESEMAT programme: impact and challenges in its Implementation*, published in the Faculty of Social Sciences and Management Studies, Kumi University, Uganda.

Sithulisiwe Bhebhe, (2017). *Teaching and learning practical subjects in primary schools*
Published in the University of Swaziland.

Tadahiko Abiko, (2018). *The future of education and skills Education 2030*, published
in Kanagawa University, Japan.

Trochim, W. (2000). *The Research Methods Knowledge Base*. 2nd Edition. Cincinnati,
OH: Atomic Dog Publishing.

Van Noord, M. L. (2017). *Identifying factors of motivation in adult learners returning
to higher education in nursing*. US: Pro-Quest Information and Learning
Company.

Worth, K. (2015) *Science in early childhood classrooms: Content and process*.
Massachusetts: Education Development Center, Inc.



**UGANDA CHRISTIAN
UNIVERSITY, MBALE UNIVERSITY COLLEGE.**
A Centre of Excellence in the Heart of Africa

Office of the Academic Registrar

To _____

Dear Sir/Madam,

Re: Academic Research

Christian greetings!

We are honored to introduce to you Mr. Mr./Miss _____
Of Registration Number, _____ pursuing a
Masters' Degree/ Postgraduate Diploma / Bachelor's Degree

_____ He/ she is required to carry out an academic research on the topic
_____ and thereafter produce a well bound hard cover research report (MARDON) in color for undergraduate and three (BLACK) copies for Postgraduate students as a University requirement for the award of a degree/diploma in the academic discipline that he / she is pursuing.

We shall be grateful for the help you may offer to him or her accordingly.
Thank you.

Yours faithfully,



Dr. Ovia Kyatuha Mwisaka

Ag. Academic Registrar

APPENDIX I: STUDENT ACHIEVEMENT TEST (PRE-TEST)

Dear Respondent,

I am undertaking a research on the “**Effect of Practical Teaching on academic performance in Biology at ‘O’ Level in Kween district**”. This exercise is to assist in finding ways of improving performance in Biology. The findings will not be used for any other purpose other than for this study. Performance assessment schedule provided here will be used to record your answer. Kindly respond to all the questions to the best of your ability.

1. You are provided with a tooth obtained from a mammal. Observe the tooth to enable you to answer the following questions.

i. Draw the tooth 1 mark

ii. Identify the tooth by writing its name above the drawing 1 mark

iii. Label the parts of the tooth 3 marks

2. Test the solution provided for the various foods using the resources provided. Record your results in the table below.

Food substance	Procedure	Observation	Conclusion

3. You are provided with a soft stem of the tradescantia or wandering Jew.

(a) Make thin cross sections of the stem. Prepare a temporary slide of the stem. Place the slide on the microscope and focus under medium power objective lens.

(b) Assume the beans are cells of the stem whose cross-section is represented by the petridish. Arrange the beans within the petridish.

Work out the equivalent length of the cells in the stem represented by beans on a petridish. Assume the stem is 1 centimeter wide.

Show your working.

APPENDIX II: Confidential list of requirements per student

1. Two handfuls of beans seeds
2. One petridish
3. Five drops of iodine solution
4. Two droppers
5. 1cm³ Benedicts solution
6. Means of heating (shared)
7. One test tube
8. Test tube holder
9. Ruler with millimeter markings
10. White tile or petridish placed on a white paper
11. 10 cm³ Measuring cylinder
12. 2cm³ solution extracted from crushed leafy plants
13. Scalpel blade
14. Microscope slide, microscope and cover slip
15. 1cm³ Water
16. Incisor, molar or premolar tooth
17. Stem of tradescantia or wandering jew

**PRACTICAL TEACHING AND ACADEMIC PERFORMANCE IN BIOLOGY AT ‘O’ LEVEL IN
KWEEN DISTRICT**

Questionnaire for Teachers

Dear Sir/ Madam

I am Susan Cherotwo, a student of Uganda University, I am carrying out an academic research on the topic; **‘Effect of Practical teaching on academic performance in biology at ‘o’ level in kaptoyoyo sub-county, kween district’**”. You have been selected as one of the respondents in the study. Please fill this questionnaire. Answers provided will be treated with highest level of confidentiality.

Please, answer all questions by ticking the right box

Thank you for the time you are going to render to participate in this research.

SECTION A: BIO DATA

Gender: Male Female

Level of education: Primary Secondary Certificate Diploma

Degree Master None

Notes: please, answer the following questions using the (SD, D, N, A, SA).

1. **SD**= Strongly disagree
2. **D** = Disagree
3. **N**=Neutral
4. **A**= Agree
5. **SA**=Strongly agree

Section B: Conventional method of teaching verses intensive practical method of teaching Biology in Secondary schools

B1: Methods employed in teaching biology at secondary schools in Kween District

N		SD	D	N	A	SA
---	--	----	---	---	---	----

1	Always use lecture method in teaching biology					
2	Always use demonstration method in teaching Biology					
3	Always use discussion method in teaching of biology					
4	Use experimental method in teaching					
5	Use both demonstration and experimental method in teaching biology					

B2: Aspects of Biology practical

N		SD	D	N	A	SA
1	Students make accurate observations					
2	Students have interest in doing investigations					
3	You always use theory when doing practical					
4	Students are eager to observe and do practical exercises					

B3: Perspectives of on various effects of biology practical on learning and performance

N		SD	D	N	A	SA
1	Practical lessons increase enjoyment of the subject					
2	Practical lessons increase understanding					
3	Practical teaching hinder syllabus coverage					
4	Improve on achievement in terms of good grades					
5	Teachers workload is an obstacle					

Section C: Quality and Nature of Biology practical lessons

N		SD	D	N	A	SA
---	--	----	---	---	---	----

1	There are adequate biology laboratories (space and equipment)					
2	Biology lessons are teacher demonstrations					
3	Biology lessons are student practicals					
4	There is adequate time for practical lessons					
5	There are enough qualified biology staff					
6	Learners are divided into groups of less than 5					

Section D: Gender and performance

N		SD	D	N	A	SA
1	Boys and girls are offered same treatment in class					
2	Groups consist of both boys and girls					
3	Girls and boys participate in same experiments					

Thank you for your participation

**PRACTICAL TEACHING AND ACADEMIC PERFORMANCE IN SCIENCE AT ‘O’ LEVEL IN
KWEEN DISTRICT**

Questionnaire for Students

Dear Sir/ Madam

I am Susan Cherotwo, a student of Uganda University, I am carrying out an academic research on the topic; ‘**Practical teaching and academic performance in science at ‘o’ level in kaptoyoyo sub-county, kween district**’. You have been selected as one of the respondents in the study. Please fill this questionnaire. Answers provided will be treated with highest level of confidentiality.

Please, answer all questions by ticking the right box

Thank you for the time you are going to render to participate in this research.

SECTION A: BIO DATA

Gender: Male Female

Level of education: Primary Secondary Certificate Diploma

Degree Master None

Notes: please, answer the following questions using the (SD, D, N, A, SA).

1. SD= Strongly disagree
2. D = Disagree
3. N=Neutral
4. A= Agree
5. SA=Strongly agree

Section B: Conventional method of teaching verses intensive practical method of teaching Biology in Secondary schools

B1: Methods employed in teaching biology at secondary schools in Kween District

N		SD	D	N	A	SA
---	--	----	---	---	---	----

1	The teacher always uses demonstration method in teaching Biology					
2	The teacher always uses discussion method in teaching of biology					
3	The teacher uses experimental method in teaching					
4	The teacher uses both demonstration and experimental method in teaching biology					

B2: Aspects of Biology practical

N		SD	D	N	A	SA
1	Students are allowed to make observations					
2	There is interest in doing investigations					
3	The teacher always uses theory when doing practical					
4	Students are eager to observe and do practical exercises					

B3: Perspectives of on various effects of biology practical on learning and performance

N		SD	D	N	A	SA
1	Practical lessons increase enjoyment of the subject					
2	Practical lessons increase understanding					
3	Practical teaching hinder syllabus coverage					
4	Improve on achievement in terms of good grades					

Section C: Quality and Nature of Biology practical lessons

N		SD	D	N	A	SA
---	--	----	---	---	---	----

1	There are adequate biology laboratories (space and equipment)					
2	Biology lessons are teacher demonstrations					
3	Biology lessons are student practicals					
4	There is adequate time for practical lessons					
5	Learners are divided into groups of less than 5					

Section D: Gender and performance

N		SD	D	N	A	SA
1	Boys and girls are offered same treatment in class					
2	Groups consist of both boys and girls					
3	Girls and boys participate in same experiments					

Thank you for your participation

APPENDIX V: Oral interview guide for Biology teachers

I am Susan Cherotwo, a student of Uganda University, I am undertaking a research on the “Effect of Practical Teaching on academic performance in Biology at ‘O’ Level In Kween district”. You have been selected as one of the respondents in the study. Please feel free to participate in this interview. Answers provided will be treated with highest level of confidentiality.

Section A: Background Information

1. Gender

Male () Female ()

2. Age in years.

3. Highest level of education

Diploma () Bachelor () Masters () PhD ()

4. Duration of Teaching Biology in years

16-20 () 21-25 () 26-30 ()

Section B: Practical teaching versus conventional teaching biology in schools

1. Talk me through the different methods of you use in teaching biology (probing begins, questions on time allocation in the time table, how often they are carried out, the availability of equipment)

.....
.....
.....
.....
.....

2. Do you explain to your learners the skills and materials used in biology practical? (probe)

.....
.....
.....

3. Biology involves drawing of specimens, do you explain to your learners what is expected when drawing specimens in a practical? (probe)

.....
.....
.....

4. Many teachers complain of low syllabus coverage when biology is intensively taught using practical approach, what is your take on that? (probe, add how he or she handles the two, how he solves the problem of under coverage, etc)

.....
.....
.....

5. In your opinion, compare retention rate of students taught with intensive approach and those taught using conventional methods of teaching?

.....
.....
.....

Section C: Frequency of biology practical in schools

1. Please how often do you teach biology using intensive practical approach in your class?(probe)

.....
.....
.....
.....
.....

2. In your honest opinion, do you think teaching learners using intensive practical approach improves performance in Biology?

.....
.....
.....
.....
.....

Section D: Girl child involvement in biology teaching

1. How often do you engage girls in the learning and teaching of Biology (probe)

.....
.....
.....

2. In your opinion, do you think engaging girls in every stage of teaching biology improves on their performance?

.....
.....

APPENDIX VI: Oral interview guide for Head teachers

I am Susan Cherotwo, a student of Uganda University, I am undertaking a research on the “Effect of Practical Teaching on academic performance in Biology at ‘O’ Level In Kween district”. You have been selected as one of the respondents in the study. Please feel free to participate in this interview. Answers provided will be treated with highest level of confidentiality.

Number of years as Head teacher.....

Number of years in the current school.....

1. Talk to me about the proportion of Science teachers in your school (probe, number of female and male, number per subject, etc)

.....
.....
.....

2. Take me through the performance of biology in your school (probe, in terms of gender, Sciences ,and Arts, etc)

.....
.....
.....

3. How often do you take part in direct supervision of teaching of Biology (probe, observations made may be asked etc)

.....
.....

4. Do you honor their requests for equipment and reagents? (probe, budget allocated for practical may be asked etc)

.....
.....
.....
.....
.....

5. How often do you encourage girl child involvement in the learning and teaching of science? (probe)

.....

.....

.....

APPENDIX VII

TIME FRAME

N_o	Month (2020)	Activity
01	September	Proposal development
03	October	Field work
04	November	Analysis and write-up
05	December	Final write-up and submission of Report

APPENDIX VIII

BUDGET

Item	Rate	Amount
Printing	200	300000
Photocopying	100	50000
Scanning	500	50000
Transport		600000
Internet		500000
Airtime		300000
Miscellaneous		700000
Total		2500000