COMPETENCIES INFLUENCING MASTERS STUDENTS' USE OF STATISTICAL ANALYSIS IN RESEARCH: A CASE OF UNIVERSITIES IN WESTERN KENYA

MUBICHAKANI JOSEPH MUKUYUNI

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DECLARATION

Declaration by the Candidate

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MUBICHAKANI, M. JOSEPH

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EDU/D.PHIL/PGC/1011/13 **DATE**

Declaration by Supervisors

This thesis has been submitted for examination with our approval as university supervisors.

_____ _____

PROF. SIMIYU JOHN **DATE**
Department of Technology Education
University of Eldoret, Kenya

_____ _____

PROF. KITAINGE KISILU **DATE**
Department of Technology Education
University of Eldoret, Kenya

DEDICATION

I dedicate this work to any researcher or research trainee, whose work in research is a source of developing our society of tomorrow.

ABSTRACT

Knowledge is key aspect to realize any progress or prosperity in various spheres. Knowledge is attributed to successful innovation in firms and research has been identified as an important source of knowledge. University students in Kenya have been accused of doing low quality research. One of the major components of research is data analysis that is either qualitative or quantitative. In quantitative analysis statistics is mostly used. Statistics start at the planning stage to establish the design and sample size all the way to data analysis. However, simple statistical notions were sometimes misunderstood or misinterpreted by research workers in many disciplines who have limited knowledge of statistics. The purpose of this study was; to determine the competencies influencing masters' students' use of statistical analysis in research, a case of universities in Western Kenya. Specifically, the study sought to determine; knowledge needs to use statistics; how prior knowledge influences use of statistics; how the masters' curriculum content and implementation meets the needs for use statistics; and how technological resources and personal factors influence use of statistical analysis in research. The study was based on normative paradigm and interpretive philosophy. The study used descriptive survey design complimented with case study design. The study used random sampling and purposive sampling to sample respondents. A total of 83 respondents from 3 different universities participated in the study. Frequencies and regression analysis were used to analyze data. The study found that all the competencies under investigation explained 79.8% of how the students found use of statistical analysis in research. Students' prior knowledge in statistics explained 45.6% of how student found the use of statistics; curriculum implementation explained 21.4%; technological resources explained 11.2% and personal factors explained 1.5%. Despite the contribution of each of the four competencies in this study, 68.4% of the masters students struggled to use statistics in research. The study exposed flaws in training of researchers in use of statistics. The study therefore noted that competency in use of statistical analysis in research was widely informed by; adequate prior knowledge in statistics, adequate training based on a rich curriculum in statistics and adequate technological resources. The students should also be motivated and put in adequate efforts to learn how to use statistics in research. If at all the universities studied wish to be in the league of research universities, they had no choice but to embrace radical changes in training of researchers in use of statistics.

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LIST OF ABBREVIATIONS

ANOVA:	Analysis of Variance
ANCOVA:	Analysis of Covariance
MANOVA:	Multivariate Analysis of Variance
ICT:	Information Communication Technology
HERANA:	Higher Education Research and Advocacy Network in Africa
KCSE:	Kenyan Certificate of Secondary Education
CUE:	Commission for University of Education
SPSS:	Statistical Package for Social Science
STATA:	Statistics and Data
SAS:	Statistical Analysis System

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CHAPTER ONE

INTRODUCTION OF THE STUDY

1.1 Introduction

Chapter one of this study outlines an introductory part. The chapter states in detail the basis on which the whole study was grounded on. It states the problem issue that prompted the investment of time and effort with a hope of suggesting solutions to it. The chapter also states the objectives, research questions and the hypotheses that guided the research all through. In this chapter the boundaries that guided the study, the conceptual framework that guided the study and the significance of the study's findings were explained.

1.2 Background of the Study

Knowledge according to oxford dictionaries is defined as; facts, information, and skills acquired through experience or education. The dictionary also gives an alternative definition as the theoretical or practical understanding of a subject. This theoretical or practical understanding was noted to be an important aspect for any community to realize development of its various spheres (Yamamoto, 2001). In religious circles knowledge is key not only for prosperity but also to avoid perishing. The amplified version bible states in Hosea 4:6 that people were destroyed for lack of knowledge. A review of related literature indicated the main role that knowledge plays in the community.

Frenz and Ietto-Gillies (2009) in their study of the impact on innovation performance of different sources of knowledge; noted that in house research and development

expenditure, bought in research and development knowledge and intra company knowledge transfers were relevant in explaining innovation performance in firms. Leiponen and Helfat (2010) carried out an inquiry into innovation objectives, knowledge sources, and the benefits of breadth. Their empirical results suggest that broader horizons with respect to innovation objectives and knowledge sources were associated with successful innovation in firms.

Foss, Lyngsie and Zahra (2013) in their study of the role of external knowledge sources and organizational design in the process of opportunity exploitation, which involved 536 Danish firms had the following findings. They noted that the use of different external sources of knowledge helped firms recognize and exploit different types of opportunities, particularly that external knowledge sources were not only important in the context of recognition but also in the context of exploitation of the opportunities. In this study Foss, et al (2013) recognizes that firms require external knowledge for their prosperity. They noted external sources to include suppliers, customers and universities.

The above studies have shown the importance of knowledge, in ensuring prosperity of any given firm. With this vital importance of knowledge it's noble to identify, protect and improve the source of knowledge. This can only be possible once the sources of knowledge were identified. In an inquest into sources of knowledge; Yamamoto (2001) noted in his report that knowledge ad to be precise scientific knowledge was increasing and he attributed the increase to the various experiments that were being carried out at different levels. Estabrooks, Rutakumwa, O'Leary, Profetto, Milner, Levers, and Scott-Findlay (2005) carried out a study of sources of practice knowledge among nurses. Their findings demonstrate that nurses categorize their sources of practice knowledge into four

broad groupings: social interactions, experiential knowledge, documents, and a priori knowledge. Assimakopoulos, and Yan (2006) carried out a study about sources of knowledge acquisition for Chinese software engineers. Their findings indicated Chinese software engineers acquire through, reading technology books and search information on the Internet; Inquiry from team colleagues to discuss their specific problems and; External sources to acquire knowledge.

Fletcher and Harris (2012) in their study of Knowledge acquisition for the internationalization of the smaller firm, which involved a survey of ten Scottish internationalizing firms, noted the following as sources of knowledge for these firms. They noted that internationalizing information can be acquired from the experience of others. It can also be acquired by hiring top manager with useful technological and market knowledge. In addition they noted that government advisors and consultants can provide this knowledge.

From the above analysis it was summarized that sources of knowledge were internal, which was mainly personal experience, and external, which includes other individuals and organizations experience. To get information from these external sources require an organized inquiry, which was the research process. Okafor (2011) noted that the main reason for carrying out research was to discover, interpret and develop approaches and models. These approaches and models he noted that they acted as a basis for advancement of knowledge on various aspects of human beings and the universe in general. The results stemming from research and development were in some cases documented in books, journals and other publications. These publications were found on

the internet, which was one of the sources of knowledge mentioned by researchers discussed above.

The study therefore deduced that research was a key component for generating knowledge. These by extension places research at the centre of development in society. This argument points the key role that research plays in advancement of knowledge. Research is the incubator of knowledge where scholars come in with an idea, collect more information about the idea, conduct thorough analysis and synthesis of the idea, test the idea and eventually emerge out of the research incubator with solid knowledge to be used by the society in general. This was just but one reason research incubator should be protected and improved so that it continues giving better and advancement knowledge. Paul, et al (2010) emphasized that there were important elements in a highly productive Research and Development enterprise. They note that fostering scientific creativity and being opportunistic for serendipitous scientific and medical findings were clearly important elements of past and future success in the pharmaceutical industry.

Research is a wide undertaking that involve both qualitative and quantitative aspects. Quantitative research involves an aspect of statistics. Sprent (2003) had the following to note about statistics in research. He noted that the role of statistics in medical research starts at the planning stage of a clinical trial or laboratory experiment to establish the design and size of an experiment that ensures a good prospect of detecting effects of clinical or scientific interest. This argument was not only limited to medical research but can also be said of social sciences research. Sprent (2003) also indicated that statistics was again used during the analysis of data to make inferences valid in a wider population. In simple situations computation of simple quantities such as P-values, confidence

intervals, standard deviations, standard errors or application of some standard parametric or non parametric tests may suffice. Sprent further notes that more sophisticated research projects often need advanced statistical methods including the formulation and testing of mathematical models to make relevant inferences from observed data. Such advanced methods should only be applied with a clear understanding both of their purposes and the implication of any conclusions based upon their use.

Zwiers and Von Storch (2004) in their research of role of statistics in climate research noted the following. Statistical analysis was important to present climatic findings and the interpretation of the findings. They noted that statistics enabled the weather specialist to extract information about weather and climatic patterns. These they noted was made possible by making a number of simplifying assumptions about the way in which the system generates information and how the analyzed data had been observed. It was based on this key role of statistics in research that the study focused on how masters' students were being trained to use statistics in research.

The study sought to ascertain through literature review the various institutions that were carrying out as well as training researchers. This was with an aim of determining the specific institutions to survey on how they were training their research trainees in statistics. Clark (1993) noted that universities in various countries across the globe had ventured into research and it formed a key element of their practice. He also noted that other than universities other players including state owned laboratories, business enterprises and nonprofit research organizations had also picked up research practice. Sawyerr (2004) indicated in his work that Africa's universities were at the centre of research. He noted that they produce majority of research findings. In addition the

African universities were also indicated to train nearly all African researchers. The study therefore focused on universities as entities of research and training researchers.

The study noted that all through the past years universities have been equal to this task of carrying out research and training researchers. Universities had been committed to the task by educating an increasing proportion of the societies they serve and challenging their outlook of aspects in society with aim of improving perspectives; universities also carried out research that was discovering and establishing new knowledge, new technologies and innovations for action; lastly universities had been a source of knowledge and skills that societies around them relied on for development and prosperity. Arthur and Bohlin (2005) in a survey of the mission statements of some British universities indicated that they generally aim to serve the needs, including social needs, of the regions in which they were situated. Universities have been and continue to prepare researchers, do research and disseminate research findings.

Universities prepare researchers through their postgraduate studies that require students to be exposed to research studies. They were also required to carry out research in one year for masters and two years for doctorate degree. This was a way of preparing the students for future research duties. Based on commission for higher education in Kenya requirements, and employment agreements of academic staff in universities in Kenya, academic staffs employed in universities were expected to mentor postgraduate students into being researchers; this was in their job description and a requirement for promotion to senior levels of being an academic staff. Academic staffs were also required to carry out research and disseminate the findings through presentation in conferences, publications and teaching them to students in lecturer rooms. These were all well spelled

out in their job description. This adequately brings out the research prowess of universities.

The research process and research training has, however, its share of challenges. Clark (1993) noted that there was enough evidence to doubt if there existed any close link between research and teaching in the contemporary system of higher education by that time, that he said included higher education also called graduate education in the United States. In addition to teaching it had also been found that involvement in research was also declining across some countries. Lioyd et al (2004) as quoted in Sabzwari, Samreen, and Khuwaja (2009) shows that clinicians' interest and involvement in research was declining in recent years in India. The findings were confirmed by Sabzwari et al (2009) by findings that majority of the junior faculty of Pakistani medical universities who participated in their study were by that time not involved in research. The study noted that, most of the research being produced in Pakistan was through required papers generated by postgraduate trainees. Findings also indicated that research in pure science in India was on the decline. In major disciplines like physics and chemistry, the number of brilliant students opting for research appears to be sharply declining (Balram, 2002).

In Kenya, University students have been accused of doing low quality research. Scott (2015) noted that there was a mismatch between Kenya’s numerous bright students and the low academic research excellence. He argues that while Kenya retains high literacy rates and impressive university completion statistics, it ranks frightfully low on quality of research output worthy of international acclaim and publication. These sentiments were also shared by Mukhwana, Oure, Too and Some (2016) who noted in their report that postgraduate students’ supervisors were often complaining about candidates who were

unwilling, or unable to conduct serious research. They further recommended that capacity for research needs to be assessed critically to ensure that undue delays were not sustained in the graduate schools.

Scott (2015) further notes that many students pursue non academic topics and try mental gymnastics to try and fit them into a research project. Thousands of Kenyan graduate students ask simple yes or no questions with answers already found hundreds if not thousands of times in literature. The same students also possess little or no concept of testing a theory or contributing to a body of knowledge by refining a theory. Scott (2015) finalizes his argument by stating that most Kenyan universities did not run anti plagiarism checks on research projects. He noted that external investigators find rampant copying and cases where others were paid to write one's research project, even among doctoral theses.

This decline of interest in research and quality of research has been blamed on universities as training institutions. Sawyerr (2004) documented that over the past two decades, African countries have tended to underfund and run down their universities and research institutions, purportedly in favor of strengthening basic education. Arguments by Scott (2015) and Mukhwana et al (2016) and the findings by Sawyerr (2004) were not specific on aspects that were lowering quality and interest. These, therefore, opened up several questions about university education and more specifically in research. Were they the students admitted for postgraduate that were not up to the task? Was it that the syllabus for research was irrelevant? Was it the learning method that did not support the implementation of knowledge? Was it the time that students did not have to carry out research? Was it the mentorship and the mentors that were incompetent? Or what made

the students not to apply the learned research knowledge competently or in worst cases look for researchers for hire? The discussed reports have highlighted this low quality research but they do not dig into the reasons for low quality research. With limited information on possible causes of poor quality researchers it can only be hypothesized. However, given the key role that statistics plays in research and the inadequacies noted in the trained researchers it was plausible that training in use of statistical analysis in research could be one of the causes. The study, therefore, sought to assess the training of masters' students in use of statistical analysis with universities being the cases for study.

1.3 Statement of the Problem

Every society values progress and prosperity which has been noted to be a direct outcome of improved knowledge (Yamamoto, 2001). Knowledge is attributed with successful innovation in firms (Frenz & Ietto-Gillies, 2009; Leiponen & Helfat, 2010). Foss, et al (2013) notes that firms require knowledge to facilitate their prosperity. Research has been identified as the main source of knowledge. Yamamoto (2001) noted that the various experiments that were being carried out by different scholars were the once that were responsible for generation of knowledge and especially scientific knowledge. Okafor (2011) noted that research was central in discovering, interpreting, and the development of new and advanced ways of doing things which in turn expanded human knowledge and skills on various matters touching on science of the universe.

However, studies carried out as indicated below had shown that all was not well with research process. Sabzwari, et al (2009) shows that clinicians' and pure scientists interest and involvement in research was declining in India. In Pakistani medical universities

students were found not involved in research. In Kenya, University students have been accused of doing low quality research. Scott (2015) noted that there was a mismatch between Kenya's numerous bright students and low academic research excellence. These sentiments were also shared by Mukhwana, et al (2016) who noted in their report that postgraduate students supervisors were often complaining about candidates who were unwilling, or unable to conduct serious research. Scott (2015) notes that, external investigators find rampant copying among postgraduate students and cases where others were paid to write one's research project, even among doctoral theses. This trend was hypothesized to seriously jeopardize the generation of the important knowledge that was needed by the society as a whole. The findings on the low quality and lack of interest in research do not, however, state the exact ailment in research.

Research is a wide undertaking that involve both qualitative and quantitative research. Quantitative research involves an aspect of statistics. Sprent (2003) noted that the role of statistics in research starts at the planning stage to establish the design and sample size. Sprent (2003) also indicated that statistics was used during the analysis of data to make inferences valid in a wider population. Zwiers and Von Storch (2004) noted that statistical analysis was needed to interpret observations. Despite this key role of statistics in research, Sprent (2003) found that simple statistical notions were sometimes misunderstood or misinterpreted by research workers in many disciplines who had only a limited knowledge of statistics. Based on this finding by Sprent the study hypothesized that incompetent use of statistical analysis was one of the reasons that research was ailing. It, however, remained unclear the specific aspects of statistics that were ailing. Was it that the syllabus content was irrelevant? Was it the syllabus implementation

process that was wanting? Were they personal factors that hinder students from being competent in use of statistical analysis in research?

The study sought to determine answers to the questions raised, with universities being the units of study. Universities were appropriate since Sawyerr (2004) indicated that Africa's universities were central in carrying out research and in addition they trained upcoming African researchers.

1.4 Purpose of the Study

The guiding purpose of this study was; to determine the competencies influencing masters' students' use of statistical analysis in research, a case of universities in Western Kenya. The purpose was with a view of incorporating necessary measures into masters' students' use of statistical analysis to develop a knowledgeable workforce in research.

1.5 Objectives of the Study

In order to accomplish its main purpose the study was broken down to specific objectives that were to be achieved by the end of the study. The following were the specific objectives that guided data collection for the study;

1. To determine statistics knowledge needed by masters' students for them to use statistics in research.

2. To find out how prior knowledge in statistics influences masters' students' use of statistical analysis in research.

3. To determine how the masters' curriculum content in statistics meets the needs for masters' students to use statistics in research.

4. To establish how masters' curriculum implementation process meets the needs for masters' students to use statistics in research.

5. To find out how technological resources influence masters' students' use of statistical analysis in research.

6. To assess how personal factors influence masters' students' use of statistical analysis in research.

1.6 Research Hypothesis and Questions

The study used both research hypothesis and research questions since different objectives required different approaches. For objectives that solicited quantitative data, the study formulated statistical hypotheses for them and these hypotheses were tested at a later stage of the study. The uses of hypotheses for objectives with quantitative data were based on quantitative purists argument that maintain that social science inquiry should be objective. That meant that time and context free generalizations were important and possible, and the actual causes of outcomes could be explored in a reliable and valid way. According to this view of research, educational researchers ought to remain objective and should not be involved in the research emotionally neither should they be involved with the objects of study. The researcher should be able to test or empirically justify their stated hypotheses (Burke & Onwuegbuzie 2004).

For those objectives that could not be subjected to hypothesis testing, because of the type of data they solicited, they were guided by research questions. Research questions were preferred for some objectives since they open up to more meaningful data in explaining the context of the situation and the variability from one respondent to the other. The use of research question was based on qualitative purists who reject quantitative purists' arguments. They argue for the superiority of constructivism, idealism, relativism, humanism, hermeneutics, and, sometimes, postmodernism (Burke & Onwuegbuzie 2004). These purists contend that multiple constructed realities abound, that time and context free generalizations were neither desirable nor possible, that research was value bound, that it was impossible to differentiate fully causes and effects, that logic flows from specific to general, and that knower and known cannot be separated because the subjective knower was the only source of reality. Qualitative purists also were characterized by a dislike of a detached and passive style of writing, preferring, instead, detailed, rich, and thick description, written directly and somewhat informally (Burke & Onwuegbuzie 2004). The study, therefore, was based on both arguments of quantitative and qualitative purists.

1.6.1 Research Hypothesis

For meaningful generalization of the findings; and for determination of whether the competencies under study have significance influence on use of statistical analysis in research; hypotheses were set by the study. The main hypothesis of the study was; selected competencies have no significant influence on masters' students' use of statistical analysis in research. To effectively test the main hypothesis the following sub hypotheses were tested in this study.

1. Master's students' prior knowledge in statistics has no significant influence on their use of statistical analysis in research.

2. Research syllabus implementation process during masters' research training has no significant influence on masters' students' use of statistical analysis in research.

3. Technological resources have no significant influence on masters' students' use of statistical analysis in research.

4. Masters students' personal factors have no significant influence on their use of statistical analysis in research.

1.6.2 Research Questions

The main question of the study was; what were the competencies influencing masters' students' use of statistical analysis in research? To effectively answer this question the study had sub questions to probe the current status and the effect of other competencies that could also be influencing masters' students' use of statistical analysis in research. This ensured that the answer to the main question was given in context with the prevailing circumstances in the field. The sub questions included;

1. What were the research knowledge needs for masters' students to use statistics in research?

2. What was the specific research content of masters' syllabus that meets the needs for students to use statistics in research?

1.7 Significance of the Study

Lancrin (2006), among other reviewed sources, identified that there exists a gap between the theory of research training process and the actual training process of the masters' students. The study, therefore, endeavored to determine this gap and contribute towards bridging the gap. The study explored the content of research syllabus; implementation process in research class; prior knowledge, technological resources and personal factors surrounding the research context with an effort of determining where exactly the gap exists in applying the knowledge learned and how to bridge this gap. The study findings led to formulation of a detailed recommendation in chapter five which was the key output of the study and an important contribution to knowledge of how to improve research training in universities.

The findings and recommendations were of help to universities as institutions of research training. The universities have an opportunity to have detailed information of how research training and specifically use of statistical analysis was being carried out. Based on this knowledge and the findings in this study universities can and will have a basis of formulating policies and strategies of improving research training. Universities also had a basis to redefine the syllabus and implementation process for teaching research particularly in statistics. Universities also have the required information to re-consider the prior knowledge, technological and students' personal factors surrounding use of statistical analysis in research with an aim of re-empowering research training. Students joining masters program also have an opportunity through this study to be aware of what they expect in research and use of statistical analysis in particular. By going through the study's findings they have an in depth of competencies that there earlier colleagues

encountered. In addition the study findings make them know where there emphasis should be in regard to use of statistical analysis in research.

The long term impact of this study goes beyond masters' students and university to bring about quality sustainable life. This long term impact will come about as follows; the study's point of intervention was in quantitative research training and specifically use of statistics. The study findings and recommendation when adopted by students and universities will improve the training, which subsequently leads to quality researchers. The quality researchers would eventually be absorbed as researchers by universities, research laboratories, business enterprises and non-governmental as well nonprofit organizations carrying out research. Since the training was quality they would in turn carry out quality research which will generate quality and reliable knowledge. When the society will adopt this quality knowledge it will in turn lead to quality sustainable life. Below is a summary figure 1.1 indicating the long term impact of the study findings and recommendation to quality sustainable life.

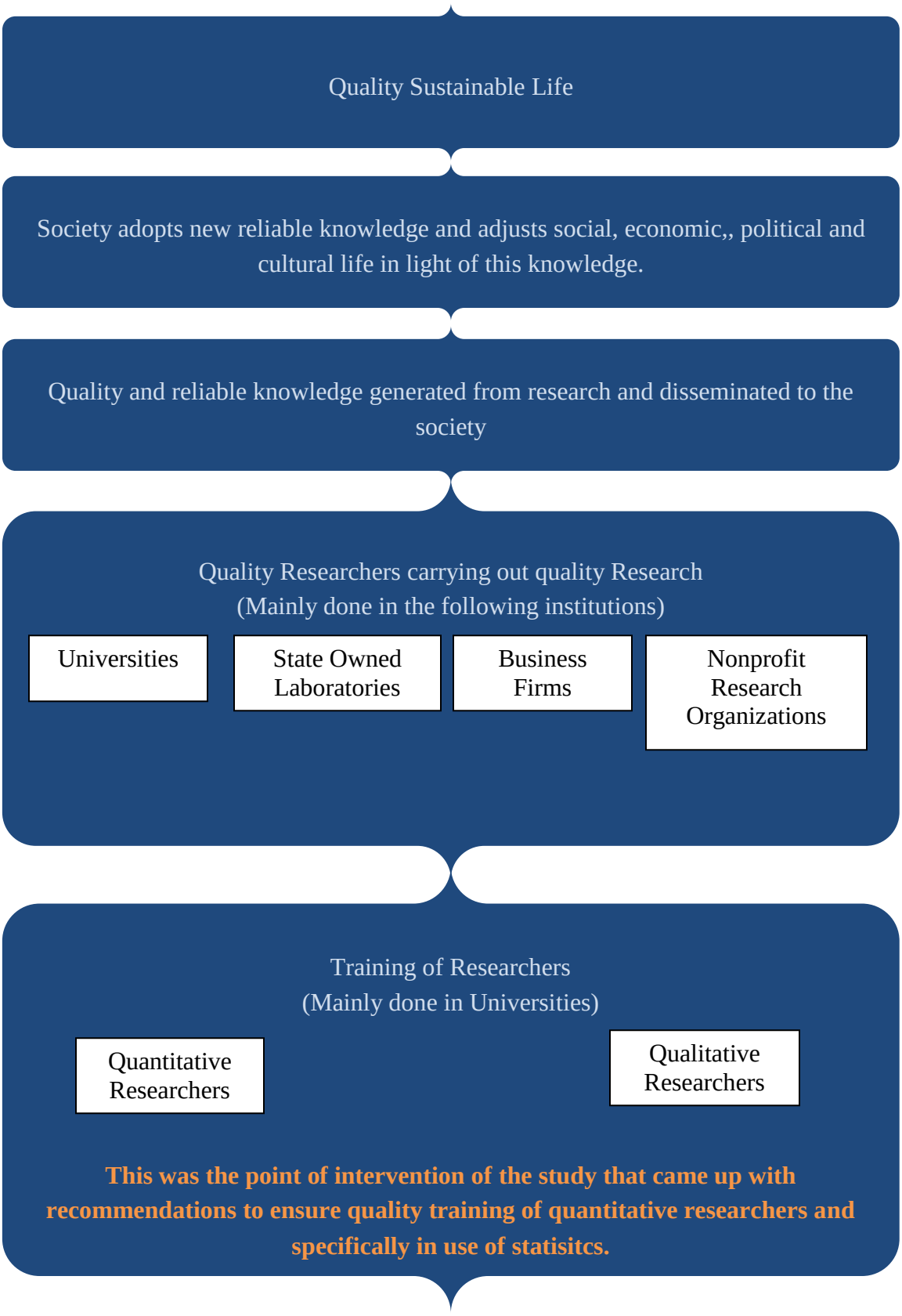

Figure 1.1: Frame work of Significance of the Study

1.8 Assumptions of the Study

This study was based on the following assumptions;

The study was based on assumption of determinism. This assumption presumes that events have causes that were determined by other circumstances and that these causal links can eventually be uncovered and understood. It was on this basis that the study sought to uncover and understand the reasons behind how masters' students' use statistics in research.

The assumption of Interpretivism which assumes that people actively construct their social world and their behavior evolve over time and were richly affected by context. People interpret events, contexts and situations, and act on the basis of those events and, therefore, explanations for each individual cannot be generalized to others. It was based on this assumption that the study interviewed some of the participants and analyzed findings qualitatively.

The study was also based on the assumption that respondents were honest in giving out their responses, and the responses were given to the best of their knowledge. In order to control dishonest responses respondents' names or identities were not disclosed an assurance to the respondents that the set of data collected was treated with maximum confidentiality and was only used for research purposes and never to be used against them.

The study was also based on the assumptions that enable use of multiple regressions on the set data that was collected. The assumptions were that the values of the residuals were

normally distributed. The values of the residuals were independent and there was no multicollinearity in the data collected.

1.9 Scope and Limitations of the Study

Various aspects stated the boundaries or the extent to which this study was carried out. Geographically the study was carried out in Western Kenya. Despite the fact that all universities across Kenya have been noted for producing low quality researchers, Western Kenya was the preferred area of study because of the many and varied universities in this region. Specifically the study targeted only continuing masters' degree students who had submitted their thesis for examination. In relation to the content the study only looked into research curriculum, implementation factors, prior knowledge, technological resources and personal factors and how they influence the use of statistical analysis in research among masters' students in universities. Furthermore the study used questionnaire, interview schedule and document analysis schedule as instruments for collection of data.

The study had two key main limitations. This study was based on survey which has a main limitation defining life and experiences in measurable terms rather than inner experience, and excludes notions of choice, freedom, individuality, and moral responsibility, regarding the universe as a machine rather than as a living organism. To control for this limitation the study incorporated interviews and content analysis which were based on individuality and contextual explanation of behaviour. On the other hand interviews also has a major limitation of abandoning scientific procedures of verification and in giving up hope of discovering useful generalizations about behavior (Cohen,

Manion, & Morrison, 2007). However, this limitation of interviews was fully covered by the strengths of survey and specifically use of questionnaire.

1.10 Conceptual Framework

This study was based on a conceptual framework that was arrived at after a review of documented findings. From the review the study identified several competencies that were hypothesized to influence the dependant variable. A detail of the competencies were as discussed below with a summary of how the competencies were related being shown in figure 1.2.

Use of Statistics in Research

This was the ultimate dependant variable of the study. The study conceptualized that finding it easy or difficult to use statistics in research was as a result of several factors. The competencies that were hypothesized by the study to be major include students' prior knowledge, students' personal factors, research curriculum content, technological resources and the curriculum implementation process. These competencies and the reasons they were hypothesized to be of influence were as discussed below.

Knowledge Needs

The study was interested in determining the knowledge and skills that students required that can supported their use of statistics. Saville (2001) and Bangdiwala (2001) state that researchers should be trained to have a basic understanding of the statistical methods that can be used in research. The study however sought to determine the specific important skills and knowledge concepts.

Students' Prior Knowledge

The study was interested in the knowledge that masters' students had related to research and statistics before joining masters program. This was of interest to the study based on argument by Starkings and Jerome (2001) that many of the students who enrolled for Data Analysis classes at South Bank University had enrolled based on their own previous experiences in mathematical/statistical courses. They argued that students who were from programs with little or no statistical courses, and categorically identified social science students, were mathematically weak and could not respond adequately to mathematical concepts using traditional textbook techniques. The authors' also noted that if these students are taken through appropriate and keen instruction they could cope with the material being presented to them. This argument meant that masters' students' previous knowledge in relation to statistics can be hypothesized to influence their understanding and use of statistical analysis in research.

Students' Personal Factors

The study was interested in indentifying the personal characteristics and factors of masters' students and how they may influence the understanding and us of statistics in research. This resolution of being interested in personal factors was based on findings that these factors were of influence in other sectors of research. Sabzwari et al (2009) noted that time, financial constraints, busy schedules and lack of interest as major deterrents to clinicians' involvement in research. Age and gender differences in research interest were also seen with younger physicians showing more inclination towards research. Inadequate mentorship and lack of time have been other major barriers in

research. It, however, remains unclear if these factors influence statistics training and its use in research.

Research Curriculum Content

This study focused into looking at the planned syllabus for research and if it had elements of statistics. The study focused on finding out if the curriculum meets the needs of learners in statistics, if it suggests how to achieve the objectives and if it provides opportunity for learners to practice what they have learned among others. Research scholars argue that content as scheduled in any given training is a key factor in determining the type of trainee the program will graduate. Different scholars have documented different opinions of how research training content should be like some have just given opinions on the scope of research training. Pearson and Brew (2002) were of the opinion that research training should be very wide and should incorporate the needs for knowledge creation. This study was concerned with an aim of determining if the curriculum in any way has an influence on the application of statistics in research.

Technological Resources

Jung (2005) indicated that Information Communication Technology (ICT) can change the way teachers teach and that it was especially useful in supporting more student-centered approaches to instruction and in developing the higher order skills and promoting collaborative activities. This sentiments were also affirmed by Mubichakani (2012) who established that computer based learning process was more fun, stimulating and satisfying as compared to traditional methods which were non technological. Based on these sentiments it can be hypothesized that if there is introduction of computer software

in data analysis it could influence the content and methodology of teaching statistics. It was, therefore, important for this study to investigate and test this hypothesis.

Curriculum Implementation

Implementation is key for success of any given curriculum. A curriculum may be well planned but if not well implemented it may not achieve its objectives. Sawyerr (2004) notes that, in universities and research institutions, the capacity of individual researchers, including their skills, competencies, attitudes, and values, were developed primarily through appropriate training programs and involvement in research activity. The study dug deep into implementation process which was key in curriculum implementation to find out if the process was being done as planned for and if it was in any way affecting the use of learned knowledge.

Intervening Variables

These were the variables that were not included in the study but also have a possibility of explaining the dependant variable. In this study the intervening variables were hypothesized but not limited to; the experience of the lecture taking masters students through research training and specifically use of statistics; the experience of the masters' student supervisors; and the reasons for the masters' students enrolls for masters. The effects of these intervening variables were siphoned out of the entire effect to the dependant variable using statistical tools namely regression analysis.

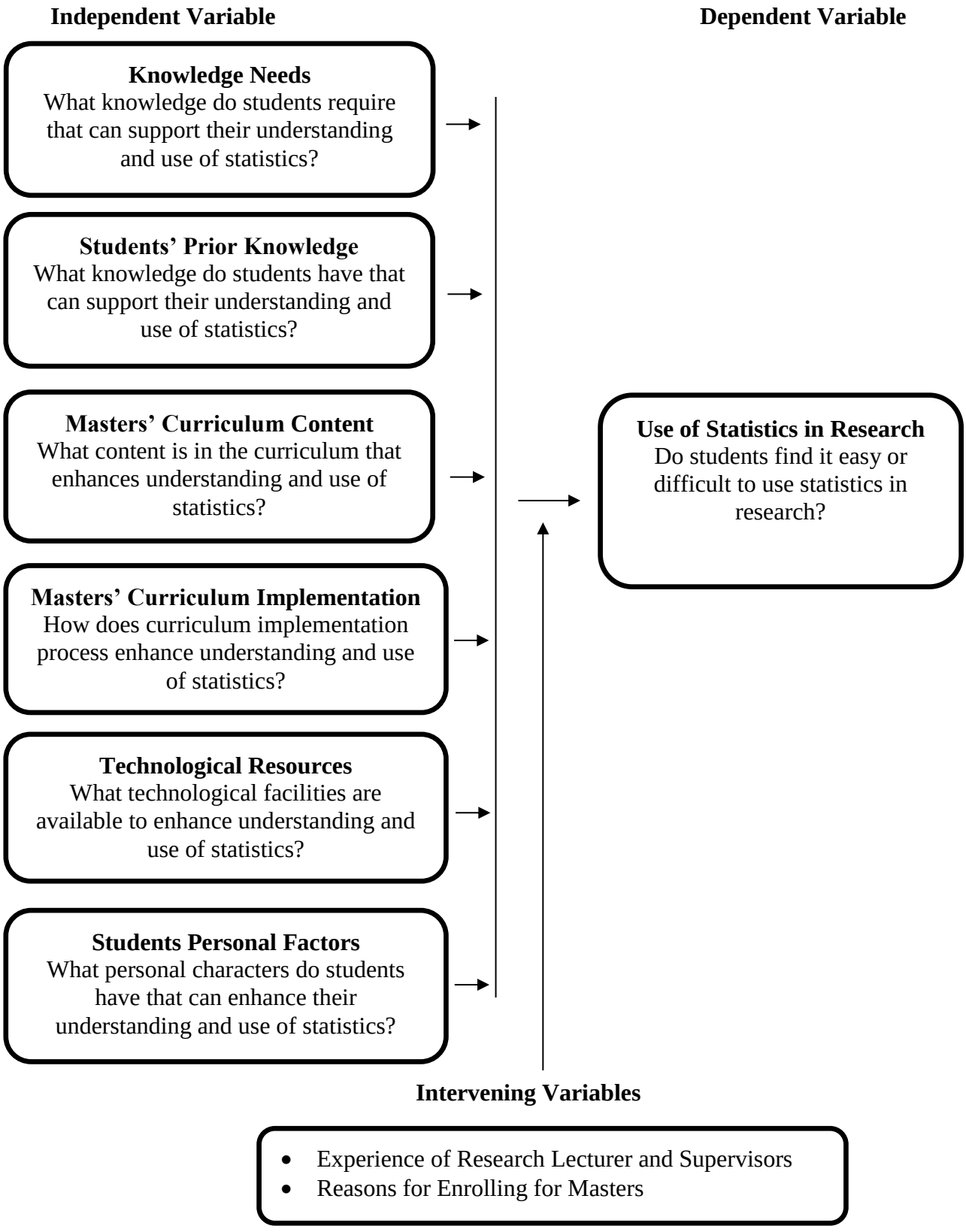

Figure 1.2: Conceptual Framework

1.11 Operational Definition of Terms

This study used some of several terminologies which sometimes were used broadly as defined by various scholars and in other cases were used narrowly as compared to wide definitions of the terms. It was, therefore, important to define the key terminologies in relation to the study and note the key attributes of the terminologies that were actively used in the study. Below is the operational definition of the terminologies.

Curriculum

Curriculum as defined by this study was a planned and guided combination of contents of a subject, concepts and tasks to be acquired, instructional practices, learning experiences, and students' performance assessment that were designed to bring out and evaluate the target learning outcomes of a particular course.

Curriculum Implementation

According to this study implementation was the carrying out, execution, or practice of a plan, a method, or any design, idea, model, specification, standard or policy for doing something. As such, curriculum implementation was the process of carrying out or executing the planned curriculum.

Knowledge

Knowledge according to this study was defined as facts, information, and skills acquired through experience or education.

Personal Factors

This study defined personal factors as the time a master's students set aside to attend to academic and specifically statistical matters. Personal factors were also defined as the personal initiative and efforts put in above the collective effort in class.

Prior Knowledge

According to this study prior was defined as formal existing or happening before particular time. Therefore, prior knowledge were the facts, information, and skills acquired through experience and or education by masters' students before joining masters' studies.

Statistics use in Research

Statistics is a branch of mathematics dealing with data collection, organization, analysis, interpretation and presentation. use of statistical analysis in research is, therefore, the science of determining sample size collecting data and uncovering patterns and trends in the collected data. Statistics in research eventually leads to summaries and generalization of research findings. The use of statistical analysis in research was measured at four levels; finding it very difficult to use; finding it difficult to use; finding it easy to use; and finding it very easy to use.

Technological Resources

According to this study technological resources were a set of machines, equipment and programs designed by humans using specified scientific knowledge for the attainment of specific goals.

1.12 Summary

Knowledge is an important aspect of development in a society. Knowledge especially scientific knowledge is an outcome of active experiments and research carried out by scholars and experts. However, all was not well with research process. There was a decline in interest and quality of research carried out. The findings on the low quality and lack of interest in research do not, however, state the exact ailment in research. Quantitative research involves aspects of statistics which were a key component. It has, however, been found that simple statistical notions were sometimes misunderstood or misinterpreted by research workers in many disciplines who have only a limited knowledge of statistics. Based on this finding the study hypothesized that incompetent use of statistical analysis was one of the reasons that research was ailing.

The purpose of this study was to determine the competencies influencing masters' students' use of statistical analysis in research, a case of universities of Western Kenya. Specifically the study sought to; determine research knowledge needs for use of statistics, determine how the masters' curriculum content meets the needs for students to use of statistics, establish how curriculum implementation process meets the needs for use of statistics, find out how prior knowledge influence masters' students' use of statistics, find out how personal factors influence masters' students' use of statistical analysis and find out how technological resources influence masters' students' use of statistical analysis in research.

CHAPTER TWO

LITRATURE REVIEW

2.1 Introduction

This chapter discussed in detail what other scholars had documented that was related to this study. The chapter discusses this work by looking into similarities and differences among scholars and identifies areas that have little knowledge documented with an aim of this study adding more knowledge to this area. The key areas of the review include; Research as a source of knowledge; Universities as institutions of research; Statistics component of research; Knowledge needs to use statistics in research; Prior knowledge and use of statistical analysis in research; Masters' curriculum content and use statistics in research; Masters' curriculum implementation and use statistics in research; Technological resources and use of statistical analysis in research; and Personal factors and use of statistical analysis in research.

2.2 Research as a Source of Knowledge

The world since ages ago to date has been marked and continues experiencing changes socially, culturally, economically and politically. These changes technically mean changes in knowledge since new things will be done differently from what used to be there but at the same it's the knowledge that will drive the changes into new spheres. Yamamoto (2001) noted that knowledge was key for any meaningful development or progress in society. If knowledge is this valued it means the source of knowledge should

be even more valuable. The study therefore sought to determine the various sources of knowledge as documented in already existing literature.

Document analysis showed that there were various sources of knowledge to the community. Yamamoto (2001) noted that knowledge and specifically scientific knowledge was increasing as a result of the various experiments that were being carried out. Estabrooks, et al (2005) carried out a study of sources of practice knowledge among nurses. Their findings demonstrate that nurses categorize their sources of practice knowledge into four broad groupings: social interactions, experiential knowledge, documents, and a priori knowledge. Assimakopoulos, and Yan (2006) in their study about sources of knowledge acquisition for Chinese software engineers. Their findings indicated Chinese software engineers acquire their knowledge through, reading technology books and search information on the Internet; Inquiry from team colleagues to discuss their specific problems and; External sources to acquire knowledge.

Fletcher and Harris (2012) in their study of Knowledge acquisition for the internationalization of the smaller firm, which involved a survey of ten Scottish internationalizing firms, noted the following as sources of knowledge for these firms. They noted that internationalizing information can be acquired from the experience of others. It can also be acquired by hiring top manager with useful technological and market knowledge. In addition they noted that government advisors and consultants can provide this knowledge.

From the above analysis it was summarized that sources of knowledge were internal, which was mainly personal experience, and external, which includes other individuals

and organizations experience. To get information from these external sources will require an organized inquiry, which was the research process. Okafor (2011) noted that the important reason of carrying out research was to discover or generate new ways of doing things in society which eventually leads to new knowledge. The results stemming from research and development were in some cases documented in books, journals and other publications. These publications were found on the internet, which was one of the sources of knowledge mentioned by researchers discussed above. Paul, et al (2010) emphasize that there were important elements in a highly productive Research and Development enterprise. They note that fostering scientific creativity and being opportunistic for serendipitous scientific and medical findings were clearly important elements of past and future success in the pharmaceutical industry. Research can therefore be deduced as key element of knowledge generation.

The study was further interested in institutions that were mandated to carry out research and also those mandated to train researchers. Clark (1993) stated that Germany universities were the first to pursue research as a key element of their mandate. He noted that there after other universities in other countries followed suit. In addition to universities he also identified other firms like laboratories, nonprofit organizations and businesses that were also engaged in research. Cloete and Maassen (2015) agreed with Clark's sentiments, they, however, also noted that given the then prevailing conditions of the global knowledge economy, knowledge production and technological innovation could not be assumed. Research had become the most important productive forces. They therefore recommend every country to have a national research system that should comprise of higher education institutions, private sector and public research centers.

Votruba (1996) noted that over the past 100 years American universities had brought science to agriculture, educated the work force for industrial expansion, provided educational access that contributed to civic literacy and social mobility, and developed the research and technology that has been instrumental in advancing every sector of American life.

In Africa Sawyerr (2004) indicated in his work that Africa's universities continue to provide the vast bulk of its research and train virtually all its researchers. He adds on that alternate sites for the generation and adaptation of knowledge were emerging and assuming prominence and this include public research institutes, private research centers, firm based research units, regional and sub regional centers and nongovernmental organizations. The Kenya Vision 2030 recognizes the critical role played by Research and Development and Innovation in accelerating economic development in the newly industrializing countries of the world. Given that Science Technology and Innovation were the foundations or enablers for socio economic transformation in the Kenya Vision 2030, a national policy has been created to support Vision 2030 and in this policy universities have been identified as key drivers in the rollout of this policy hence their manpower training should be aligned in providing skilled manpower for this national need (Mukhwana et al, 2016). Based on this documented literature across different continents and countries it was summed that research was being carried out by universities and non teaching research centers.

In summary Yamamoto (2001) noted the value of knowledge as an important aspect of for progress and prosperity for human beings. Sources of this knowledge included; research, social interactions, experiential knowledge, documents, and a priori knowledge

(Yamamoto (2001); Estabrooks, et al (2005); Assimakopoulos, & Yan (2006) & Fletcher & Harris (2012)). Based on this documented literature across different continents and countries it was summed that research was being carried out by universities and non teaching research centers (Clark (1993); Votruba (1996); Sawyerr (2004); Cloete & Maassen (2015) & Mukhwana et al (2016)).

2.3 Universities as Institutions of Research

Votruba (1996) argues that universities should be partners in addressing issues such as the society being economically competitive, improving quality of education, overcoming the tragic human and economic costs associated with urban and rural poverty, and promoting health care access and delivery. Votruba further clarifies that while universities cannot and should not be expected to solve this problems, it was legitimate to expect them to help inform the problem solving process through the responsible extension and application of their academic expertise. This argument opened up questions about the role of universities in the society? Documented literature showed that universities have different roles, they were discussed below.

Cloete and Maassen (2015) noted that universities were increasingly being focused as for their contributions to innovation that was necessary for economic development. This meant that, universities were being placed at the center stage and their role as a source of knowledge was important. The authors go ahead to quote Castells, who provided a a clear picture and view of higher education in society by then. Castells noted that;

> *"We live in a global knowledge economy and in societies based on processing information, which is a primary university function. This implies that the quality,*

> *effectiveness and relevance of the university system will be directly related to the ability of people, society, institutions, to develop."* (Cloete, & Maassen, 2015, P. 1)

The sentiments above give the overview of the role of universities in society, the specific roles of universities include the following:

Universities play a major role of training in the skilled work force for the market and this had been central to its functions ever since higher education was established. Cloete, and Maassen (2015) note that, the Napoleonic model and the Chinese Imperial systems used specific institutions of higher learning to prepare individuals for specific responsibilities in the government. African universities were established following after independence following a basic assumption that they were expected to train work force that was required by their countries: in particular, the development of employees for the civil service. This was as a result of trying to fill the many vacant positions that had been left by the colonial governments, (Cloete, & Maassen, 2015). This indicated that universities across Africa carry with them this key role of training labour force.

The second role of universities was associated with what the German universities were venturing in as from the second half of the 18th century. German universities had picked a new role of being research centres. This led to the development of a university that could be called a science university. The key function of this science university was the production of scientific knowledge (Altbach 2013). German was only but the first country to have research universities, after it this type of universities has spread across the world. After the Second World War in 1945, that aspect of universities focusing on research was adopted by US universities (Cloete, & Maassen, 2015). Geiger (2017) note

on this matter by stating that during the last quarter of the nineteenth century, the flood tide of influence from German universities, and the academic boom of the nineties all contributed to the fixing of research as an indelible commitment of the leading American universities. Chinese universities have been noted by Wei, Y. (2001) not only to be practicing research but also as being responsible for training the researchers.

Sawyerr (2004) note that, African universities' have a crucial role of knowledge generation, which mainly through research. Mukhwana et al (2016) notes that Kenyan universities were centers of research training and in relation to that have strived to have Graduate schools regulations which guide the training of postgraduate students. Sawyerr and Mukhwana are, however, silent on whether the African universities were adequate in fulfilling this role. Altbach (2013) amplifies the doubt of African universities being research centers in his statement that in developing economies very few universities focused on research. Musiige and Maassen (2015) note the importance of research into themes such as health care, nutrition, sustainable energy, environmental protection, agricultural mechanization, education, and industrial production in Africa. They indicate that it was based on this that governments, donor agencies and private actors were collaborating with African universities to build stronger research capacity and productivity. They eventually conclude with a heart breaking statement that, nearly all sub Saharan African universities were struggling to improve their academic research productivity.

Given the importance of research to development of the community it was expected that developing countries especially in Africa should be on the fore front of research. This however was not the case as it has been noted based on Musiige and Maassen (2015)

findings. Researchers were not a sleep they were working on finding out the situation and its causes as it is discussed in the section below. However, the studies were not exhaustive on causes of African universities to struggle in research. This study's findings also contribute to explaining the situation and its causes especially in use of statistical analysis in research.

2.3.1 Research in African Universities

Most of the postgraduate programs, specifically master's and doctorate studies, in African countries involve carrying out of research. Given the potential that these programs have towards in adding to the research carried out in Africa, this study browsed through the documented literature. Higher Education Research and Advocacy Network in Africa (HERANA) project carried out a study in eight universities namely; The universities of Botswana, Cape Town, Dar es Salaam, Eduardo Mondlane, Ghana, Mauritius, Makerere and University of Nairobi. The findings on enrollment of master's and doctorate students in these universities as documented by Bunting, et al (2015) were as follows; Masters enrolments in the eight universities nearly doubled over this five year period, increasing from 14 099 in 2007 to 26 052 in 2011. Exceptional growth in masters enrolments were recorded by University of Nairobi, which was up by 5 662 (or 92%) in 2011compared to 2007, and Ghana, which was up by 2 777 (or 185%) over the same period. Doctoral enrolments grew by 76% in 2011 compared to 2007. High growth occurred at Makerere, which was up by 531 (or 1 659%) in 2011 compared to 2007; Ghana, which was up by 206 (or 187%); and Nairobi, which was up by 193 (or 311%) over the same period.

Further review shows that research publication outputs increased at the same level as doctoral graduates. The largest increases were at Cape Town, which was up by 500 (or 49%) in 2011 compared to 2007; at Makerere, which was up by 149 (or 64%); and Ghana, which was up by 109 (or 179%) over the same period (Bunting, et al 2015). At University of Nairobi, the only Kenyan University in the team, despite recording a good increase in postgraduate enrollment falls out of the list of increased research publications. This raises questions on the type of research that could be going on in postgraduate classes in University of Nairobi and by extension, Kenyan universities.

In relation to general research, and not particularly research by students, Tijssen (2015) in a study of, research output and international research cooperation in African flagship universities, noted the following. In a count of Web of Science journals, Africa has only 101 journals out of the estimated 14 000 journals globally. This translates to 1% of the journals. In addition Tijssen (2015) notes that out the 101 African journals, 87 were South African. Tijssen (2015) further documented a survey of publication of eight universities that were participating in HERANA project for the period running from 1996 to 2013. He noted that all eight universities showed an upward trend towards 2013, some from low baseline levels. The rise of the University of Cape Town and Makerere University was particularly significant. The findings showed there was a considerable percentage increase in publication output, particularly beyond 2010, with Makerere and Ghana in the lead. Once again there was bad news for University of Nairobi and University of Botswana that were noted to be slowing down towards the year 2013.

A narrow focus on Kenyan situation in an attempt to dig the reasons why research was slowing down revealed the following. Scott (2015) noted that, many students pursued non

academic topics and tried mental gymnastics to try and fit them into a research project. He noted that thousands of Kenyan graduate students ask simple yes or no questions with answers already found in literature and they settle to it as research. He argues that the same students also possess little or no concept of testing a theory or contributing to a body of knowledge by refining a theory. Mukhwana et al (2016) adds voice to the sentiments above by noting that postgraduate students' supervisors in Kenya often complained about candidates who were unwilling, or unable to conduct serious research. The study sought to review the reasons behind these state of research in Africa and Kenya in particular. The findings of this review were as presented in the section below.

2.3.2 Research Challenges in African Universities

Reviewed literature revealed several challenges that African universities were facing in relation to research. Some of these challenges were not unique to Africa; they were either experienced or were being experienced by other countries across the world including developed counties. Clark (1993) identified one of the key challenges universities were facing in relation to research was the transition from elite to mass higher education. He noted with specific examples how universities had increased intake over the years. He indicated that at the end of 1980 United States was awarding 400,000 advanced degrees annually. This was not only limited to the United States, several other countries have also experienced increased intakes in higher education. In Kenya the numbers of students joining universities have increased tremendously both at undergraduate and postgraduate. Data from Kenya National Bureau of Statistics (2013) indicated that in 2007 there were a total of 85,351 students enrolled at undergraduate level and this number increased to 170,417 in 2013. At postgraduate level the bureau indicated that 6,789 were enrolled in

2007 and this number increased to 24,417 in 2013. This was an increase of approximately 350% in postgraduate intake in Kenyan universities over a period of 6 years.

The increase in student enrollment which Clark refers to as mass higher education in itself was good. However, this increase in enrollment has been documented to be posing challenges to postgraduate training and specifically research training. Clark (1993) found that increased intake at postgraduate level in American universities had greatly informed the type of instruction that were being used at postgraduate level. The author noted that at postgraduate level they were being exposed to manly undergraduate approaches that had little link to research. He noted that because of the large numbers in higher education, the system had opted to focus on training for professions at the expense of developing research skills. This instruction approaches and selective devotion to training professional with no research was slowly killing the quality of education at higher education. Votruba (1996) argues that mankind lives in a society that generally places higher premium on what people know than on what degrees or credentials they hold. It's, therefore, just a matter of time that the society will begin noticing the low quality postgraduate trainees in general and research trainees in particular. Since this increase in enrollment was a worldwide challenge it cannot exhaustively explain the lack of research culture in Africa and specifically Kenya.

The second challenge African universities were facing were financial challenges in higher education. Sawyerr (2004) noted that Organization of Economic Cooperation and Development (OECD) countries, as donors, exercise so much influence on the development of Africa's higher education systems. These countries downgraded their support to African Universities in the 1980s and 1990s, pressing African governments to

favor basic education at the expense of higher education. Sawyerr (2004) further noted that African countries have ceded to this pressure from the international financial institutions and the donor community, as well as from their weak economic situation. Sawyerr's study documented that over the past two decades, African countries have tended to underfund and run down their universities and research institutions, purportedly in favor of strengthening basic education.

The mass higher education coupled with underfunding places African universities in general, and Kenyan universities in particular, under immense pressure to live up to their objectives. As a way of coping, Agoki and Maasai (2017) noted that Universities in Kenya reacted to the crisis of the increased Kenyan Certificate of Secondary Education (KCSE) graduates who needed to enroll for university education by coming up with the double intake and parallel programs which caused a shortage of physical facilities in public universities in Kenya; lecturers' teaching load became prohibitively heavy with semesters that run back to back and no break for lecturers and death of financial source. However, they did not give much in relation to how these situations were affecting research training. Scott (2015) gives a blanket statement that proper research conceptualization exercises do not exist in most classes of research training in Kenya. He, however, does not expound on how or what was leading to failure of conceptualizing research concepts. This study, therefore, sought to determine how research trainees were being trained especially in use of statistical analysis in the context of these challenges.

Clark (1993) documented that another challenge universities were facing in relation to higher education and postgraduate training in particular was the labor market requirement for advanced knowledge and skills. On one end demand for access was stretching

universities from the input side; the increasing demand for advanced laborers in skills and knowledge was stretching the system on the output side. Several countries across the world have increased their requirements for employees. Clark (1993) found that in the European countries undergraduate studies were seen a prerequisite leading to professional studies. The author equated these professional studies to a masters' degree in the United States. In the American system most serious specialized study has been raised to the graduate level. In Japan, where employers seek out university students as they take the bachelors degree, now increasingly in engineering and sciences employers consider employees when they have the masters' degree in hand. In Kenya Commission for University of Education (CUE) guidelines as quoted in Agoki and Maasai (2017) states the minimum requirements to be a university lecturer was to have a PhD.

These challenges to a great extend remains unclear on how its influencing research training process. However, Sabzwari et al (2009) notes that some efforts were being made to improve training in research both at undergraduate and postgraduate. These efforts range from increasing research funding to increasing research training. Clark (1993) noted that the creation of post doctoral research training in American universities was a dramatic example of this stretching response to challenges at higher level of research training. The author indicated that in biological and medical sciences and in some of the physical sciences, the post doctoral training has become in a decade or two the rule, not the exception. These one to three year research training appointments, beyond the work of the PhD program, have also become more frequent in the social sciences and even humanities. Recognizing the immense importance of science and technology India, has built up a strong research and development base in both

governmental and private sectors in all areas of science and technology. This has lead to an impressive quality of research publications. As reflected in the publications indexed in international multidisciplinary subject databases, India's publication growth rate has been relatively much faster in recent years (Gupta & Dhawan, 2006).

Despite the challenges being universal, Kenya as a country and Kenyan universities has not come out clearly with strategies of addressing these challenges. It was with this in view that the study sought to determine, in addition to these universal challenges, the specific challenges being experienced by Kenyan universities and with that knowledge enable the coming up with a comprehensive strategy of addressing research training and specifically data analysis training challenges.

As a way of improving research, some African countries have come up with incentives for knowledge production through research. Monteiro (2010) argued that Mozambique, an African country, lacked a robust research culture that was manifested, amongst others, in low research outputs and low postgraduate enrolments. These sentiments were shared by (Bunting et al. 2014). As a mitigation measure Mozambique has put into place policies and other incentives to research. Langa et al. (2014) note that, all major policy documents in Mozambique advocate for the need to encourage scientific research as a means of training students, solving societal problems and supporting the development of the country. Other incentives include salary supplements for researchers. Wangenge, Lutomiah and Langa (2015) note that Higher Education Strategic Plan (2012‑2020) emphasizes the need to link progression in academic careers to academic and research performance. Mozambique regulations also make provision for innovation, scientific

discoveries and inventions. Wangenge, et al (2015) however note that these incentives have not been implemented.

In Kenya an observation from the University of Nairobi case study was that there were several incentives at the university that were provided by: University of Nairobi, the national research council, NGOs and other entities that offer consultancy opportunities to academics. These principals were concerned with publications made in peer reviewed journals at international level, successful supervision of postgraduate students, and consultancy services offered, Wangenge, et al (2015). Wangenge and the team, however, note that despite the university placing a premium on research and postgraduate supervision as evidenced in the promotions criteria, the existing monetary incentives for module teaching seem to encourage more teaching at the expense of research. University of Nairobi has also been noted to be inconsistent and not uniformly applying the incentives across the university, Wangenge, et al (2015).

In this two cases it can be noted that although the governments have in their policies incentives for research they were not closely monitored and keenly implemented. Those that were at the discretion of university management were also not well rolled out to effectively cultivate the research culture in Kenya and Mozambique. This study endeavored to determine if there other issues, in relation to use of statistics, that were diminishing the possibilities of developing a research culture in Kenya other than the laxity in policy implementation noted here. Statistics was a key area of concern to the study given its importance in research process, as discussed below, and the little research that has been carried about how it influences research.

In summary Universities have a major role of training labour force (Cloete, & Maassen, 2015) and research (Wei, Y. (2001); Sawyerr (2004); Altbach (2013); Cloete, & Maassen (2015); Mukhwana et al (2016); Geiger (2017)). However, African universities were still struggling in research (Musiige & Maassen, 2015). In a count of Web of Science journals, Africa has only 101 journals out of the estimated 14 000 journals worldwide. This translates to 1% of the journals (Tijssen, 2015). Tijssen also noted that the contribution of University of Nairobi towards published research work was slowing down towards the year 2013. Scott (2015) and Mukhwana et al (2016) attributes this to poor quality research in Kenya. Challenges contributing to this low research in Africa were found to be; increased enrollment (Clark (1993) & KNBS (2013)) and low funding (Sawyerr 2004). Little was known about training postgraduate students in use of statistics, which was the core mandate of this study.

2.4 Statistics Component of Research

Reviewed literature so far has indicated the bad state of research in Africa. Africa was contributing just about 1% of the research worldwide (Tijssen, 2015). Specifically in Kenya research has been found to be slowing down (Tijssen, 2015). Scott (2015) and Mukhwana et al (2016) has attributed this slow down to poor quality research being carried out in Kenya. Further review has indicated the challenges to be high enrollment and funding, Clark (1993) KNBS (2013) & Sawyerr (2004)). However, little was being said about training postgraduate students in research in African universities especially in Kenya. Based on the fact that Kenyan students were doing poor quality research, the research training process and the context of training cannot be ignored as a factor to be

looked into. Research, sometimes referred to as scientific inquiry, was an extensive discipline that comprises several components.

Bishop and Talbot (2001) noted that the generally accepted approach to answering research was observation, they also identified use of laws and theories, and lastly they acknowledged experimentation and inference. In this five categories Bishop and Talbot (2001) argue that in observation, experimentation and inference statistics is at the center stage and cannot be ignored. They noted that statistics enables one to; read and comprehend data resulting from the process; statistics also enables one to present data that answers research questions; and infer reliable conclusions based on collected and presented data. Sprent (2003) indicated that the role of statistics in medical research starts at establish the design and size of an experiment. The author noted that statistics was useful during the analysis of sample data to make inferences valid in a wider population. Zwiers and Von Storch (2004) noted the importance of statistics in specifically climate research. They said that statistical analysis helps to quantify the effects of uncertainty in climate research, both in terms of observation and measurement and in terms of our understanding of the processes, which govern climate variability. Generally they concluded that;

> *"The study of the climate system is, to a large extent, the study of the statistics of weather; so, it is not surprising that statistical reasoning, analysis and modelling are pervasive in the climatological sciences."* (Zwiers & Von Storch, 2004, p. 665*)*

Given this important role of statistics in research the study sought to determine from literature the influence of adequacy or inadequacy of statistical knowledge to the quality of research carried out. Most of the information in this aspect was mainly from Asia, Europe and United States. Murray (1991) noted that several reports in the medical literature were flawed because of poor presentation of numerical results, or, more seriously, by the use of inadequate or inappropriate statistical methodology. Maindonald (1999) points out that when he reads published papers, Maindonald was persuaded that there was a serious problem with design of data collection and with data analysis. Svensson (2001) came up with findings that agree with Murray and Maindonald. The author noted that based on analysis of paper's published in medical journals, there had been a trend of poor quality of methodology and statistics that were used. The author further argued that the problem was being magnified by researchers who tried to use complex and advanced statistics to analyse their data.

Bishop and Talbot (2001) noted that Postgraduate students from non statistical disciplines often present low quality research because they have trouble designing their first experiment, survey or observational study. This case they found to be worse if the student's supervisor does not also have a statistical background. Bishop and Talbot (2001) argue that once such a mistake has happened even a research consultant cannot rescue a poorly designed study. Sprent (2003) records that despite the wide use of statistical analysis in research; simple concepts were sometimes misunderstood or misinterpreted by research workers in other disciplines who have only a limited knowledge of statistics. This the author noted that it leads to papers, or research findings, that were often submitted that give inadequate statistical analyses or present results in an

inappropriate way and the worst was they can present wrong results. As stated earlier this studies were carried out in Asia, Europe and America, little was known about if the same issue of statistics affected the quality of African research, and particularly in Kenya.

The study sought to find out more on why some researchers either misunderstand or fail to understand how to use statistics which leads to the poor quality research discussed above. The first reason that was determined was the aspect of research being carried by non statisticians. Glencross and Binyavanga (1997) in their contribution on this matter noted that it was because in modern world, much work involving data collection and data analysis is being conducted by non statisticians. They further stated that many of this researchers, without statistical background, have little knowledge of the range of appropriate methods of data collection, were unaware of the basic assumptions underlying the statistical methods of analysis they choose, and were unable to provide sensible interpretations of the results of their analyses. It may be argued that research should then be left to statisticians alone. This will however raise other incompetence issues now not in statistics but in the core discipline that research was being carried.

Saville (2001) proposes a more sensible solution that there should be continual communication between statisticians and researchers in various fields. This however was not an authorization for non statistician's researchers to avoid having information on statistics all together. Saville (2001) the proponent of this proposal recommends that, best results could be arrived at in a situation where the researcher has general knowledge of statistics and specifically understands the basics of the statics being used in his/her research. On the other the author noted that statistician should also have general understanding of the research area and the objectives of the research being anlysed. This

point was also made by Bangdiwala (2001). The coming up of statistical software has, however, reduced the over reliance on statistician consultants, except in unique and complex cases that cannot be solved by the software. Svensson (2001) however, warned that reliance on statistical software with little statistical knowledge is detrimental and could lead to using inappropriate statistic. This, therefore, means training of researchers in how to use statistics was not optional. Once trained, it will be a solution to poor quality research resulting from ignorance in statistics. This leads us to the second reason of poor quality research, which was inadequate training in statistics.

Harraway, et al (2001) pointed out the major areas of inadequacies in research for students in the sciences. The authors identified training in study design and the second area was training in statistical methodology. Both these areas are important for planning and executing research as well as analyzing data. Mukherjee (2001) agreed with Harraway and went ahead to point out the benefits of proper training. The author stated that, training in statistics enabled researchers in various disciplines to comfortably and appropriately handle statistics for their research. On the other hand Iversen (2001) had a different opinion on what training in statistics for researchers should be all about. The author argued that the purpose of teaching students pursuing an art program statistics was not to make them be competent in research. Instead he noted that the students were supposed to be prepared to appreciate the application of statistics in today's society. All in all the researchers agree that statistics training was important to a researcher. While other continents across the world have documented information on training and use of statistical analysis in research, Africa was lagging behind on this aspect.

It can, therefore be hypothesized based on reviewed literature that use of statistical analysis was contributing towards the minimal and poor quality research being carried out in Africa and specifically in Kenya. This study therefore sought to determine the training and use of statistical analysis for researchers and its use in Kenya. Specifically the study sought to determine; the specific skills and knowledge that one needs to use statistics effectively; the prior knowledge that research trainees had in statistics; what the research training curriculum have on statistics and how its implemented; the technological resources available for use during statistical analysis; and the personal issues that may affect use of statistics. In subsequent sections in this chapter the study reviewed each of the above aspects and how they have been handled especially in developed countries. This was to act a bench mark for the study as it surveys the Kenyan situation.

In summary Statistics in research enables one to; Plan for research; collect data that could easily answer research questions; and infer appropriate conclusions from the analysed data (Bishop & Talbot (2001); Sprent (2003); Zwiers & Von Storch (2004)). Inadequate understanding of statistics and/or misinterpretation of statistics has been noted to lower the quality of research findings (Murray (1991); Maindonald (1999); Svensson (2001) Bishop and Talbot (2001); Sprent (2003)). The review noted the two main causes of inadequate understanding of statistics and/or misinterpretation of statistics across Asia, Europe and America; one was research being carried by non statisticians (Glencross & Binyavanga, 1997); and secondly inadequate training in use of statistical analysis in research (Harraway, et al 2001). It can, therefore be hypothesized based on reviewed literature that use of statistical analysis was contributing towards the minimal and poor

quality research being carried out in Africa and specifically in Kenya. This study therefore sought to determine the training and use of statistical analysis for researchers and its use in Kenya.

2.5 Knowledge needs to use Statistics in Research

The study sought to establish the knowledge and skills requirements for a researcher to effectively use statistics in their research. Several concepts were identified as key to effective use of statistical analysis and they were discussed below: The first need was the general knowledge of statistics. Saville (2001) and Bangdiwala (2001) state that researchers should be trained to have a basic understanding of the statistical methods that can be used in research. This they argue that will enable the researcher to be able to choose the best method and statistic to use. For the specified and indepth knowledge in statistics the two note that the researcher can consult a statistics expert. Mukherjee (2001) added to this argument when the author noted that the main aim of statistics training for researchers was to equip students with general knowledge of statistics that could allow them to handle general problems and not narrowing down to only their project requirements. The general knowledge was also determined to include the aspects of interpreting figures and tables. Sprent (2003) noted this inadequacy when in his research found cases of misunderstanding or misinterpreting figures and tables.

The second that was shown by earlier researchers to be a key need for one to use statistics was the concept of descriptive statistics. Elmore and Woehlke (1998) examined 1906 articles published in the three journals of the American Educational Research Association and revealed that, descriptive statistics was the second most popular among researchers.

Blumberg (2001) based on the importance of descriptive statistics in research, noted that it was appropriate to invest tie and energy so as to properly use and interpret descriptive statistics. Hirotsu (2001) described elementary statistics as a key course to learn that was very useful in research practice.

The third need for use of statistical analysis in research was the aspect of inferential statistics. Once again Elmore and Woehlke (1998) determined in their research that the use of analysis of variance (ANOVA), analysis of covariance (ANCOVA), and multivariate analysis of variance (MANOVA) combined was the common static used. These were followed by correlation and regression in third and fourth commonly preferred statistics. Blumberg (2001) indicated that teachers who wished to be researchers had to have an understanding of the logic of hypothesis testing, they should have an idea of population parameter and sample statistic and how they relate to each other, and should know how to use the terminology of "do not reject the null" and "reject the null". Hirotsu (2001) in relation to inferential analysis noted that design of experiments, multivariate analysis and advanced analysis including analysis of variance (ANOVA) were key to use of statistical analysis in research.

The fourth important knowledge need that was established was the basic computer knowledge and skills and knowledge of statistics packages. Blumberg (2001) advocates for having knowledge of computer packages for one to be able to successfully use statistics packages. McLean (2001) indicated that it was important for researchers to be familiar with use of statistical models and software. In the university of Glasgow graduate school curriculum, it was a requirement that all students to be eligible to be in Research Training Programme Induction class must be competent in basic Information

Technology skills. Equipped with this reviewed needs as the ideal needs the study surveyed on the needs that Kenyan postgraduate students identified. A report on the survey is discussed in chapter four.

In summary The study review of literature established the following needs to use statistics in research; General knowledge of statistics (Saville (2001); Bangdiwala (2001); Mukherjee (2001); Sprent (2003)); The second was the concept of descriptive statistics (Elmore and Woehlke (1998); Blumberg (2001); Hirotsu (2001)); The third need for use of statistical analysis in research was the aspect of inferential statistics (Elmore and Woehlke (1998); Blumberg (2001); Hirotsu (2001)); The fourth important knowledge need that was established was the basic computer knowledge and skills and knowledge of statistics packages (Blumberg (2001); McLean (2001))

2.6 Prior Knowledge and use of statistical analysis in Research

According to this study prior was defined as formal existing or happening before particular time. Therefore, prior knowledge was the facts, information, and skills acquired through experience and or education by postgraduate students before joining their postgraduate studies. Sabzwari et al (2009) in their study indicated that very small proportion of its sampled respondents had received any training in research during their undergraduate studies. Since use of statistical analysis as had been determined earlier needs both knowledge of statistics and information communication technology (ICT) the study sought to assess the prior knowledge in both for masters' students. Documented literature showed that ICT skills levels among undergraduate students in developed countries appear quite high (Oliver, & Towers, 2000). However, the two researchers also

noted that there were still many university students whose access to ICT and use of ICT would likely impede their learning and progression in courses and programs where use was made of contemporary forms of ICT. In developing countries, Adetimirin (2012) noted that ICT literacy skills were inadequate among undergraduate students and this constituted a limitation to their effective use of the skills. The same sentiments were echoed by Danner and Pessu (2013).

In relation to statistics the reviewed documents showed that there variations on whether students take statistics at undergraduate or not. Blumberg (2001) pointed out that in the United States of America few undergraduate education degree programs required students to take statistics courses. Dempster and McCorry (2009) also indicated that students entering postgraduate studies in social sciences, education and other non mathematical fields often do not have a strong mathematics background and often dislike anything mathematical. They noted that the threat of working with numbers can be enough to cause some students to transfer courses. For the cases of those who were taught statistics at undergraduate the reviewed literature showed that not all were able to understand well. Estepa & Sánchez, (2001) noted that few undergraduates exhibited an understanding of properties of the correlation coefficient. In particular they noted that non dimensionality, strength of correlation, and negative correlation were not well understood by first degree graduates.

Having a shaky or strong background in statistics has been noted to be influential on the learning of the statistical concepts. Starkings and Jerome (2001) noted that tutors teaching data analysis units for the social science students at South Bank university had a great deal of problems with students who were taking these statistically based units. The

reasons for the problems they identified to be that; many students were uncomfortable with numerical data and lack the intuitive feel for interpreting it; secondly they noted that statistics has a jargon of its own which can confuse the non statistician and often makes the subject look more difficult than it really is. Dempster and McCorry (2009) indicated that, statistics exam performance among psychology students was positively related to previous experience of statistics and of mathematics.

Estepa & Sánchez (2001) noted that some of the misconceptions in statistics at undergraduate were not always corrected at subsequent levels of learning. They noted that correlation and regression judgments were influenced by previously learned theories and misconceptions that were never corrected before, they further deduced that judgments were at times based on the acquired misconceptions. It was therefore not a guarantee that having a prior knowledge in statistics will benefit in understanding and use of statistics, it can also be detrimental if the prior knowledge was not well understood. Estepa and Sánchez (2001) warned that if prior knowledge was not well handled and formed a basis of subsequent teaching, the conceptions of new statistics acquired by trainees could be biased and incomplete, and will produce improper uses of statistics and, consequently, incorrect research conclusions. It was therefore important to survey the situation of prior knowledge in statistics and how it influences training and use of statistical analysis in research with a specific case being Western Kenya.

Reviewed literature in this section revealed that; there was limited prior knowledge of matters of research in general for masters' students (Sabzwari et al, 2009); there was adequate ICT knowledge among undergraduates in developed countries, (Oliver, & Towers, 2000) on the other hand ICT knowledge was limited among undergraduates in

developing countries (Adetimirin (2012); Danner & Pessu (2013)). In relation to statistics there was limited preparation at undergraduate for non mathematical courses (Blumberg (2001); Dempster and McCorry (2009)) and those taught also had limited understanding (Estepa & Sánchez, 2001). Inadequacy of statistical prior knowledge has been found to have effect on future learning of statistics (Starkings & Jerome (2001); Dempster and McCorry (2009); Estepa & Sánchez (2001))

2.7 Masters' Curriculum Content and use Statistics in Research

The content as scheduled in any given for training is a key factor in determining the type of trainee the program will graduate. Mukhwana et al (2016) points out that all Universities in Kenya have coursework for masters' students' which include courses on research statistics. A perusal through the published research has little on what specifically was contained in these curriculums. The study, therefore sought to determine the content. However, it was important to lay down an ideal situation of such a curriculum and a benchmark curriculum in order to effectively evaluate the Kenyan masters' curriculum in relation to statistics. The study used a benchmark curriculum of Graduate School for Social Sciences, University of Glasgow.

Scholars as discussed below argue that a good curriculum for research statistics should be brought enough to give an overall picture of statistics. Pearson and Brew (2002) were of the opinion that research statistics training should be very wide and should incorporate the needs for knowledge creation. Pearson and Brew (2002) documented that research training should improve student throughput, be more flexible in an open system and provide students with more support. Mukhwana et al (2016) argued that major scientific

discoveries cannot be planned. They noted that discoveries come from giving creative thinkers the freedom to follow new ideas. They indicated that this fact, as most countries agree, underlines the need for research programs and institutional structures that enable innovative approaches and encourage researchers to take risks.

Mukherjee (2001) posted that training of researchers in statistics was to equip with general knowledge to enable them handle general research cases and not narrowing only to the statistical needs of their projects. He noted that training researchers to competently use of statistical analysis was a more general than the narrow view of teaching statistics. Iversen (2001) takes it a notch higher by noting that statistics training to students in liberal arts should go beyond making them researchers. He argued that the purpose was for them to identify and appreciate the role of statistics in the community. These expectations by scholars were very high and it puts pressure on curriculum specialists and trainers. Below is a look into the benchmark curriculum and how it meets these expectations.

Benchmark Curriculum

The research training program was designed to train researchers on basic concepts and specifically concepts about research methods, research philosophy and design, and data analysis, and to familiarize trainees with a variety of practical research concepts. The general goals for research training program were to equip students with competency in: Research Design; Qualitative Methods; Quantitative Data Analysis; Applied Qualitative Methods; Introduction to Social Theory for Researchers; and generalized Linear Models. In order to meet these general requirements the curriculum has specific courses that will

be presented in subsequent stages. The courses are both core courses and elective courses for those who wish to dig deep into research.

The curriculum had a means of recognizing competency after successful training by issuing a Postgraduate Certificate in Social Science Research Methods. The certificate was designed to be given to students who met the requirements by attending classes and workshops and performed above the set threshold.

(Source: University of Glasgow research training handbook)

The benchmark curriculum can be noted to have had general goals that meet the general requirements of the scholars above. But it was important to note that the core stated in the curriculum were few and do not meet all the general goals, the curriculum, however, has provisions for elective courses to cover for the inadequately met goals. The Kenyan masters' curriculum will be looked at in light of the scholars requirements and benchmarked with this sample curriculum.

Apart from the general overview of statistics, scholars also have an opinion that statistics training should also focus of specifics that were necessary. Wei (2001) argued that the aim of training in statistics should also be to increase the trainee's abilities in their practice. The main abilities he noted that should contain designing and specifically survey designing, data collection, describing, computing, analyzing presentation and explaining. In order to achieve this purpose, Wei (2001) proposes that these statistical concepts should be put into training materials as well as textbooks. Bishop and Talbot

(2001) noted that attention should be devoted to strategic issues in statistics such as the most appropriate technique to use and data collection should be organized so as to achieve the set objectives. McDonald (2001) recommended that postgraduate courses on training of researcher in use of statistical analysis should have a section on advantages and disadvantages of micro data. He gives gave specific cases to be included as use of hierarchical data sets, how researchers should deal with cases where respondents due to some reasons did not respond, the best way of using of weights, how to carry out analysis in cases of complex sample design, and how to control confidentiality. The study looked into the benchmark curriculum to note if it meets this specific requirements. The benchmark curriculum as indicated below had the specific concepts that scholars were advocating for, although some of them were captured in optional courses.

Benchmark Curriculum

The curriculum had the following specific courses;

Research Design; research design course in the benchmark curriculum aimed at introducing research trainees to the general research designs available for social scientists. The course also targeted to expose students to advanced research methods used by social scientists. The course intended to equip trainees with knowledge and skills of designing research objectives and questions, selecting cases for study, measuring and collecting data and the choice of appropriate statistics to use during data analysis.

Generalized Linear Models; this is a course that focused on advanced aspects of statistics for the trainees. The key reason of having the course included in the curriculum

was to expose students to regression modeling that was above the basic requirement of linear models. The curriculum required that before a trainee is enrolled in this course he/she was supposed to have covered the pre-requisite courses that were noted to be College of Social Science Graduate School's Quantitative Data Analysis or an equivalent course to the one mentioned.

Quantitative Data Analysis; this course focused solemnly on data analysis. It presented various ways of data analysis that ranged from univeriate statistics to multivariate linear regression. The objective of this course was to equip students with knowledge and skills of summarizing analyzing and presenting data appropriately. The students were also to understand basic inferential statistics and how they relate to each other.

Further Epidemiology and Statistics; Further epidemiology and statistics was an optional course in the curriculum. This course required students to have covered particular courses before joining the class. The prerequisite course stated in the curriculum was Epidemiology and Introduction to Statistical Methods. The curriculum also allowed a student who had an experiences related to the prerequisite course even if they had not done the course itself. The objective of the course was to develop on the concepts that were covered in introductory courses on statistical methods and epidemiology. The course was to expose students to commonly used advanced methods of analysis with emphasize on practical aspects and use of statistical software. **Researching Human Geography:** Design, Methods, Ethics; This is an optional course that comprises several themes. The themes that are related to statistics in this course are; "Quantitative versus qualitative; Objectivity versus subjectivity; Research design, the

ideal, the reality and why it gets a bit messed up; and Data handling workshops (6 workshops).

(Source: University of Glasgow research training handbook)

Jung (2005) notes that because of rapid development in information communication technology (ICT) especially the Internet, traditional initial teacher training as well as in-service continued training institutions worldwide were undergoing a rapid change in the structure and content of their training and delivery methods of their courses. These sentiments by Jung had been reported earlier by Bishop and Talbot (2001). They noted that much of statistical education of researchers was focusing on training in specific techniques including the use statistical packages and interpreting results. Starkings (1997) noted that educational establishments need to be updating the curriculum to keep pace with changes in society and the work environment. He argued that technology was and will be a major part of our everyday life.

Given that statistical packages were increasingly being used by researchers, then based on Starkings argument they should be included in statistics training. However, such changes may also come with challenges as noted by Jung (2005) that combining new technologies with effective pedagogy had become a daunting task for both initial teacher training and in-service training institutions. McDonald (2001) recommends practical experience with large and realistic statistical data sets during the training of researcher on how to use statistics. He indicated that it was important for researchers in the field of quantitative research to get the chance to have an idea of software used for analysis of

large sets of data. In addition he noted that if possible they should be trained in the principles of software applications. There were no specific courses on information communication technology in the benchmark curriculum. However, the ICT concepts, specifically statistical software, were well integrated in the courses listed below. It was also noted that the curriculum recommended use of sets of data and real research applications.

Benchmark Curriculum

Generalised Linear Models; In this course trainees were to acquire knowledge and skills of application and interpretation of general linear models. The students were to be able to apply the acquired knowledge and skills in modeling social phenomenal with the aid of tools of inference. The course was to be taught both theoretically and also have an opportunity to apply it in a computing environ.

Quantitative Data Analysis; this course emphasized on the need for students to understand the association of the learned statistical techniques and how they are applied in the world of social sciences. The course also aimed at equipping students with computing skills in addition to statistical skills so that students would be able to associate the two and apply the same in a statistical computing environment. All this was done with an aim of making the student be competent in applying acquired skills and knowledge to not only their research projects but even others. Students were expected to evaluate theories and claims accurately using appropriate statistics with the aid of statistical software in the case of the curriculum being R code. Emphasize was on teaching and

learning the concepts in an environment that the concepts would be applied.

Further Epidemiology and Statistics; the course endeavored to equip students with application of advanced methods of analysis. It aimed at nurturing students in a practical environment using contemporary statistical computing packages.

Apart from the course contents listed above the curriculum and course outlines were also noted to have extra requirements for ICT training. The two main requirements were as follows;

"All students attending the Research Training Programme Induction must already possess basic IT skills. It is their responsibility to ensure they have these skills before the course starts, as computers are used extensively throughout the Research Training Programme. Students who do not possess basic skills in the use of word-processing and the use of e-mail must acquire those skills early in the first semester. Courses that allow students to acquire these computing skills are offered by the University's IT Education Unit."

For specific courses a note to students intending to join Quantitative Data Analysis class read *"There will be an introductory R software session on Monday 11th December 2017, 12pm – 3pm, location TBC. You are strongly advised to attend this session if you intend to enrol in this class."*

(Source: University of Glasgow research training handbook)

A review of the literature revealed that different countries have adopted different ways of training researchers in statistics. Wei (2001) indicated that in China colleges universities and research institutions were the once mandated to training researchers in the use of statistics. He noted that these institutions were applying different techniques to carry out the training. The most common he identified were; Class teaching, group discussion, field training, TV, broadcasting programs and Internet. Hirotsu (2001) recommends that Japan should extend its training of researchers beyond the university training to training in companies in the actual context that the statistics knowledge will be applied. Some of these may be queer requirements but the study sought to determine the extent to which the statistics training curriculum meets them. A look into the benchmark curriculum showed that the approaches recommended were; lectures, tutorials, class discussion and presentations and workshops. In relation to assessment the benchmark curriculum had a various ways of assessment depending with the curse content and objectives. Generally, essays, exercises and project work were the common mode of assessment. Each course assessment requirement was based on written examination in the form of a project/lab report and/or a 4000 word essay. Assessment for specific courses was as indicated below.

Benchmark Curriculum

Research Design; in this course the student were required to hand in a proposal of between 1500 to 2000 words. The proposal was required to cover the areas of theory of proposed study a review of related literature, research design and the proposed method of analysis. Alongside the proposal students were also required to hand in another essay of 2500 word discussing the strengths and weaknesses of the proposal they have submitted.

Generalized Linear Models; in this course the curriculum proposed to have a sample of a population survey carried out being provided to students. The students were required to identify research questions and select the best statistics to use, from those covered in the course, and analyze the sample survey using the learned statistical software. The process was to be done with an aim of answering the research questions. Each student was required to write a 3000 word report giving reasons as to why they picked on the statistic that was used and stating if all the assumptions for the statistic were met.

Quantitative Data Analysis; students in this course were to be evaluated based on a sample of data to be analyzed. Students were to be provided with data from which they were to identify key variables formulate questions and decide on the best statistic to be used. The students were to employ the statistic chosen and write a report of not less than 4000 words and not more than 5000 words. The analysis was to be carried out using computer software.

Researching Human Geography; this course had three proposed assessments. **Assessment 1** involved writing an essay of not more than 2000 words regarding a critique of research methods that can be used in a research.

Assessment 2 involved an oral examination of 10 minutes and questions for 5 minutes of a proposal that was developed by the student.

Assessment 3 involved a mini report of a project that was to be original and without direct quotation. The report was to be not more than 4000 words.

(Source: University of Glasgow research training handbook)

Literature from Africa and specifically Kenya on issues of the curriculum for research training in general and statistics in particular was scanty. Clark (1993) created doubt on if postgraduate training curriculum in developing countries was a well structured document. He states that in any national education system the undergraduate studies were dominant in terms of population of students. Of most interest he reported that postgraduate studies in such countries were prone to be sidelined and end up being just an addition of a few more years of schooling with little structured learning for a limited number of learners. Sawyerr (2004) argued that the extreme weakness of graduate study programs in most African universities was among the most serious of the institutional limitations on research capacity development. Clark and Sawyerr, however, do not present any specifics of the weakness in the research training curriculums.

In summary scholars argue that a good curriculum for research statistics should; Be brought enough to give an overall picture of statistics (Pearson and Brew (2002); Mukhwana et al (2016); Mukherjee (2001); Iversen (2001)); Have specifics that were necessary for data analysis (Wei (2001); Bishop and Talbot (2001); McDonald (2001)); Include information technology and use of statistic software (Jung (2005); Bishop and Talbot (2001); Starkings (1997); McDonald (2001)); Include various ways of training (Wei (2001); Hirotsu (2001)). In Africa this curriculum has been suspected to be weak (Clark (1993); Sawyerr (2004)) however these suspicions have not been proved.

2.8 Masters' Curriculum Implementation and use of statistical analysis in Research

Muia and Oringo (2016) noted that training was an important aspect of research productivity in universities. The importance of this aspect can be reflected in the curriculum set by the university but the same should also be reflected in its implementation. Votruba (1996) argued that universities that were committed to strengthening and more fully integrating outreach should be able to advance the pedagogy of outreach in order to maximize its impact. These same sentiments can be said of statistics training. Universities that were after training commitment researchers, who can comfortably use statistics, had no choice but to employ the best training strategies. Sawyerr (2004) noted that, in universities and research institutions, the capacity of individual researchers, including their skills, competencies, attitudes, and values, were developed primarily through appropriate training programs and courses and by use of strategies that involve trainees in research activity. Review of literature revealed various strategies and methods that were employed by different Universities and research institutions to implement their set statistics training curriculum. Some of these strategies were as discussed below.

Clark (1993) indicted that as a result of mass education majority of research trainees were primarily exposed to systematic, sequential course work. Harraway, et al (2001) note that one of the ways of implementing the set curriculum was requiring students to attend formal lecture courses, provided by statisticians or established researchers. Wei (2001) note that most of the Chinese universities and research institutions were using Class teaching in addition to other strategies to train researchers in statistics. This traditional form of training was wide spread across all continents. Harraway, et al (2001) noted that

lecture method has been used at University of Otago, alongside offering short courses to compliment it. They, however, noted that the situation was not satisfactory. Out the staff they surveyed on this matter, 70% thought that students were inadequately prepared when they started research. Of the students, 75% thought that they were inadequately prepared. These findings cast doubts on the effectiveness of lecturer method as a way of training researchers in statistics.

Documented research findings indicated that some of the universities have complimented the lecturing strategy with a second strategy of training. The second strategy that was revealed from survey was the workshop strategy. Rossman (1997) found that workshop Statistics was quickly gaining momentum as a statistics training technique. According to his research workshop Statistics was a project that involved the development and implementation of curricular materials which guide students to learn fundamental statistical ideas through self discovery. Classes were held in microcomputer equipped classrooms in which students spend class time working collaboratively on activities carefully designed to enable them to discover statistical concepts, explore statistical principles, and apply statistical techniques. He noted that in institutions that workshop statistics was being used, the lecture format was completely abandoned. Saville (2001) a statistician consultant noted that he normally organizes one day statistics workshops to train his colleagues and students in statistics. He indicated that he designs the workshops specifically to teach ideas rather than methods of calculation.

Mji and Glencross (2001) indicated that the University of Transkei has fully embraced use of additional methods mainly use of workshops as well as short courses, supplemented by a various research seminars so as to adequately train researchers in

social sciences. The university has gone a step further to set up a fully operational research resource center just for the purpose of training researchers. Crivisqui, et al (2001) noted that since eighties, the Data Processing Methodology Laboratory of the Université Libre de Bruxelles, Belgium, in collaboration with other European universities, had been conducting statistical methods seminars in countries of Argentina, Bolivia, Chile and Paraguay. These seminars mainly focused on statistical methodology and associated data processing technology, applied to sampling surveys in socio economic studies. In 1993, they note that this same program was extended to South American universities. Harraway, et al (2001) also identifies short courses organized by statisticians or established researchers as a way of training. In each of the cases discussed above there was record of success of the workshop strategy of training.

The third approach indicated by scholars as a way of training researchers in statistics was by consultancy. Belli (2001) in an electronic survey of 106 USA departments of statistics noted that, consulting service was an important avenue for learning given the interest that the student would have in his/her own set of data. Saville (2001) noted that he teaches statistical concepts through consultation services that he provides to researchers. Although not much research has been done on this strategy of consultation training, the two studies have shown positive effects of the strategy. Lastly, Harraway, et al (2001) determined that personal initiative by researchers to learn on their own with guidance from established researchers was also a key way of learning how to handle statistics. They noted that the approach seemed to be common. They further cautioned that it was not an effective way of learning or training as it led to the researchers having gaps in their knowledge that they were sometimes not even aware of.

The main undoing of statistics training in China was pointed by Wei (2001). He noted that in most statistical majors and training programs, the statistical courses and computer courses were offered separately. The textbooks were separately edited and published. This puts the students and trainees in a situation where they cannot solve the problems and questions using computer skillfully. In Africa Sabzwari et al (2009) notes that most teachers who were reputed in their research were unaware of the effectiveness of teaching methods. This sentiment opened up several questions on how the statistics training curriculum was being implemented in Africa and specifically Kenya.

The following were the main implementation strategies that were identified in this section as being practiced across the world; lecture method (Clark (1993); Harraway, et al (2001); Wei (2001)); workshop method (Rossman (1997); Saville (2001); Mji and Glencross (2001); Crivisqui, et al (2001); Harraway, et al (2001)); consultation approach (Belli (2001); Saville (2001)); and self study (Harraway, et al 2001). The main challenges of curriculum implementation identified were; teaching of statistics and computer separately (Wei, 2001); and statistics trainers being unaware of the effective method (Sabzwari et al, 2009).

2.9 Technological Resources and use of statistical analysis in Research

Information communication technology was increasingly being used in several sectors in the contemporary world. ICT once adopted into a sector has its own benefits and such sectors have to adjust to work hand in hand with ICT. Generally Jung (2005) indicated that Information Communication Technology (ICT) can change the way teachers teach and that it was especially useful in supporting more student-centered approaches to

instruction and in developing the higher order skills and promoting collaborative activities. This sentiments were also affirmed by Mubichakani (2012) who established that computer based learning process was more fun, stimulating and satisfying as compared to traditional methods which were non technological. Mubichakani and Koros (2014) also noted that computer based learning ensured every student was subject to same treatment i.e. same encouragement, same motivation and same chances in the process of learning regardless of the gender. A positive to be noted was that at the basic education level ICT was likely to be embraced based on the findings by Rotich, et al (2018) that primary school teachers have positive attitude toward computers.

Specifically ICT has made its way into statistics and especially how it was applied during research. Jones (1997) argues that manual calculation of a correlation coefficient, such as the Pearson product moment correlation coefficient, was tedious, extremely time consuming, and has great potential for computational error. However, he notes that statistical packages have been developed which makes the calculation quick and accurate. Friedman (2001) points out the computer revolution that has completely altered data collection and analysis. He noted that much of data was automatically recorded with computers. The result of which has been the collection and analysis of very large data in terms of both the number of observations, and the number of measurements recorded. Ashley (2018) gives a good summary of the quantitative data analysis computer software available. They were as follows; Statistical Package for Social Science (SPSS); STATA, the name STATA is an abbreviation for the word statistics and data; and Statistical Analysis System (SAS)

This introduction of statistical software has changed the way statistics was being trained in universities. Starkings (1997) points out that Calculators and computers must be recognized as tools of basic importance were available to all teachers and students, and teaching methods and syllabuses should take account of these resources. Sawyerr (2004) indicated that research training should be rich in technological resources in addition to rich methodologies. This changes and call for changes were noted to have taken root in some universities, especially research universities. Wei (2001) found that in Chinese colleges and training centres computer aided teaching was popular with many of the institutions training course for SAS.

Mji, and Glencross (2001) noted that the University of Transkei, as an institution of higher learning in South Africa, had established a research resource centre fully furnished with technological resources. One of the aims of the resource centre was to create an environment that enabled postgraduate students' access computers and statistical software for training and production of reports. However, not all Universities may have a privilege of having these resources. Wei (2001) indicated that China, being a developing country, was yet to meet the needs of the higher education development. He indicated that computer systems and teaching facilities in most universities and training centers lag relatively behind. This can also be hypothesized to be the case for Kenyan universities, a hypothesis that this study sought to test.

In summary information communication technology has been adopted in several sectors and has had the following impacts; Generally it has changed the teaching methodology and contexts (Jung (2005); Mubichakani (2012); Mubichakani and Koros (2014)); and specifically in statistics it has made it easy to carry it out using statistical software and

was also possible to do data analysis on large scale (Jones (1997); Friedman (2001); Ashley (2018)). Consequently Starkings (1997) and Sawyerr (2004) have called for use of technological tools when training researchers. This call has been adhered to by some universities who now have the resources (Wei (2001); Mji, and Glencross (2001)) in China, however the resources were lacking (Wei (2001)) this study sough to find out the case for Kenyan universities.

2.10 Personal Factors and use of statistical analysis in Research

An individual's role in research undertaking and specifically use of statistical analysis cannot be ignored. The study's review identified two main individual factors that can influence carrying out of research or being trained as a researcher. The two were individual's initiative and the availability of time. Jowett, et al (2000) noted lack of interest among clinical officers as major deterrents to their involvement in research. Lechuga and Lechuga (2012) found various individual attributes that were instrumental in stimulating the research behavior of academics. A number of these were individual passion for or interest in the discipline, ambitions, self esteem, and level of intrinsic motivation. This can be summed up into an individual initiative or determination. Interviews conducted in the Agriculture and Environmental Science College; attest to the notion of the role of individual determination and passion to engage in research as key (Bunting et al. 2014).

On the other hand Lioyd et al (2004) found that lack of time was the major barrier in research. Rosemann and Szecsenyi (2004) also added to this finding by Lioyd when they determined that time constraints was a factor that greatly influenced research. Sabzwari et

al (2009) had a positive approach when they noted that it was encouraging to note that a large majority of doctors considered research helpful for their profession and had positive attitudes towards research. However, at the same time, the same doctors of participating faculty considered it difficult to conduct research, with the most common barriers being lack of time, research training, statistical support and mentorship. Jowett, et al (2000) noted the busy clinical practices as major deterrents to clinicians' involvement in research. Jung (2012) pointed out to teaching time versus research time as a determining issue on whether one will be involved in research or not. Given that the two individual factors were determinants of research participation the study sought to determine if they also influence training and use of statistical analysis in research.

In summary the study's review in this section identified two main individual factors that can influence carrying out of research or being trained as a researcher. The two were individual's initiative (Jowett, et al (2000); Lechuga and Lechuga (2012); (Bunting et al. 2014)) and the availability of time (Lioyd et al (2004); Rosemann and Szecsenyi (2004); Sabzwari et al (2009); Jowett, et al (2000); Jung (2012)). Given that the two individual factors were determinants of research participation the study sought to determine if they also influence training and use of statistical analysis in research.

2.11 Summary

Yamamoto (2001) noted that knowledge is an important aspect for progress and prosperity in every sphere of human understanding. Research was identified as a key source of knowledge (Yamamoto (2001); Estabrooks, et al (2005); Assimakopoulos, & Yan (2006) & Fletcher & Harris (2012)). The review also established that research was

being carried out by universities (Clark (1993); Votruba (1996); Sawyerr (2004); Cloete & Maassen (2015) & Mukhwana et al (2016)). However, African universities were still struggling in research (Musiige & Maassen, 2015). Challenges contributing to this low research in Africa were found to be; increased enrollment (Clark (1993) & KNBS (2013)) and low funding (Sawyerr 2004). The study looked into the role of statistics in research and established the following.

Statistics in research enables one to; Plan research, collect data, analyze data and derive conclusions and generalizations based on data (Bishop & Talbot (2001); Sprent (2003); Zwiers & Von Storch (2004)). Inadequate understanding of statistics and/or misinterpretation of statistics has been noted to lower the quality of research findings (Murray (1991); Maindonald (1999); Svensson (2001) Bishop and Talbot (2001); Sprent (2003)). The review noted the two main causes of inadequate understanding of statistics and/or misinterpretation of statistics across Asia, Europe and America; one was research being carried by non statisticians (Glencross & Binyavanga, 1997); and secondly inadequate training in use of statistical analysis in research (Harraway, et al 2001). The review was interested in what one needs to effectively use statistics.

The study review of literature established the following needs to use statistics in research; General knowledge of statistics (Saville (2001); Bangdiwala (2001); Mukherjee (2001); Sprent (2003)); The second was the concept of descriptive statistics (Elmore and Woehlke (1998); Blumberg (2001); Hirotsu (2001)); The third need for use of statistical analysis in research was the aspect of inferential statistics (Elmore and Woehlke (1998); Blumberg (2001); Hirotsu (2001)); The fourth important knowledge need that was established was the basic computer knowledge and skills and knowledge of statistics

packages (Blumberg (2001); McLean (2001)). The study was further interested in what prior knowledge postgraduate students have before joining masters program. Reviewed literature revealed that; there was limited prior knowledge of masters of research in general for masters' students (Sabzwari et al, 2009); there was adequate ICT knowledge among undergraduates in developed countries, (Oliver, & Towers, 2000) on the other hand ICT knowledge was limited among undergraduates in developing countries (Adetimirin (2012); Danner & Pessu (2013)). In relation to statistics there was limited preparation at undergraduate for non mathematical courses (Blumberg (2001); Dempster and McCorry (2009)) and those taught also had limited understanding (Estepa & Sánchez, 2001). Inadequacy of statistical prior knowledge has been found to have effect on future learning of statistics (Starkings & Jerome (2001); Dempster and McCorry (2009); Estepa & Sánchez (2001))

In order to gauge the adequacy of training the study sought to determine an ideal curriculum. Scholars argue that a good curriculum for research statistics should; Be brought enough to give an overall picture of statistics (Pearson and Brew (2002); Mukhwana et al (2016); Mukherjee (2001); Iversen (2001)); Have specifics that were necessary for data analysis (Wei (2001); Bishop and Talbot (2001); McDonald (2001)); Include information technology and use of statistic software (Jung (2005); Bishop and Talbot (2001); Starkings (1997); McDonald (2001)); Include various ways of training (Wei (2001); Hirotsu (2001)). In Africa this curriculum has been suspected to be weak (Clark (1993); Sawyerr (2004)) however these suspicions have not been proved.

In relation to implementation the following were the main implementation strategies that were identified as being the best across the world; lecture method (Clark (1993);

Harraway, et al (2001); Wei (2001)); workshop method (Rossman (1997); Saville (2001); Mji and Glencross (2001); Crivisqui, et al (2001); Harraway, et al (2001)); consultation approach (Belli (2001); Saville (2001)); and self study (Harraway, et al 2001). The main challenges of curriculum implementation identified were; teaching of statistics and computer separately (Wei, 2001); and statistics trainers being unaware of the effective method (Sabzwari et al, 2009). Scholars also advocated the use of adequate resources (Starkings (1997); Sawyerr (2004)). The study's review identified two main individual factors that can influence carrying out of research or being trained as a researcher. The two were individual's initiative (Jowett, et al (2000); Lechuga and Lechuga (2012); (Bunting et al. 2014)) and the availability of time (Lioyd et al (2004); Rosemann and Szecsenyi (2004); Sabzwari et al (2009); Jowett, et al (2000); Jung (2012)).

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter gives the design and the methodology that the study adopted. The chapter provides the philosophical basis of the study and the subsequent design that was accepted for the study. Chapter three also presents the geographical context, the basis of selecting respondents and the means through which the study collected analyzed and presented data. The chapter was divided along the following sub themes; research philosophy and design, area of study, study population, sampling procedure and sample size, research design, research instruments, data collection and data analysis techniques.

3.2 Philosophical Paradigm

Research has been defined by Cohen et al (2007) as the systematic, controlled, empirical and critical investigation of hypothetical propositions about the presumed relations among natural phenomena. This research process was heavily influenced by the view that an investigator has about human behavior or the also referred to as the philosophy they hold about human behavior. Cohen et al (2007) notes that the perspective or philosophy of the study of human behavior has profound implications on research. The choice of problem, the formulation of questions to be answered, methodological concerns, the kinds of data sought and their mode of treatment were mainly directed by the perspective of human behavior commonly known as the research philosophy. This study was based on the following philosophies.

The study was based on normative paradigm a key paradigm in positivism philosophy. Normative paradigm argues that human behavior is essentially rule governed, and that it should be investigated by the methods of natural science. A key concept within the normative paradigm is that behavior is as a result of responses either to external environmental stimuli, or to internal stimuli, or the need to achieve (Cohen et al, 2007). In either case, the cause of the behavior lies in the past. According to this paradigm, the basic reality is the collectivity; it is external to the actor and manifest in society, its institutions and its organizations. It, therefore, implies that this reality can be explored and understood using methods of natural science.

It was on this basis that the study explored using methods of natural science the general reasons or the general rules behind use statistics in research by postgraduate students. However, this form of inquiry based on normative paradigm has been found to have its shortcomings. Cohen et al (2007) observe that this philosophy ignores the explanation and understanding of the unique and particular individual case's behavior. This was a serious shortcoming that the study sought to mitigate. A review of the philosophies showed each had its shortcoming and, therefore, no single philosophy was adequate for the study. To mitigate the shortcoming of ignoring the explanation and understanding of the unique and particular individual case's behavior the study adopted the interpretive philosophy which has its strength in understanding and explaining individual cases.

The interpretive paradigm is characterized by a concern for the individual. The central endeavor in the context of the interpretive paradigm is to understand the subjective world of human experience. Efforts were made to get inside the persons world and to understand from within. The imposition of external form and structure is resisted, since

this reflects the viewpoint of the observer as opposed to that of the actor directly involved (Cohen et al, 2007). The study adopted this philosophy because there was need to interpret the subjective meanings which individuals place upon their action and reasons they give for each case. This philosophy has a weakness of ignoring commonalities among individuals; however, this weakness was fully covered by the normative paradigm.

3.3 Research Design

Schindler (2003) defines a research design as a blueprint for fulfilling the objectives and answers to research questions. The writer emphasizes that a research design is a plan and a structure of investigation so conceived as to obtain answers to research questions. Similarly Yin (2003) defines research design as the logic that links data to be collected to initial questions of the study. The research design expresses both the structure of the research problem and the plan for investigation used to obtain empirical evidence on the relations of the research problems. Research designs were mainly guided by the philosophy of the study. Different philosophies favor different designs. Since the study was based on two different philosophies it was directed by the philosophies into adopting two different designs.

The study adopted a descriptive survey design. According to Orodho (2005) a survey is a method of collecting information by administering a questionnaire to a sample of individuals to obtain data useful in evaluating present practices and improving basis for decisions. This design was picked upon because of its main aspect of gathering large scale data in order to make generalizations (Cohen et al, 2007). This design is highly

favored by the normative paradigm because of its capabilities to collect large scale data which was very important in exploring general rules. This design was handy in establishing the general reasons behind use statistics in research among postgraduate students in universities. The design formed a basis for generalizing the results of the analyzed data to the target population.

On the other hand interpretive philosophy believes in analyzing individual's behavior as opposed to general causes of behavior. According to this philosophy descriptive survey design cannot adequately capture the unique complexities of an individual's behavior. The study, therefore, used case study design, in addition to descriptive survey, to catch the complexity and situatedness of behavior among postgraduate students' use of statistical analysis in research. Yin (2003) stated that a case study is an inquiry that investigates contemporary phenomenon within its real life context. Robson (2002) noted that, a case study is an investigation of a single instance. The single instance is of a bounded system, in this case being a master's student.

Yin (2003) notes that case study designs were preferred when 'why' and 'how' questions were being asked, which was the case for this study. He noted that this design was important when the investigator has little control over the phenomenon but wants to get the situation as it was in context. This design was important to the study because it provided unique example of a real student in real situations, enabling readers of this study to understand ideas more clearly than simply presenting them with abstract theories or principles. Case studies enabled the study to penetrate situations in ways that were not always susceptible to numerical analysis. As Robson (2002) remarks, case studies opt for

analytic rather than statistical generalization, that is they develop a theory which can help researchers and readers to understand other similar cases, phenomena or situations.

3.4 Area of Study

The study was carried out in universities in Western region of Kenya. Kenya is a country in East Africa with coastline on the Indian Ocean. It encompasses savannah, lakelands, the dramatic Great Rift Valley and mountain highlands. The study divided the country into six regions namely, northern region, eastern region, costal region, Nairobi region, central region and Western region. Kenya had a total of 48 chartered universities by the end of the year 2017, out of which 30 were public universities and 18 private. The full list of universities, the year they were chartered and the location of their main campus was as indicated in appendix I. However, below in table 3.1 is a summary of the distribution of universities' main campus across these regions of Kenya.

Table 3.1: Distribution of Universities in Kenya

Region	**Public**	**Private**	**Total**
Western	11	5	16
Nairobi	4	11	15
Central	10	2	12
Costal	3	0	3
Eastern	2	0	2
Total	**30**	**18**	**48**

Western region had the leading number of universities followed by Nairobi and central regions. Western region of Kenya was purposively selected on to be the area of study

because of its high number of universities. Western region according to this study covered the following 20 counties; West Pokot, Trans Nzoia, Elgeyo Marakwet, Baringo, Uasin Gishu, Bungoma, Busia, Kakamega, Nandi, Vihiga, Siaya, Kisumu, Kericho, Nakuru, Narok, Bomet, Nyamira, Kisii, Homabay and Migori. A map of this Western region was as shown in appendix II. The 16 universities in this region were distributed in 11 counties namely; Narok, Nakuru, Kericho, Kisii, Migori, Siaya, Kisumu, Kakamega, Bungoma, Nandi and Uasin Gishu.

3.5 Study Population

The study was interested in determining how the students found the process of using statistics in research and exploring the factors that led them to experiencing the process the way they did. This meant that the study was interested in students who had participated in research. Sabzwari et al (2009) in their study sampled respondents and after collecting data from them noted that a very small proportion of the respondents had received any training in research during their undergraduate studies. The study noted that the most significant factor associated with involvement in research was training during post-graduation education. This, therefore, led the study to narrow down from just any other student to postgraduate students in universities.

Postgraduate students can be categorized into three programs, postgraduate diploma, masters' and doctoral programs. Postgraduate diploma in most universities has limited training in research and, therefore, postgraduate diploma students could not be the appropriate population for the study. Doctoral students have an elaborate research training process; however, they were also not the best target population because; they

were introduced to research at masters' level and in some cases some of them take a long period after masters' before joining doctoral class making it hard to siphon out intervening variables when measuring the effect of research training on use of statistical analysis in research.

The target population for the study was, therefore, masters' students who had submitted their theses for examination from selected public and private universities in Western region of Kenya. These groups of individuals were picked on because they had gone through a detailed research process. The memory of how the experience was assumed to be still fresh, and it was easy to trace the general reasons behind how they found data analysis because of the short period they had been in training unlike their counterparts pursuing doctoral degree. The study purposely targeted students who were inclined to quantitative data analysis techniques. The study, therefore, narrowed down to masters' students in schools of Education, Business and Administration and school of Social Sciences. This schools were picked upon because they were the ones that there masters' students commonly use survey design which in most cases yields large data that require quantitative statistics techniques to analyze. According to Mukhwana et al (2016) programs in these three schools which they referred to them as clusters accounts for 38% of the total programs offered in universities in Kenya. A full list of the programs was as shown in appendix III.

The study sought to find out from the target population how they found the process of using statistics in research. The study further sought to find out from them the factors that influenced their use of statistical analysis in research. The study also targeted research

lecturers because of the key information they hold concerning the training of researchers in universities based on the fact that they were the trainers.

3.6 Sampling Procedures and Sample Size

Sampling is basically the process of obtaining a manageable part of population that supposedly possesses the same qualities as the whole (Kothari, 2004). Therefore a sample is the manageable part of the whole. The study used a sample of 90 masters' students who participated in the descriptive survey, 4 masters' students who were interviewed for in depth information and 3 research methods lecturers who were also interviewed to give key information in relation to the concept of study. A total of 97 respondents participated in the study. The following was the procedure that was used to arrive at the 97 respondents.

Out of the targeted 16 universities, 11 public and 5 private, in Western region of Kenya stratified random sampling was used to sample 3 universities, 2 public and 1 private. The Universities were categorized into public and private and a random sample of 20% was selected from each strata. The study deemed 20% to be a representative sample of the target universities. The target population in the sampled universities was estimated to be 114 masters' students. This estimation was arrived at basing on the commission for university education report documented by Mukhwana et al (2016). The commission for university education team led by Mukhwana (2016) noted the following trends, as shown in table 3.2 below, in graduation of masters' students across 64 universities in Kenya. The number of universities differs with what was being used by the study because the CUE report includes universities with interim letter and constituent college universities.

Table 3.2: Masters' Graduates from Universities in Kenya

Year	2012	2013	2014	2015	Average Per Year
Number of Masters' Graduates	4,347	5,289	7,270	8,591	6,375

Source: Mukhwana et al (2016)

The study, therefore, deduced that the average number of masters' graduates per university across the 64 universities was 100. Since the study was only targeting masters' students from school of Business and Administration, Social Sciences and School of Education which the CUE report notes that programs in this schools were 38% of the total programs in universities, the study worked on assumption that the same percent was reflected in graduates and, therefore, arrived at a conclusion that on average 38 masters' students graduated from the target schools in a university in a year. The study, therefore, concluded that the expected students who had submitted their thesis for examination in the target schools were 38 in each of the sampled universities, giving a total target population of 114 masters' students.

The study further determined, using a sampling formula from creative research systems computer software that with a target population of 114 a sample of 88 was representative of the target population, the study, however, rounded up the figure to 90 so that the sample can be drawn equally from the three selected universities with each university having a sample of 30.

Random sampling technique was used to arrive at the sample of 90, with each sampled university having a sample of 30 masters' students. The 90 respondents were involved in descriptive survey with the main tool for data collection being questionnaire. In addition to the sampled respondents 4 more masters' students were purposively sampled to be

interviewed for in depth information. The study sought a student who found it very hard to use statistics in research, the second was a student who felt use of statistical analysis was fairly hard, the third was the one who felt use of statistical analysis was fairly easy and the fourth was a student who felt use of statistical analysis was very easy. The study further randomly sampled three research lectures from a pool of all research lecturers in the sampled universities as key informants to the study. In total 97 respondents were sampled to participate in the study.

3.7 Research Instruments

The study employed three research instruments for the purpose of collecting data from the sampled respondents and the relevant documents. The instruments used were; Content analysis schedule, Questionnaire and depth interview schedules. A brief summary about the instruments is as discussed below. Each of the instruments had an introductory letter which also was used as a research consent form from the researcher and the contents of the letter coupled with consent form were as shown in appendix IV.

3.7.1 Content Analysis Schedule

Content analysis consists of analyzing the contents of documentary materials such as books, magazines, newspapers (Kothari, 2004). Content analysis in this study was used to assess the research curriculum and its relevance to the needs of the learners for statistical data analysis. Through content analysis the study sought to determine the objectives that were supposed to be achieved in relation to data analysis after instruction, it also sought to determine the content that was planned to be taught to masters' students, the implementation practices proposed and the proposed resources and evaluation

procedures. Guideline for content analysis was developed by the researcher in accordance with the stated objectives and the detail part of it was as shown in appendix V.

3.7.2 Students Questionnaire

In order to discover the universal laws of application of statistical knowledge and human conduct within it, the study used questionnaire. A Questionnaire is a research instrument that gathers data over a large sample and, therefore, can enable generalizations (Kombo and Tromp, 2004). The researcher in this study used questionnaire to collect data regarding the prior knowledge that masters' students had in relation to data analysis, the personal traits of the students and how they could have influenced their involvement in data analysis, the pedagogical practices employed in class in relation to data analysis and technological resources that could have influenced use of statistical analysis in research.

The questionnaire had both open and closed ended items so as to collect both numerical data and qualitative explanation of the situation. The questionnaire had likert scale questions that were rated on 5 scale responses. Since a questionnaire was a standard research instruments it allowed for uniformity in the manner in which questions were asked and makes it possible to be compared across respondents (Cohen et al, 2007). It was also suitable because the target population was literate and was unlikely to have difficulties responding to questionnaire items. The questionnaire items were developed by the researcher in relation to the study objectives and the full questionnaire is shown in appendix VI.

3.7.3 Interviews Schedules

In order to collect data that was necessary to explain reasons behind the actions students take and to explain the context, in which such actions were taken, four sampled masters' students and three sampled research lecturers were interviewed. According to Ngaroga (1996) an interview is a face to face interpersonal role situation in which the interviewer asks the interviewee questions designed to elicit answers pertinent to the research problem. Depth interviews were those interviews that were designed to discover underlying motives and desires and were often used in motivational research. Such interviews were held to explore needs, desires and feelings of respondents. In other words, they aim to elicit unconscious and also other types of material relating especially to personality dynamics and motivations. Kothari (2008) observes that interview schedules were particularly suitable for intensive investigation, which the study plunged into for the purposes of interpreting actions.

Some of the advantages of using interview in this study were that the researcher obtained more information in greater depth, personal information as well as supplementary information about the respondent's personal characteristics and environment which was of great value in interpreting results. The Interview enabled the researcher to get in depth information and required data through the use of probing questions regarding the prior knowledge of masters' students, students' needs for data analysis, curriculum implementation process, personal factors and technological resources that influence application of statistical knowledge and whether the knowledge was applied personally with ease or with difficulties. Interviews were flexible, took care of sensitive remarks and had high rate of response. The interview guide was developed by the researcher in

accordance with the set objectives and the detail schedule for students is as indicated in appendix VII and for lecturers in appendix VIII.

3.8 Piloting

The research instruments were piloted in one university in Western Kenya, the university was not part of the selected universities for research. The piloting was important to the study as it sought to establish if: There were any items in the research instruments that were ambiguous; if there were any problems and complexity that could be encountered during data collection and analysis and if the research instruments were reliable. The research instruments were validated and their reliability tested using the following procedures.

3.8.1 Validity of the Research Instruments

Validity is the measure of accuracy of data obtained from the instruments used in the study (Mugenda and Mugenda, 1999). The developed instruments were assessed for both content and construct validity. Content validity was to ensure the instruments cover exhaustively the study objectives. Construct validity was to ensure the instruments measured what they were intended to. The instruments were given to supervisors and lecturers in the department of curriculum instruction and media to assess their validity. The final instruments that were used for data collection put into consideration the contribution of lecturers and the supervisors. This, therefore, meant the instruments were approved as valid to collect data.

Reliability has been defined as the measure of the degree to which the instruments yielded consistent results after repeated trials (Mugenda and Mugenda, 1999). The developed instruments were assessed for reliability. The test retest method was used in assessing reliability. The researcher administered instruments to respondents who were not part of the main study. These respondents were given instruments to respond to and after a period of two weeks the researcher again administered the same instruments to the same respondents under the samilar conditions. For questionnaire both sets were scored and the scores correlated using Pearson product moment correlation coefficient. If the correlation was above 0.7, in accordance to Fraenkel and Wallen (2000) the questionnaire was to be considered reliable. When the reliability test was carried out after piloting the pearson product moment correlation was 0.81. Based on this correlation in comparison with the acceptance correlation of 0.7 the questionnaire was considered reliable in collecting data.

The suitability of the term reliability for qualitative research is contested. Golafshani (2003) prefer to replace reliability with terms such as credibility, consistency and trustworthiness, in particular the notion of dependability. The researcher, therefore, assessed the consistence of responses in the interview schedule and content analysis schedule. The aim of the assessment was to determine if the responses to the open ended questions in the questionnaire and interview schedules communicated the same point in test one and two with an allowance of difference in the language used. When the schedules were assessed after piloting they were found to be communicating the same point in the two different administrations,, therefore, the schedules were considered reliable or consistent.

3.9 Data Collection Procedures

The researcher sampled the universities to participate in the study and further sampled the masters' students' respondents to participate in the study. From the list of the sampled students the research identified one student in each university and they were trained as research assistants. The training was for one day and included; general understanding of research purpose and objectives; going through the questionnaire to understand it; and a test of collecting data using the questionnaire. The trained research assistants then proceeded to administer the questionnaire to the sampled students in their respective universities. After the questionnaires were returned the researcher analyzed them for general trends which informed the subsequent data collection through interview. Concurrently as the data was being collected using questionnaires the researcher was analyzing sampled masters' curriculum.

After a period of one month from date of completion of data collection using questionnaire and content analysis schedule, the researcher sampled four masters' students for in depth interview guided by the students' interview schedule. The interviews were conducted by the researcher. General trends from this interviews and specific cases were also noted and these cases informed the subsequent interview with research lecturers. Two weeks after the interviews with students were concluded the researcher sampled three research lecturers and interviewed them using the lecturers' interview schedule and the general and specific trends captured in the first and second phase of data collection.

3.10 Data Analysis Techniques

In data analysis the study employed both descriptive and inferential statistics. Descriptive statistic used was percentages. Percentages were crucial to the study in establishing the general demographics of the respondents, specifically the masters' students who participated in the filling questionnaire. The percentages were also used by the study in determining the general response of the respondents concerning the various questions that they were asked. The descriptively analyzed data was presented in form of pie charts and bar graphs. This form of presentation was preferred because of its simplicity to compare different percentages and its appeal to the reader.

Inferential statistic used in the study was multiple linear regressions. Landau and Eviritt (2004) notes that multiple linear regression is a method of analysis for assessing the strength of the relationship between each of a set of explanatory variables and a single response variable. The study sought to determine the influence of selected competencies on use of statistical analysis in research; therefore, multiple linear regression was the best statistic to used based on its use as indicated by Landau and Eviritt (2004).

Applying multiple regression analysis to a set of data results in a model summary which includes the multiple correlation coefficient, R, its square, R square, and an adjusted version of R square summary. The multiple correlation coefficient R indicated correlation between the observed values and those values predicted by the regression model. R square explains the variability in the explained variable accounted for by the explaining variable, adjusted R square is an attempt at improved estimation of R square in the population. The index is adjusted down to compensate for chance increases in R square.

The error terms in multiple regression measure the difference between an individual's observed value and the mean observed values of respondents. The model summary also has the change statistics that provide the changes in R-square and also provides an F-test for the null hypothesis that none of the explanatory variables were related to the explained variable.

Qualitative data collected by open ended questions and interview schedule was used to enrich the discussion of quantitative data. It was also used to explain reasons for some responses in questionnaire and variations in some of the responses in quantitative data.

3.11 Ethical Considerations

Ethics were judgments about what was right or wrong, good or bad, acceptable or unacceptable (woods et al, 2009). The study observed the codes of conduct of the participants as pertaining to anonymity and the use of information that was acquired for research purpose only. Respondents were not coerced or bribed into providing any data and respondents were free to withdraw from the study any time they felt like. A copy of informed consent on ethical issues was provided for participants to read and sign.

3.12 Summary

This study was based on two philosophies, the positivism philosophy and interpretivism philosophy. These philosophies differ in various aspects including their view on the nature of knowledge and reality,, however, they complement each other on their weaknesses and that was the main reason for using them both. The study adopted a descriptive survey design, and the study also used a case study design to catch the

complexity and situatedness of behavior among masters' students. The two designs were adopted to meet the needs of the two different philosophies used in the study.

The study was carried out in universities in Western region of Kenya. The target population for the study was masters' students who had submitted their theses for examination from selected public and private universities in Western Kenya. To meet the requirements of the descriptive survey design, stratified and simple random sampling procedures were used to arrive at a sample that participated in the study. Purposive sampling was also used to select seven individuals who were taken through a detailed interview to catch the complexity and situatedness of behavior among masters' students.

Content analysis schedule, Questionnaire and depth interview schedules were used in data collection. The researcher began data collection by analyzing sampled masters' curriculums and giving the sampled students questionnaires by the researcher and research assistants. After a period of one month from the collection of questionnaires the researcher interviewed four students for in depth information. Lastly the researcher interviewed three lecturers for more information. Collected data was analyzed using frequencies and multiple linear regression.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter mainly analyzed the collected data presented, interpreted and discussed the findings of the study. In this chapter data was interpreted and discussed in relation to other studies and findings. The study answered the research questions in this chapter; it also presented findings in relation to objectives and tested the stated hypotheses.

4.2 Respondents Background Information

Respondents were very key to the success of this study and the data they provided largely informed the writing of this report, it is, therefore, of importance that the background details of the respondents be known to everyone interested in the study for the purposes of determining the validity and reliability of the data collected. A total of 94 students were sampled to participate in the study, 90 were to answer questionnaire and 4 to be interviewed. Out of the 90 students 76 students responded and answered questionnaire and 4 were successfully interview. A total of 3 lecturers participated in the study by being interviewed. This translated to a total of 83 respondents who participated in the study translating to 85.6% of the sampled respondents. Out of the sampled students 14 did not fully fill the questionnaire. The 14 students opted to pull out of the study midway without explanation. Since pulling out was acceptable the study never pressed for reasons from the students who opted to pull out. Below is a presentation of the key aspects of the

student respondents who participated in descriptive survey and how each could contribute to or affect the dependability of the data collected.

4.2.1 Sex of the Respondents

Out of the total respondents 37 (48.7%) were male and 39 (51.3%) were female. Sex was a main aspect of concern especially when statistics or generally mathematics is a concept under discussion because of arguments raised by the following scholars. Mbathia (2005), notes that fewer girls achieve in Mathematics and majority under perform. He further states that fewer girls than boys continue with Mathematics courses after secondary school. Sabzwari et al (2009) noted that gender is a factor that was influencing participation in research. The researchers however did not specifically indicate the type of relation between gender and research. On the other hand Mubichakani and Koros (2014) noted that in cases of carrying out a mathematical task using computer software, with minimal intervention by human teachers, differences in gender of students do not significantly explain the outcome of the activity.

The presented scholars' arguments do not precisely indicate how sex sometimes called gender will have influenced use of statistics, their concerns can, however, not be ignored. Since sex was not part of the studies explaining variables, it was important that each sex was represented. The percent of the male and female in the study presented above indicated that each sex was well represented. This, therefore, takes care of both genders and the results can be generalized to the whole population regardless of gender or sex.

4.2.2 Age of the Respondents

The study was also interested in the age of the students who were participating in the study. The study determined that majority of the respondents 19 which translate to 25% of the total respondents were aged between 26 to 30 years, they were closely followed by those who were between 36 to 40 years who were 18 and the least group was of respondents between 41 to 45 years who were 11 which was 14.5% of the total. Figure 4.1 below shows the different age categories that participated in the study.

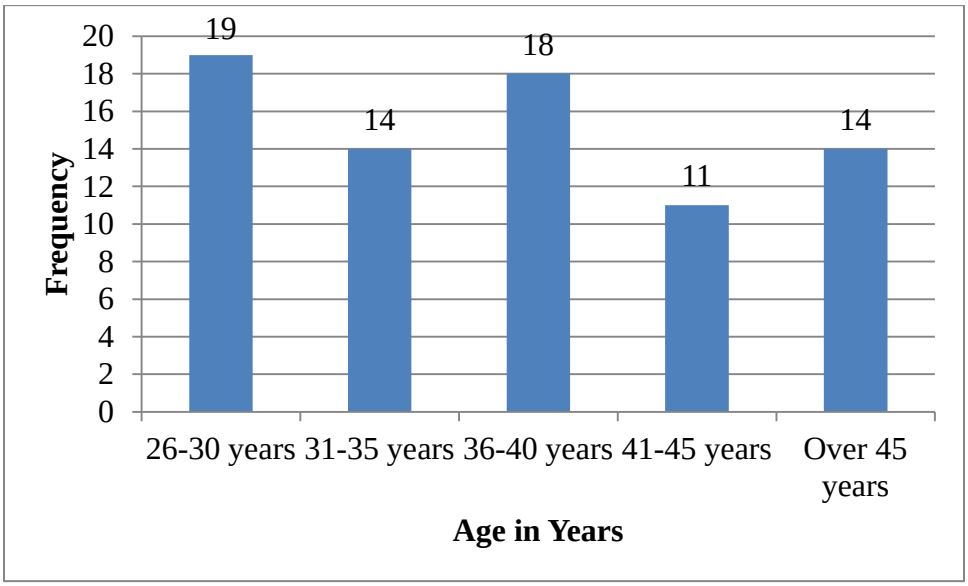

Figure 4.1: Age of the Respondents

Age was a factor that cannot be ignored in this study because of the points that have been raised by the following scholars; Selwyn, et al (2001) notes that despite the levels of access to ICT having improved, there was a disparity in terms of age and use of ICT. This was key to the study since use of statistical analysis involves use of statistical software. In relation to research Askew et al (2002) in their study identified that age was a factor that influenced participation in research. Sabzwari et al (2009) further expounded on age

difference as a factor of research. They noted young physicians showing more inclination towards research than their older counterparts. Based on the findings above respondents age ranged from 26 to above 45 years. This was an assurance that data collected was immune of the digital divide and the age difference factor in research. This means the findings represent the views of all categories of students in relation to age.

4.2.3 Institution of Learning for the Respondents

Institution of learning in this study meant either public university or private university. Both universities were mandated to produce researchers. Graduates from both cases serve the community without any favoritism based on their institution of learning. However, the process of hiring management and the hierarchy in the two universities differs and this can be hypothesized to affect daily business in the universities differently. It was, therefore, important that the study notes the institution of study. A question was posed to respondents and it was found that 24 of the respondents, 32% were from private universities and 52 which was 68% were from public universities.

The difference in percentage of responders from private and public institutions was as a result of the sampling procedure used. The two categories of institutions were, however, well represented in the study in relation to the number of private and public institution in Western region of Kenya. This gave the study the confidence to generalize the findings to all university masters' students regardless of whether the institution was private or public.

4.3 Masters' students' use of statistical analysis in Research

Statistics is an important aspect of research; Bishop and Talbot (2001), stated that it was important in observation, experimentation and inference; Sprent (2003) and Zwiers and Von Storch (2004) followed suit to agree that statistics was important in research. Given this importance the study sought to determine how masters' students in the sampled universities found the process of using statistics in their research. The study found that 7.9% of the respondents found use of statistical analysis to be very easy, 23.7% found it a little easy, 44.7% felt it was a little difficult and 23.7% found the process of using statistics to be very difficult. Summary of the findings was as indicated in figure 4.2 below.

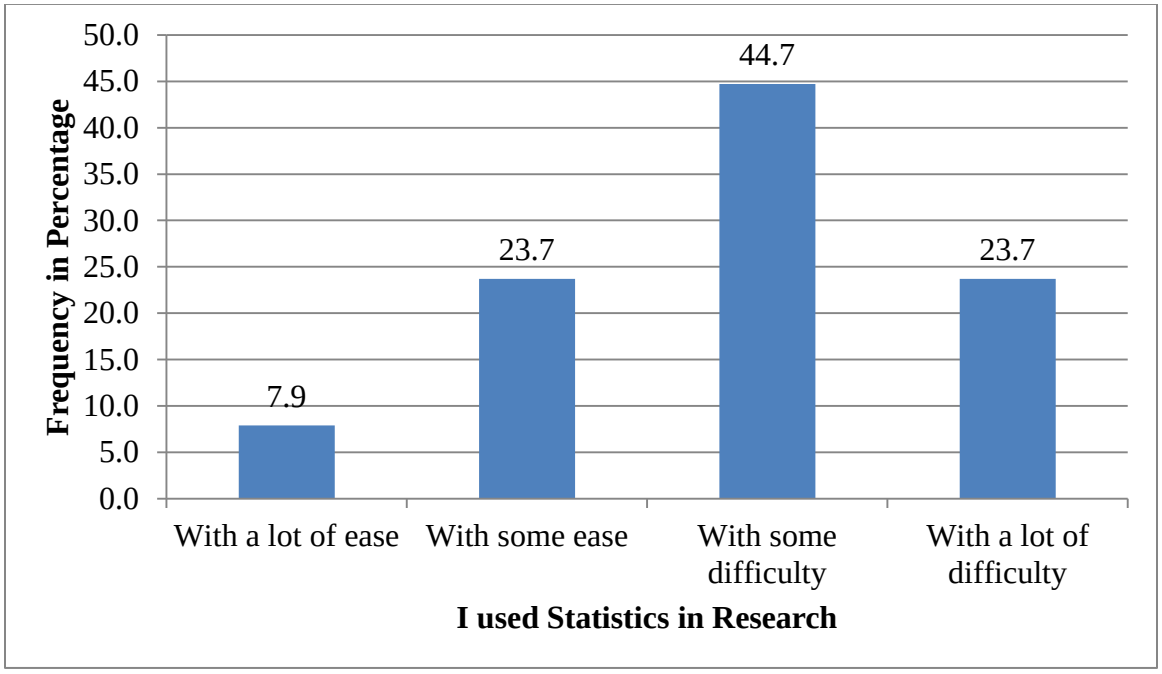

Figure 4.2: students' use of statistical analysis in Research

Generally the study determined that majority of the masters students 68.4% were finding it difficult to use statistics in research. Despite the importance of statistics in research (Zwiers & Von Storch 2004) et al this study in summary found that majority of the masters' students in Kenya struggle to use statistics, this explains why there was little interest in carrying out research and low quality research out puts (Mukhwana et al 2016) et al.

This finding compliments the finding by Murray (1991) who was interested in finding if the statistics were appropriately used in research. He noted that the use of statistical analysis was flawed, inadequately or inappropriately used. Sprent (2003) had also recorded a similar case where he noted that simple concepts were sometimes misunderstood or misinterpreted by research workers in other disciplines who have only a limited knowledge of statistics. Collectively this study and the study by Murray and Sprent confirm Maindonald (1999) suspicion that there was a serious problem with design of data collection and with data analysis in research. His suspicion came about after realizing the poor quality papers that were being published by some researchers. The study findings explain the findings by Bishop and Talbot (2001) who noted that Postgraduate students from non statistical disciplines often present low quality research.

This finding adds to Scott (2015) noted that there was a mismatch between Kenya's numerous bright students and our low academic research excellence. The study adds to this by noting that there was a mismatch between masters' students' mastery and use of content in their area of specialization and mastery and use of statistical analysis in research. The findings also explain why postgraduate students' supervisors were often complaining about candidates who were unwilling, or unable to conduct serious research as

noted by Mukhwana et al (2016). The poor quality research and inadequate statistical used in published research was explained in this study by the large number of masters' students that have been found to be struggling to use statistics in research. This should be noted that the struggle was after the students have finished their class work which was supposed to train then in use of statistics. Despite this findings having been already indicated by previous researchers, it was important that the same was done by this study to allow testing of the influence of various competencies on use of statistical analysis in research statistically. An explanation of what goes on in this training will be done by this study at a letter stage.

4.4 Knowledge Needs for use of statistical analysis in Research

The finding of this study in section 4.3 above indicated that majority of the students struggle to use statistics and Glencross and Binyavanga (1997) noted that this was a common phenomenon for researchers in disciplines that have little statistics. Since this study was also conducted among students in non statistical disciplines, it sought to determine if they had an idea of what was expected of them to use statistics. Did the masters' students who participated in the study have an idea of the key aspects required to use statistics effectively? Or they just found themselves in a situation that was too overwhelming to an extent that they even missed the overall picture of statistics in research? The study established that, 93.4% of respondents noted that knowledge of determining the statistic to use was beneficial, 96.1% identified interpreting figures and tables to be important, 75.0% indicated that descriptive analysis was important, 68.4% agreed inferential statistics was important, 88.2% noted that basic computer skills were important and 76.3% indicated that knowledge of how to use computer software to carry

out data analysis was important. Summary of the finding was as presented in figure 4.3 below.

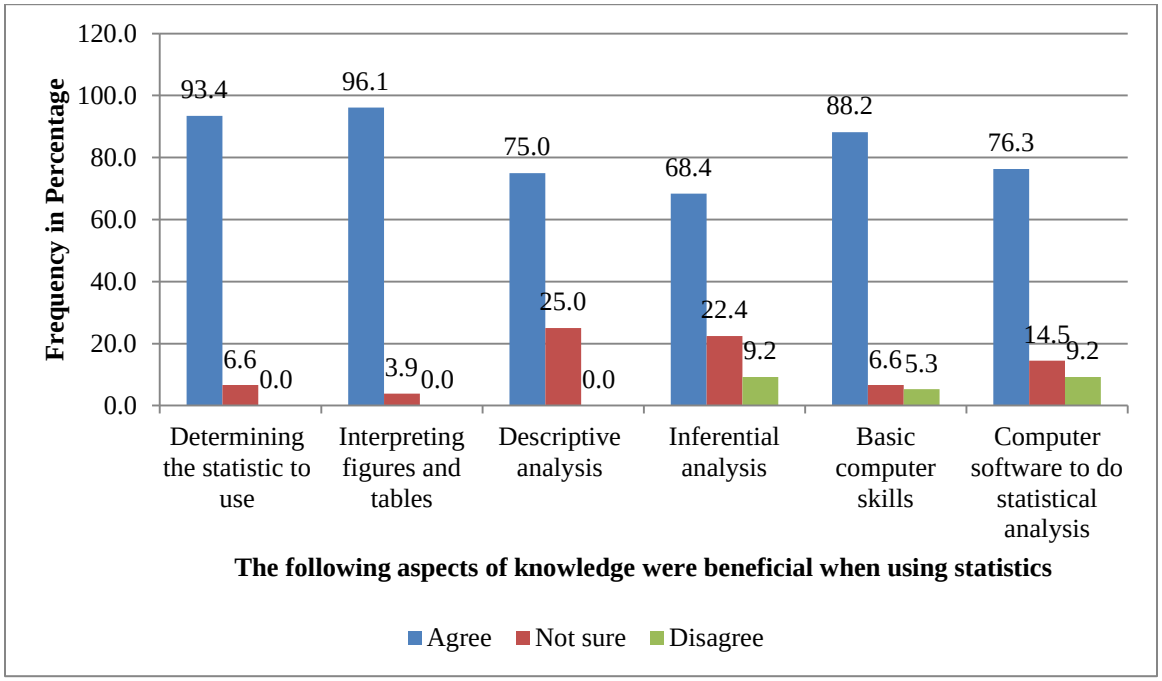

Figure 4.3: Knowledge needs for use of Statistics

The study determined that majority of masters' students in sampled Kenyan universities were aware of the importance of knowledge of determining the statistic to use. Majority of the students acknowledged that having an idea of reading and interpreting tables and figures was important in use of statistics.

This identification by masters students confirms the determination made earlier by Saville (2001) who indicated that for a research to effectively use statistics they must have the general knowledge of statistics. This knowledge will give them ample time to choose the most appropriate statistic to use. The general knowledge will also allow them to have an idea of how to interpret tables and figures. Bangdiwala (2001) and Mukherjee

(2001) also had similar sentiments of the researcher having general knowledge of statistics.

Majority of the students noted that descriptive statistics was an important knowledge requirement for them to use statistics. In addition to descriptive, students also identified inferential statistics as an important concept to allow use of statistical analysis in research. The study noted that the students who acknowledged descriptive as important were more than those who identified inferential statistics. The discrepancy in descriptive and inferential statistics can well be explained by Elmore and Woehlke (1998). They found that descriptive statistics was commonly used in research than inferential statistics. The findings agree with Blumberg (2001) and Hirotsu (2001) who described elementary statistics and inferential statistics as key courses that were very useful in research practice.

Majority of the students identified knowledge of basic computer skills and use of statistical software as being important to their use of statistics. this same knowledge were identified by Blumberg (2001) who advocated for having knowledge of computer packages for one to be able to successfully use statistics packages. The same was also noted by McLean (2001). Few respondents noted that inferential statistics, basic computer knowledge and knowledge of using statistical software was not important to them. These same students were noted to have only used descriptive statistics and some did the analysis manually. Inferential statistics and use of computer software to this group of students was not a requirement. During interview with lecturers the study determined that not all students used inferential statistics. This they noted was because it was mainly limited to testing hypotheses and, therefore, it was not a requirement to those who used

research questions. The study also established that a minority of the students were not sure of knowledge required of them to use statistics, even after they had carried out quantitative research. This category of students was noted by Harraway et al (2001) as a group of researchers having gaps in their knowledge that they were not even aware of.

In summary Blumberg (2001) et al identified general statistics knowledge, descriptive and inferential statistics, basic computer skills and statistical software skills as requirements to use statistics in research in developed countries. This study found that, these were the same knowledge needs that to use statistics in research in developing worlds, a case of Kenya.

4.5 Prior Knowledge and use of statistical analysis in Research

The study categorized this subsection into two categories. A survey of the statistics and ICT prior knowledge that students had before joining masters; and secondly how the prior knowledge influenced use of statistical analysis in research.

4.5.1 Survey of Masters' students Prior Knowledge in Statistics and ICT

Glencross and Binyavanga (1997) noted that, students who have limited or no background knowledge in statistics normally have a problem in using statistics in research. The study sought to determine the prior knowledge that masters students had in statistics and information communication technology. The study determined that; 55.3% of the sampled masters' students had knowledge of how different basic statistics can be used; 52.6% knew how to interpret basic statistical figures and tables; and 57.9% knew how to carry out descriptive statistics before joining masters' program. In relation to

advanced statistics and ICT; 13.2% stated that they had knowledge of carrying out inferential statistics; 89.5% said they had basic computer knowledge and skills and 23.7% stated that they knew how to use computer statistical software before joining masters' class. Summary of the findings were as shown in figure 4.4 below.

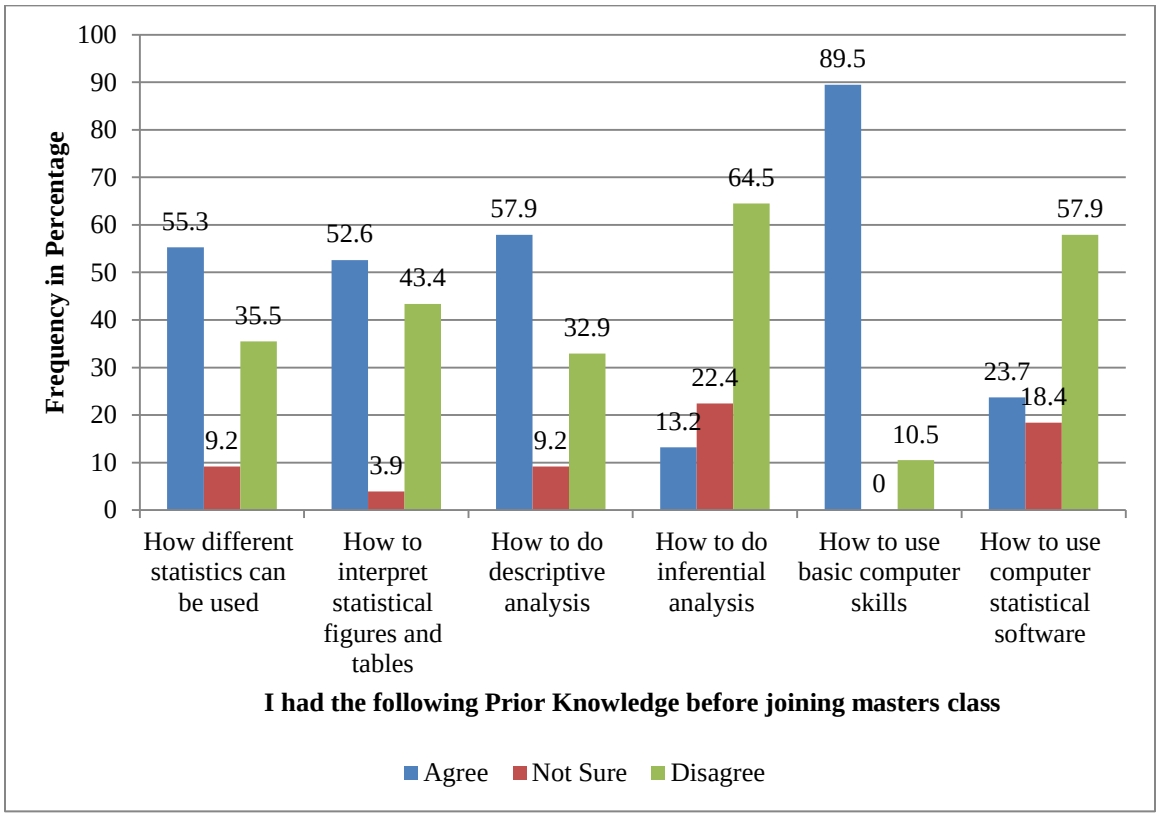

Figure 4.4: Students Prior Knowledge

The study determined that the more than half of the sampled respondents had prior knowledge in basic statistics including; knowledge of how different basic statistics can be used, how to carry out basic descriptive statistics and how to interpret the findings. The finding seemed to be contradicting with the findings of Dempster and McCorry (2009). Dempster and McCorry (2009) conducted a study to determine the knowledge postgraduate students had in mathematics based on their undergraduate studies. They

indicated that students entering postgraduate studies in social sciences, education and other non mathematical fields often do not have a strong mathematics background.

A clarification to this seeming contradiction was found after interviewing sampled students and lecturers. The interviewed students and research lectures noted that basic statistics were covered in class from as early as primary and secondary school. Students who were keen in mathematics in primary and secondary school still had the basic knowledge of statistics even if it was not covered in their undergraduate studies. Not all students like and perform well in mathematics at basic level. Gitaari et al (2013) indicated that performance of students in mathematics in K.C.S.E has been generally poor as compared to other subjects in Kenya. Wafubwa (2015) notes the same and further that before introduction of SMASSE workshops in Rangwe division Kenya students' attitude towards mathematics was generally low. Poor attitude coupled with low performance will make some of the students completely forget about basic statistics concepts long after they were taught. This explains the category of students who reported lack of knowledge in basic statistics despite them learning at basic school level.

The study determined that very few students had prior knowledge in inferential statistics. This finding was attributed to finding by Blumberg (2001) who noted that out that very few first degree programs require students preparing to be teachers to take a course in statistics. Dempster and McCorry (2009) had similar findings but further noted that it was not only limited to student teacher programs, it extends to other programs that were non statistical. This implies that the sampled students never had an opportunity to learn inferential statistics in their basic education as well as their undergraduate.

Majority of the students had knowledge of basic computer. However, the study through interviews noted that this knowledge in computer was mainly acquired through other means rather being taught in their undergraduate. This finding adds more information to the finding by Adetimirin (2012) and Danner and Pessu (2013) who noted that ICT literacy skills were inadequately taught among undergraduate students in developing countries. The study finding indicate that despite it being true that teaching ICT was inadequately taught at undergraduate level graduate students in Kenya were adequately knowledgeable of basic computer skills. This finding puts Kenyan graduates at par with graduates in developed countries who were indicated by Oliver and Towers (2000) to be having high ICT skills.

Despite having basic computer knowledge, very few students knew how to use statistical software to carry out data analysis. The interviewed lecturers and students noted that use of software to carry out statistics was not taught at undergraduate. Lecturers noted that some masters' students were working or had previous working experience in research firms or were assisting research individual researchers in carrying out research and, therefore, they got knowledge of computer statistical software from such experiences.

4.5.2 Prior Knowledge in Statistics and ICT and use of statistical analysis in Research

Having noted in section 4.5.1 above that prior knowledge among the sampled masters' students greatly varied, the study sought to determine if in any way it influenced use of statistical analysis in research. A regression analysis done by the study found that; having prior knowledge of descriptive statistics explained 21.3% of finding it easy or difficult to

use statistics in research, having both descriptive and inferential statistics knowledge explains 36.8% and having descriptive and inferential statistics as well ICT prior knowledge explains 51.4% of how the sampled students found the process of using statistics in research. The percentages were derived from the R square values against each model as shown in the table below. Regression findings indicate that prior knowledge explained for 51.4% of the process of using statistics in data analysis. The summary of regression findings were as indicated in tale 4.1 below.

Table 4.1: Regression Model Summary of Prior Knowledge.

Model	R	R Square
1 (Descriptive statistics prior knowledge)	.461[a]	.213
2 (Descriptive & inferential statistics prior knowledge)	.607[b]	.368
3 (Descriptive, inferential statistics & ICT prior knowledge)	.717[c]	.514

The study sought to establish the type of relationship between having prior knowledge and using statistics in research. The study singled out those sampled students who had prior knowledge in basic statistics, inferential statistics and use of computer software to carry out data analysis. The study found that the singled out students found it very easy to use statistics in research. The study findings were, therefore, summarized as; students who had prior knowledge in key areas of need were 51.4% more likely to find it easy to use statistics in research.

The study sought to determine if prior knowledge in statistics and ICT explanation of use of statistical analysis in research was statistically significant. An analysis of variance (ANOVA) was carried out and the resultant significant value tested at alpha level of 0.05. Based on Sig. values indicated against each model in the table below, the study noted that

each was below the alpha level of 0.05. This means that prior knowledge in descriptive statistics; inferential statistics and ICT were all statistically significant in explaining use of statistical analysis in research. Summary of findings were as indicated in table 4.2 below.

Table 4.2: ANOVA Summary of Prior Knowledge.

Model		Sum of Squares	df	Mean Square	F	Sig.
1(Descriptive statistics)	Regression	12.368	3	4.123	6.490	.001[b]
	Residual	45.738	72	.635		
	Total	58.105	75			
2 (Descriptive & inferential statistics)	Regression	21.409	4	5.352	10.356	.000[c]
	Residual	36.696	71	.517		
	Total	58.105	75			
3 (Descriptive, inferential statistics & ICT)	Regression	29.858	6	4.976	12.156	.000[d]
	Residual	28.247	69	.409		
	Total	58.105	75			

The study further used stepwise linear regression to exclude prior knowledge aspects that could have explained the dependant variable by chance. In table 4.3 below Model 1 was for inferential statistics and model 2 was for inferential statistics and ICT. Based on Sig. F change values indicated against each model in the table below, the study noted that each was below the alpha level of 0.05. The study therefore, determined that prior knowledge in inferential statistics and prior in ICT significantly influences use of statistical analysis in research. Both inferential statistics and ICT prior knowledge combined increases the possibility of a student finding it easy to use statistics by 45.6%.

This was as indicated by the R square value of 0.456 against model 2 in the table below. Summary of the findings were as indicated in the table 4.3 below.

Table 4.3: Summary of Specific Significant Prior Knowledge.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.592[a]	.350	.341	.71441	.350	39.846	1	74	.000
2	.675[b]	.456	.441	.65816	.106	14.190	1	73	.000

Based on these findings the study rejects the null hypotheses that *prior knowledge has no significant influence on student's use of statistical analysis in research.* This means that prior knowledge in statistics and ICT significantly influences students' use of statistical analysis in research. It should be noted that the sampled students regardless of them having prior knowledge in statistics and ICT or not had gone through training program of how to use statistics. After the training the study noted that students having prior knowledge in statistics and specifically inferential statistics and ICT were better positioned to find it easy using statistics in research. This finding can be explained by two possibilities as discussed below.

The finding can be explained by the aspect that those students who had prior knowledge in statistics and ICT were favored to have the knowledge. Since the students were favored they always were ahead in understanding and applying the understood knowledge. This explanation was based on findings by Starkings and Jerome (2001) who noted that tutors teaching statistics to students with little or no statistical background had

a great deal of problems. The reasons for the problems they identified to be that statistics has a jargon of its own which can confuse the non statistician and often makes the subject look more difficult than it really is. Based on this argument it was noted that, sampled students without prior knowledge in statistics could have struggled to understand the concepts and by extension struggle to apply the concepts. Dempster and McCorry (2009) supported this argument when they indicated that, statistics exam performance among psychology students was positively related to previous experience of statistics and mathematics.

On the other hand Estepa & Sánchez (2001) brought in a new dimension when they noted that if prior knowledge was not accurate it can negatively influence the new learning process. Estepa and Sánchez (2001) warn that without proper integration of the prior knowledge and current teaching, the conceptions of correlation and regression acquired by future researchers may be faulty. This will eventually lead to students with prior knowledge that was not correct struggling or even worse off than those without prior knowledge. An alternative explanation of the finding was that the training of use of statistical analysis in research for the sampled students was flawed. Since it was flawed the students heavily relied on prior knowledge to use statistics. At this stage this explanation remains hypothetical and will be explored by this same study in subsequent sections.

In summary on this objective the study found that majority of the sampled masters' students joined masters program with knowledge of descriptive statistics and basic computer. Very few sampled students had knowledge of inferential statistics and how to use computer software to carry out data analysis. The study further determined that prior

knowledge and specifically in inferential statistics and ICT was statistically significant in using statistics in research. This was in favor of the students with the prior knowledge.

4.6 Masters' Curriculum Content and use of statistical analysis in Research

The study findings so far have shown that majority of the masters students found the process of using statistics to be difficult for them. From the interpretation and discussion already covered in sections above, there was reason to doubt if there was a thorough statistics training process at masters' level. The study in this section sought to determine how the masters' curriculum has planned to meet the needs for students to use statistics in research. Data for this objective was collected using a content analysis guide and sampled curriculums were analyzed using this guide. The findings in this section were reported based on the following sub sections; Research and statistical entry requirement for masters' program; general objectives of the curriculum in relation to statistics; specific statistical aspects of the curriculum; specific ICT aspects of the curriculum; curriculum recommendations for implementation; and curriculum recommendations for assessment.

4.6.1 Research and Statistical Requirements for joining a Masters Class

The study findings in earlier sections have identified key knowledge aspects and skills that were necessary to use statistics in research. The study has also identified the importance of having prior knowledge in statistics and ICT for easier application of statistics. In this section the study sought to determine if the masters' curriculum in any way recognizes and requires these skills and knowledge for one to be enrolled for masters' degree. The study found that the two requirements for admission were; having a

degree in a related field; and the application of university admission regulation. An extract from a sampled curriculum on admission requirements was as presented below.

Curriculum Extract 1

"The common University admission regulation for the Masters degree shall apply. The candidates with the following academic qualifications shall be considered for admission; a degree in ……."

(Source: Sampled Curriculums)

Since all the sampled curriculums were referring to university admission regulations, the study followed up to determine what the regulations were. The surveyed universities had several similarities in requirements for joining masters program. Universities required that the applicant should have degree in related field with first class or second class upper division. If the applicant had a second class lower division, universities required that, he/she should have at least two years of working experience to qualify for admission. The admission requirements were silent about those applicants who had a pass at their undergraduate level.

Mukhwana et al (2016) noted that minimum admission requirements for post-graduate training in Kenya were similar across all universities. The study based on this point to note that the admissions requirements above were applicable to all universities in Kenya. These requirements do not put into consideration the importance of prior knowledge in statistics and ICT as noted in this study and in other studies including; Starkings and

Jerome (2001); Dempster and McCorry (2009) and Estepa and Sánchez (2001) who noted that inadequacy of statistical prior knowledge has an effect on future learning of statistics and its application. Oliver and Towers (2000) noted that inadequacy in ICT was likely to impede learning and progression in courses and programs where use was made of contemporary forms of ICT.

Despite the curriculum not putting into consideration the arguments above it cannot be noted as a major weakness of the curriculum. This was because the students were to be trained in how to use statistics. It is, however, important that the trainers were aware of possibilities of having students with no prior knowledge in statistics and ICT. The curriculum and trainers should therefore be very thorough in their training. The study sought to determine if in any way there was a provision to determine the prior knowledge of masters' students. It was established that in the application forms for masters' program applicants were required to fill their previous research experience. This item was a requirement but not a determine factor on whether a student will be enrolled or not.

A perusal through the sampled curriculums did not have any aspects of improving the thorough training that may be required by the admitted students. This conclusion was based on a comparison with benchmark curriculum of Graduate School for Social Sciences, University of Glasgow. The benchmark had mandatory requirements like;

> *"All students attending the Research Training Programme Induction must already possess basic IT skills. It is their responsibility to ensure they have these skills before the course starts, as computers are used extensively throughout the Research Training Programme. Students who do not possess basic skills in the use of word-processing and the use of e-mail must acquire those skills early in the*

> *first semester. Courses that allow students to acquire these computing skills are offered by the University's IT Education Unit."* (University of Glasgow research training handbook p. 8)

This will make the students put in effort to learn aspects that they did not have but were important to be trained in statistics. The sampled curriculums were missing these requirements that will push the students to enhance thorough training. The weakness of the sampled curriculums was identified by the study to be; the lack of clauses to ensure the students' were adequately prepared for thorough training in use of statistical analysis in research.

4.6.2 Curriculum Objectives in relation to Statistics

The study was interested in noting the weight given to statistics training for masters' students in sampled universities. The sampled curriculums were analyzed. The study found that the sampled curriculums had a general objective on research. The study also established that specific courses related to statistics had specific objectives that adequately covered the requirements for statistics training. Extracts from the sampled curriculums were as shown below.

Curriculum Extract 2

The general objective in relation to statistics in sampled curriculum was;

"To provide students with appropriate knowledge and competencies in developing independent research on core aspects."

The following objectives were extracted from specific courses related to statistics

- Formulate research objectives and hypotheses or research questions.
- Use the various scales of measurements in arranging data for analysis.
- Analyze data using appropriate statistical procedures.
- Understand quantitative and qualitative data, parametric and non-parametric tests.
- Understand descriptive and inferential statistics
- Understand Analysis of variance, rational and terms
- Differentiate different types of decisions
- Identify decision analysis software
- Use the various scales of measurements in arranging data for analysis.
- Analyze data using appropriate statistical procedures.
- Understand main aspects of Linear optimization models
- Understand decision making over unbound horizon
- Understand probabilistic dynamic programming

(Source: Sampled curriculums)

The study determined that the sampled curriculum had adequately covered in its objectives the breadth and depth of research statistics training as recommended by; Pearson and Brew (2002) who recommends that research statistics training should be very wide and should incorporate the needs for knowledge creation; Mukhwana et al (2016) note that the training should broad enough to encourage innovation and creativity; Mukherjee (2001) posts that training should equip researchers to handle their research

problems in general. The analyzed curriculums were found to have adequately covered the requirements stated by the scholars above.

The curriculums were, however, found to have less emphasis on research training in general as compared to benchmark curriculum of Graduate School for Social Sciences, University of Glasgow. The benchmark curriculum had a special certificate being given for research trainees who qualify. This certificate was a way of noting the competency of researchers but also made the research training to be taken seriously by trainees. Sabzwari et al (2009) found that very small proportions of students receive any training in research during their undergraduate studies. This means that the training they get at masters' level was their maiden training in research. Considering that it was the first it was actually prudent that universities in Kenya consider issuing a certificate the same Glasgow university school of social sciences was doing. Despite some short comings the study notes that the sampled curriculum general objectives and specific objectives adequately covered the requirements for use of statistical analysis in research.

4.6.3 Statistics Content in the Curriculum

Apart from the general objectives and specific objectives, Wei (2001) indicated that the aim of training in statistics should also be to increase the trainee's abilities in their practice. This means content was of importance to increase these abilities. The study, therefore, sought to determine the specific content that had been set aside in the curriculum to meet the objectives stated. The study found that the curriculum with the highest number of statistical courses had 4 courses. All the curriculums had 2 core courses in statistics and in one case one curriculum had 2 optional courses. The study

determined that the scheduled content for the core courses covered descriptive and inferential statistics. The optional courses, for the curriculums that had them, provided an opportunity for advanced statistics techniques. Extracts from the sampled curriculums were as shown below.

Curriculum Extract 3

Research Methods: "The Design and application of quantitative and qualitative research strategies, Secondary data; Sampling methods; data collection; Data analysis; interpretation and presentation techniques."

Statistics: Statistical principles as they relate to research, quantitative and qualitative data, parametric and non-parametric tests, statistical errors, research hypothesis, demographic projections; Analysis of variance; rationale and terms; Multiple comparisons, two-way analysis; Factor analysis and other multivariate techniques.

Decision Analysis: Structural decisions I; alternatives, consequences, objectives and uncertainties, structural decisions II; Objectives, hierarchies, and decision trees: Decision analysis software; multi objective value analysis; sensitivity analysis; probability analysis; subjective probability; modeling risk attitude; Theoretical probability distributions.

Operations Research: Formulation of Linear Optimization Models; Algebraic and Geometric representations of Linear Optimization Models; simplex method of solution; Introduction to optimization Models; Dynamic optimization of inventory scheduling; Decision making over unbounded horizon; Optimization methods for an unbound

horizon; Optimization with a non-linear objective function; Probabilistic dynamic programming models; waiting the model; computer simulation of management; implementation of operations research.

(Source: Sampled Curriculums)

Based on the study findings it was noted that the sampled curriculums met some of the needs of statistics training as stated by different scholars discussed below. Wei (2001) noted that training curriculum should contain survey designing, data collecting and data analysis. All this aspects were noted by the study to have been included in the sampled curriculums. Bishop and Talbot (2001) noted that attention should be devoted to strategic issues in statistics such as what technique was most appropriate and how to organize data collection. This requirement by Bishop and Talbot (2001) was found not adequately covered in the sampled curriculums. The sampled curriculums had general concepts about this aspect but were not specific to determining the best statistic and how to organize data. This makes implementation of the curriculum very general and may or may not cover the need of determining best statistic to use. The benchmark curriculum has very specific expectations on this. It expects students to be competent is selecting research questions measuring and collecting data and choosing suitable methods for data analysis. This was determined as a non conformity of the sampled curriculums. Recommendations by McDonald (2001) that university courses on quantitative research should include advantages and disadvantages of small data, how the students should handle missing values, and appropriate use of complex sample designs were also

determined to be inadequately covered. Despite the inadequacies that need to be improved, the study notes that the sampled curriculums content covers the statistical knowledge needs to enable use of statistical analysis in research.

4.6.4 Information Communication Technology Content

The study in section 4.4 determined that ICT was a need for one to use statistics in research. The findings were in agreement with Jung (2005) who notes that structure and content of training in this contemporary society that relies on ICT should always have elements of ICT. The study sought to determine if ICT concepts were adequately catered for in the sampled masters' curriculums. The study determined that ICT concepts were included in three courses which were Statistics, Decision analysis and Operations research. The ICT concepts in each of the three courses were not related to each other. Every course was concerned about a different ICT concept. An extract from the sampled curriculum was as shown below.

Curriculum Extract 4

Statistics: Use of Statistical software (SYSTAT and SPSS).

Decision Analysis: Decision analysis software; multi objective value analysis; sensitivity analysis; probability analysis; subjective probability; modeling risk attitude;

Operations Research: Computer simulation of management;

(Source: Sampled Curriculums)

The study findings show that the sampled curriculums complied with sentiments by Starkings (1997) and Bishop and Talbot (2001). They noted that educational establishments need to be updating the curriculum to keep pace with changes in society and the work environment. The work environment in use of statistical analysis as indicated by Jones (1997) and Friedman (2001) involves use of computer software for data analysis. Despite the sampled curriculums being compliant with scholars' requirements and the needs to use statistics, the way the ICT concepts were included was challenging to execute. The ICT concepts were included with other concepts making the courses too wide to be effectively learned in one semester of 4 months. At the same time the ICT concepts were treated as an addition to the courses which they were included.

The study noted that this inclusion method was an inferior way as compared to the bench mark curriculum which integrated ICT in every statistical concept covered. The benchmark curriculum advocates for use of statistical software at every stage of statistics and also recommends use of sets for data for this exercise. The way the sampled curriculums have treated ICT concepts leaves room for the implementers of the curriculum to teach ICT as a separate concept from statistics. The benchmark curriculum also has additional requirements that make the research trainees cover through their own initiative some of the ICT concepts. Examples of the additional requirements include asking students to attend workshops on use of software for data analysis. This was an element that the sampled curriculums were missing making them less likely to achieve the set objectives. The study determined this adding on rather than integrating ICT concepts and statistics concepts to be a major setback of the sampled curriculums. The

study, therefore, notes that the way the sampled curriculums had presented ICT concepts cannot adequately meet the ICT knowledge needs to use statistics in research.

4.6.5 Curriculum Recommendation for Instruction Procedures and Evaluation

The study established that the sampled curriculum content in some cases was adequate and in other cases inadequate as discussed in section 4.6.3 and 4.6.4 above. The study further sought to determine the recommendations made by the curriculum in relation to instruction process. The study established that lectures, class discussion and students presentations common across the sampled curriculums. Extracts from the sampled curriculums were as shown below.

Curriculum Extract 5

Research Methods: "The approach adopted for this study will be basically lecture and discussion methods. The students are expected to do further out-of-class explorations and bring questions and findings to class."

Statistics: "Teaching will involve lectures, class discussion, and field trips to selected business organizations, case studies, resource person, films and videos."

Decision Analysis: The approach adopted for this study will be basically lecture and discussion methods. The students are expected to do further out-of-class explorations and bring questions and findings to class.

Operations Research: Lectures, Case study, Discussions, and Students presentations.

(Source: Sampled Curriculums)

The study finding was similar to findings by Wei (2001) who indicated that training researchers in the use of statistical analysis in China was through Class teaching and group discussion. However, Wei (2001) also notes that field training, TV, broadcasting programs and Internet were also used. These methods were conspicuously missing in the sampled curriculums. Hirotsu (2001) recommends that training should be done in context. This recommendation by Hirotsu (2001) was not put into consideration by the sampled curriculums. The study looked at the sampled curriculum recommended instruction process against ideal standards set by the Wei and Hirostu and noted that the sampled curriculums had inadequacies. Additional inadequacies were noted when the sampled curriculums were measured against the benchmark curriculum. The benchmark curriculum recommended approaches were; lectures, tutorials, class discussion and presentations and workshops. The benchmark curriculum was superior because of the additional tutorials and workshop method. The study, therefore, notes that the recommended approaches for instruction in sampled curriculums were inadequate to meet the needs for use of statistical analysis in research.

Myyry and Joutsenvirta (2015) noted that assessment methods were essential for students' learning experiences. The study, therefore, looked at the proposed evaluation procedures in the sampled curriculums. The study established that continuous assessment tests and end of semester sit in exam were the common form of exams administered. In addition in one case there were also term papers and practical in some courses. Extracts from the sampled curriculums were as shown below.

Curriculum Extract 6

Research Methods: Select and refine a researchable topic, then write 18 page typed double spaced proposal for a case field study, (20%).

Present a final form, a research proposal including the findings, data analysis, summary, conclusion and recommendation. The paper should not exceed 20 paged typed double spaced, (20%).

Final Exam (60%).

Statistics: Continuous assessment tests and final examination.

Decision Analysis: Continuous Assessment Tests (CATs) and Assignments review of journals /Term Paper/ Practicals, 40%.

End of Semester Examination, 60%.

Operations Research: Student Assessment: Continuous assessment tests and final examination.

(Source: Sampled Curriculums)

The study determined that emphasis was placed on end of semester examination with continuous assessments, projects and practical accounting to a maximum of 40%. The study findings concur with Mukhwana et al (2016) who noted that at the postgraduate level, coursework examination follows the same process as undergraduate programs. Mukhwana et al (2016) indicated that the students sit and write the exam at the end of the semester in which the course was taught. On passing the required coursework they

proceed to next stage of research. The study noted shortcomings in the recommended evaluation procedures based on the discussion below.

Strijbos, and Sluijsmans (2010) note that summative evaluation was out of context, individualistic and was isolated from the learning process. Guligers et al. (2006) found that when the assessment form was perceived as authentic, the students were more prone to adopt deep learning strategies and there were also increases in generic skill achievement, such as problem-solving, analytic skills, and written communication skills. Myyry and Joutsenvirta (2015) noted that most of the students taking the open-book examination learned deeply and focused on understanding as compared to those taking class examinations. The study, therefore, noted that the recommended assessment procedures in sampled curriculum were not adequately encouraging mastery of skills. A comparison with the benchmark curriculum showed big variation in the way the learned knowledge and skills were assessed. The benchmark curriculum emphasized on open book assignments that were in context with how the knowledge will be applied. On the other hand the sampled curriculums emphasized on closed book end of semester exams that were out of context. The study identified assessment procedures as a major setback for understanding and using statistics in research.

In summary the study found that the curriculum proposes that one was qualified to be admitted for masters and subsequently training in use of statistical analysis in research if; they have a degree in a related field; and meet other university admission regulation. The study also established that; general objectives and specific objectives in courses related to statistics adequately covered the requirements for statistics training; the scheduled content for the core courses covered descriptive and inferential statistics; ICT concepts

were adequately catered for in the sampled masters' curriculums, however, the courses too wide to be effectively learned in one semester of 4 months; The study established that lectures, class discussion and students presentations common across the sampled curriculums. The study established that continuous assessment tests and end of semester sit in exam were the common form of exams administered. In addition in one case there were also term papers and practical in some courses.

4.7 Masters' Curriculum Implementation and use Statistics in Research

The finding in section 4.6 above indicate that the masters' curriculum content except the proposed evaluation procedures and teaching strategies meets the needs for use of statistical analysis in research. The study further sought to determine if and how curriculum implementation process meets the needs for students to use statistics in research. The study presented the findings based on three key sections namely what was taught, how it was taught and how what was taught and how it was taught influenced use of statistical analysis in research.

4.7.1 Survey of what was taught in Masters' Class in Relation to Statistics

The study sought to determine the statistics and ICT concepts that were taught in class. The study found that 92.1%, 68.4% and 77.6% of the sampled respondents were taught how to determine the statistic to use, how to interpret figures and tables and descriptive statistics respectively. The study determined that 46.1% were taught inferential statistics and only 30.3% and 31.6% were taught basic computer skills and how to use statistical computer software respectively. Summary of the findings were as shown in figure 4.5 below.

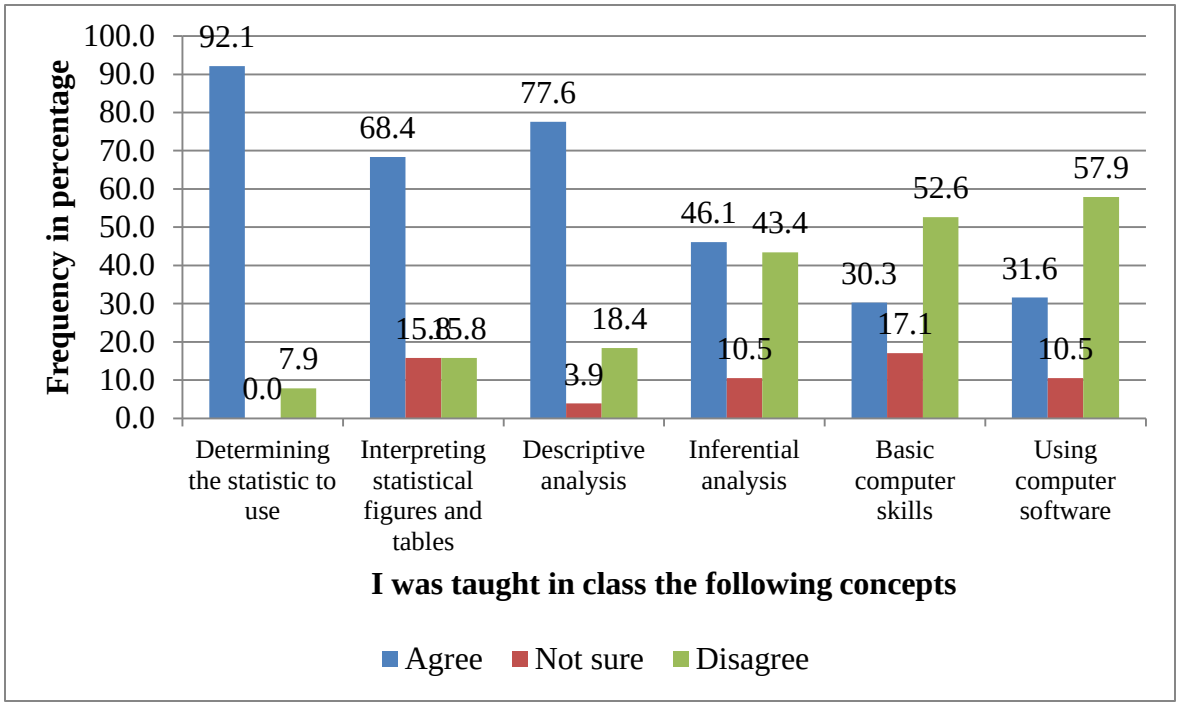

Figure 4.5: Concepts taught in Class

The study had established earlier that all the concepts in question above except for basic computer skills were in the curriculum for masters students. Despite the concepts being in curriculum inferential statistics was taught to less than half of the sampled students and use of computer software was taught to less than third of sampled students. An interview with four sampled students revealed the same picture as stated above. The interviewed students noted that some of them miss classes and never bother to make a follow up on what was taught. This explains the cases of students not knowing if a concept was taught in class or not. Interviewed lecturers noted that they rarely teach basic computer skills because they expect the learners to do it on their own. In relation to use of statistical software, which was a requirement by the curriculum to be taught, lecturers noted that in most cases they don't teach due to inadequate computers and the software itself was not availed to them by the university.

All the interviewed lecturers noted that they taught inferential statistics concepts as stated in the curriculum they were using. They, however, said in most cases they taught that manual calculation of inferential statistics and how to use the findings to test the stated hypotheses. The students interviewed confirmed they were theoretically taught concepts of chi-square, t-test and analysis of variance among other inferential statistics. They also noted that these concepts were covered so fast and some of them had little understanding of the concepts. In one case an interviewee stated that it's just like he never learned anything despite being in those classes of inferential statistics. It came out at that point that according to lecturers they taught inferential statistics and according to students they were in those classes but about half learned little to none of the concepts of inferential statistics. This explains the discrepancy in lecturers' response and students' response on whether they covered inferential statistics.

The study findings were different from the scenario that Bishop and Talbot (2001) noted in developed countries. They noted that much of statistical education of researchers was focusing on training in specific techniques including the use statistical packages. McDonald (2001) recommended that it was important for researchers to have the opportunity either to become familiar with software commonly used with large data sets or were trained in the principles of software applications. Apart from statistical software Wei (2001) proposes that these statistical concepts including inferential statistics should be put into training materials. The study findings, therefore, means that master's students were inadequately prepared to use statistics in research. Specifically the students were not well prepared to handle inferential statistics and to use computer software for data analysis.

4.7.2 Survey of how the teaching was carried out in Masters' Class

The study sought to determine if the curriculum implementation process followed the recommended teaching strategies. Some of lecturers during interview noted that they have fully integrated information communication technology into teaching statistical concepts but lamented that the exercise was time consuming. The study established that 30.3% of the sampled respondents were in classes where ICT and statistics concepts were well integrated. For the remaining students the concepts were taught in isolation and in some cases they were not taught at all. The study narrowed down to these 30.3% of the students to determine how they found the process of data analysis. The study found that 82.6% of this group found the process to be easy and 17.4% found the process difficult.

The study through interviews established that the one method that was used to teach statistical concepts was lecture method. The study also found that 56.6%, 69.7% and 60.5% of the sampled respondents were taught determining of statistic to use, interpreting tables and figures and descriptive statistics respectively using samples of data. On the other hand only 28.9%, 26.3% and 35.5% of the sampled students were taught inferential statistics, basic computer skills and use of computer software respectively using samples of data. Summary of the findings were as shown in figure 4.6 below.

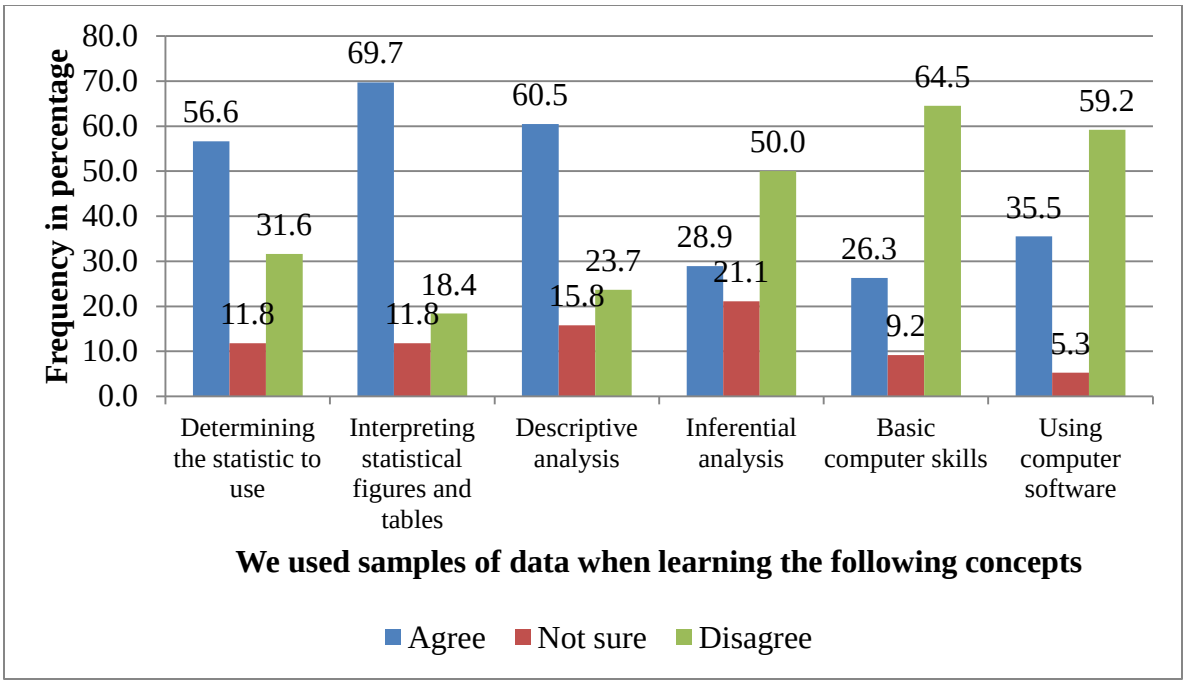

Figure 4.6: How concepts were taught in Class

The study established that just about 60% of the classes used samples of data when teaching basic statistics and about 30% used samples of data to teach inferential and ICT concepts. During interview with students they noted that the sets of data they were using during basic statistics and inferential statistics were being calculated manually with little to no use of computer software to do the same. Lecturers also confirmed teaching these concepts of statistics without use of computer software and when asked why they raised the aspect of inadequacy of computers and computer software for data analysis. These findings fall short of the requirements by McDonald (2001) who recommends practical experience with large and realistic statistical data sets during the training of researcher on how to use statistics. The findings also were contrary to findings by Sawyerr (2004) who notes that in research universities the capacity of individual researchers was developed through appropriate training by use of strategies that involve trainees in research activity.

The study, therefore noted that inadequate use of sample data was a cause of inadequate training in use of statistical analysis in research.

The study also established that lecturer method was the common method being used. This finding agree with Clark (1993) who indicted that as a result of mass education majority of research trainees were primarily exposed to systematic, sequential course work using lecture method. Harraway, et al (2001) also found that one of the ways of implementing the set curriculum was requiring students to attend formal lecture courses, provided by statisticians or established researchers. Other researchers have however noted that lecture method alone was not adequate. Harraway, et al (2001) noted that University of Otago was offering short courses to compliment lecture method. Mji and Glencross (2001) indicated that the University of Transkei has fully embraced use of workshops and short courses, supplemented by a variety of research seminars in the training of social science researchers. The findings however indicated that these other methods that were being embraced by other universities were not practiced in sampled universities. During interview respondents noted that workshops were occasionally organized by universities and were always optional. They also noted that in most cases they were more of paper presentations rather than training sessions. The study, therefore, noted that lecture method that was being used was inadequate to train students in using statistics in research.

4.7.3 Influence of Curriculum Implementation on use of statistical analysis in Research

The study sought to determine the influence of curriculum implementation on use of statistical analysis in research. A regression analysis was carried out and the output value

tested against the set alpha level of 0.05. Predictor variables were categorized in two models, model one and model two. Model one was about if the concepts were taught or not and model two comprised of both if concepts were taught or not and if they were well practiced in class using samples of data. The study found that teaching or failure to teach required statistical concepts accounted for 27.6% of finding it easy or difficult to use statistics in research. This was as indicated by the R square value of 0.276 against model 1. When teaching of the concepts was combined with practice using samples of data it accounts for 68% of using statistics in research. This was as indicated by the R square value of 0.680 against model 2. The results were as shown in table 4.4 below.

Table 4.4: Regression Model Summary of Curriculum Implementation.

Model	R	R Square
1 (Concepts were taught in class)	.526[a]	.276
2 (Concepts were taught in class and practiced)	.824[b]	.680

The findings indicated that a student who was taught all the required statistical concepts and used samples of data during the learning process was 68% more likely to find use of statistical analysis in research easy. Model one explains 27.6% of the dependant variable and model one and two combined explains 68.0% of the dependant variable. The study sought to determine if this influence was statistically significant. An analysis of variance was carried out. The Sig. value for model 1 and were 0.001 and 0.000 respectively. Both were below the testing alpha level of 0.05 meaning that teaching statistical concepts and practicing the same concepts with sets of data was statistically significant in explaining use of statistical analysis in research. The results were as shown in table 4.5 below.

Table 4.5: ANOVA Summary of Curriculum Implementation Process.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.058	6	2.676	4.392	.001[b]
	Residual	42.048	69	.609		
	Total	58.105	75			
2	Regression	39.485	14	2.820	9.240	.000[c]
	Residual	18.620	61	.305		
	Total	58.105	75			

The study findings imply that if the curriculum was well implemented the students would have been better placed to use statistics in research. However, this analysis was inclusive of all variables under study in relation to curriculum implementation. It was worth noting that some of the variables contribution was not statistically significant and could have just occurred by chance. To eliminate the aspect of occurrences by chance being included in regression analysis the study employed an automated stepwise exclusion of these variables.

After a stepwise linear regression analysis four variables were found to be the ones that were statistically significant in explaining the dependant variable. The four variables were; Integrating of statistics and ICT concepts; Being taught how to determine the statistic to use when analyzing data, Being taught how to use computer software to do statistical analysis; and learning and practicing inferential analysis. The first model of the analysis was made up the first variable above and the subsequent models had one additional variable based on the order of the variables above. The R square value for

model 1, 2, 3 and 4 was 0.264, 0.360, 0.399 and 0.443 respectively. Significant F change for model 1, 2, 3 and 4 was 0.000, 0.001, 0.032 and 0.022 respectively. This meant that all the four variables were significant in explaining the use of statistics. In addition the analysis determined that curriculum implementation accounts for 44.3% of use of statistical analysis among Master's students. The results were as shown in table 4.6 below

Table 4.6: Summary of Significant Variables of Curriculum Implementation.

Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Change Statistics**				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.514[a]	.264	.254	.76025	.264	26.531	1	74	.000
2	.600[b]	.360	.342	.71396	.096	10.906	1	73	.001
3	.632[c]	.399	.374	.69616	.040	4.781	1	72	.032
4	.665[d]	.443	.411	.67526	.043	5.527	1	71	.022

The study findings lead to rejecting the null hypotheses that *Statistical syllabus implementation process has no significant influence on student's use of statistical analysis in research*. These meant that students who were adequately trained in use of statistical analysis were 44.3% more likely to use statistics easily. On the other hand students who were not adequately trained in use of statistical analysis were 44.3% less likely to use statistics with ease in research. The study noted that curriculum implementation for statistics training among masters' students in sampled universities was inadequate and this was affecting students' use of statistical analysis negatively.

This finding concurs with Clark (1993), who noted that institutions of higher education were operating under mandates systematically at odds with interests of science. He argued that students training of non science professionals, academic staffs were steered by expectations and duties that have little to do with pursuit of research or the training of future researchers. The findings limit the possibility of sampled universities being research universities unless the curriculum implementation was fixed. This was based on the argument by Muia and Oringo (2016) who noted that training was an important aspect of research productivity in universities. Sawyerr (2004) also noted that, the capacity of individual researchers, including their skills, competencies, attitudes, and values, were developed primarily through appropriate training programs. This training program was determined by the study to be inadequate in sampled universities.

On this objective the study determined that majority of the sampled respondents were taught how to determine the statistic to use, how to interpret figures and tables and descriptive statistics. The study determined that less than half of the sampled students were taught inferential statistics and less than a third were taught basic computer skills and how to use statistical computer software. Not all who were taught these concepts practiced them in class using sets of data. The study established that 30.3% of the sampled respondents were in classes where ICT and statistics concepts were well integrated. The study determined that students who were adequately trained in use of statistical analysis were 44.3% more likely to use statistics easily.

4.8 Technological Resources and use of statistical analysis in Research

Friedman (2001) points out the computer revolution that has completely altered data collection and analysis in research. He noted that much of was automatically recorded and analyzed with computers. The study sought to determine if these computers and computer software were available in sampled universities. This section was divided into two, one looking at the availability of the resources and the second looking at how the availability influenced use of statistical analysis in research.

4.8.1 Availability of Technological Resources

The study sought to determine if sampled universities had computers and statistical software. Based on data collected by questionnaire, 72% of the respondents noted that their universities did not have enough computers and statistical software, 16% noted that their universities had enough technological resources and 12% were not aware if the resources were adequate or not. The study established during interview schedules that sampled universities had postgraduate computer labs or section set aside for postgraduate students but these labs had very few computers in relation to the postgraduate students enrolled. In some cases the set aside sections were just for postgraduate students to find a sitting space but with no computers at all.

The study also sought to determine if individual students had access to their own technological resources. The analysis showed that 84.2% of the sampled respondents had easy access a computer, 42.1% easily accessed computer software for data analysis and 73.7% had easy access to source of power. The findings were as indicated in figure 4.7 below.

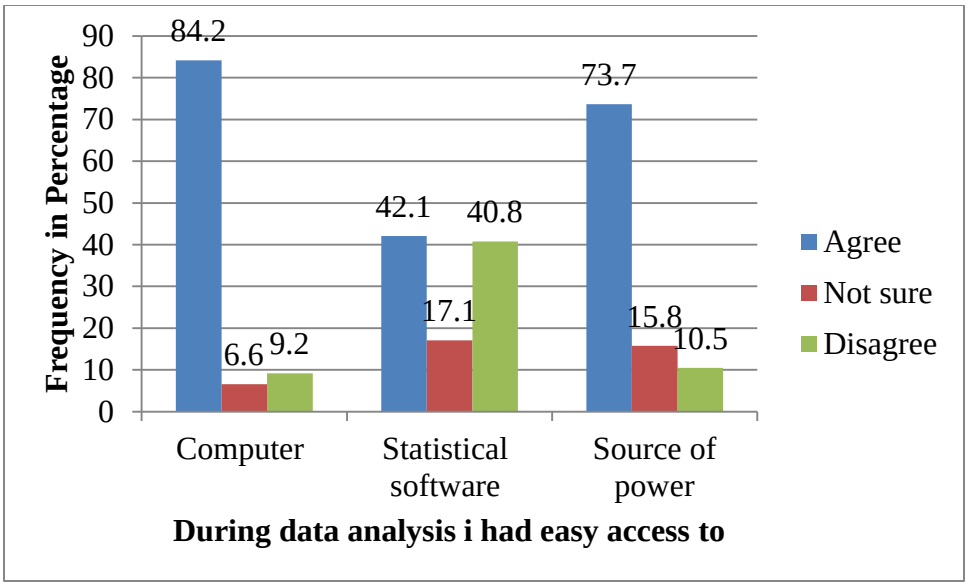

Figure 4.7: Access to Personal Technological Resources

The findings indicate that majority of the sampled universities did not have adequate technological resources. Majority of individual students, however, were noted to have easy access to computers but less than half could access statistical software. These findings were similar to Muia and Oringo (2016) finding that Nairobi University had inadequate materials and equipment for research. This was also the case in other countries. Wei (2001) indicated that in China computer systems and teaching facilities in most universities and training centers lag relatively behind.

These findings indicate that the situation has not changed despite Muwhana et al (2016) sentiments that universities were striving to provide support infrastructure to graduate students. They noted that the support included research laboratories and computers. A comparison of the finding to research universities shows a completely different picture. Research universities have invested in acquisition of technological resources for research. Mji, and Glencross (2001) noted that the University of Transkei had established a

research resource centre fully furnished with technological resources. The study, therefore, noted that inadequacy of technological resources in sampled universities was a factor of concern. However, the impact of inadequacy of resources was slightly lowered by the fact that students were accessing their own resources.

4.8.2 Availability of Technological Resources and use of statistical analysis in Research

The study sought to determine how the adequacy or inadequacy of technological resources was influencing the use of statistical analysis in research. A regression analysis was carried out and the findings were as follows; Access to computers whether privately or in institution explains 17.6% of use of statistics, this as indicated by R square value of 0.176 against model 1; Access to computer and statistical software explains 40.5%; and access to computer, statistical software and source of power explains 44.6%. The percentages were determined by the R square value of 0.176 against each model. The results of the analysis were as shown in table 4.7 below.

Table 4.7: Regression Model Summary of Technological Resources.

Model	R	R Square
1 (Easy access to computers)	.420[a]	.176
2 (Easy access to computers and statistical software)	.637[b]	.405
3 (Easy access to computers, statistical software and source of power)	.668[c]	.446

From the findings indicated that a student who has access to technological resources being discussed was 44.6% more likely to use statistics. It was important to determine if the percentages presented above that technological resources explain use of statistical

analysis was just by chance or were percentages that were statistically significant. An analysis of variance was carried out and resulting significant figures tested at alpha level of 0.05. The study determined that the significant values for all the three models were 0.000. This means that the influence of adequacy of technological resources was statistically significant. The results were as indicated in table 4.8 below

Table 4.8: ANOVA Summary of Technological Resources.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.230	1	10.230	15.813	.000[b]
	Residual	47.875	74	.647		
	Total	58.105	75			
2	Regression	23.554	2	11.777	24.883	.000[c]
	Residual	34.551	73	.473		
	Total	58.105	75			
3	Regression	25.899	3	8.633	19.299	.000[d]
	Residual	32.207	72	.447		
	Total	58.105	75			

In order to determine the most significant variables of the three, access to computer, access to software and access to source of power, a stepwise multiple linear regression was applied to the set of data. The outcome indicated that access to statistical software and access to power source explained the use of statistical analysis more than just accessing computer alone. Model 1 was access to statistical software and Model 2 was access to statistical software and source of power. The analysis determined that R square for model 2 was 0.442 meaning that technological resources in question explain 44.2% of

use of statistics. Significant values for model 1 and 2 were 0.000 and 0.001 respectively both being lower than 0.05. This means that technological resources were statistically significant in explaining use of statistics. Summary of the results were as shown in table 4.9 below.

Table 4.9: Summary of Significant Technological Resources.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.592[a]	.351	.342	.71386	.351	40.024	1	74	.000
2	.665[b]	.442	.427	.66628	.091	11.946	1	73	.001

The study finding leads to rejecting the hypotheses that *Technological resources have no significant influence on student's use of statistical analysis in research.* In other terms having access to computers, statistical software and source of power greatly improves the chances of a student finding the process of use of statistical analysis easy. This meant that if universities could improve on availing resources especially computers and computer software for data analysis it will greatly improve the likelihood of their students' finding it easy to use statistics in research.

The study findings agree with sentiments by Sawyerr (2004) who noted that research training should be rich in resources. The findings indicated that sampled universities were not taking into consideration Starkings (1997) point that Calculators and computers must be recognized as tools of basic importance and should be available to all teachers and students. This ignoring of availing technological resources was determined by the study to be a stumbling block to use of statistical analysis among masters' students. It would be

expected that given the importance of resources in using statistics universities should embrace equipping laboratories with resources. Clark (1993) identified that one of the key challenges universities were facing in relation to equipping laboratories with resources was the transition from elite to mass higher education. He noted that this has led universities to extended first degree instruction approaches that were often not closely linked with research and were theoretical to postgraduate levels. This was also coupled up with limited funding at postgraduate level in favor of basic education as noted by Sawyerr (2004). Despite the stated reasons the study determined that inadequate resources were negatively impacting the use of statistical analysis in research.

In summary the study determined that majority of the sampled universities did not have adequate computers and statistical software. The study showed that majority of the sampled respondents had easy access a computer and source of power but less than half easily accessed computer software for data analysis. The study determined that access to computers, statistical software and source of power greatly improves the chances of a student finding the process of use of statistical analysis easy.

4.9 Personal Factors and use of statistical analysis in Research

Lioyd et al (2004) noted that inadequate mentorship and lack of time have been major barriers in research but did not specify if it could influence specifically data analysis. The study, therefore, sought to find out how personal factors influence masters' students' use of statistical analysis in research. Specifically the study sought to determine if students' had time and took personal initiative to learn and use the learned concepts in statistics.

4.9.1 Availability of Personal Time and Initiative

The study sought to determine if students had time to attend classes and to carry out data analysis. The findings indicated that 38.2% of the students had time to attend all classes and 71.1% had time to carry out data analysis. The findings were as indicated in figure 4.8 below.

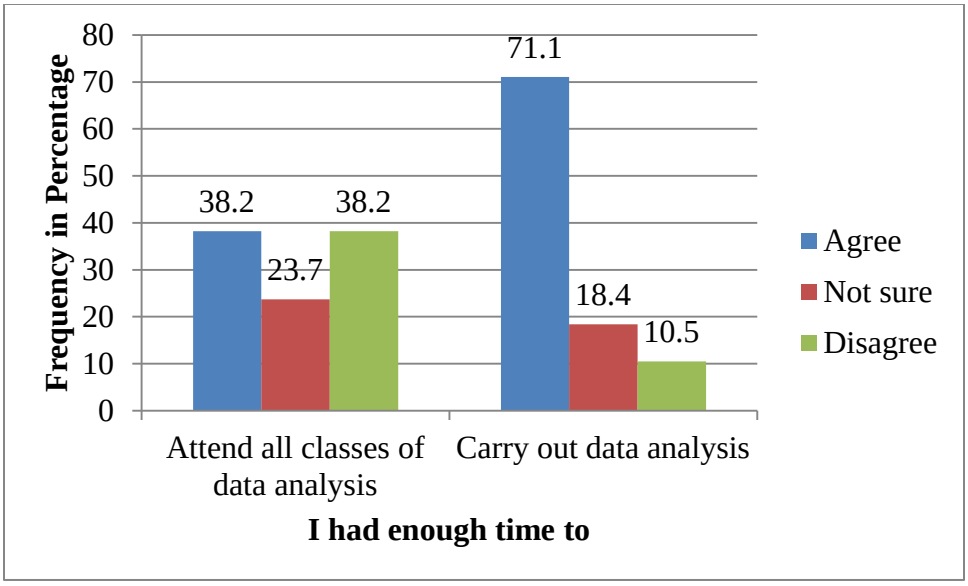

Figure 4.8: Time that Students had for Data Analysis

The study noted that some of the students were not sure whether they attended all classes or not. Clarification of this was sought during interview schedule and the interviewees stated that in some cases the masters' class timetable was not followed and the local arrangement made it difficult for students to track which class was at what time and some ended up missing classes without knowing they had missed. The study also established that some of the students were working and, therefore, did not have time to attend all classes. Lecturers were also aware of this and noted that employed students missed classes sometimes. The interviewees in the study noted that missing of classes was also

because to personal factors including family responsibilities. The respondents were noted to have set aside time to carry out data analysis. When students who were interviewed were asked how they got time for data analysis and not for classes, they noted that data analysis was flexible and they could do it from their homes or over the weekends when they had time.

The findings contradict Harraway, et al (2001) who noted that one of the ways of implementing the set curriculum was requiring students to attend formal lecture courses. The sampled students were noted to be busy and not attending all classes. According Harraway, et al (2001) such a situation cannot allow effective implementation of curriculum. Jung (2012) pointed out to teaching time versus research time as a determining issue on whether one will be involved in research or not. The study findings were in agreement with Sabzwari et al (2009) who noted that doctors who participated in their research considered it difficult to conduct research because of lack of time. Jowett, et al (2000) also noted the busy clinical practices as major deterrents to clinicians' involvement in research. The study, therefore, identified lack of time on the side of students as a key factor to explain their use of statistics.

The study also sought to determine if the students took any personal initiative learn on their own the concepts of how to use computer statistical software or any other concepts related to data analysis. It was determined that 85.5% of the students took initiative to learn how to use computer software and 90.8% took initiative to learn other concepts related to use of statistics. The results were as shown in figure 4.9 below.

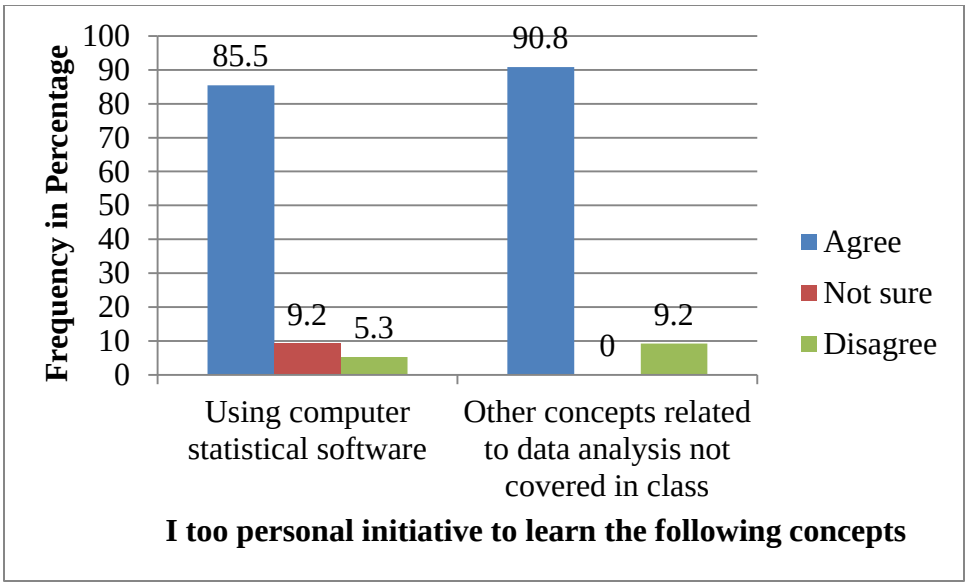

Figure 4.9: Students Personal initiative in Data Analysis

It was determined that majority of the students were taking time to learn on their own how to carry out data analysis using computer software and other concepts related to that. This was explained by the earlier finding in this study that data analysis concepts that were being taught in class were not well integrated with technology that was required to apply the same knowledge. The finding was also explained by the finding that less than half of sampled students were taught in class how to use statistical software and inferential statistics. The study found from the students it interviewed that more and more students were taking personal initiative and seeking more knowledge and skills of analyzing data using computer software from research organizations and individuals with data analysis competence. When lecturers were asked if they were aware of students seeking knowledge and skills elsewhere, they agreed to be aware but indicated that due to scarcity of resources and time they have little to offer to help the students with required knowledge and skills.

The interviewed students further noted that despite learning on their own how to use computer software to carry out data analysis they could also not understand the concepts. They stated that in some cases they were even more confused on what to do with the many tests available in the software that they had little understanding of. This meant that the students were having the will and time to acquire knowledge and skills of using computer software to carry out data analysis but lacked the basics and guidelines to understand the concepts they were learning. These findings agree with Harraway, et al (2001) who determined that researchers also learn about statistics informally from their own reading, with assistance from established researchers. They noted that the approach seemed to be common. Harraway, et al (2001) in their research also determined that the approach was not altogether satisfactory because it may result in the researchers having gaps in their knowledge that they were not even aware of. The findings agree also agree with Jowett, et al (2000) who noted lack of interest among clinical officers as major deterrents to their involvement in research. Lechuga and Lechuga (2012) also found that individual passion for or interest in research was a determining factor. The study determined that personal initiative, although was not an effective method of learning, contributed towards explaining the use of statistical analysis in research.

4.9.2 Availability of Personal Time and Initiative and use of statistical analysis in Research

The study sought to determine the influence of personal factors use of statistical analysis in research. The study found that time to attend classes did not explain use of statistical analysis in research. Time to carry out data analysis explained 27.6% of use of statistics. Time to carry out data analysis and study computer explained 28.1%. Finally time to

carry out data analysis and to study computer software and other statistical concepts explained 33.3% of use of statistics. The percentages were derived from R square value for model 1, 2, 3 and 4 being 0.000, 0.276, 0.281 and 0.333 respectively. The findings of regression were as shown in table 4.10 below with.

Table 4.10: Regression Model Summary of Personal Factors.

Model	R	R Square
1 (Time to attend classes)	.017[a]	.000
2 (Time to attend classes & carry out data analysis)	.525[b]	.276
3 (Time to attend classes, carry out data analysis & study computer software)	.530[c]	.281
4 (Time to attend classes, carry out data analysis & study computer software and other data analysis concepts)	.577[d]	.333

The aspect attending masters' classes not adding any advantage to a student using statistics was explained by earlier findings in this study which indicated that the planned curriculum was not the implemented curriculum. The implemented curriculum was theoretical and not linked to contemporary ways and means of data analysis using computer software. This, therefore, does not give any advantage to a student who regularly attends class to learn data analysis. However, if the planned curriculum was the one that will be implemented in class it has a lot to offer in helping students carry out data analysis using contemporary computer software.

In order to have meaningful interpretation of personal factors and how they impact on use of statistical analysis in research, it was important to assess whether the explanation in

percent determined above was by chance or it was statistically significant. Analysis of variance test was carried out on the data and the significant values for model 1, 2, 3 and 4 were 0.883, 0.000, 0.000 and 0.000 respectively. When tested at alpha level of 0.05, model one was above and all the others were below. This means that that model attending or failing to attend classes was not statistically significant. On the other hand having time to carry out data analysis, and having personal initiative to learn how to use computer software and other related concepts to statistics were all statistically significant in explaining use of statistics. The following in table 4.11 were the results.

Table 4.11: ANOVA Summary of Personal Factors.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.017	1	.017	.022	.883[b]
	Residual	58.088	74	.785		
	Total	58.105	75			
2	Regression	16.013	2	8.007	13.886	.000[c]
	Residual	42.092	73	.577		
	Total	58.105	75			
3	Regression	16.339	3	5.446	9.389	.000[d]
	Residual	41.766	72	.580		
	Total	58.105	75			
4	Regression	19.353	4	4.838	8.864	.000[e]
	Residual	38.752	71	.546		
	Total	58.105	75			

When a stepwise multiple regressions was carried out, the study determined that among the personal factors having time to carry out data analysis was the most influencing factor

on use of statistics. This variable alone was found to explain 26.0% of how the student found the process of using statistics. The other personal factors were filtered out by regression with a possibility that they could have influenced use of statistical analysis by chance. The results of this regression were as shown in table 4.12 below.

Table 4.12: Summary of Significant Personal Factors.

Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Change Statistics**				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.510[a]	.260	.250	.76203	.260	26.063	1	74	.000

This finding led to rejecting the null hypotheses that, *time to carry out data analysis has no significant influence on student's use of statistics*. This meant that masters' students who had enough time to carry out data analysis were 26% more likely to find use of statistical analysis easier than their counterparts. The findings were in agreement with Lioyd et al (2004) who found that lack of time was the major barrier in research. Rosemann and Szecsenyi (2004) also added to this finding by noting that adequate time was key for successful research. The findings also concur with Bunting et al. (2014) time in addition to individual determination and passion to engage in research was important to quality research.

The study sought to determine if students had time to attend classes and to carry out data analysis. The findings indicated that less than half of the students had time to attend all classes and majority had time to carry out data analysis. The study also determined that

majority of the students took initiative to learn how to use computer software and other concepts related to use of statistics. The study established that masters' students who had enough time to carry out data analysis were 26% more likely to find use of statistical analysis easier than their counterparts.

4.10 Discussion of Competencies influencing use of Statistical Analysis in Research

Analysis in previous sub sections of this chapter was mainly based on the objectives of the study and was also geared to answering the study questions and testing hypotheses. In this sub section of the chapter the study analyzed and discussed all the concepts combined. The study this far had established that students' prior knowledge in statistics; implementation of curriculum; technological resources and personal factors of the students influence their use of statistical analysis in research. The study in this section sought to determine the contribution of each of the above concepts and aspects when they were combined together towards explaining use of statistical analysis by masters' students. A multiple regression analysis was carried out and included all variables that were found to be significant using the stepwise selection method at each of the objectives discussed above.

Model 1 of the regression analysis was about prior knowledge. Model 2 of the regression table comprised prior knowledge and curriculum implementation. Model 3 had three objectives, prior knowledge, curriculum implementation and technological resources. Model 4 had prior knowledge, curriculum implementation, technological resources and personal factors. The analysis determined that; model 1, 2, 3 and 4 had an R square change of 0.456, 0.214, 0.112 and 0.015 respectively. The significant F change for model

1, 2 and 3 was 0.000 and that of model 4 was 0.030. Summary results were as shown in table 4.13 below.

Table 4.13: Regression of Competency Domains influencing use of Statistics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.675[a]	.456	.441	.65816	.456	30.569	2	73	.000
2	.819[b]	.670	.641	.52711	.214	11.203	4	69	.000
3	.885[c]	.783	.757	.43429	.112	17.324	2	67	.000
4	.893[d]	.798	.770	.42214	.015	4.911	1	66	.030

From the above findings R square for model 4, which comprises all the variables, was 0.798 meaning that all the variables under consideration explain 79.8% of how the students found use of statistical analysis in research. The remaining 20.2% was explained by variables that were not considered by this study. The R square change indicated that prior knowledge of the students explains 45.6% of how student found use of statistics; curriculum implementation explains 21.4%; technological resources explain 11.2% and personal factors explain 1.5%. All the significant F change values were below the testing alpha level of 0.05, meaning that all the competencies were significant in explaining how the students found the process of using statistics.

Based on the findings above prior knowledge was determined to be the most influential factor when it comes to explaining how the students found the process of using statistics. An analysis presented in the section of prior knowledge indicated that students who had

strong statistical and research background found the process of using statistics easy. Prior knowledge was meant to facilitate easy training. If the training was properly carried out prior knowledge should fade away, meaning that whether someone had adequate or inadequate prior knowledge should not matter after training. The study's establishment of high influence of prior knowledge in use of statistical analysis after training had been done was an indicator of inadequate training.

Descriptive survey of prior knowledge by this study and reviewed literature revealed that; there was limited prior knowledge of matters of research in general for masters' students (Sabzwari et al, 2009); there was inadequate ICT knowledge among undergraduates in developing countries (Adetimirin (2012); Danner & Pessu (2013)). In relation to statistics there was limited preparation at undergraduate for non mathematical courses (Blumberg (2001); Dempster and McCorry (2009)) and those taught also had limited understanding of statistics (Estepa & Sánchez, 2001). These, therefore means the 45.6% contribution from prior knowledge was a contribution from a very meager understanding of research and statistics taught in class. This was with an exception for those students who had research and statistics experience elsewhere apart from the classroom learning. This means that the students who rely on university training in research and use of statistical analysis will keep on struggling to use statistics in research.

The findings indicate that the curriculum implementation process explained a minimal 21.4% of the process of using statistics in research. It was at the masters' level that a researcher was trained (Mukhwana et al 2016), however, in sampled universities this training only accounts for 21.4% of the applied knowledge. This study established that; general objectives and specific objectives in courses related to statistics adequately

covered the requirements for statistics training; the scheduled content for the core courses covered descriptive and inferential statistics; ICT concepts were adequately catered for in the sampled masters' curriculums, although the courses too wide to be effectively learned in one semester of 4 months. These means the curriculum was well set and cannot be blamed for the dismal 21.4% contribution. The flawed training program was as a result of poor curriculum implementation.

The mediocrity in implementation starts with poor methods of teaching suggested by the curriculum. This was also accompanied by poor evaluation procedures suggested by the curriculum. The study noted that the sampled universities relied on lecture method as a way of implementing the curriculum. Lecture method was commonly used but had been found to be inadequate in preparing researchers for use of statistics, (Clark (1993); Harraway, et al (2001); Wei (2001)). Universities wishing to have competent researchers have opted for other methods which include; workshop method (Rossman (1997); Saville (2001); Mji and Glencross (2001); Crivisqui, et al (2001); Harraway, et al (2001)); consultation approach (Belli (2001); Saville (2001)); and self study (Harraway, et al 2001). The sampled universities did not have evidence of engaging in these alternative methods seriously. Some of the classes in sampled universities were still having the main challenges of curriculum implementation of teaching of statistics and computer separately identified by Wei (2001). This finding indicated that the presumption that research skills had been obtained at a Masters level was not as it is assumed to be. This, therefore, explained the observation made by Mukhwana et al (2016) that supervisors of students at PhD level often complained about candidates who were unwilling, or unable to conduct serious research.

The study established that technological resources explained 11.2% of the use of statistical analysis in research. The study established that despite the technological changes in use of statistical analysis the sampled universities have not fully embraced them. Technology in statistics has made it easy to carry it out using statistical software and was also possible to do data analysis on large scale (Jones (1997); Friedman (2001); Ashley (2018)). Consequently Starkings (1997) and Sawyerr (2004) have called for use of technological tools when training researchers. This call has been adhered to by some universities who now have the resources (Wei (2001); Mji, and Glencross (2001)). These resources were inadequate in sampled universities. If there is any hope of taking advantage of technology to enhance use of statistics, universities should equip themselves with resources.

Lastly the study noted that personal factors contributed a minimal percent of 1.5 towards use of statistics. These minimal levels of personal initiative indicate that the students were not ready for the vigorous exercise of research and data analysis specifically. This finding concurs with Scott (2015) who noted that many students pursue non academic topics and try mental gymnastics to try and fit them into a research project. He noted that thousands of Kenyan graduate students ask simple yes or no questions with answers already found hundreds if not thousands of times in literature. The same students also possess little or no concept of testing a theory or contributing to a body of knowledge by refining a theory. The study's review identified two main individual factors that can influence carrying out of research or being trained as a researcher. The two were individual's initiative (Jowett, et al (2000); Lechuga and Lechuga (2012); (Bunting et al. 2014)) and the availability of time (Lioyd et al (2004); Rosemann and Szecsenyi (2004);

Sabzwari et al (2009); Jowett, et al (2000); Jung (2012)). The two, personal initiative and adequate time, were found to be inadequate in some of the sampled respondents.

All the above competencies coupled together spell doom for a researcher to use statistics in research. The competencies above explain why African universities were still struggling in research (Musiige & Maassen, 2015). It explains why the contribution of Kenyan Universities towards published research work was slowing down (Tijssen, 2015).

In summary the study established that students' prior knowledge explained 45.6% of the process of being involved in data analysis, curriculum implementation accounted for 21.4%, technological resources accounted for 11.2% and personal factors accounted for 1.5%. In total the competencies under study accounted for 79.8% of use of statistical analysis in research.

4.12 Summary

The study established that majority of the masters' students in Kenya struggle to use statistics. The study found that majority of the sampled masters' students joined masters program with knowledge of descriptive statistics and basic computer. Very few sampled students had knowledge of inferential statistics and how to use computer software to carry out data analysis.

The study established that; general objectives and specific objectives in courses related to statistics adequately covered the requirements for statistics training; the scheduled content for the core courses covered descriptive and inferential statistics; ICT concepts were adequately catered for in the sampled masters' curriculums, however, the courses

too wide to be effectively learned in one semester of 4 months; The study established that lectures, class discussion and students presentations common across the sampled curriculums. The study established that continuous assessment tests and end of semester sit in exam were the common form of exams administered. In addition in one case there were also term papers and practical in some courses.

The study found that majority of the sampled respondents' were taught how to determine the statistic to use, how to interpret figures and tables and descriptive statistics. The study determined that less than half of the sampled students were taught inferential statistics and less than a third were taught basic computer skills and how to use statistical computer software. Not all who were taught these concepts practiced them in class using sets of data. The study established that 30.3% of the sampled respondents were in classes where ICT and statistics concepts were well integrated.

The study determined that majority of the sampled universities did not have adequate computers and statistical software. The study showed that majority of the sampled respondents had easy access a computer and source of power but less than half easily accessed computer software for data analysis. The findings indicated that less than half of the students had time to attend all classes and majority had time to carry out data analysis. The study also determined that majority of the students took initiative to learn how to use computer software and other concepts related to use of statistics.

Generally the study established that students' prior knowledge explained 45.6% of the process of being involved in data analysis, curriculum implementation accounted for 21.4%, technological resources accounted for 11.2% and personal factors accounted for

1.5%. In the total the competencies under study accounted for 79.8% of personal involvement in data analysis.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The purpose of this study was to determine the competencies influencing masters' students' use of statistical analysis in research, a case of universities of Western Kenya. The purpose was with a view of incorporating necessary measures into masters' students' use of statistical analysis to develop a knowledgeable workforce in research. The study established that majority (68.4%) of the sampled masters' students in sampled universities struggle to use statistics. The study, therefore sought to; determine knowledge needs to use statistics in research; find out how prior knowledge influences use of statistical analysis in research; determine how the masters' curriculum content meets the needs to use statistics in research; establish how masters' curriculum implementation process meets the needs to use statistics in research; find out how technological resources influence use of statistical analysis in research; and find out how personal factors influence use of statistical analysis in research. The summary of findings, conclusion and recommendation of each of the specific case studied were as presented below.

5.2 Knowledge needs to use Statistics in Research

The study sought to determine the knowledge needs for masters' students to use statistics in research. The study established the following as key concepts for one to use statistics

in research; general statistics knowledge, descriptive and inferential statistics, basic computer skills and statistical software skills.

These were the important aspects that training of researchers in use of statistical analysis should consider. The needs were universal to all quantitative researchers regardless of the university country of course being pursued. These needs should be the guiding principles of the content that should be included in statistics training class.

The study, therefore, recommends that universities and research training institution should assess their training curriculums in line with these needs and where necessary restructure the curriculum.

5.3 Prior Knowledge and use of statistical analysis in Research

The study sought to determine the prior knowledge that masters' had in statistics and how the knowledge influenced their use of statistical analysis in research. The study found that majority of the sampled masters' students joined masters program with knowledge of descriptive statistics and basic computer. Very few sampled students had knowledge of inferential statistics and how to use computer software to carry out data analysis. The study further determined that prior knowledge and specifically in inferential statistics and ICT was statistically significant in influencing the use statistics in research. This was in favor of the students with prior knowledge in statistics and ICT.

The study noted that prior knowledge should not be ignored at all even if it was not a compulsory requirement for admission into masters' program. If at any given moment at undergraduate a concept related to research or statistics specifically is taught, it should be

well emphasized because it forms the foundation of future researchers. Experience in use of statistical analysis in research was very important in forming the prior knowledge.

The study recommends that students at undergraduate should be engaged in thorough use of statistical analysis in research to have the adequate knowledge and experience before joining masters' program. Given opportunity undergraduate students and prospective masters' students should be attached to a researcher to get the hands on experience of using statistics in research.

5.4 Masters' Curriculum Content and use of statistical analysis in Research

The study sought to determine how masters' curriculum content meets the needs for students to use statistics in research. The study established that; general objectives and specific objectives in courses related to statistics adequately covered the requirements for statistics training; the scheduled content for the core courses covered descriptive and inferential statistics; ICT concepts were catered for in the sampled masters' curriculums, however, the courses were too wide to be effectively learned in one semester of 4 months; The study established that lectures, class discussion and students presentations were common methods of instruction across the sampled curriculums. The study established that continuous assessment tests and end of semester sit in exam were the common form of exams administered. In addition in one case there were also term papers and practical in some courses. However the end of semester exam carried more weight of 60%.

It was important to note that it was at masters' level that the student for the first time was exposed to a thorough training in use of statistical analysis in research. It's important that

the curriculum is also thorough and without any loopholes for inadequate training. The study noted that the curriculum content was too wide to be covered in a single semester. This creates room for curriculum implementers to rush through in order to stay on schedule. The curriculum also did not integrate ICT in all statistical concepts but rather it was treated as a separate entity in courses that it was included. This creates a situation where not all lecturers training researchers will appropriately integrate ICT. The study notes that the proposed instructional methodologies were not adequate for training of researchers to use statistics. The proposed evaluation procedure was not adequate in assessing all the acquired skills especially the application aspects of the learned knowledge. This provides avenue for implementers who were not keen with training to drill students for examination and eventually miss out on important concepts.

The study, therefore, proposes the following for universities and other training intuitions. ICT, especially the use of statistical software be integrated in every concept being taught in statistics. Secondly the study recommends that for quantitative researchers, research inclusive of statistical courses be increased to a minimum of four and not less than two others to be optional. This would provide an opportunity for masters' students to be well trained in use of statistical analysis in research. A certificate for quantitative research should be given to students who perform well in research and statistics in research courses. Such students were the ones who should be entrusted with teaching research in future and supervising postgraduate students with a bias to use of statistical analysis in research. Lastly the study recommends that examination for use of statistical analysis in research should be open book examinations. The examinations should require the student to design a study with consideration of contemporary modes of data analysis, collect data

using contemporary methods and tools, analyze data using contemporary software, interpret, test hypotheses and report findings using contemporary ways and write a report about the entire process he/she has one through with an intention of future improvement.

5.5 Masters' Curriculum Implementation and use of statistical analysis in Research

The study sought to determine how the curriculum was implemented in relation to use of statistical analysis in research. The study also was to determine how the implementation was influencing use of statistical analysis in research. The study determined that majority of the sampled respondents were taught how to determine the statistic to use, how to interpret figures and tables and descriptive statistics. The study determined that less than half of the sampled students were taught inferential statistics and less than a third were taught basic computer skills and how to use statistical computer software. Not all who were taught these concepts practiced them in class using sets of data. The study established that 30.3% of the sampled respondents were in classes where ICT and statistics concepts were well integrated. The other classes were either not taught ICT or it was taught in separation with statistical concepts. The study established that students who were adequately trained in use of statistical analysis were significantly more likely to use statistics easily in their research.

The curriculum implementation process was flawed in majority of the classes and did not meet the needs to use statistics in research. The flaws were attributed to various issues including; First the courses were too wide and therefore a thorough implementation meant that the course could not be finished on time; Secondly the curriculum did not adequately integrate ICT and specifically use of statistical software; Third was the

inadequate technological resources; Fourth were the poor instructional methodologies used; And lastly was the inadequate assessment tools that could not encourage thorough training. The tools of assessment were also not able to bring out the inadequacies in the training process.

The study, therefore, stands by the recommendations made in other subsections of this chapter in relation to; increase of training courses, appropriate integration of ICT and statistics, availing of resources and improving assessment techniques. In addition to this the study recommends that instructional methodologies should be enriched to enhance training. Training institutions and universities should adapt use of workshops and attachment in addition to lecture method, tutorials and class presentations by students. Masters' students should attend at least three workshops concerning use of statistical analysis in research organized by the training institution. This should be compulsory and should count towards graduation of the student. It should also be compulsory that a student is attached to a research project or firm that is actively involved in use of statistical analysis in research. The attachment should be for a period of not less than three months and it should count towards the graduation of the student.

5.6 Technological Resources and use of statistical analysis in Research

The study sought to determine the availability of technological resources in universities and at individual level and how the availability influenced use of statistical analysis in research. The study determined that majority of the sampled universities did not have adequate computers and statistical software. The study found that majority of the sampled respondents had easy access a computer and source of power but less than half easily

accessed computer software for data analysis. The study determined that access to computers, statistical software and source of power significantly improves the chances of a student finding the process of use of statistical analysis easy.

Universities had very few computers and statistical software and this was a major setback to facilitating students' use of statistical analysis in research. Despite students accessing personal computers it was of little use if they do not have an opportunity to practice what has been learned together with their lecturer. Hands on training of use of statistical analysis cannot be possible without computers and computer software being availed by institution. Use of workshops and practical as instruction approaches cannot be possible with limited resources. The study noted that the inadequacy of resources hampered curriculum implementation which in turn negatively affected use of statistical analysis in research.

The study recommends that training institutions should establish postgraduate research centers. The centers should be well equipped with adequate computers, statistical software and internet connection. This will facilitate use of practical, workshops and working on examinations by the students.

5.7 Personal Factors and use of statistical analysis in Research

The study sought to determine if students had time to attend classes and to carry out data analysis. Additionally the study sought to find out if the students had personal initiative to learn more about use of statistical analysis in research. The findings indicated that less than half of the students had time to attend all classes and majority had time to carry out data analysis. The study also determined that majority of the students took personal

initiative to learn how to use computer software and other concepts related to use of statistics. The study established that masters' students who had enough time to carry out data analysis were significantly more likely to find use of statistical analysis easier than their counterparts.

This was evidence that not all students can make it to be good in use of statistical analysis in research. Students apart from the concepts learned during training need to set aside adequate time and also be interested in what they were doing. It was therefore important for masters' students to have adequate time and personal initiative. The study, therefore, recommends that universities should consider time availability and personal initiative of the student before admitting them for a masters' program.

5.8 Competencies influencing use of Statistical analysis in Research

The study sought to determine the competencies that were influencing the use of statistical analysis in research among masters' students. Four competencies were considered by the study and the competencies were; students' prior knowledge in statistics, curriculum implementation, technological resources and personal factors. All the variables under consideration explained 79.8% of how the students found use of statistical analysis in research. The remaining 20.2% was explained by variables that were not considered by this study. Prior knowledge of the students in statistics explained 45.6% of how student found use of statistics; curriculum implementation explained 21.4%; technological resources explained 11.2% and personal factors explained 1.5%. Despite the contribution of each of the four competencies in this study 68.4% of the masters' students struggled to use statistics in research.

The contribution of the factor towards use of research in statistics was not much. Prior knowledge in statistics stood out from other competencies but does not favor all considering that not all students have a statistical background. The study noted that a student joining a masters' training class on how to use statistics in research with limited or no statistical prior knowledge will graduate half baked. The student will graduate from the training with about 34.1% of knowledge of how to use statistics in research. The study has exposed the flawed process of training researchers in use of statistical analysis in sampled universities and similar other universities in Kenya. The few students who were comfortable with use of statistical analysis in research was mainly because of their statistical background and little input from training at masters level.

5.9 Summary

The study noted that competency in use of statistical analysis in research was widely informed by; adequate prior knowledge in statistics, adequate training based on a rich curriculum in statistics and adequate technological resources. The students should also be motivated and put in adequate efforts to learn how to use statistics in research. The study noted that if at all the studied universities wish to be in the league of research universities, they have no choice but to embrace radical changes in training of researchers in use of statistics. The study in previous sections of this chapter has indicated the recommendations that these universities can adapt to have effective training of researchers in use of statistics.

5.10 Recommendation for Further Research

The study recommends that a similar research be carried on other aspects of research such as qualitative data analysis, report writing, critique of reviewed literature among others.

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APPENDICES

Appendix I: List of Universities in Kenya

S/N	Name	Year Chartered	Category	Main Campus County	Region of Kenya
1	University of Nairobi	1970	Public	Nairobi	Nairobi
2	Moi University	1984	Public	Uasin Gishu	Western
3	Kenyatta University	1985	Public	Kiambu	Central
4	Egerton University	1987	Public	Nakuru	Western
5	University of Eastern Africa, Baraton	1991	Private	Nandi	Western
6	Catholic University of Eastern Africa	1992	Private	Nairobi	Nairobi
7	Jomo Kenyatta University of Agriculture and Technology	1994	Public	Kiambu	Central
8	Daystar University	1994	Private	Nairobi	Nairobi
9	Scott Christian University	1997	Private	Kericho	Western
10	United States International University	1999	Private	Nairobi	Nairobi
11	Maseno University	2001	Public	Siaya	Western
12	Africa Nazarene University	2002	Private	Nairobi	Nairobi
13	Kenya Methodist University	2006	Private	Meru	Central
14	Masinde Muliro University of Science and Technology	2007	Public	Kakamega	Western
15	Paul’s University	2007	Private	Nairobi	Nairobi
16	Pan Africa Christian University	2008	Private	Nairobi	Nairobi

17	Strathmore University	2008	Private	Nairobi	Nairobi
18	Kabarak University	2008	Private	Nakuru	Western
19	Mount Kenya University	2011	Private	Kiambu	Central
20	Africa International University	2011	Private	Nairobi	Nairobi
21	Kenya Highlands Evangelical University	2011	Private	Kericho	Western
22	Dedan Kimathi University of Technology	2012	Public	Nyeri	Central
23	Great Lakes University of Kisumu	2012	Private	Kisumu	Western
24	Chuka University	2013	Public	Tharaka Nithi	Central
25	Technical University of Kenya	2013	Public	Nairobi	Nairobi
26	Technical University of Mombasa	2013	Public	Mombasa	Costal
27	Pwani University	2013	Public	Kilifi	Costal
28	Kisii University	2013	Public	Kisii	Western
29	University of Eldoret	2013	Public	Uasin Gishu	Western
30	Maasai Mara University	2013	Public	Narok	Western
31	Jaramogi Oginga Odinga University of Science and Technology	2013	Public	Siaya	Western
32	Laikipia University	2013	Public	Laikipia	Central
33	South Eastern Kenya University	2013	Public	Kitui	Eastern
34	Meru University of Science and Technology	2013	Public	Meru	Central
35	Multimedia University of Kenya	2013	Public	Nairobi	Nairobi

36	University of Kabianga	2013	Public	Kericho	Western
37	Karatina University	2013	Public	Nyeri	Central
38	KCA University	2013	Private	Nairobi	Nairobi
39	Adventist University of Africa	2013	Private	Nairobi	Nairobi
40	Kibabii University	2015	Public	Bungoma	Western
41	Rongo University	2016	Public	Migori	Western
42	The Co-operative University of Kenya	2016	Public	Nairobi	Nairobi
43	Taita Taveta University	2016	Public	Taita Taveta	Costal
44	Murang'a University of Technology	2016	Public	Murang'a	Central
45	University of Embu	2016	Public	Embu	Central
46	Machakos University	2016	Public	Machakos	Eastern
47	Kirinyaga University	2016	Public	Kirinyaga	Central
48	KAG EAST University	2016	Private	Nairobi	Nairobi

Appendix II: Map of Kenya showing Western Region

Appendix III: Programs per cluster in Private and Public Universities of Kenya

Cluster	Public	Private	Total	Proportion
Agriculture, Forestry and Fisheries	354	9	363	10.7%
Architecture	26	0	26	0.8%
Business and Administration	268	117	385	11.3%
Computing	109	54	163	4.8%
Education (Arts)	219	68	287	8.4%
Education (Science)	50	6	56	1.6%
Engineering	138	7	145	4.3%
Environment	126	8	134	3.9%
Health and Welfare	244	60	304	8.9%
Humanities and Arts	326	149	475	13.9%
Journalism and Information	69	16	85	2.5%
Law	6	7	13	0.4%
Life Science and Physical Science	352	13	365	10.7%
Manufacturing	10	1	11	0.3%
Mathematics and Statistics	127	13	140	4.1%
Security and Conflict Resolution	41	9	50	1.5%
Services	59	12	71	2.1%
Social and Behavioral Science	120	57	177	5.2%
Teacher Training	65	29	94	2.8%
Veterinary	31	1	32	0.9%
Other	13	19	32	0.9%
Total	**2,753**	**655**	**3,408**	**100.0%**

Appendix IV: Research Consent Form

Mubichakani M. Joseph
Department of Curriculum Instruction and Media
University of Eldoret

Dear Respondent

I am Mubichakani Joseph, a doctor of philosophy student in mathematics education, university of Eldoret. As a student I am carrying out a research with the general purpose being to examine competencies influencing use of statistical analysis in research among masters' students. Participation in this study is voluntary.

The findings of this study will provide the participant and other stake holders with useful information about current trends in the learning and use of statistical analysis methods. There are no anticipated risks associated in participating in this study.

To protect your privacy as a respondent and the privacy of your institution of study no names should be used in all your responses. Transcripts of interviews and questionnaires will be kept secure by the researcher and can be available only to you as a participant.

As a participant you will be allowed to make changes to the transcripts if they do not accurately reflect your views. In addition you will be allowed to withdraw from the study if you feel so

I have read the above and consent to my participation in this study.

Date: ……..

Signature: ……

CONDUCT PERSON: Mubichakani M. Joseph

PhD Student, University of Eldoret Tel: 0724 449 339

Appendix V: Curriculum Content Analysis Schedule

Section A: Entry Requirements and Objectives

1. The specific masters program curriculum being analyzed
2. What are the general requirements of joining that master's program in relation in relation to research skills, information communication technology and statistical knowledge?
3. What are the objectives for each of the following courses if they are being offered in that masters program?
    - Research methods
    - Information communication technology
    - Statistics
4. Are the specific course objectives identified in 3 above in line with the needs of postgraduate students to use statistics in research?

Section B: Curriculum Content

1. What are the key concepts covered in each of the following courses that are geared towards enabling masters' students to use statistics in research?
    - Research methods
    - Information communication technology
    - Statistics
2. What other needs as identified through interviews with lecturers and questionnaires from students that are not being catered for by the curriculum content?
3. To what level are the concepts in the three broad areas of research, information communication technology and statistics integrated with an aim of preparing masters' students to participate in data analysis?

Section C: Practices and Evaluation Procedures

1. What are the specific practices recommended by the curriculum in each of the courses below that are geared towards enabling students to use statistics in research?
    - Research methods
    - Information communication technology
    - Statistics
2. How sufficient are the recommended practices in enabling masters' students to use statistics in research?
3. What are the specific evaluation procedures recommended by the curriculum in each of the courses below that are geared towards assessing the competency of students carrying out statistical data analysis?
    - Research methods
    - Information communication technology
    - Statistics
4. What is the context of evaluation procedures recommended by the curriculum in each of the courses below that are geared towards assessing the competency of students carrying out statistical data analysis?
    - Research methods
    - Information communication technology
    - Statistics

Section D: Timelines, Resources and References

1. What is the specific duration recommended in each of the courses in master's curriculum related to the following broad areas that will enable the students to develop the capability to carry out data analysis?
    - Research methods
    - Information communication technology
    - Statistics

2. What are the specific resources recommended in each of the courses below in master's curriculum that will enable the students to carry out data analysis? Are the resources relevant?
    - Research methods
    - Information communication technology
    - Statistics
3. What are the specific references recommended in each of the courses below in master's curriculum that will enable students carry out data analysis? Are the references relevant?
    - Research methods
    - Information communication technology
    - Statistics

Appendix VI: Students Questionnaire

Section A: Background Information

Please respond by ticking the most appropriate choice

1. What is your sex? Male [ ] Female[ ]
2. What was your age bracket when pursuing your masters' degree?
   21-25 years [ ] 26-30 years [ ] 31-35 years [ ]
   36-40 years [ ] 41-45 years [ ] Over 45 years [ ]
3. What was your area of specialization (e.g masters of philosophy in curriculum instruction and media)……..
4. In which institution did you pursue your postgraduate (Masters) studies in?
   Private Institution [ ] Public Institution [ ]

Section B: Needs Assessment

1. Please respond by ticking appropriately against each statement. These statements are to determine whether the following knowledge areas were of help or no help during your data analysis. A for agree, NS for Not Sure, and D for Disagree.

Knowledge Area	**A**	**NS**	**D**
Knowledge on **determining the statistic to use** was of great help during data analysis			
Knowledge on **interpreting statistical figures and tables** was of great help during data analysis			
Knowledge on **descriptive analysis (determining mean and frequency)** was of great help during data analysis			
Knowledge on **inferential analysis (hypothesis testing)** was of great help during data analysis			
Knowledge on **basic computer skills including use of word and excel** was of great help during data analysis			
Knowledge on **using computer software to do statistical analysis** was of great help during data analysis			

2. What other areas of knowledge were of help during your data analysis

   ……

   ……

   ……

Section C: Curriculum Relevance

1. Please respond by ticking appropriately against each statement. These statements are to determine the relevance of **Statistics curriculum** to your needs during data analysis. A for agree, NS for Not Sure, and D for Disagree.

Statement on Curriculum Content Taught	**A**	**NS**	**D**
I was taught in class how to **determining the statistic to use** when analyzing data.			
I was taught in class how to **interpret statistical figures and tables** when analyzing data.			
I was taught in class how to do **descriptive analysis (determining mean and frequency)** when analyzing data.			
I was taught in class how to do **inferential analysis (hypothesis testing)** when analyzing data.			
I was taught in class how to use **basic computer skills including use of word and excel** when analyzing data.			
I was taught in class how to **use computer software to do statistical analysis** when analyzing data.			

2. What other concepts or areas were included in the curriculum that were of great benefit in preparing you for data analysis?

   ……

   ……

   ……

3. What other concepts were relevant to data analysis but were never taught in your masters' class?

   ……

   ……

   ……

Section D: Curriculum Implementation Process

1. What was your mode of study when pursuing your masters' degree?

   Full time [ ] School based [ ] Evening and weekends [ ]

2. Please respond by ticking appropriately against each statement. These statements are to determine the implementation process of **Statistics curriculum**. A for agree, NS for Not Sure, and D for Disagree.

Statement on Curriculum Implementation	**A**	**NS**	**D**
When learning how to **determining the statistic to use** when analyzing data we used lots of data samples.			
When learning how to **interpret statistical figures and tables** when analyzing data we used lots of data samples.			
When learning how to do **descriptive analysis (determining mean and frequency)** when analyzing data we used lots of data samples.			
When learning how to do **inferential analysis (hypothesis testing)** when analyzing data we used lots of data samples.			
When learning how to use **basic computer skills including use of word and excel** when analyzing data we used lots of data samples.			
When learning how to **use computer software to do statistical analysis** when analyzing data we used lots of data samples.			
When learning how to analyze data the concepts were well integrated making it one whole concept			
When learning data analysis computers were readily available making the learning be in context of data analysis			

3. What is your opinion about how the curriculum of masters' course was implemented in relation to data analysis when you were pursuing your masters' degree?

   ……

   ……

   ……

Section E: Prior Knowledge Factors

1. Please respond by ticking appropriately against each statement. These statements are to determine your entry behavior into masters' class. A for agree, NS for Not Sure, and D for Disagree.

Entry Behavior	**A**	**NS**	**D**
I had knowledge of how different **statistics can be used** before joining masters program.			
I had knowledge of how to **interpret statistical figures and tables** before joining masters program.			
I had knowledge of how to do **descriptive analysis (determining mean and frequency)** before joining masters program.			
I had knowledge of how to do **inferential analysis (hypothesis testing)** before joining masters program.			
I had knowledge of how to use **basic computer skills including use of word and excel** before joining masters program.			
I had knowledge of how to **use computer software to do statistical analysis** before joining masters program.			

2. What are the other skills, knowledge and practices that you had before joining masters program that helped you in your data analysis?

   ……

   ……

   ……

3. What are the skills, knowledge and practices that you **DID NOT** acquire at undergraduate and real **diminished** your understanding and use of statistical analysis in research?

   ……

   ……

   ……

Section F: Personal Factors

1. Please respond by ticking appropriately against each statement. These statements are to determine how your personal factors influenced use statistics in research. A for agree, NS for Not Sure, and D for Disagree.

Statement	**A**	**NS**	**D**
I had enough time to attend all classes scheduled in relation to data analysis			
I had enough time for carrying out data analysis			
I took a personal initiative to learn using my own means how **to use computer software** to carry out data analysis			
I took a personal initiative to learn using my own means other concepts related to data analysis that we had not learned in class.			

2. In which ways did your personal factors influence your use of statistical analysis in research?

   ……

   ……

   ……

Section G: Technological Resources

1. Please respond by ticking appropriately against each statement. These statements are to determine how technological resources influenced data analysis. A for agree, NS for Not Sure, and D for Disagree.

Statement	**A**	**NS**	**D**
I had easy access to **a computer** to enable me carry out data analysis			
I had easy access to **statistical software** to enable me carry out data analysis			
I had easy access to **power source** to enable me carry out data analysis			

2. Which other aspects of technology helped you in doing data analysis?

   ……

   ……

   ……

Section H: Summary Remarks and Recommendations

1. Please respond by ticking the most appropriate choice that explains your case.

Statement	**With a lot of ease**	**With a some ease**	**With a some difficulty**	**With a lot of difficulty**
I did statistical data analysis for my thesis.				

2. What would you recommend that should be done by universities, lecturers and/or students to facilitate a smooth use statistics in research?

   ……

   ……

   ……

Thank you and May God bless you.

Appendix VII: Students Interview Guide

Section A: Background Information

1. What is the sex of the respondent?
2. What was your age bracket when pursuing your masters' degree?
3. What was your area of specialization (e.g masters of philosophy in curriculum instruction and media)
4. Did you pursue your masters in a private or public institution?

Section B: Needs Assessment

1. What were the concepts that were crucial to carrying out data analysis based on your experience as a masters' student?

Section C: Curriculum Relevance

1. What are the concepts that you covered in class that were very key in carrying out data analysis?
2. Could you point out the broad courses that you covered each of the concepts identified above?
3. What concepts were crucial to your data analysis that was not taught in your masters' class?

Section D: Curriculum Implementation Process

1. What was your mode of study when pursuing your masters' degree?
2. Can you please describe the learning experiences as far as instructional materials are concerned in relation to concepts of data analysis?
3. With what level of integration were the different concepts related to data analysis presented?
4. To what extent were computers used during the instruction process of data analysis concepts?

Section E: Prior Knowledge Factors

1. What knowledge did you have related to data analysis before joining your masters program?
2. What knowledge did you have related to using computers software to carry out data analysis before joining your masters program?
3. What are the skills, knowledge and practices that you did not acquire at undergraduate and real diminished your understanding and use of statistical analysis in research?

Section F: Personal Factors

1. What can you say about the availability of time to attend classes related to data analysis?
2. What can you say about the availability of time to carry out data analysis?
3. Did you take any personal initiative to learn any of the concepts related to data analysis and what were those concepts?
4. In which ways did your personal factors influence your use statistics in research?

Section G: Technological Resources

1. How easy was it for you to access a computer to carry out data analysis?
2. How easy was it for you to access statistical software to carry out data analysis?
3. Which other aspects of technology helped you in doing data analysis?

Section H: Summary Remarks and Recommendations

1. How easy was it for you to carry out your data analysis?
2. What would you recommend that should be done by universities, lecturers and/or students to facilitate a smooth use of statistical analysis in research?

Thank you and May God bless you.

Appendix VIII: Lecturers Interview Guide

Section A: Background Information

1. What is the sex of the respondent?
2. What was your area of specialization, i.e what you teach at masters' level I relation to data analysis?
3. Are you teaching in a private or public institution?

Section B: Needs Assessment

2. What concepts are crucial to carrying out data analysis based on your experience as an instructor of data analysis related course?

Section C: Curriculum Relevance

1. What are the concepts that are covered in your course that are very key in carrying out data analysis?
2. Could you point out other broad courses that have key concepts related to data analysis, and what are those key concepts?
3. What concepts are crucial to data analysis that you think are not being taught to masters' students?

Section D: Curriculum Implementation Process

1. What modes of study do you have in this institution for students pursuing masters' degree?
2. Can you please describe the learning experiences in classes that you instruct as far as instructional materials are concerned in relation to concepts of data analysis?
3. With what level of integration are the different concepts related to data analysis presented?
4. To what extent are computers used during the instruction process of data analysis concepts?

Section E: Prior Knowledge Factors

1. Do your students have knowledge related to data analysis before joining your masters program?
2. How do you find the level of application of concepts between students with prior knowledge ad those without?
3. Do your students have prior knowledge related to using computers software to carry out data analysis before joining your masters program?
4. What are the skills, knowledge and practices that your students did not acquire at undergraduate and real diminishes their understanding and use of statistical analysis in research?

Section F: Personal Factors

1. What can you say about the availability of time for your students to attend classes related to data analysis?
2. What can you say about the availability of time for your students to carry out data analysis?
3. Do you know of any cases your students have taken any personal initiative to learn any of the concepts related to data analysis and what were those concepts?
4. In which ways do students' personal factors influence their use statistics in research?

Section G: Technological Resources

1. How easy is it for your students to access a computer to carry out data analysis?
2. How easy is it for your students to access statistical software to carry out data analysis?
3. Which other aspects of technology help your students in doing data analysis?

Section H: Summary Remarks and Recommendations

1. Are you aware if your students are using statistics in research?
2. What would you recommend that should be done by universities, lecturers and/or students to facilitate a smooth use of statistical analysis in research?

Appendix IX: University Research Authorization Letter

University of Eldoret
flame of knowledge and innovation

P.O. Box 1125-30100,
ELDORET, Kenya
Tel: 0774 249552
Fax No. +254-(0)53-206311 Ext 2232
deansoe@uoeld.ac.ke

SCHOOL OF EDUCATION

DEPARTMENT OF CURRICULUM AND INSTRUCTION

DATE: 4th January, 2018

Our Ref: UOE/B/CIM/LA/59
The Executive Secretary,
National Council for Science Technology & Innovation
P.O.BOX 30623-00100,
NAIROBI.

Dear Sir/Madam,

RE: RESEARCH PERMIT FOR MUBICHAKANI M JOSEPH
EDU/DPHIL/PGC/1011/13

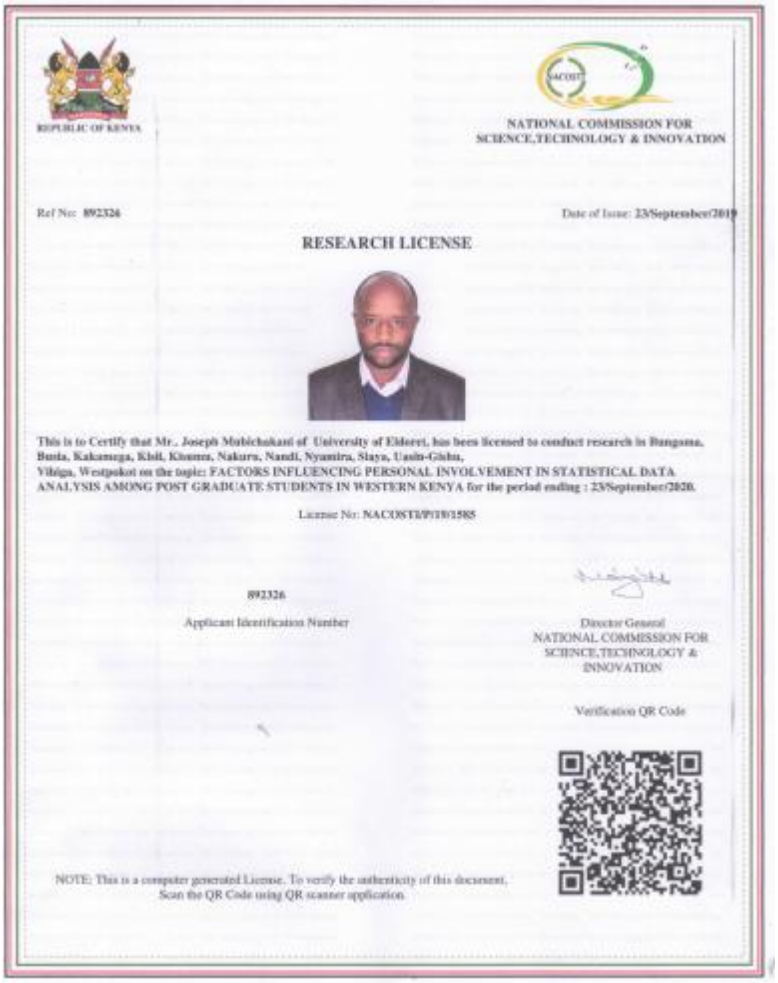
This is to confirm that the above named Post Graduate Student has completed Course work in Doctor of Philosophy in Education with specialization in Mathematics Education.
He is currently preparing for field work to collect data on the thesis title: ***"Factors Influencing Personal Involvement in Statistical Data Analysis among Post Graduate Students."*** The proposal was examined and approved by academic board of examiners of the school of education on 19thJune, 2017.

Any assistant accorded him to facilitate acquiring research permit for data collection will be highly appreciated.

Head of Department
Curriculum & Instruction
UNIVERSITY OF ELDORET

DR. JACOB LOLELEA NATADE
HEAD, DEPARTMENT OF CURRICULUM & INSTRUCTION/
EDUCATIONAL PSYCHOLOGY

Appendix X: NACOSTI Research Permit



REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 892326

Date of Issue: 23/September/2019

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