

# THE INFLUENCE OF PERSONAL FACTORS ON MASTERS' STUDENTS' USE OF STATISTICS IN RESEARCH

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**Abstract:** Knowledge is valued as a vital asset for progress and prosperity in every sphere of human understanding. Knowledge is attributed with successful innovation in firms. Research has been identified as the main source of knowledge. In Kenya, University students have been accused of doing low quality research. Statistics is important in research, it starts at the planning stage to establish the design and sample size. Studies have pointed to wrong use of statistics as a contributing factor towards low quality research. The purpose of this study was; to determine the influence of personal factors on masters' students' use of statistics in research, a case of universities of western Kenya. The study was based on normative paradigm and interpretive philosophy. The study used descriptive survey design complimented with case study design. 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 out that 68.4% of the masters' students struggled to use statistics 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 post graduate students who had enough time to carry out data analysis were significantly more likely to find use of statistics easier than their counterparts. The study recommends that universities should consider time availability and personal initiative of the student before admitting them for a masters' program.

**Keywords:** Personal Factors, Statistics, Research

## INTRODUCTION

Knowledge is an important aspect in any given society. Yamamoto (2001) noted that knowledge is valued as a vital asset for progress and prosperity in every sphere of human understanding. Given this importance of knowledge it's prudent that sources of knowledge are identified and protected. Review of documented literature identifies research as a key source of knowledge (Yamamoto (2001); Estabrooks, et al (2005); Assimakopoulos, & Yan (2006) & Fletcher & Harris (2012)). The review also established that universities are the main centres of research and training researchers (Clark (1993); Votruba (1996); Sawyerr (2004); Cloete & Maassen (2015) & Mukhwana et al (2016)).

Since research and research training is core in generation of knowledge, it is expected that every university should be striving to perfect it. However, this is not the case for African universities. African universities are 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, Kenya, towards published research work was slowing down. Scott (2015) and Mukhwana et al (2016) attributes this to poor quality research in Kenya.

Statistics has been identified as a key concept of research. Statistics in research enables one to; Plan for research; Produce data that provide clear answers to important questions; and Draw trustworthy conclusions 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)). Literature review noted two main causes of inadequate understanding of statistics and/or misinterpretation of statistics across Asia, Europe and America. One of the causes identified was research being carried by non statisticians (Glencross & Binyavanga, 1997); and secondly inadequate training in use of statistics in research (Harraway, et al 2001). The causes of low quality research in Kenya remain unclear

but can be hypothesized to be caused by inadequacies in use of statistics as it has been found out in other continents.

The guiding purpose of this study was; to determine the personal factors influencing post graduate students use of statistics in research, a case of universities of western Kenya. The purpose was with a view of incorporating necessary measures into post graduate students use of statistics to develop a knowledgeable workforce in research. 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 are the specific objectives that guided data collection for the study; determine how masters' students use statistics in research, determine the availability of time to be trained and carry out statistics, determine the personal initiative of students to learn and use statistics and determine how this personal factors influenced use of statistics.

## LITERATURE REVIEW

### Statistics Component of Research

Research, sometimes referred to as scientific inquiry, is an extensive discipline that comprises several components. Bishop and Talbot (2001) note that the generally accepted approach to the solving of problems or the answering of questions in research is based around observation, use of laws, use of theories, experimentation and inference. In this five categories Bishop and Talbot (2001) argue that Statistics has an important role to play in observation, experimentation and inference. They note that statistics enables one to; Read data, critically and with comprehension; Produce data that provide clear answers to important questions; and Draw trustworthy conclusions based on data. Sprent (2003) indicates that the role of statistics in medical research starts at establish the design and size of an experiment. He noted that statistics is 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."*

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, he is persuaded that there is a serious problem with design of data collection and with data analysis. Svensson (2001) came up with findings that agree with Murray and Maindonald. He noted that reviews of medical journals have highlighted the poor quality of methodology and statistics in medical research. He further argues that the increasing use of complex methods, such as survival analysis and multiple regression analysis, and the use of questionnaires and rating scales, are adding to the problems.

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 statistics in research; simple concepts are sometimes misunderstood or misinterpreted by research workers in other disciplines who have only a limited knowledge of statistics. This he noted that it leads to papers, or research findings, that are often submitted that give inadequate statistical analyses or present results in an inappropriate way and the worst is they can present wrong results. As stated earlier this studies were carried out in Asia, Europe and America, little is known about if the same issue of statistics affects 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 is the aspect of research being carried by non statisticians. Glencross and Binyavanga (1997) in their contribution on this matter noted that it is because in modern world, much work involving data

collection and data analysis is being conducted by non statisticians. They further stated that many of these researchers, without statistical background, have little knowledge of the range of appropriate methods of data collection, are unaware of the basic assumptions underlying the statistical methods of analysis they choose, and are 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 is being carried.

Saville (2001) proposes a more sensible solution that there should be continual communication between statisticians and researchers in various fields. This however is 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 are obtained when the researcher has a basic understanding of the statistical methods being used, and the statistician has a basic understanding of the research area and the objectives of the research. This point is 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, warns that reliance on statistical software without enough statistical knowledge could result in incorrect statistical treatment of data. This, therefore, means training of researchers in how to use statistics is 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 is inadequate training in statistics.

Harraway, et al (2001) points out that serious problems for research students in the sciences often revolve around inadequate training in study design principles and statistical methodology, both essential for planning research and analyzing data. Mukherjee (2001) agrees with Harraway and has gone ahead to point out the benefits of proper training. He states that, "training in statistics enable researchers in various disciplines to derive due benefits from proper use of statistical methods and techniques." On the other hand Iversen (2001) has a different opinion on what training in statistics for researchers should be all about. He argues that the purpose of teaching students statistics in a liberal arts program is not to make them into researchers or amateur statisticians, being able to do empirical research themselves. Instead he says, the purpose is for them to be able to understand the role played by statistics in today's society. All in all the researchers agree that statistics training is important to a researcher. While other continents across the world have documented information on training and use of statistics in research, Africa is lagging behind on this aspect.

It can, therefore be hypothesized based on reviewed literature that use of statistics is contributing towards the minimal and poor quality research being carried out in Africa and specifically in Kenya. This study therefore sought to determine how personal factors are contributing towards use of statistics in research.

### **Personal Factors and use of Statistics in Research**

An individual's role in research undertaking and specifically use of statistics 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 out 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 Liloyd et al (2004) found out that lack of time is the major barrier in research. Rosemann and Szecsenyi (2004) also added to this finding by Liloyd 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 statistics in research.

## METHODOLOGY

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 post graduate 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 3 universities in western region of Kenya, 2 public and one private. The target population for the study was masters' students who had submitted their theses for examination from selected universities. To meet the requirements of the descriptive survey design, stratified and simple random sampling procedures were used to arrive at a sample of 90 masters' students that participated in the study. Purposive sampling was also used to select 4 masters' students and 3 research statistics lecturers who were taken through a detailed interview to catch the complexity and situatedness of behavior among masters' students.

Questionnaire and depth interview schedules were used in data collection. The researcher began data collection by 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.

## FINDINGS AND DISCUSSION

### Masters' Students Use of Statistics in Research

Statistics is an important aspect of research; Bishop and Talbot (2001), states that it is important in observation, experimentation and inference; Sprent (2003) and Zwiers and Von Storch (2004) follow suit to agree that statistics is 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 out that 7.9% of the respondents found use of statistics 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 is as indicated in figure 1.1 below.

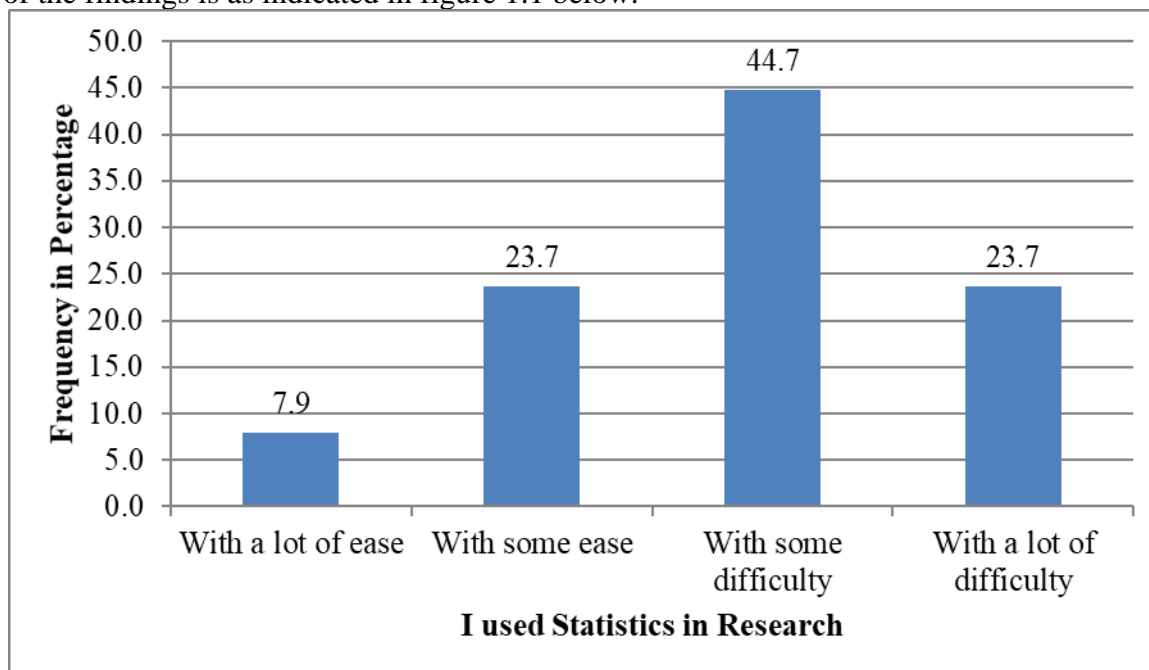


Figure 1.1: Students use of Statistics in Research

Generally the study determined that majority of the masters students 68.4% were finding it difficult to use statistics in research. This finding compliments the finding by Murray (1991) who was interested in finding if the statistics are appropriately used in research. He noted that the use of statistics was flawed, inadequately or inappropriately used. Sprent (2003) had also recorded a similar case where he noted that simple concepts are 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 is 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) note that there is a mismatch between Kenya's numerous bright students and our low academic research excellence. The study adds to this by noting that there is a mismatch between masters' students' mastery and use of content in their area of specialization and mastery and use of statistics in research. The finding also explain why post graduate students supervisors are often complaining about candidates who are 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 is 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 is after the students have finished their class work which is supposed to train then in use of statistics. An explanation of what goes on in this training will be done by this study at a letter stage.

### 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 are as indicated in figure 1.2 below.

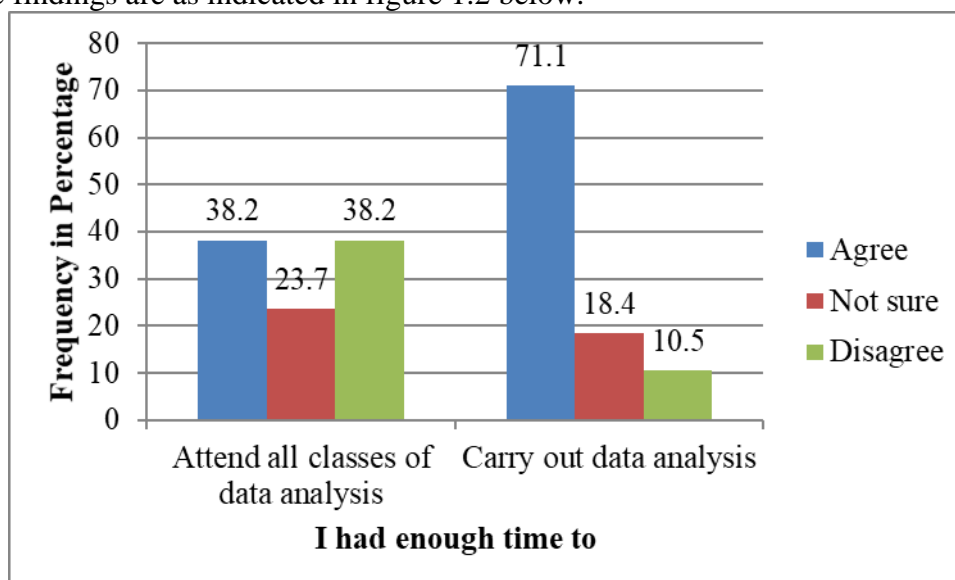


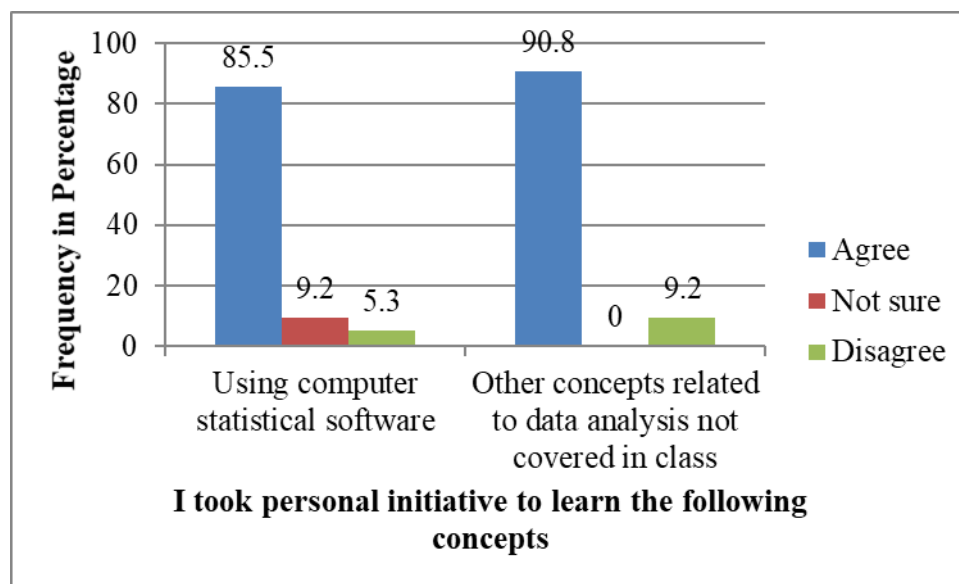
Figure 1.2: Time that Students had for Data Analysis

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 is when 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 notes that one of the ways of implementing the set curriculum is 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 are 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 are as shown in figure 1.3 below.



**Figure 1.3: 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 is 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 is required to apply the same knowledge. The finding is 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 out 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 is not altogether satisfactory because it may result in the researchers having gaps in their knowledge that they are 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 out that individual passion for or interest in research is a determining factor. The study determined that personal initiative, although was not an effective method of learning, contributed towards explaining the use of statistics in research.

### **Influence of Personal Time and Initiative on use of Statistics in Research**

The study sought to determine the influence of personal factors use of statistics in research. The study found out that time to attend classes did not explain use of statistics 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 are 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 are as shown in table 1.1 below with.

Table 1.1: Regression Model Summary of Personal Factors.

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

The aspect attending masters' classes not adding any advantage to a student using statistics is explained by earlier findings in this study which indicated that the planned curriculum is not the implemented curriculum. The implemented curriculum is 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 is 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 statistics 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 is above and all the others are 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 1.2 are the results.

Table 1.2: ANOVA Summary of Personal Factors.

| Model |            | Sum of Squares | df | Mean Square | F      | Sig.              |
|-------|------------|----------------|----|-------------|--------|-------------------|
| 1     | Regression | .017           | 1  | .017        | .022   | .883 <sup>b</sup> |
|       | Residual   | 58.088         | 74 | .785        |        |                   |
|       | Total      | 58.105         | 75 |             |        |                   |
| 2     | Regression | 16.013         | 2  | 8.007       | 13.886 | .000 <sup>c</sup> |
|       | Residual   | 42.092         | 73 | .577        |        |                   |
|       | Total      | 58.105         | 75 |             |        |                   |
| 3     | Regression | 16.339         | 3  | 5.446       | 9.389  | .000 <sup>d</sup> |
|       | Residual   | 41.766         | 72 | .580        |        |                   |
|       | Total      | 58.105         | 75 |             |        |                   |
| 4     | Regression | 19.353         | 4  | 4.838       | 8.864  | .000 <sup>e</sup> |
|       | 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 statistics by chance. The results of this regression are as shown in table 1.3 below.

Table 1.3: Summary of Significant Personal Factors.

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics |          |      |     |               |
|-------|---|----------|-------------------|----------------------------|-------------------|----------|------|-----|---------------|
|       |   |          |                   |                            | R Square Change   | F Change | d f1 | df2 | Sig. F Change |

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 post graduate students who had enough time to carry out data analysis were 26% more likely to find use of statistics easier than their counterparts. The findings are in agreement with Lioyd et al (2004) who found out that lack of time is 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 is important to quality research.

These minimal levels of personal initiative indicate that the students are 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.

## CONCLUSION AND RECOMMENDATION

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 statistics 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 post graduate students who had enough time to carry out data analysis were significantly more likely to find use of statistics easier than their counterparts.

This is evidence that not all students can make it to be good in use of statistics in research. Students apart from the concepts learned during training need to set aside adequate time and also be interested in what they are doing. It is 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.

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