UNIVERSITY OF CAPE COAST

THE LEARNING EXPERIENCES OF POSTGRADUATE STUDENTS IN STATISTICS: A CASE STUDY OF A GHANAIAN UNIVERSITY

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BY

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Thesis submitted to the Department of Mathematics and ICT Education, Faculty of Science and Technology Education, College of Education Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Philosophy in Mathematics Education

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature …… Date ……

Candidate's Name: Dorothy Ankomah

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's Signature …… Date …….

Supervisor's Name: Dr. Forster Ntow

ABSTRACT

Statistics is a compulsory course for almost all postgraduate students in the universities due to its importance to their research works. The purpose of acquiring this statistical knowledge is to enable students answer research questions carefully based on the use of appropriate methodology. It has been indicated that most postgraduate students seem to have issues dealing with statistics as a course and that anxiety seems to be one of the causes. This necessitated an investigation into MPhil postgraduate students' level of anxiety in statistics in order to positively influence instructional discourse. To guide the study, two research questions and two hypotheses were formulated. The research design used was sequential explanatory-mixed method design. The census-purposive sampling technique was used to obtain the respondents and participants for the study. The census involved 151 MPhil postgraduate students from a college in a Ghanaian university as respondents in the quantitative phase of the study and the purposive sampling technique had twelve participants based on the quantitative findings for the focus group discussion. The major findings were: postgraduate MPhil students of the university experienced anxiety in statistics; the level of the postgraduate MPhil students' anxiety in statistics was mostly mild and the level of postgraduate students' anxiety in statistics was related to the sex of the student and the programme they pursued. It was recommended that teachers of statistics should employ positive immediacies in the statistics classroom.

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DEDICATION

To my blessed children, Nana Aba Ayeyi Acquah and Nyamedze Kodwo Acquah

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LIST OF ABREVIATIONS

KMO	Kaiser-Meyer-Olkin
MPhil	Master of Philosophy
PA	Parallel Analysis
PCA	Principal Component Analysis
STARS	Statistical Anxiety Rating Scale

CHAPTER ONE

INTRODUCTION

Background to the Study

Statistical knowledge is required of every postgraduate student to be in the best position to collect appropriate data, analyse carefully, and bring out findings necessary for a particular study. It is, therefore, believed that a postgraduate student will be able to do this after successfully going through a statistics course. For this reason, students offering research-intensive postgraduate programmes must take at least a course in statistics (Koh & Zawi, 2014). Onwuegbuzie and Wilson (as cited in Chew & Dillon, 2014) also mentioned that Universities now incorporate at least one statistics course as a required component of their degree courses due to the increasing demand for the application of statistical techniques in a wide range of industries and workplaces.

Statistics is a compulsory course for almost all postgraduate students in universities. This is due to its relevance to their research work. Acquiring basic statistical knowledge as a postgraduate student will enable students to answer research questions circumspectly based on data collected using appropriate methodology. This will put them in a good position to oversee the data collection and apply suitable statistical tests for data analysis, interpretation, and results reporting in a manner that is appropriate for academic publication.

Many researchers around the world have indicated that most postgraduate students seem to have issues dealing with statistics as a course (Ali & Iqbal, 2012; Koh & Zawi, 2014; LeBourdais & Eduljee, 2015; Mandap, 2016). These issues

may be a result of several factors of which anxiety is one. Anxiety in statistics according to Cruise, Cash and Bolton (1985), is a state of worry or anxiety associated with or when doing statistical analysis; collecting, analysing, and interpreting data. According to Onwuegbuzie, DaRos, and Ryan (1997), anxiety in statistics is a condition that manifests itself in any scenario where a student is exposed to statistics, regardless of the format or timing. Macher, Paechter, Papousek, and Ruggeri, (2012) have defined anxiety in statistics as a situation where individuals exhibit an enduring and habitual type of anxiety.

According to Slootmeackers and Merramans (2012) as indicated by Koh and Zawi (2014), after leaving school for so long a time and not particularly dealing with number-related courses, a little apprehension is likely to ensue when students eventually need to enrol in one such class. Students approach the statistics course with different thoughts and attitudes that may either increase or reduce their anxiety towards statistics. This is because these students come from different backgrounds, from those who completed their first degree a decade or more ago or those who completed it in a short while. The course may turn out to be one of the most difficult things to deal with, as in, teaching or learning.

Koh and Zawi (2014), indicated that the anxiety of students towards statistics may have been caused by inadequate skills or knowledge, but may have also been a result of how they perceive statistics and all their previous negative experiences with either statistics in particular or numbers in general. Perney and Ravid (as cited in Eduljee & LeBourdais, 2015) in their paper ‘Gender differences in statistics anxiety with undergraduate college students’, also indicated that many

students experience statistics-related anxiety due to the fact that the majority of college students view statistics classes as barriers to obtaining their intended degrees.

Williams (as cited in Eduljee & LeBourdais, 2015) noted that students who have anxiety in statistics experience or exhibit a certain amount of discomfort throughout lecture, exam-taking, and statistical computations. They once more stated that most students are compelled to postpone enrolling in a statistics course since it is sometimes a really unpleasant experience. Onwuegbuzie (1997) indicated that students who are taking statistics courses procrastinate because they have anxiety in statistics. This anxiety, according to Williams (2010), can lead to poor performance in students; low self-efficacy and feelings of inadequacy in activities related to statistics, which tends to delay their completion of the degree programme (Finch & Jameson, 2007; Galli, Ciancaleoni, Chiesi, & Primi, 2008; Onwuegbuzie & Wilson, 2003). Therefore, knowing the anxiety levels that students may experience as a result of taking statistics courses could aid statistics instructors in figuring out how to lessen the detrimental effects of anxiety and improve their students' learning experiences (Baharun & Porter, 2009).

Onwuegbuzie and Wilson (2003) opined that statistics anxiety affected 80% of graduate students in the social and behavioural sciences. Statistics anxiety can result from various factors such as test and in-class experience, how one can interpret statistical issues and the desire to ask for help on issues concerning statistics. How one perceives the worth of statistics, one's self-concept on statistical computations, and how the statistics instructors are perceived are also some factors

resulting from statistics anxiety. Again, the immediacy issues that exist between the students and instructors of statistics cannot be overlooked as some of these factors (Cruise, Cash & Bolton 1985; Onwuegbuzie, 2004; Wilson, 2004). Thus, statistics anxiety is a multifaceted construct (Cruise, Cash & Bolton, 1985; Onwuegbuzie, DaRos & Ryan, 1997). Also, it has been noted that students right from Junior High School and Senior High School have very high anxiety towards mathematics-related courses or programmes (Bruce, 2016). This negative anxiety at the early stage when not well dealt with tends to affect their continuation to tertiary institutions. Sometimes if they find their way out there too, they try as much as possible to escape it. These factors can influence the level of one's statistics anxiety as low, moderate, or even high.

A particular programme one studies may or may not have a relationship with their statistics anxiety level. Other factors identified as contributing to statistics-related anxiety are socio-demographics such as age and sex (Eduljee & LeBourdais, 2015; Koh & Zawi, 2014). It will therefore be necessary for a study like this to consider the various programmes of study the respondents offer and how much influence it can have on their level of anxiety in statistics. Studies have also revealed that statistics-related anxieties can also be a result of one's sex (Mandap, 2016). This reason has also necessitated sex to be one of the factors to consider in such a study. Sex in this case referring to male or female may affect a person's level anxiety in statistics. While some researches claim that there is no sex variation in statistics anxiety, others have found that female have higher levels of anxiety in statistics than male. Some other researchers also noted that males have more anxiety

than females in statistics (DeCesare, 2007; Onwuegbuzie, 2004; Papanastasiou & Zembylas, 2008; Vahedi, Farrokhi, & Bevrani, 2011; Zhang *et al.*, 2012). Due to the contradictory findings, this study seeks to determine whether postgraduate students' sex and their anxiety in relation to statistics are connected. It will also look out for how much influence sex has on postgraduate students' statistics anxiety. The situation in Ghanaian Universities concerning anxiety in statistics as a branch of Mathematics seems not different (Anamuah – Mensah, Mereku & Asabere Ameyaw, 2004; Azure, 2011).

Some researchers in Ghana have indicated that students' attitudes which include anxiety towards mathematics are either positive or negative. Eshun (2000) as stated in Asare - Inkoom (2008), noted that girls have higher mathematics anxiety than boys which may be a result of less confidence in the subject and its use. According to Eshun and Abledu (as cited in Asare - Inkoom, 2008), students' attitudes toward the learning of mathematics-related courses come due to a deficiency in confidence and motivation. For Anamuah-Mensah *et al.* (2004), better performance in these mathematics-related courses or areas comes from high self-confidence. These researchers noted that anxiety towards mathematics comes as a result of different factors such as teacher immediacy, future aspirations of students and their sex. Though these researchers were specific with mathematics as a course in Junior High School, statistics is a branch of mathematics and therefore this story seeks to look at it in Ghana to see how the results will be in our part of the world.

Azure (2011) in his study, "Correlate of course anxiety and academic procrastination in higher education" implied that reduction in statistics anxiety is

also seen to be a measure to curb procrastination in higher education in Ghana. Hence, fear of the statistics lecturer, fear of asking for help, computational self-concept, interpretation anxiety, test and class anxiety, worth of statistics and immediacy, when well dealt with may be some of the factors that can lower or increase a student's level of anxiety in statistics. This may in turn affect the finishing ability of this student as identified by researchers. At the postgraduate level, the student has no chance of escaping statistics which is a mathematics-related course. This is because it forms an integral part of their programme. The research nature of the postgraduate programmes demands a student to offer a statistics course in one way or the other. This calls for the need for a study of this nature to consider the outcome and seek the way forward.

Statement of the Problem

Zeidner (as cited in Macher, Papousek, Ruggeri & Paechter, 2012) indicated that many students see their statistics class to be the most anxiety-inducing one in their curriculum. Macher *et al.* (2012) also intimated that students who experience anxieties are likely to postpone learning and spend less time on learning. Papousek *et al*. (2012) observed that statistics anxiety consumes processing capacity. All these have necessitated empirical research into the level of students' statistics anxiety to prescribe antidotes to make learning beneficial to students.

Researchers from all across the world have undertaken several research in the area of anxiety related to statistics (Chew & Dillon, 2014; Chiesi, Primi, & Carmona, 2011; Macher, Paechter, Papousek, & Ruggeri, 2012; Papanastasiou & Zembylas, 2008). Some of these studies indicate that statistics anxiety exists

among students at different levels such as the undergraduate levels and postgraduate levels. Some of these works revealed the correlation between anxiety in statistics and the sex of the students, anxiety in statistics and the performance of these students and also anxiety in statistics and the completion rate of these learners. However, my literature suggests that very little research has been done in Ghana focusing on this phenomenon apart from the study by Azure (2011). Azure's (2011) study examined the connection between the six characteristics of statistical anxiety and academic procrastination revealing that academic procrastination correlates significantly to these dimensions. Anecdotal evidence gathered through informal interactions among students in a University in Ghana seems to suggest that anxiety in statistics exists among postgraduate students.

Hence, this research aims to investigate the dearth of research on postgraduate students' statistics anxiety levels by investigating into students' statistics learning experiences.

Purpose of the Study

The goal of this research is to look at postgraduate students' level of anxiety in statistics and associated factors in a public university in Ghana.

Research Objectives

This study has two specific objectives, that is,

1. identify the level of Postgraduate students' anxiety in statistics.
2. investigate what factors contributed to postgraduate students' level of anxiety in statistics.

Research Questions

1. What is the level of postgraduate students' perceived anxiety in statistics?
2. What factors contribute to students' reported anxiety in statistics?

Research Hypotheses

1. **H_0:** There is no statistically significant difference in postgraduate students' level of anxiety in statistics based on sex.
2. **H_0:** There is no statistically significant difference in postgraduate students' level of anxiety in statistics based on the programme of study.

Significance of the Study

This study that examines graduate students' anxiety levels related to statistics in a public university in Ghana stands to benefit postgraduate students; lecturers who teach statistics, especially, at the postgraduate level; authorities in charge of post-graduate education and other researchers. For instance, postgraduate students will find the work beneficial because they would be aware of the possible anxiety in statistics and equip themselves to face it when it occurs. This will enable them to minimize any negative effect anxiety might impose on them. Again, lecturers of statistics, through this study, would know measures to employ to sustain or improve students' level of confidence in the study of statistics.

The University concerned and others will also benefit from the study, in the sense that it would give them feedback on how students respond to their courses and the results of the interaction between students and lecturers. Other researchers who want to replicate the study or work on similar subjects will find the work as literature. Knowledge will be expanded by this investigation by confirming either

of the findings that there are or no significant variation in anxiety levels in statistics among different programmes of study, thereby putting all stakeholders on alert of its consequences and the way forward. Eventually, the study would have provided information on what is happening in our nation and how stakeholders can deal with it by proffering local responses since anxiety in itself is culture-specific.

Delimitation

The issue of anxiety is very broad and there is a need to put this particular study in scope. The study will look at anxiety in statistics and will seek to find out if there are sex differences with regard to the course. It will also consider if there are differences in anxiety levels regarding a programme a student pursues. And finally, look at how lecturers contribute to students' anxiety levels when it comes to statistics. The research will consider only postgraduate MPhil students pursuing education-related programmes as respondents.

Limitation of the study

The research encountered some few limitations worthy to mention. Firstly, the purposive choice of programmes with fifteen or more students, though for enough representation of a programme, poses a limitation on the study. This means that any programme with students less than fifteen from the College of Education Studies were not considered in the research. Therefore, the outcome of this study may not be generalised over all postgraduate MPhil students from the College of Education Studies, but to postgraduate MPhil students in the selected programmes.

Again, the use of phone call as a medium for the focus group interview may be considered as a limitation since poor network from one end of the call could

disrupt a free flow of communication between the interviewer and the respondent. This was as a result of a difficulty (due to an outbreak in the country) in getting the needed respondents for the face to face interview. However, the researcher made sure that the respondents confirmed a clear and an uninterrupted networks from both ends before the commencement of the interview.

Finally, the two focus groups of six members each may have limited the amount of additional rich information that may have been gathered to clarify in detail the levels of Postgraduates MPhil Students' Anxiety in statistics. Nevertheless, the necessary clarification was given during the substantial focus group discussion.

Organisation of the Study

The research is organized into five chapters. Chapter One introduces the study under the following headings: background to the study, statement of the problem, purpose of the study, research questions and hypotheses, significance of the study, delimitations, limitation and organization of the study. Chapter Two entails the literature review under the themes: theoretical framework: Social Cognitive Theory and Approach Avoidance Theory, Concept of Anxiety, Anxiety and Academic performance, concept of immediacy and empirical review.

Chapter Three of the study will describe the methodology which comprises of research design, research approach, population, study area, sampling procedure, data collection instruments, data collection procedures, and data processing and analysis. Chapter Four of the study will also comprise the presentation of collected

data, analysis, and discussion of results. The last, Chapter Five, will focus on the summary of the findings, conclusion and recommendations.

CHAPTER TWO
LITERATURE REVIEW

Randolph (2019) stated that literature reviews educate students about notable scholars and research teams in the subject. This chapter's main objective is to look into the experiences of graduate students pursuing degrees in statistics in addition to other pertinent subjects including theoretical and conceptual frameworks; social cognitive theory and approach-avoidance theory. Concepts of anxiety, anxiety and academic performance; and empirical review of the level of anxiety in statistics among others are also reviewed.

Theoretical Framework

Many researchers have investigated statistics anxiety and have theorised about it. This section discussed some of the theories that fit into statistics anxiety level among postgraduate students. The theoretical framework of this study is built on the social cognitive theory and the approach-avoidance theory.

Social Cognitive Theory

The social cognitive theory holds the view that seeing people in the context of social interactions, experiences, and outside media influences can have a direct impact on a person's acquisition of knowledge. This was a theory advanced by Bandura (2003) as an extension of his social learning theory. The theory, as advanced by Bandura (2003), says that when people watch a model engage in certain activities and the results or repercussions of that behaviour, they tend to fall on it as a guide in subsequent behaviours. The ability to imitate the behaviour of others is essential to humanity's existence (Bandura, 2003).

The theory by Bandura (2003) offers a structure for understanding the ways in which people's environments actively shape them (Vinney, 2019). This can be further explained that people as agents to be influenced or to influence based on observation, serve as a major component of the theory. People tend to learn quickly what consistently happens around them as they observe. The consistent exposure and use of statistical tools in this regard tend to influence such students to practice what they observe. Students exposed to numerous use and practice of statistical tools and their analysis may end up being better or poorer with it depending on how well or poor they observed and, or were exposed to. The theory is related to the study because the relationship that exists between instructors and students of the course frequently guides behaviour change.

Physical characteristics such as age, size, sex, race, and physical attractiveness cause people to produce varying reactions to their social environment quite apart from what they say and do (Lerner, 2021). People by their status and noticeable characteristics can influence their social environment before they say or act anything. The social reactions so elicited tend to affect recipients' conceptions of themselves and others in ways that either fortify or change the environmental bias (Snyder, 2015).

As indicated by Bandura (2003), people are influenced actively by their environment. Thus, how students perceive statistics as a course to embrace it with all positive efforts or otherwise is influenced actively by the classroom environment. Therefore, replicating what consistently happens around them. This further indicates that statistics presented in a more interesting and friendly manner

in the classroom, making all needed resources and support available and consistently exposing students to the use of appropriate tools and their analysis, would surely have a positive impact as a result. There may not be anxiety at all or there will exist very low-level anxiety in this area since students have good reasons to pursue statistics as a course, practice it in their research works, etc.

Considering the various interactions that take place in a typical statistics classroom setting, various factors such as teacher behaviour can nullify, reduce or increase students' level of anxiety. This is the reason this study is adopting the social cognitive theory.

Approach-Avoidance theory

To approach, according to Oxford Dictionary, means going close or nearer to something. Avoidance also means moving away from something. One cannot move towards and away from a thing simultaneously. Positive consequences of a decision encourage the decision maker to approach or go forward with the goal or event, just as negative repercussions encourage the decision maker to avoid the objective or event.

According to Coghlan and Brannicq (2003), this Kurt Lewin notion tends to focus on how students view statistics as a key element of their research projects. Statistics is identified to be an important component of research studies of postgraduate students in universities (Onwuegbuzie & Wilson, 2003), to the students, can be one encounter or event which will either pull them to it or away from it. The student, being the decision maker here, may start moving in the direction of the objective of acquiring enough and appropriate statistical knowledge

which will intend to decrease their anxiety (Campbell & Uusimaki, 2006), however, when awareness of the drawbacks grows, a desire to evade the objective could surface, resulting in uncertainty or indecisiveness.

According to the approach-avoidance theory, feelings induced by external cues have a direct impact on behavioural reactions related to approach, avoidance, and related behaviours. It examines the relationship between emotions and behaviours by measuring the pleasure, arousal, and opportunity for dominance gained after a contact with the environment (Clark, *et al.*, 2009). People are more likely to approach situations in which they are feeling moderately aroused; thus, the most crucial factor determining a person's inclination to approach a situation is pleasure, which comes before arousal and dominance.

The study is linked to the approach-avoidance theory. This implies that students are likely to approach statistics with ease if lecturers teach the subject in a friendly manner, therefore, demystifying the fear associated with it. Such an approach to statistics is likely to reduce anxiety associated with the subject, all other things being equal. However, if lecturers approach statistics differently and give credence to the fear associated with it, students are likely to avoid it and this may increase their anxiety when studying the subject.

The Concept of Statistics Anxiety

Statistics anxiety as a concept has been defined and explained by many researchers (Cruise, Cash & Bolton, 1995; Onwuegbuzie, DaRos & Ryan, 1997; Zeidner, 1991). According to Koh and Zawi (2014), statistics anxiety can be described as a performance that, when exposed to statistics content, instruction

situations, or evaluation context, is marked by intense concern, intrusive thoughts, mental disarray, tension, and physiological arousal. It is frequently asserted that this performance impairment impairs performance in a wide range of academic contexts by interfering with the manipulation of statistical data and the resolution of statistics problems. The definition by Koh and Zawi (2014) presupposes that statistics anxiety is a situation where learners feel uncomfortable when dealing with all aspects of statistics and where their performances are affected eventually.

Cruise, Cash and Bolton (as cited in Mandap, 2016), agreed with Koh and Zawi and described statistics anxiety as a feeling experienced during statistical analysis or a statistics training. Eduljee and LeBourdais (2015) in their paper, Gender differences in statistics anxiety with undergraduate college students, defined statistics anxiety as a state-reaction that arises when a learner encounters statistics in any format and at any given moment. All the definitions were unanimous, per their definition that anxiety directly or remotely affects students either positively or negatively.

Based on the definitions provided and the consideration of what constitutes anxiety the study defines anxiety in statistics as students' experience of nervousness when dealing with statistics as a course or applying statistics in their research work. It is the feeling of uneasiness when they have to go through a statistics course as a classroom lesson or during an examination.

It can be observed, therefore, that anxiety in statistics is one of the common forms of anxiety and it is basically associated with dealing with statistics. Anxiety associated with statistics should therefore be taken care of to minimize or eliminate

its adverse consequences. As recorded by Onwuegbuzie (2000), one of the most anxiety-inducing subjects in their study curricula is statistics for many students (Blalock 1967; Caine, Centa, Doroff, Horowitz, & Wisenbaker, 1978; Gaydosh, 1990; Lundgren & Fawcett, 1980; Schacht & Stewart, 1990, 1991; Zeidner, 1991).

Postgraduate Statistics Anxiety

As there are different levels of education, all over the world, it can be said also that experiencing a particular challenge such as anxiety may differ as per one's level of education. Many researchers have worked on undergraduate students' statistics anxiety while others have worked on postgraduate students' statistics anxiety. Koh and Zawi (2014) indicated in their paper, statistics anxiety among postgraduate students, that almost all postgraduate programmes require students to engage in a statistics course due to the research component regardless of their background. They noted again that not all of these postgraduate programmes are science-based. Therefore, students from these non-science biased programmes, though knowing the significance of statistics to their studies, will not easily embrace it as part of their programmes. It can be a result of several factors such as preconceived thoughts and, or attitudes. This means that anxiety in statistics can be associated with postgraduate students too. It can therefore be said that postgraduate statistics anxiety is not different or far away from the statistics anxiety known to exist at all other levels.

Postgraduate Students' Anxiety Level in Statistics

One's anxiety level can be measured using a suitable instrument. Depending on the instrument used, it can be said that one's anxiety level is either low or high.

The Cruise, Cash, and Bolton (1985) Statistical Anxiety Rating Scale (STARS), for example, is useful for figuring out the levels in anxiety in statistics of postgraduate students. This STARS instrument is based on a 5-point Likert scale. A high score from a student's response indicates a high anxiety in statistics level while a lower score indicates a lower level of anxiety in statistics. In some cases, postgraduate students may have or experience high anxiety in statistics in some areas while they may have lower levels anxiety in statistics in other areas. The STARS anxiety is made up of six subscales namely, worth of statistics, computational self-concept, fear of statistics teachers, interpretation anxiety, test and class anxiety and fear of asking for help. A respondent may have a higher score under any of these subscales and at the same time lower score under the other subscales of the same instrument. It should therefore be noted also that a student may not experience any form of statistics anxiety at all and that may have no anxiety. An instrument with a Likert scale ranging from no anxiety (1) to high anxiety (5) may see a student having 1's indicating no anxiety, 2's indicating minimal anxiety, 3's indicating mild anxiety, 4's indicating moderate anxiety and 5's indicating high anxiety.

Onwuegbuzie (2000) in his paper, Statistics Anxiety; Nature, Etiology, Antecedents, Effects, and Treatment: A Comprehensive Review of the Literature, noted that uncomfortable level of statistics anxiety seems to be experienced by between two-thirds and four-fifths of graduate students. He noted that students' levels of anxiety in statistics have been noted to be so high that having anything to do with statistics and its related courses by many has been regarded as highly negative and also a threat to finishing their degrees.

It is, therefore, necessary to check the level of students' anxiety in statistics to set out appropriate solutions to reduce or eliminate these anxieties to further improve the academic discourse. Mandap (2016) noted that to adopt effective strategies and make necessary adjustments for a statistics class, it is prudent to establish and get acquainted with students' anxieties. Additionally, knowing the level of these anxieties will help instructors to know where and how to go about the adjustments.

Factors affecting postgraduate students' Anxiety in Statistics

In various parts of the world, researchers have found several factors affecting students' anxiety in statistics. Some of the factors identified by these researchers are instructor immediacy, sex, age, and programme of study, among others. Tonsing (2017) indicated that when instructors increase the use of positive immediacies and reduce the use of negative immediacies, it will in turn reduce students' level of statistics anxiety. Williams (2010) also noted that teacher immediacy and statistics anxiety are associated, and that instructors should think about using more of these constructive immediacy actions to lower anxiety.

Sex issues in relation to statistics anxiety have been identified by researchers with varying results. Compared to female students, male students appear to experience less statistics anxiety, according to certain research (Baloglu, 2003; Benson, 1989; Hsiao & Chiang, 2011; Mji, 2009; Zeidner, 1991). However, Mandap (2016) found out that, in comparison to male students, female students actually have lower levels of statistics anxiety. In statistics, some other researchers

have likewise found no statistically significant link between sex and anxiety. (Lacasse & Chiocchio, 2005; Onwuegbuzie, 1999, 2004; Zhang *et al*., 2012).

Hsiao and Chiang (as cited in Eduljee and LeBourdais, 2015), found no difference between females and males concerning their anxiety in statistics. Their results imply that even though they found some amount of correlation between statistics and anxiety, they did not find any difference concerning sex. Males and females have equal responses to statistics anxiety. The research on the relationship between anxiety and statistics based on sex is not clear-cut.

North and Zewotir (2006) indicated that behavioural and social scientists enter academia with no expectation to learn statistics, hence attributing their failure in statistics courses to their anxiety about statistics. Onwuegbuzie and Wilson (as cited in Faber, *et al*., 2018) observed that statistics seems to be a challenge for students in the social sciences, education, psychology, and business, both at the undergraduate and graduate levels and consequently develop and maintain a high level of anxiety in statistics. According to Koh and Zawi (2014), postgraduate students' anxiety in statistics can be associated with their different academic backgrounds. Noting that students with a background in the social sciences might not have much experience with numbers and could think they are not very good at them.

This calls for attention to consider the programme of study to know whether it contributes to one's anxiety levels in statistics to manage its effects on students in our part of the world.

Empirical Review

Tutkun's (2019) study investigated graduate students' statistics anxiety using a qualitative approach. The study involved 26 respondents, selected purposively through interviews. The anxiety was attributed to the importance of the course, the need for daily classes and self-learning, and the need for computer skills. The study also suggested that students should be math-biased and have computer knowledge. However, the study did not interview statistics teachers, making it unfit for generalization. The study's qualitative nature makes it unsuitable for generalization.

Koh and Zawi's (2014) study examined statistics anxiety among postgraduate students at the National University of Malaysia. The researchers used a census method and questionnaire to collect data on anxiety towards class activities, statistics class, attitudes towards mathematics, and expected performance in statistics courses. The mixed method analysis revealed minimal anxiety levels, with sex not influencing anxiety levels. Ethnicity, particularly Malays, was found to be more anxious. The study recommends teachers to ease students' anxiety in statistics courses, but this recommendation was not adequate due to the study's three objectives.

Afolayan, Bitrus, Olayinka, Adeyanju and Agama (2013) worked on the relationship between anxiety and the academic performance of nursing students in the Niger Delta in Nigeria. What the study set out to do was to: identify the various forms of anxiety experienced by students; find out the relationship between anxiety and academic performance and assess the relationship between sex and anxiety in

relation to academic performance. They employed descriptive statistics. Respondents for the study were purposively selected and in all, 50 students were used. Chi-square was employed to analyse data and the study concluded that anxiety causes poor performance. Again, sex does not affect students' anxiety.

They recommended that students must prepare very well before the examination to build self-confidence. Also, teachers and lecturers must guide students on how to handle anxiety and that some level of anxiety is needed to influence performance. Educators must create an enabling environment to ease anxiety among students and examinations, and continuous assessment tests and assignments need to be planned well in order not to cause anxiety among students. The choice of chi-square as a non-parametric analytical tool was in order because sampling was not randomly done. However, even though, the study chose to find the various forms of anxiety among students, it was not significantly clear in the results.

Also, the recommendations included things that were not found in the study. For example, the study mentioned that some level of anxiety was necessary to influence performance but this was not found in the work. What was found was that anxiety negatively influences performance. Again, the point on examination was not part of the objectives and therefore was not supposed to be part of the recommendations. Lastly, two out of three objectives were quantitative and so the researchers should have adopted the probability sampling method which would have allowed them to use parametric tools in the data analysis.

Ali and Iqbal (2012) worked on the statistics anxiety among Psychology graduates at Karachi University. The study objectives were to find out how statistics anxiety affected statistics performance; to assess how students' anxiety affect their scores in mathematical calculations and to evaluate the relationship between the use of a scientific calculator and statistics anxiety. Sixty-six respondents in all were chosen for the research. The researchers adopted the Statistics Anxiety Scale developed by Vigil-Colet *et al*. (2008). The scale related to the trait and neuroticism anxiety. The study used the bivariate correlation and one sample t-test.

It was found that some moderate negative relationship existed between anxiety and students' academic performance. And that students with less statistics anxiety scored high marks in mathematics. Lastly, they found that students who could use scientific calculators were less anxious. The study, in the first place, did not give any indication of how the respondents were selected. Again, the research design used was not clear and this makes any academic assessment of the study very difficult. The study failed to make any recommendations based on the findings. This is not the best since recommendations could have added to the knowledge on the topic.

Lastly, Amanda (2010) studied the anxiety of students and instructor immediacy. The study aimed to investigate the relationship between instructor immediacy and statistics anxiety. The study used the experimental research design and adopted the control and the experimental groups. The researcher used the pre-test and post-test methods in the data collection. A total of 76 graduate students were used for the research. The Statistics Anxiety Rating Scale (STARS) was the

data collection instrument. The Kruskal Wallis H-test and Mann-Whitney U-test were the data analysis tools used. The work concluded that instructor immediacy is significantly related to factors affecting statistics anxiety. It was recommended that statistics instructors must use immediacy behaviours to reduce students' anxiety.

It can therefore be said that the current study remains unique due to several reasons. The level of respondents (postgraduate students), study area (in a Ghanaian context) and the mathematics content area (statistics) are essential aspects that mark out the current study as unique in comparison with all such research in the body of literature.

Conceptual Framework

This section presents the conceptualisation of the Social Cognitive Theory as propounded by Bandura. The theorists believed that people observe a model and the model's behaviour tends to influence those who witness it. By this, the theorist assumes that human survival depends on the imitation of the actions of some stakeholders in society. By expansion, the theory believes people are shaped by their environment. Additionally, people learn with ease what they are exposed to. Thus, the study believes that each individual is different and that their characteristics as well as the environment determine their level of anxiety.

Bandura (2003) maintained that a person's self-efficacy, observation and environment are major determinants of how they are affected by anxiety. Figure 1 displays the conceptual foundation for the research. It depicts the relationship between people's characteristics and their anxiety levels. From the figure, it is clear

from reading that a person's observation, perception, and interactions with their surroundings all contribute to their level of anxiety.

If the person, with his/her make-up, interacts with the environment, including lecturers and statistical tools, the outcome of the association can result in high or low anxiety depending on how favourable the interaction is. If the interaction is favourable, it is expected that his/her anxiety level will be low and vice versa.

A PERSON'S PERSONALITY

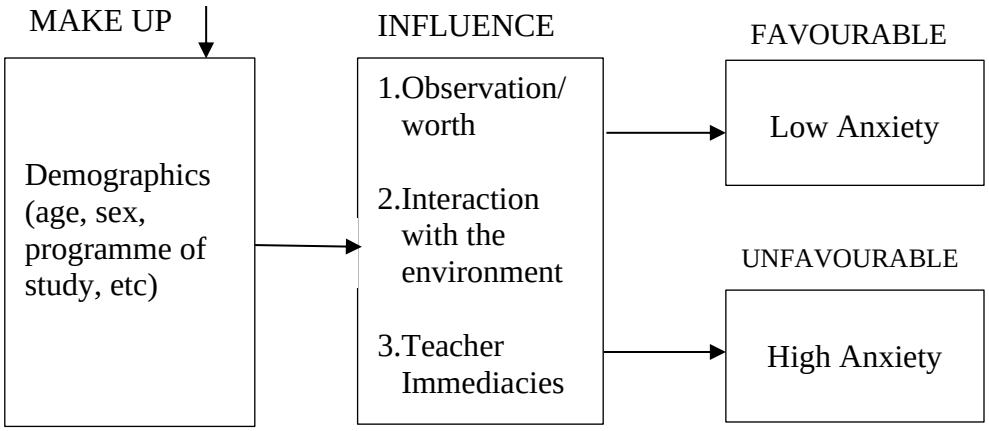

Figure 1: Conceptual Framework of postgraduate anxiety in Statistics

Source: Author's construct

Chapter Summary

The goal of the chapter was to review relevant literature for the investigation. The literature looked at the Social Cognitive Theory and the Approach-Avoidance theory. The study is thus linked to the Social Cognitive theory which implies that people are shaped by their environment and that a conducive environment leads to less anxiety while a hostile environment leads to high anxiety.

The Approach-Avoidance theory also indicates that students learn statistics with ease and less anxiety if statistics facilitators create a friendly environment. It is summarised from the literature that postgraduate students also go through anxiety with respect to statistics. However, the impact of personal characteristics on anxiety is not straightforward. Different findings have emerged as to how sex and programme of study affect students' statistics anxiety. Lastly, the literature has revealed how instructors can influence students' anxiety levels. It was found that a conducive environment by facilitators can lessen students' anxiety.

The current study, therefore, draws inspiration from uncertainties like sex and programme choice influence, environment and availability of resources, etc. surrounding this literature to consider investigating the statistical experiences such as anxiety of postgraduate students to determine their level of these anxieties in our part of the world. The literature review influenced the study in its adoption of the definition of statistics anxiety. The study benefited from the research strategy, data collection methods, analytical tools, and research design that were identified in the literature review.

CHAPTER THREE

RESEARCH METHODS

According to Kothari (2004), research methodology is a process for methodically resolving a research issue. It might be viewed as a science that studies how scientific research is conducted. Research methodology takes into account and clarifies the reasoning behind research procedures and approaches. Research methods can also be and are associated with different kinds of research design (Bell, Bryman, & Harley, 2022). This chapter looked at the methodology that was used for the data collection and analysis of the study. It considered topics such as the research design, the target population of the study, sample size and sampling procedures, data collection instruments, pre-test of instruments, ethics in fieldwork, data collection procedure and processing and framework for data processing and analysis. This chapter describes the framework upon which the study was conducted.

Research Design

Creswell and Clark (2017) defined mixed methods research as research projects that incorporate a minimum of one quantitative and one qualitative component. One major characteristic of mixed methods design is that the method combines quantitative and qualitative approaches in data collection and analysis (Gay, Mills & Airasian, 2012). The design, therefore, used in this study is the explanatory sequential mixed methods design. This design is characterised by first collecting and analysing quantitative data followed by the collection and analysis of qualitative data (Creswell & Clark, 2017). Thus, quantitative data were collected

using a questionnaire and analysed after which an interview was also conducted to collect qualitative data.

The idea behind this strategy is to use qualitative data to help analyse and explain quantitative study findings. Creswell & Clark (2017) observed that the mixed method approach is employed to get over a single design's drawbacks that is, overcoming the weaknesses that come with either a quantitative or qualitative approach. This design will explain, interpret and report on the level of anxiety in statistics of postgraduate students.

Study Area

The study was conducted in a public university in Ghana. The University is a Ghanaian public collegiate research university. The university was founded to prepare graduate teachers for positions in second-cycle educational institutions including technical colleges and colleges of education. Since then, it has expanded its role to accommodate the labour demands of the nation's other ministries and businesses. This is because several of its faculties and schools have grown, and its programme offerings have become more varied. In this context, the university has established the School of Graduate Studies, whose job it is to oversee graduate-level curriculum development for all university colleges. The University's School of Graduate Studies oversees and counsels university colleges connected to this university regarding their graduate programmes.

The University has six colleges including the College of Education and the College of Humanities and Legal Studies. This public university was chosen for the research study because it satisfied a few requirements the researcher considered

earlier before the study. That is, all of these colleges have students pursuing postgraduate programmes under the School of Graduate Studies and therefore offer statistics as a course in all their postgraduate programmes and also the readiness and availability of these postgraduate students for the study.

Population

The study population included all first-year MPhil postgraduate students of the 2019/2020 academic year in one of the colleges in the selected public university in Ghana. This is as a result of the target group and the aim of the research. According to the institution's Management Information System (MIS), this College during the 2019/2020 academic year had 897 first-year postgraduate students which included 269 MPhil students for the various programmes.

Sample and Sampling Technique

Purposive sampling was used to select the College of Education Studies in this selected public university in Ghana. This was because it met the criterion of having all students pursue statistics as a course as part of their postgraduate programmes. The study purposively selected departments whose programmes had at least fifteen or more students. This was to ensure that the study had enough representation of each programme in the research. The census method was adopted for the data collection. A count or survey of every component of the population is referred to as a census method (Powell, 2004). In quantitative research, the usual guideline is that "the larger the better" when deciding sample size. Probability samples with fewer than 100 members are typically regarded as unlikely to

represent the total population. (Mouton & Babbie, 2001; Hafner, 1998; Powell & Silipigni, 2004).

However, it should be remembered that selecting an excessively large sample size could also be costly and time-consuming. Since there is no formula that determines the appropriate sample size for qualitative research, the degree of richness and complexity of the data are crucial (Powell & Silipigni; 2004). In both qualitative and quantitative research, a sample's ability to produce an objective representation is typically not guaranteed. According to Hafner (1998), it is insufficient to assume that the results of a sample would be repeated in the population. In light of these factors and the fact that the sample size of 151 students is insufficient for a meaningful analysis, a population-wide census was chosen for the study. One can be certain that the population is representative and that the study's goals will be met by conducting a census.

According to Kish and Varm (1986), the census approach of data collection is accurate and thorough. The inverse of sampling variability is known as precision. Additionally, the Census technique provides data in great detail for local locations, particularly tiny domains, something that sampling are unable to do. While not always the case, censuses tend to yield more comprehensive coverage than sample surveys. As such, their population coverage tends to be more inclusive than that of sample surveys. This is partially due to the fact that the census method produces comprehensive data because each item is carefully inspected. Notwithstanding its significance, Kish and Varm (1986) noted that measurement biases could cause censuses to be more incorrect than sampling. The number 151 is the total number

of postgraduate MPhil first-year students within the seven selected programmes from the college under consideration. Table 1 below displays the breakdown.

Table 1: Breakdown of the representation of the seven selected programmes

Programme of Study	Male	Female	Total
MPhil Accounting Education	16	8	24
MPhil Art Education	9	7	16
MPhil Clinical Health Education	12	5	17
MPhil Home Economics Education	4	23	27
MPhil Basic Education	8	10	18
MPhil Management Education	6	10	16
MPhil Mathematics Education	26	7	33
GRAND TOTAL	**81**	**70**	**151**

Source: MIS, College of Education Studies 2019/2020

Thus, the sample size used for the study was 151 postgraduate MPhil first year students within the seven selected programmes.

Data Collection Instruments

Data for the study were gathered using two instruments. Instruments were used to collect data for the study. These were an adapted questionnaire and a focus

group discussion guide. The Statistical Anxiety Rating Scale (STARS) questionnaire developed by Cruise, Cash and Bolton (1985) and the Instructor Immediacy Scale questionnaire by Wilson (2006) were adapted to form one instrument to collect the quantitative data, while a discussion guide was developed for focus groups to gather the qualitative data.

Questionnaire

The 51 items of the STARS questionnaire are divided into two sections and six subscales. Three subscales totaling twenty-three items make up the first section: eight items measure test and class anxiety, eleven items measure interpretation anxiety, and four items measure dread of asking for help. On a 5-point Likert scale ranging from not at all nervous to highly anxious, participants were asked to rate how anxious they felt about a certain situation.

The second portion, which consists of three subscales measuring attitudes towards statistics, assesses computational self-concept (7), fear of statistics teachers (5), and worth of statistics worry (16). Additionally, there was a 5-point Likert scale for this, ranging from strongly disagree to strongly agree. There are six non-verbal immediacy questions and seventeen verbal immediacy questions in the instructor immediacy scale. It is intended to assess instructor immediacy signs that are expressed verbally as well as nonverbally.

Every question has a 5-point Likert scale, and each participant's total immediacy score is calculated by averaging the items. It was appropriate to adopt the STARS and the Instructor Immediacy scale as a single instrument to collect the quantitative data. This is due to the primary aim of the instrument as a tool to

ascertain the existence and level of respondents' anxiety in statistics among psychology students. However, a few contextual circumstances led to minimal modifications.

Firstly, the two different scale measurements on the STARS and also on the Instructor Immediacy scale instrument were complicated. Therefore, there was the need to bring all the items in both instruments under one measurement scale for easy understanding by respondents. The new measurement that was used was "no anxiety = 1", "minimal anxiety = 2", mild anxiety = 3", "moderate anxiety = 4", and "high anxiety = 5". Again, some of the questions were restructured to be in line with the new response from "no anxiety" to "high anxiety". Since some of the words were somewhat complicated, they were modified to make it easier for respondents to understand how important the statement was. The adapted instrument eventually considered eight subscales namely: interpretation anxiety, test and class anxiety, fear of statistics teachers, worth of statistics anxiety, computation self-concept, verbal immediacy and non-verbal immediacy as used in the study. An example of items on each subscale and how they were modified is shown in Table 2 below.

Table 2: Examples of Modification made on the STARS and Instructor Immediacy scales

Subscale	Original items	Modified items
Interpretation Anxiety	Determining whether to reject or retain a null hypothesis	I feel anxious whenever I have to determine whether to reject or retain a null hypothesis
Test and Class Anxiety	Studying for an examination in a statistics course	I enjoy studying for examinations in a statistics course
Fear of statistics teachers	Asking one of my teachers for help in understanding a printout	I feel tensed asking my statistics lecturer for help in understanding a concept
Worth of statistics	I wish the statistics requirement would be removed from my academic programme	My life on campus would have been comfortable if the statistics requirement was removed from my academic programme

Table 2: Continue

Subscale	Original items	Modified items
Computation self-concept	I can't even understand secondary school mathematics; how can I possibly do statistics.	I struggled to understand SHS mathematics so the idea of doing postgraduates statistics worried me a lot
Fear of asking for help	Asking a fellow student for help in understanding a printout.	I feel comfortable seeking for explanation to statistical print out in class
Verbal Immediacy	Calls on students to answer questions even if they have not indicated that they want to talk	I feel worried when my statistics lecturer calls me unaware to answer questions in class
Non-Verbal Immediacy	Gestures while talking in class	My statistics lecturer gestures a lot in class which makes me anxious

Source: Field Work 2021

Interview Guide for Focus Group Discussion

According to Tuckman (quoted in Cohen, Manion, & Morrison, 2002), an interview is a unique research technique. According to Tuckman, interviews allow one to see behind someone's masks and provide information about their knowledge, preferences, and dislikes. An interview as a tool for data collection again helps the interviewer to be able to probe further into partially answered questions. According to Cohen, Manion, and Morrison (2002), an interview can ensure that the respondent is the only one answering the questions. It should also be noted that despite the many advantages of using an interview as a data collection tool, it has limitations such as the particular traits (sex, age, personality, social status, etc.) of the target group may have an impact on interviews.

To follow up and explain further findings from the quantitative data, a focus group discussion guide which contained open-ended items was developed for a focus group discussion. The guide consisted of sixteen items placed under the eight subscales considered in the study. Items one and two sought to explain respondents' answers given on the level of anxiety they experience when required to understand statistical data and others. Items three and four basically aimed at further explaining how anxious were the respondents when it came to studying for a statistics course exam.

Items five, six, and ten, eleven were asked to assess students' concern over asking for help in comprehending statistics material and students' opinions of statistics teachers, respectively, in order to explain respondents' nervousness in asking for help and fear of statistics teachers. In order to learn more about the

respondents' opinions on the value of statistics in their academic, professional, and personal life, further questions were posed to them. Additionally, they were questioned about the respondents' self-concept, verbal immediacy, and non-verbal immediacy anxiety in computing.

The interviewees were allowed to openly express their opinions, experiences, and challenges in the learning of statistics. Every instrument may have its weaknesses however; it is anticipated that the results will be thoroughly explained by the integration of both quantitative and qualitative methodologies.

Pre-test of Instrument

The questionnaire was pre-tested using postgraduate students at the College of Humanities and Legal Studies for the reliability of the instruments. This is because postgraduate students in these colleges have similar statistical experiences as that of the College of Education Studies.

Validity and reliability of instrument

The adapted instrument was piloted using postgraduate students in one of the Colleges in a public university in Ghana for the reliability of the instruments. This was because postgraduate students in that college have similar characteristics in terms of their statistical experiences as that of students in the target population. The focus group discussion guide items were also provided for expert examination and peer review to guarantee validity (Cohen, *et al.*, 2002). By asking the same questions of respondents in both the questionnaire and the interview, reliability was further guaranteed. The researcher solely led the focus group discussion using the

focus group discussion guide for uniformity. According to Table 3 below, the instrument's reliability score following the pilot test was as follows.

Table 3: The Reliability Score of the Instrument after the Pilot Test

SUB SCALE	RELIABILITY SCORE
Interpretation anxiety	.85
Test and Class anxiety	.79
Fear of statistics teachers	.91
Worth of statistics	.86
Computation self-concept	.83
Fear of asking for help	.89
Verbal immediacy	.90
Non-verbal immediacy	.77

Norman and Fraenkel (2000) suggested a minimum reliability score of 0.70 as satisfactory therefore, confirming the credibility of the data gathered.

Ethical consideration

In research ethics, it is the researcher's duty to safeguard oneself by carrying out the investigation in a responsible and safe manner (Oliver, 1997). When doing research, ethics must always be taken into consideration, especially when fieldwork is involved. The justification for this is that during fieldwork for a study, researchers delve into the private lives of participants and make the information publicly accessible. The moral decisions, obligations, and concerns that researchers have while doing their work are all covered under research ethics (Edwards & Mauthner,

2002). According to ethical guidelines, researchers must preserve neutrality, show accountability, competency, and propriety, as well as safeguard respondents (Akparep, 2019). In the end, ethical considerations are determined by the discipline, the phenomenon being studied, and the study's setting.

It is imperative to acknowledge that respondents in study ought to be duly informed about the purpose of the investigation and should not be coerced into participating. According to Akparep (2019), this implies that the participants must agree to part of the interview. Giving their consent and willingly taking part in the study indicates that respondents are in the known of the risks associated with participation in the study as well as its advantages. In an unpublished thesis, Yeboah (2010) made the argument that, for instance, unforeseen issues may arise during an interview and that these issues may cause the process to go in unexpected directions. It is crucial to honour the respondents' informed consent at all times during the communication process, particularly if something unexpected occurs. The ability to withdraw from the research at any moment must be made clear to respondents. The respondents voluntarily provided information when answering the questions. They were neither tricked nor forced into giving information; instead, they were made aware of the benefits of the study. Respondents were provided with the choice of answering or not answering a certain question, as well as the freedom to end the interview at any time. Once again, respondents were assured of their anonymity and the confidentiality of their responses, allaying their concerns that the interview was only meant for academics. Overall, the research employed moral principles to guarantee that the participants' rights were sufficiently safeguarded. Prior to data

collection, ethical clearance was obtained from the University of Cape Coast's Institutional Review Board.

Data Collection Procedure

Following receipt of the University's ethical approval, quantitative data was gathered from respondents through online means. An online means was considered after Covid 19 had caused the normal face-to-face school session to cease for some time and means to get through to respondents were a little challenging.

The researcher got through to course representatives of the various needed programmes to, in turn, communicate to colleagues on the researcher's behalf with an internet address sent to their various WhatsApp platforms. Respondents found it easy to willingly help by answering the questionnaire since it demanded about thirty – five minutes of their time. It also made it easy to monitor if respondents were answering the complete questionnaire to avoid any lapses. This ensured the gathering of complete data.

All students considered in the study responded to the questionnaire which gave a 100% return rate. The online exercise was scheduled to conclude in a span of fourteen days. Approximately 80% of the participants had finished it by the tenth day. The researcher again sent a reminder through the course representatives to the respondents who were yet to complete the questionnaire. The online questionnaire had been satisfactorily completed by every respondent who was taken into account for the study on the fourteenth day. Following that, they were told that a phone call will be made to some of them inviting them to participate in a focus group

discussion. This was so they could explain difficult problems that arose when they answered the quantitative items.

The development of the focus group discussion guide was guided by the results of the quantitative data, which were ready after roughly a month. Some of the respondents were identified and invited to participate in the conference call focus group discussion. They selected a time and day that worked for them to show that they were accepting and participating. They were again reminded through phone calls a day before the discussion. 12 out of the 14 who agreed to be part of the discussion through the conference call made it. A recording device was made ready as the researcher put the call through to the first six for the discussion which took about an hour. The same was done for the second six which also took the same time. I gave a brief introduction as the moderator and greeted the focus group discussion participants. An introduction to the subject matter was given, along with the purpose of the discussion, the guidelines for participation, and the estimated length of time. The participants were made aware that they were being recorded so that their answers might be reported in an anonymous manner. As far as they knew and could speak to, they were urged to feel free to respond in a straightforward and impartial manner. Following their introductions, the participants were given complete freedom to talk without any interruptions from the researcher, who was leading the conversation. When there were no more ideas from participants, the situation hit data saturation. After the debate was over, the researcher gave the participants a summary of all that had happened by reading out some of their

comments for confirmation. The researcher then thanked them for their time and ended the calls.

Data Processing and Analysis

Both quantitative and qualitative data were produced by the data gathering tools used, and several methods for analysing both types of data were taken into consideration. The sequential mixed method strategy was used in the investigation. According to Onwuegbuzie and Teddlie (2013), this study prioritised the quantitative data in order to guide the examination of the qualitative data. This section of the chapter is covered under the headings of quantitative and qualitative data processing and analysis.

Quantitative Data Processing and Analysis

After being converted in numerical form from the online survey to an Excel file, the data were exported to SPSS for analysis. Frequency and percentages, mean and standard deviations, Principal Component Analysis (PCA), Mann-Whitney U-test, and Kruskal Wallis H-test were the statistical methods used for data analysis. Frequencies and percentages were utilised to evaluate the demographic characteristics of the respondents. It was only appropriate to utilise such statistical tools for the demographic variables in the analysis, which were all categorical (nominal and ordinal levels of measurement). The frequency is the count of numbers in a specific range or category in a data set and percentage on the other hand means the proportion of a specific number concerning all the numbers in a data set.

Specifically, the frequencies were used in determining differences in levels of anxiety in statistics based on sex and a programme one pursues. Data gathered on research question one which states that "What is the level of postgraduates students' anxiety in statistics?" was analysed through frequencies and percentages and mean and standard deviation. Since the research question required respondents' levels of anxiety in statistics, an average mean score was, therefore, necessary to determine.

Frequencies and percentages were obtained on the eight subscales under the five point Likert scale ranging from No Anxiety (NA) to High Anxiety (HA). This was done to determine the number of respondents and their choices under the eight subscales under consideration. The frequencies and percentages gives a fair representation of the choices made by the respondents resulting or thereby showing their levels of anxiety in statistics.

Again, the study considered a mean range of 1.00-1.49 to indicate no anxiety, 1.50-2.49 as minimal anxiety, 2.50-3.49 as mild anxiety, 3.50-4.49 as moderate anxiety and 4.50-5.00 as high anxiety (Koh & Zawi, 2014). Range in statistics represent the difference between the smallest and largest value in a dataset. This is important as it shows the spread of the entire dataset and also the extreme values possible in a given dataset. Thus, showing the spread of the mean scores obtained to aid in determining the levels of postgraduate MPhil Students' anxiety in statistics.

The mean, a composite score that depicts the distribution of scores within a certain population, was deemed a suitable statistical instrument. It is also the most

accurate indicator of central tendency when measured at the interval or ratio level (scale). A five-point Likert scale, which was regarded as a scale, was used to measure each variable.

Standard deviation, statistically, is the best measure of dispersion to consider when the mean is reported. Understanding how much responses to statistics anxiety are clustered or scattered from the mean can be gained by looking at the Standard Deviation. When all respondents provide the same answers and the replies are deemed to be homogeneous (agreed or disagreed at the same level), a low standard deviation (standard deviation approaches 0) is anticipated. On the other hand, if the responses differ, the standard deviation is typically high (generally above 1).

Research question two, which sought to find out about the factors contributing to students' reported anxiety in statistics, was analysed using the Principal Component Analysis (PCA) and Parallel Analysis (PA). Jolliffe and Cadima (2016) state that PCA is a statistical tool for analysing large data sets with a high number of features (dimensions per observation, maximal information preservation, enhanced interpretability of data, and multidimensional data visualisation). Therefore, PCA makes sense in this study since it looks for different factors that affected the postgraduate MPhil students' level of statistics fear. The eigenvalue – 1 criterion was applied to ascertain how many factors to keep. Eigenvalues show how much variation a factor contains. The eigenvalue criteria is used because each factor should account for the variability in at least one variable. Additionally, according to the eigenvalue criterion, factors should only be kept if

their eigenvalues are bigger than one. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy is a statistic that shows how much of the variance in a set of variables may be due to underlying factors; values near to one (high values) suggest that PCA can be applied. Eigenvalues are utilised in retaining factors in this way. The correlation matrix's identity matrix null hypothesis is tested using Barlett's test of sphericity. Barlett's test of sphericity and the KMO Measure of Sampling Adequacy assess all available data together. There may be a significant connection in the data if the KMO value is greater than 0.5 and the Barlett's test significance level is less than 0.05 (Yong & Pearce, 2013). The degree to which one variable is associated with other variables is indicated by its variable collinearity.

PCA can only identify main components if there is a correlation between the features; otherwise, it cannot determine the features or dimensions. Once more, PCA is sensitive to the feature scale; hence, it is crucial to first standardise the data. As part of the assumptions of PCA, outliers were removed before performing it since it is not robust against outliers. PCA also assumes a linear relationship between features. With regards to this assumption, although linearity can be tested using a matrix scatter plot, since the scatter plot can sometimes have over five hundred linear relationships, few possible relationships were randomly selected for the text. This text was done in SPSS statistics using scatter plot. Since the algorithm is not well suited to capturing non-linear relationships, log transform was used to turn non-linear relationships into linear ones. All these assumptions were tested using SPSS statistics. Bearing these assumptions in mind and putting them into consideration, PCA was used in answering research question two. This was to

determine the principal factors that influenced postgraduate students' anxiety in statistics.

Parallel analysis as indicated by Kaufman and Dunlap (2000) is a strategy or an approach proven to be superior to more widely known methods for determining the number of factors to retain in exploratory factor analysis or a PCA. Parallel Analysis is done to identify the optimal number of factors so as to avoid over-extraction of factors. It helps to ensure that only significant factors are retained, leading to more accurate and interpretable results. The purpose of employing this method is to serve as an aid in confirming the factors as retained from the PCA. Thus, parallel analysis was done to cross-validate the findings from PCA.

Hypothesis 1 which states that; *There is no statistically significant difference in postgraduate students' level of anxiety in statistics based on sex* was analysed using the Mann-Whitney U test. When comparing differences between two independent groups, the Mann-Whitney U test is employed if the dependent variable is not normally distributed but is either ordinal or continuous. Unlike the independent sample t-test, the Mann-Whitney U test, which is sometimes regarded as the non-parametric substitute for the independent t-test, permits one to make different conclusions about one's data based on assumptions made about one's data distribution. These findings can be as basic as declaring whether or not the two populations differ or as complex as figuring out whether or not the group medians differ.

There are four assumptions in the Mann-Whitney U test, all of which were taken into account before it was used. It is expected that the dependent variable, as in this study, should be measured at the continuous or ordinal level. The Mann-Whitney U test once more, presupposes observational independence. This implies that there shouldn't be any correlation between the observations within each group or between the groups themselves, just as there shouldn't be between male and female respondents' sex in the study. Finally, a Mann-Whitney U test can be used (and was used in this study) when the two variables under consideration are not normally distributed. All these assumptions were keenly considered in using the Mann-Whitney U test in testing the first hypothesis to determine whether there are differences in the levels of postgraduate students' anxiety in statistics based on their sex.

Kruskal-Wallis H test was also used in analysing the second hypothesis which states that; "*There is no statistically significant difference in postgraduate students' level of anxiety in statistics based on programme of study".* To find out if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable, one can apply the rank-based non-parametric Kruskal-Wallis H test. In order to compare more than two independent groups, it is a non-parametric substitute for the one-way ANOVA and an extension of the Mann-Whitney U test. It is significant to remember that these presumptions were taken into consideration when evaluating the Kruskal-Wallis H test.

First, the amount of respondents' anxiety in statistics should be quantified at the ordinal or continuous level using a Likert scale ranging from 1-No Anxiety to 5-High Anxiety. Once more, there should be two or more categorical independent groups that make up the independent variable. The study course that is being considered is the independent variable in this investigation. As is the case with this study's seven distinct study programmes, there should be independence of observations, which implies that there should be no relationship between the observations in each group or between the groups themselves.

Being an omnibus test statistic, the Kruskal-Wallis H test is unable to identify particular sets of independent variables that differ from one another statistically substantially. All it indicates is that there were at least two distinct groupings. Given that this study examined seven groups instead of just two, it is crucial to identify the differences between the groups, which is why a pairwise comparison text was taken into consideration. The question of whether the mean rank of one group differed noticeably from the mean rank of another group was posed for each pairwise comparison test.

Qualitative Data Processing and Analysis

The recording equipment was used to collect qualitative data, which was then transcribed. The transcription was completed by the researcher and a fellow researcher. Errors were determined after comparing the generated transcripts to each other. Data analysis was done using thematic template analysis. According to Brooks and Kings (2012), this type of analysis enables data analysts to examine qualitative data that has preconceived themes or codes, also known as a priori

themes. The analyst applies a deductive approach to code, which involves finding concepts that align with the specified subject. However template analysis also allows for the creation of new themes or the modification of existing themes when concepts don't fit (inductive approach). According to Braun and Clarke (2006), ideas can also be connected in a hierarchical fashion using main and minor themes. Template analysis was appropriate because of the preexisting themes (a priori themes) that were taken into consideration from the quantitative findings. These themes are clarified by the concepts that were developed from the qualitative data. The procedures outlined by King and Brooks (2016) for template analysis were adhered to, including familiarising oneself with the data, preliminary coding, clustering, creating an initial template, applying and developing the template, and ultimately interpreting the data. Ideas within the themes were distinguished by colour coding. In the reporting, narratives and themes were used. Anderson (2005) noted that themes and narratives are a good approach when reporting focus group interviews or discussions. An overview of the quantitative and qualitative data analysis is given in Table 4.

Table 4: Summary of Data Analysis

Research Questions/ Research Hypothesis	**Instrument**	**Analytical Technique**
Research Question 1: What is the level of postgraduate students' perceived anxiety in statistics?	Questionnaire/Focus Group Discussion Guide	Frequencies, Percentages, Mean, Standard Deviation

Table 4: Continue

Research Questions/ Research Hypothesis	Instrument	Analytical Technique
Research Question 2: What factors contribute to students' reported anxiety in statistics?	Questionnaire/Focus Group Discussion Guide	Principal Component Analysis/ Parallel Analysis/ Template Analysis
Hypothesis 1: There is no statistically significant difference in postgraduate students' level of anxiety in statistics based on sex	Data from Questionnaire/Focus Group Discussion Guide	Mann-Whitney U-test /Template Analysis
Hypothesis 2: There is no statistically significant difference in postgraduate students' level of anxiety in statistics based on the programme of study.	Data from Questionnaire/ Focus Group Discussion Guide	Kruskal-Wallis H-test/Template Analysis

Fieldwork (2021)

Chapter Summary

The sequential explanatory mixed method design was used in the study to investigate the statistics anxiety levels of postgraduate students. The choice of this

design made it possible to collect quantitative data on the anxiety levels of postgraduate MPhil students from the College of Education Studies (N=151) using an instrument modified from STARS and the Instructor Immediacy Scale. In order to clarify the quantitative results, twelve postgraduate MPhil students participated in a focus group discussion where they provided qualitative data. This was done to understand their levels of anxiety in statistics.

The instruments were pre-tested in one of the Colleges in a public university in Ghana for their reliability. The research questions and hypotheses were addressed using descriptive statistics (frequency and percentages, mean and standard deviation), PCA, Mann-Whitney U test, and Kruskal Wallis H test.

CHAPTER FOUR

RESULTS AND DISCUSSION

Overview

Results and a discussion on postgraduate students' anxiety in statistics are presented in this chapter. In all, 151 data points were gathered from postgraduate students in the College of Education Studies in the University concerned. These were students who had completed their coursework on educational statistics and had taken their final examinations for the course. Hence, the examination of their anxiety in statistics reflected their experience with the course. It was discovered that there was no missing variable. This was a result of the respondents' cooperation over the whole exercise.

Through the use of extreme case sample, twelve participants were selected for a follow-up focus group discussion during the qualitative phase. The follow-up focus group discussion through the conference call took about sixty minutes for each session. Since the participants had chosen to sit in calm settings specifically to facilitate the exercise's seamless flow, no discomfort was noticed on their behalf.

For easy reportage, and organisation in this chapter, the respondents' demographic details are provided firstly. The key assumptions to determine whether to use parametric or non – parametric statistical tools that is the normality test follows. For the purpose of better understanding by the readers, the quantitative results, follow-up qualitative results, and discussion are arranged according to their respective research questions or hypotheses.

Demographic Characteristics of Respondents

The demographic attributes of the postgraduate students considered were their sex and programme of study. These variables provided basic information about the group that was assessed. Moreover, gathering data on their respective programmes of study was necessary since the postgraduate students were sampled from different programmes. Also, it helped to analyse Hypotheses One and Two which seek to determine differences in the statistics anxiety of the postgraduate students based on their sex and programme of study.

The data collected were analysed using frequency and percentages and the results are presented in Table 5.

Table 5: Demographic Characteristics of Respondents

Variable	Subscale	Freq.	%
Sex	Male	81	53.6
	Female	70	46.4
Programmes of Study	Management Education	16	10.7
	Clinical Health Psychology	16	10.7
	Mathematics Education	33	22.0
	Basic Education	18	12.0
	Accounting Education	24	16.0
	Arts Education	16	10.7
	Home Economics	27	18.0
Total		**151**	**100.1**

Source: Field survey (2021)

The findings indicate that most of the respondents were male postgraduate students (n = 81, 53.6%). Concerning the respondents' programme of study, this research comprised postgraduate students from seven different programmes. The majority of the respondents read Mathematics Education (n = 33, 22%). This was

followed by Home Economics, which had 18% of the respondents reading that programme. The Accounting Education programme had the third-highest number of respondents (n = 24, 16%) while twelve percent of the respondents read Basic Education. However, Management Education, Clinical Health Psychology and Arts Education programmes had an equal number of postgraduate students who read each of those programmes (n = 16, 10.7%).

Research Question One:

What is the level of postgraduate students' perceived anxiety in statistics?

The purpose of this research question was to determine the level of postgraduate students' anxiety in statistics. The data collected were analysed using frequency, percentage, mean and standard deviation. The result of the frequencies and percentages is presented in Table 6.

Table 6: Distribution showing Postgraduate Students' Level of Anxiety in Statistics

Anxiety in Statistics	No anxiety	Minimal Anxiety	Mild Anxiety	Moderate Anxiety	High Anxiety
	n (%)	n (%)	n (%)	n (%)	n (%)
Interpretation Anxiety	6 (4.0)	29 (19.2)	67 (44.4)	43 (28.5)	6 (4.0)
Test and class Anxiety	3 (2.0)	18 (11.9)	89 (58.9)	35 (23.2)	6 (4.0)
Fear of Asking for Help	3 (2.0)	42 (27.8)	76 (50.3)	25 (16.6)	5 (3.3)
Worth of Statistics	8 (5.3)	36 (23.8)	84 (55.6)	21 (13.9)	2 (1.3)
Computation Self-Concept	2 (1.3)	16 (10.6)	89 (58.9)	40 (26.5)	4 (2.6)

Table 6: Continue

Anxiety in Statistics	No anxiety	Minimal Anxiety	Mild Anxiety	Moderate Anxiety	High Anxiety
Fear of Statistics Teachers	6 (4.0)	40 (26.5)	70 (46.4)	32 (21.2)	3 (2.0)
Verbal Immediacy	3 (2.0)	18 (11.9)	104 (68.9)	23 (15.2)	3 (2.0)
Non Verbal Immediacy	9 (6.0)	34 (22.5)	70 (46.4)	31 (20.5)	7 (4.6)

Field work 2021

From Table 6, it can be seen that out of the 151 respondents, only 6 respondents representing 4% asserted that they had no interpretation anxiety in statistics and 6 representing 4% had high interpretation anxiety in statistics. Sixty-seven respondents representing 44.4% indicated that they had mild interpretation anxiety in statistics. On test and class anxiety, 3 respondents representing 2% indicated they had no such anxiety in statistics. Meanwhile, 6 of them representing 4% had high test and class anxiety in statistics. It is clearly indicated that 89 (58.9%) of the respondents had mild test and class anxiety in statistics.

The level at which students experienced statistics anxiety as a result of fear of statistics teachers is mild as indicated by 70 (46.4%) out of the 151 respondents. Six (4%) respondents indicated they had no such anxiety, 40 (26.5%) indicated they had minimal anxiety, 32 (21.2%) representing moderate anxiety and 3 (2.0%) representing high anxiety in statistics in the area of fear of statistics teachers. From Table 6, it can be seen that the level of statistics anxiety in the area of fear of asking for help was also mild (76 representing 50.3% out of the total respondents). Three (2%) respondents, 42 (27.8%) respondents, 25 (16.6%) respondents and 5 (3.3%)

respondents indicated they had no anxiety, mild anxiety, moderate anxiety and high anxiety respectively as related to fear of asking for help.

Out of the 151 respondents, 8 respondents representing 5.3% and 2 respondents representing 1.3% indicated they had no anxiety and high anxiety in statistics in the area of the worth of statistics. It can be seen and concluded that in the area of worth of statistics anxiety, most of the respondents had mild statistics anxiety (84 respondents representing 55.6%). Respondents' statistics anxiety level in terms of computation self-concept was noted to be mild by 89 respondents representing 58.9% out of the total. 2 (13%) and 4 (2.6%) of the respondents meanwhile, indicated they had no statistics anxiety and high statistics anxiety respectively in the area of computation self-concept.

With regards to students' statistics anxiety in verbal immediacy, It is evident that the majority of the respondents (68.9% of the sample, or 104 respondents) experienced a mild level of statistics anxiety as compared to the others such as no anxiety (3 respondents representing 2%) and high anxiety (3 respondents representing 2%). Comparing the various levels of statistics anxiety in the area of non-verbal immediacy, as in, no anxiety (9 respondents 6%), minimal anxiety (34 respondents 22.5%), mild anxiety (70 respondents 46.4%), moderate anxiety (31 respondents 20.5) and high anxiety (7 respondents 4.6%), it can be concluded that respondents have a mild level of statistics anxiety.

The result of the mean and standard deviation is displayed in Table 7.

Table 7: Mean and Standard Deviation of Postgraduate Students' Level of Anxiety in Statistics

Variable	*M*	*SD*
Interpretation Anxiety	2.91	.99
Test and class Anxiety	3.16	.90
Fear of Asking for Help	2.75	.93
Worth of Statistics	2.86	.91
Computation Self-Concept	3.02	.84
Fear of Statistics Teachers	2.89	.93
Verbal Immediacy	2.91	.86
Non-Verbal Immediacy	2.68	.98
Average Mean/Standard Deviation	2.89	.91

Fieldwork (2021)

For a better understanding and clarity of the outcomes, data were gathered in two rounds to address research question one. Phase one was a questionnaire answered by respondents while phase two was an oral interview with some of the respondents to further express their views on the answers given in the questionnaire.

Questionnaire

The questionnaire aimed at eliciting postgraduate students' responses that showed their level of anxiety in statistics. Clear instructions were given to ensure understanding and clarity of the questions. Their responses were collated, sorted and put under subscales that were analysed and reported as follows:

Interpretation Anxiety

The majority of the respondents indicated that they had mild interpretation anxiety in statistics (M= 2.91, SD= .99). That is to say that the postgraduate students believe they felt anxious when interpreting the meaning of an output generated from

analyses and were anxious whenever they had to determine whether to reject or retain a null hypothesis. As a result, trying to decide which analysis was appropriate for a given dataset was a headache for them as it can been seen from Table 7.

Test and class Anxiety

On the whole, the results from the responses of the postgraduate students showed that they had a mild level of test and class anxiety in statistics (M= 3.16, SD= .90). The postgraduate students appeared to be relaxed in going to the classroom to take a statistics test, hence they did not find it that stressful to go over a quiz immediately after taking that test. The respondents' mild level of test and class anxiety also implies that they were slightly uncomfortable when they found that other students in the class got different answers than they did to a statistical problem.

Fear of statistics teachers

A large number of the respondents believed the level at which they feared their statistics teachers was mild (M= 2.89, SD= .93). It means they were slightly tensed whenever they saw their statistics lecturers and did not feel much tension any time their statistics lecturers used terminology they did not understand. Also, this implies that the respondents were less likely to have felt anxious even if their statistics lecturers appeared not interested in the postgraduate students' learning in the statistics class.

Fear of Asking for Help

Even though the anxiety level at which the students feared their statistics teachers was mild, it might in a way affected how they sought assistance in situations when

they encountered difficulties with their learning. It appears that was why most of the postgraduate students pointed out that they slightly feared asking for help regarding statistics lessons (M = 2.75, SD = .93). This means that the respondents were not much tensed in asking their statistics lecturers for help in understanding a concept. As a result, the students were more likely to have felt comfortable asking their colleagues for help in understanding a concept in statistics. Also, they felt comfortable seeking explanations for statistical printouts in class.

Worth of Statistics

Concerning the worth of statistics, most of the respondents indicated mild anxiety regarding the need to study statistics in class (M = 2.86, SD = .91). The implication is that the postgraduate students found their lives on campus comfortable because the statistics requirement was not removed from their academic programme, and learning statistics posed less stress to them. Therefore, the respondents saw the need to do statistics in class.

Computation self-concept

Furthermore, the respondents' anxiety level for computation self-concept was mild (M = 3.02, SD = .84). This implies that even though the postgraduate students might have felt a bit anxious during lectures, most of them were not much worried in the statistics class because of their mathematics background. That is, they might have not struggled to understand SHS mathematics so the idea of doing postgraduate statistics did not worry them that much.

Verbal Immediacy

The results in Table 7 show that the respondents' anxiety level for verbal immediacy was mild (M = 2.91, SD = .86). That is, they were less anxious as to whether or not their statistics lecturers created a relaxing learning environment for them. Also, it means that the postgraduate students were not much worried/concerned whenever their statistics lecturers called them unaware to answer questions in class. The respondents further pointed out that their statistics lecturers were receptive to different viewpoints, so they were able to share their views. Due to this, most of the respondents revealed they were glad that their statistics lecturers were ever ready to assist them whenever they asked questions in class.

Non-Verbal Immediacy

The respondents' level of anxiety towards non-verbal immediacy was found to be mild (M = 2.68, SD = .98). This means that even though the statistics lecturers gestured a lot in class, the postgraduate students were not so much bordered about it. Moreover, statistics lecturers' movement in the classroom while teaching did not make the students worried much.

Generally, the postgraduate students' level of anxiety in statistics was found to be low. This is evident in their mean of means and standard deviations (Grand Mean = 2.91, Grand SD = .91).

What factors contribute to students' reported anxiety in statistics?

Research Question Two was formulated to determine the significant factors that contribute to students' reported anxiety in statistics. This was meant to provide

teacher educators with areas to focus on in reducing students' anxiety in statistics, thereby improving their desire for Statistics as well as enhancing their performance in Statistics. In achieving this objective, the PCA was conducted to determine the principal factors that influence postgraduate students' Statistics anxiety.

According to Yong and Pearce (2013), a KMO value greater than 0.5 and a significant threshold for Barlett's test less than 0.05 indicate that the data exhibit a significant correlation. To identify the factors of postgraduate students' Statistics anxiety, the PCA was run with an item loading cut-off point of .5 with a Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy of .927, and Bartlett's Test of Sphericity, χ^2 (df = 465) = 2281.356, $p < .001$), which shows that the test was significant, thus passing and validating the needed test of assumption for PCA. The results are presented in Table 8.

Table 8: Determinants of Postgraduate Students' Reported Anxiety in Statistics

Component	Initial Eigenvalues			Prcntyle
	Total	% of Variance	Cumulative %	
Interpretation and Text Anxiety	13.183	42.525	42.525	.288618
Fear of Asking for Help	1.691	5.456	47.981	.194370
Fear of Statistics Teachers	1.313	4.235	52.216	.140563
Computation Self-Concept	1.160	3.741	55.957	.085875
Worth of Statistics	1.012	3.264	59.220	.037817
	.018			.024516
	.014			.018942

Note: KMO = .927; Approximate Chi-square = 2281.356; *df* = 465, $p < .001$
Field survey (2021)

As may be observed from Table 8, five factors, which represents 59.2% were extracted through the varimax method of rotation. The components are interpretation and text anxiety, fear of asking for help, fear of Statistics teachers, computation self-concept and worth of Statistics anxiety.

As can be seen in Table 8, the factors which explained much variance in postgraduate students' Statistics anxiety is interpretation and text anxiety (42.52%). This determinant appears to be dominant among all the determinants and seems to pose the greatest problem to postgraduate students' Statistics anxiety. Fear of asking for help (5.46%) and fear of Statistics teachers (4.24%) add up to interpretation and text anxiety to compound students' Statistics anxiety (52.22%). The least determinant is the worth of statistics anxiety (3.26%). From the results in parallel analysis, it can be seen that the factors retained earlier in the PCA (that is, Interpretation and Test Anxiety, Fear of Asking for Help, Fear of Statistics Teachers, Computation Self-Concept, and Worth of Statistics) were the same factors retained with Interpretation and Test anxiety recording a prcntyle of (.288618), Fear of Asking for Help (.194370), Fear of Statistics Teachers (.140563), Computation Self-Concept (.085875), and Worth of Statistics (.037817).

Comparing results from the totals of PCA and prcntyle of Parallel Analysis, it can be observed that the first five factors retained in PCA had values greater than the same first five factors retained by Parallel Analysis. The rest of the factors in PCA were less than the same factors left in Parallel Analysis distinguishing between meaningful and trivial factors. This comes as a confirmation of the retained factors in PCA by the Parallel Analysis.

Upon examining the scree plot, Figure 2, a distinct break is evident following the first principal component. This break suggests that the most significant factor contributing to postgraduate students' statistics anxiety is interpretation and text anxiety. The graphical representation highlights that these elements play a crucial role in shaping the level of anxiety experienced by postgraduate students when engaging with statistical concepts and methodologies in their academic pursuits.

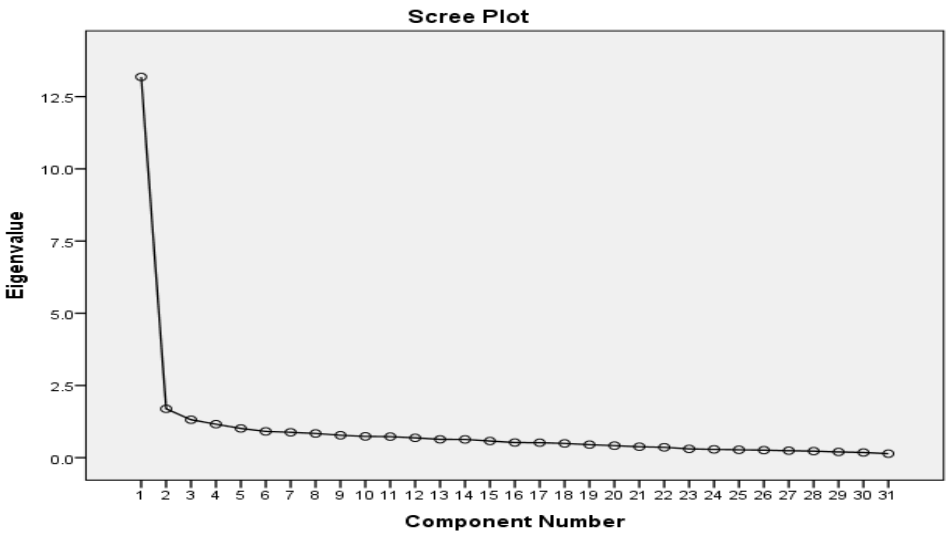

Figure 2: scree plot

Normality Test

The test for normality is essential in determining whether to use parametric or non-parametric statistics in analysing the hypotheses formulated for the study. According to Field (2018), the Kolmogorov-Smirnov and Shapiro-Wilk tests are robust approaches for testing for normality in a distribution. The author indicated that when the probability index (p-value) is less than .05, the distribution being

tested for normality is not normal; when it is above .05, the variable is normal. Table 9 presents the normality results.

Table 9: Normality Results for Statistics Anxiety Variables

	Kolmogorov-Smirnov			Shapiro-Wilk		
Anxiety	Statistic	Df	Sig.	Statistic	Df	Sig.
Interpretation	.099	151	.001	.979	151	.023
Test and Class	.099	151	.001	.979	151	.020
Fear of Asking for Help	.123	151	.000	.978	151	.016
Worth of Statistics	.106	151	.000	.970	151	.002
Computation Self-concept	.101	151	.001	.966	151	.001
Fear of Statistics Teachers	.120	151	.000	.972	151	.004
Verbal immediacy	.113	151	.000	.960	151	.000
Non-Verbal	.176	151	.000	.949	151	.000

Source: Field survey (2021)

It can be observed from Table 9 that the significant values indicated by both Kolmogorov-Smirnov and Shapiro-Wilk are all below .05 for Interpretation, Test and Class, Fear of Asking for Help, Worth of Statistics, Computation Self-concept, Fear of Statistics Teachers, Verbal immediacy and Non-Verbal anxieties which formed the overall construct (Statistics test anxiety). The significant value for the overall construct is also below the .05 level of significance. Hence, it is concluded that data gathered on the variables are not normally distributed. Therefore, non-parametric statistics (Mann-Whitney U-test and Kruskal Wallis H-test) were used in analysing the formulated null hypotheses.

Thus, the data was analysed through the Mann-Whitney U-test to determine if the sex of the respondent contributed to their anxiety in statistics (hypothesis one) and also through the Kruskal Wallis H-test to determine the difference between

respondent level anxiety in statistics and their programme of study (hypothesis two).

Hypotheses

H_0: *There is no statistically significant difference in postgraduate students' level of anxiety in statistics based on sex.*

The essence of this hypothesis was to determine if the sex of the postgraduate students contributed to their anxiety in statistics. Hence, the data gathered was analysed through the Mann-Whitney U-test due to the failure to meet the normality assumption. Table 10 displays the results that were acquired.

Table 10: Mann-Whitney Results for Anxiety in Statistics and Sex

Anxiety	Sex	Median	IQR	Mean Rank	U	Z	*P*
Interpretation	Male	2.75	1.00	71.14	2441.00	-1.479	.139
	Female	3.00	1.00	81.63			
Test and Class	Male	3.00	.80	68.74	2247.00	-2.207	.027*
	Female	3.20	1.00	84.40			
Fear of Asking for Help	Male	2.50	.75	66.99	2105.50	-2.742	.006*
	Female	3.00	1.00	86.42			
Worth of Statistics	Male	3.00	1.00	76.51	2793.50	-.157	.875
	Female	3.00	1.00	75.41			
Computation Self-concept	Male	3.00	.88	71.20	2446.50	-1.464	.143
	Female	3.00	1.00	81.55			
Fear of Statistics	Male	2.67	1.00	66.90	2098.00	-2.779	.005*
Teachers	Female	3.33	1.00	86.53			
Verbal immediacy	Male	2.83	.67	72.11	2520.00	-1.182	.237
	Female	3.00	.80	80.50			
Non-Verbal immediacy	Male	2.50	1.00	68.17	2201.00	-2.416	.016*
	Female	3.00	1.00	85.06			
General statistics anxiety	Male	2.81	.52	68.07	2193.00	-2.396	.017*
	Female	3.00	.63	85.17			

Source: Fieldwork (2021)

The findings indicate a statistically significant distinction between the male (Median = 2.81, IQR = .52, MR = 68.07) and female (Median = 3.00, IQR = .63, MR = 85.17) students' anxiety in Statistics; U = 2193.00, Z = -2.396, *p* = .017 (2-tailed). Therefore, the null hypothesis that *there is no statistically significant difference in postgraduate students' level of anxiety in statistics based on sex* was rejected. This means that the anxiety of the female postgraduate students was higher than their male counterparts. The anxiety in Statistics construct is a multi-dimensional construct (Interpretation, Test and Class, Fear of Asking for Help, Worth of Statistics, Computation Self-concept, Fear of Statistics Teachers, Verbal immediacy and Non-Verbal immediacy), hence differences were examined on their specific sub-construct to determine the exact sub-component that resulted in the differences between the male and the female graduate students.

Significant results were obtained on four of the components of Statistics anxiety: test and class, fear of asking for help, fear of statistics teachers, and Non-verbal immediacy. For the test and class anxiety, the results show that the female postgraduate students (Median = 3.20, IQR = 1.00, MR = 84.40) had higher anxiety than their male counterparts (Median = 3.00, IQR = .80, MR = 68.74); U = 2247.00, Z = -2.207, *p* = .027 (2-tailed). Similar findings were found on fear of statistics, U = 2098.00, Z = -2.779, *p* = .005 (2-tailed) and non-verbal immediacy, U = 2201.00, Z = -2.416, *p* = .016 (2-tailed). These specific test anxiety factors contributed to the overall significance obtained in statistics anxiety construct.

The second hypothesis was to determine if the programmes of study of the postgraduate students contributed to their anxiety in statistics

H_0: *There is no statistically significant difference in postgraduate students' level of anxiety in statistics based on a programme of study.*

This was to assist in the selection of pedagogical approaches in instructing knowledge in Statistics to postgraduate students. Hence, the data gathered was analysed through the Kruskal Wallis H-test at a significance level of .05. The results obtained are presented in Table 11.

Table 11: Kruskal Wallis H-test Results for Anxiety in Statistics and Programme of Study

Anxiety	χ^2	*Df*	*P*
Interpretation	3.181	6	.786
Test and Class	8.385	6	.211
Fear of Asking for Help	15.116	6	.019*
Worth of Statistics	9.765	6	.135
Computation Self-concept	7.891	6	.246
Fear of Statistics Teachers	8.231	6	.222
Verbal immediacy	16.381	6	.012*
Non-Verbal immediacy	18.935	6	.004*
General statistics anxiety	13.560	6	.035*

Source: Fieldwork (2021)

The findings illustrate that the students' anxiety in statistics based on their programme of study is statistically significant, χ^2 (6) = 13.560, p = .035. Therefore, the hypothesis that *there is no statistically significant difference in postgraduate students' level of anxiety in statistics based on the programme of study* was rejected. Specifically, significant results were obtained for Fear of Asking for Help, χ^2 (6) = 15.116, p = .019; Verbal immediacy, χ^2 (6) = 16.381, p = .012; and Non-Verbal immediacy, χ^2 (6) = 13.560, p = .035. To determine where the differences lie, a pairwise comparison was run. The findings are shown in Table 12.

Table 12: Pairwise Comparisons of Statistics Anxiety Based on Programme of Study

Anxiety	Groups	MR Comparison	Test Statistic	Adj. Sig
Fear of Asking for Help	Acc. Edu.- Mgt. Edu.	62.33 < 105.63	43.292	.039
	Math Edu.- Mgt Edu.	64.03 < 105.63	41.595	.033
Verbal Immediacy	Acc. Edu.- Mgt Edu.	60.77 < 103.94	43.167	.041
Non-Verbal Immediacy	Math Edu.- Mgt. Edu.	63.94 < 114.81	50.873	.002
	Acc. Edu.- Mgt. Edu.	64.94 < 114.81	49.875	.006
	Basic Edu.-Mgt. Edu.	68.08 < 114.81	46.729	.029
	H. Econs-Mgt. Edu.	73.20 < 114.81	41.609	.040
General statistics Anxiety	Acc. Edu.- Mgt. Edu.	60.58 < 103.69	43.104	.044

Note: Mean Rank
Source: Fieldwork (2021)

Concerning fear of asking for help, the Accounting education students' (MR = 62.33) level of statistics anxiety was relatively lower than the Management education students (MR = 105.63). Also, Mathematics education students (MR = 64.03) had lower fear of asking for help anxiety as compared with Management Education students. (MR = 105.63). The Accounting education students (MR = 60.77) also showed lower statistics anxiety in Verbal immediacy than the Management education students (MR = 103.94). Concerning non-verbal immediacy, management education students (MR = 114.81) experienced higher

anxiety than mathematics (MR = 63.94), Accounting (MR = 64.94), Basic (MR = 68.08) and Home Economics (MR = 73.20) education students.

Except for the management programme, no significant results were obtained among the other programmes considered in the study. It appears that management education students experienced much anxiety in statistics. This was in the area of fear of asking for help, verbal immediacy and non-verbal immediacy.

Follow-up Explanations of Postgraduate MPhil Statistics Anxiety

The study's quantitative phase was followed by a qualitative phase that provided further details and context for the postgraduate MPhil students' mild degree of statistical concern. Twelve participants, with the following characteristics, participated in a follow-up focus group discussion to carry this out.

Features of participants

Extreme Case Sampling was used to choose the twelve participants. As a result, they were considered appropriate extreme examples in the dataset to account for the mild degree of anxiety in statistics that postgraduate MPhil students reported experiencing during the survey. These participants used fictitious names Fran, Gigi, Wala, Race, Kiku, Prof, Fond, King, Ako, Dot, Del, and Roi. Table 13 presents the features of the participants.

Table 13: Features of Participants

Participants	Sex	Statistics Anxiety level
Fran	Male	HA
Gigi	Male	MiA
Wala	Male	MoA

Race	Male	MA
Kiku	Male	MiA

Table 13: Continue

Participants	Sex	Statistics Anxiety level
Prof	Male	MiA
Fond	Male	MoA
King	Male	NA
Ako	Female	HA
Dot	Female	MiA
Del	Female	HA
Roi	Female	MiA

Note: NA = No Anxiety; MA = Minimal Anxiety; MiA = Mild Anxiety; MoA = Moderate Anxiety; HA = High Anxiety.

Source: Fieldwork (2019)

Some of the respondents seemed to have experienced statistics anxiety on a high level while one person, King indicated he experienced no form of anxiety in statistics. Apart from Race who reported that he experienced minimal anxiety in statistics, two participants also indicated that their anxiety was moderate. Gigi, Kiku, Prof, Dot and Roi also indicated that though they experienced statistics anxiety, it was mild.

Views of Postgraduate MPhil students on Anxiety in statistics.

In a focus group discussion, the participants (Postgraduate MPhil Students) provided their views on their sources of anxiety in statistics. This provided an explanation for their mild level of anxiety in statistics.

Sources of anxiety in statistics

As stated by the Postgraduate MPhil Students, their anxiety in statistics was influenced by several sources. These are programme of study, Sex, Worth of the course, Teacher approach and use of immediacies and Availability of needed resources. The following sub–themes describe postgraduate MPhil students' sources of anxiety in statistics.

Sex

The Postgraduate MPhil Students acknowledged the fact that one's sex has something to do with his/her anxiety in statistics. This is to say that being a male or female pursuing statistics as a course can generate a form of anxiety. This was summarised by some of them as quoted below.

No, I did not experience any form of anxiety in statistics. And this is because I did not choose my programme of study because I am a male or female but because of my interest (King). It was basically because I love the programme knowing it has statistics as a major component. My sex actually did not influence my experiencing anxiety or not in statistics.

Though I am a male, I still experience some form of anxiety in statistics. I will therefore say that my sex had some form of influence on my statistics anxiety (Kiku).

Yes, I experienced a high level of anxiety in statistics and I personally think it is because I am female because some courses to me, are for men only because they are mathematics-related (Del).

This appears to suggest that a person's physical status as a male or female influences his/her level of anxiety in statistics.

Programme of Study

The programme of study as indicated by participants of the focus group discussion seems to have some sort of influence on their level of anxiety in statistics. As some indicated that its influence is positive in terms of making them feel less anxious because of the nature of their programmes (more calculations), others indicated the influence is not all that positive. Here are the remarks made by a participant.

I experienced some sort of anxiety in statistics though minimal and that is because my programme of study is already more of calculations and so I considered statistics as such. After all, statistics is a branch of mathematics which is full of calculations and so per my background, the anxiety level I experienced was quite minimal (Race).

Roi also had this to say,

I expected to do courses which were solely related to my programme until I was made to understand that statistics was part of my programme and that was because of the research aspect of the MPhil programmes. It actually made me anxious upon hearing about that but I had no option than to take that course which was a major part of my programme.

This seems to confirm the influence a programme of study has on one's level of anxiety experienced in statistics. It could be none, minimal, mild, moderate or even high depending on who is pursuing which programme.

Worth of the statistics course

The postgraduate MPhil students reported the importance of the worth of statistics with regard to their level of anxiety in statistics. It was made known that how important or not something is to a person may affect its acceptance. Some noted that statistics, as a major part of their research works alone, makes them less confident in pursuing it, hence making them highly anxious. Others indicated that statistics is more practically applicable to real-life situations than it is for academic purposes (that is, worth more than just for academic work), hence, making them more confident in pursuing it. This in turn makes them feel not anxious or less anxious dealing with statistics. Here are some of their comments,

I actually see statistics to be applicable in real-life situations other than for academic purposes only, hence, learning statistics is very relevant to me (Gigi).

For me, I think I value statistics so much knowing its worth to my research study and also with my mathematics background. I love to delve more into mathematics-related courses. (Prof)

Left to me alone, statistics as a course will be out of some programmes like mine. I am saying this because I don't see a significant need for statistics in my area. Statistics has nothing to do with my area yet because of the research nature I am to offer it as part of my programme at all costs. It actually makes me feel uneasy but what can I do than to do it like that. (Ako)

This creates the impression that how relevant or not statistics is to a student may cause some form of anxiety. However, the importance of the course to a student may also attract no form of anxiety.

Teacher approach and use of immediacies

Approaches and immediacies used by statistics lecturers as indicated by the participants are also a big contributing factor to their levels of anxiety in statistics. They opined that these immediacies (be it verbal or non-verbal) either positively or negatively affect their reception of lecturers and the courses they present. Thus, immediacies employed by statistics lecturers may sprout, reduce or clear off forms of anxieties related to statistics. One of the participants had this to say.

The strictly business nature or style of my statistics lecturer made it difficult for me to actually fall in love with statistics as a course though it could have been the case. For my statistics lecturer, until he brings up issues for interaction, you really do not see reasons to or even get the opportunity to do so. And this actually makes it difficult for me to want to ask for clarifications (Fran).

Dot, a participant, also had this to say,

For me, it is much easier to consult my colleagues than my lecturer. This is so because my lecturer seems almost always busy making it look like he wouldn't be available for issues of such nature. Most times in class he uses only the board for his presentations and that's all. Nothing like going around the class to supervise our work and also to help where necessary.

My statistics lecturer's approach helped me to be in a position to search for information on my own. It was actually good for my level as a postgraduate student.

Also, my statistics lecturer's strict appearance in a way helped me and others to be serious with the course. For him, though strict, he created a friendly environment for effective studies, going around to check if we were doing the right things in the laboratory. (Fond)

From their submissions, it can clearly be said that the actions and inactions of statistics lecturers have a way of influencing the students' experiences with regard to the course. That is to say that, the immediacies used by teachers of statistics influences the existence and level of anxiety students experience in statistics.

Availability of needed resources

When participants were asked about what can be done to make statistics more enjoyable to them, they made it clear that the inadequate essential resources that aid in the better understanding of the course should be checked and worked on. They had the following to say;

A student to a computer of r statistics class will enable us all to practice what is been taught, hence, faulty machines at the ICT lab should be fixed or replaced. (Wala).

If possible, a lecture hall for statistics should be the ICT lab or better still, should be well furnished with enough access to electricity for students to use their PCs for better access. This will help the teaching and learning of the statistics course to be more practical and engaging. (Ako)

More lecturers should be employed to reduce the workload of the existing ones which will in turn allow them to attend to the needs of the students (Roi)

The numbers for a statistics class should be sizeable in order for each student to get enough attention from the lecturer. (Kiku)

Gigi was of the view that the duration for studying statistics courses should be extended if possible, to cover the time for thesis writing. He said it will help them to practice what they learn to make it a little easier than it is now.

The participants drew clear attention to available and adequate needed resources in order to reduce drastically their anxiety in statics or better still take their anxiety away completely.

Summary of Postgraduate MPhil Students' Sources of anxiety in statistics

The anxiety of postgraduate MPhil students in statistics was influenced by multiple factors. The sources of anxiety for postgraduate MPhil students in statistics are summarised in Figure 3.

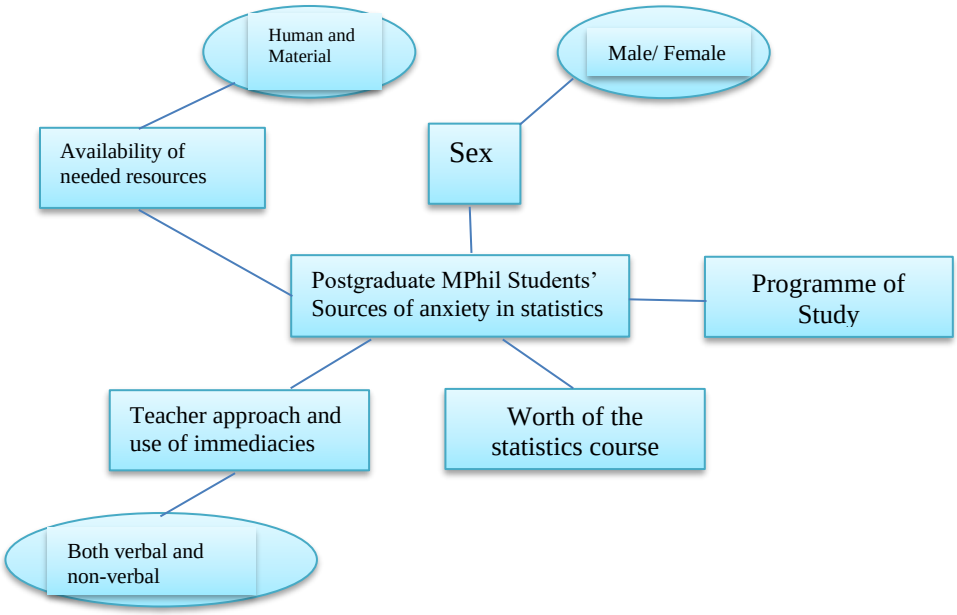

Figure 3: Sources of Postgraduate MPhil Students' anxiety in Statistics

Source: Empirical evidence from Postgraduate MPhil Education Students (2019/2020 academic year)

Discussion for Research Question One

This research which considered the statistical experiences of postgraduate MPhil students sought to find out the level of their anxiety in statistics if there exists any. This was necessitated by anecdotal evidence gathered from postgraduate MPhil students about their anxiety experiences in statistics after they offered the course. Statistics which is a major part of the postgraduate MPhil programmes in literature has been identified as a contributing factor to students' finishing ability. As a result, the first research question was: What is the level of Postgraduate MPhil Students' anxiety in statistics?

The quantitative data acquired showed that the Postgraduate MPhil Students were mildly anxious in terms of interpretation, test and class, fear of statistics teachers, fear of asking for help, worth of statistics, computation self-concept, verbal immediacy and non-verbal immediacies in statistics. Thus, the postgraduate MPhil students' level of anxiety in statistics was found to be mild. This means that though they experienced some form of anxiety in statistics it was not much of a bother. The intensity was low. This means that their anxiety about statistics was not going to stop them from finishing their programmes. This mild level of statistics anxiety of these postgraduate MPhil students was a result of influences from sex (Baloglu, 2003; Benson, 1989, Hsiao & Chiang, 2011; Mji, 2009; Zeidner, 1991), programme of study (North & Zewotir, 2006; Koh & Zawi, 2014), worth of the

statistics course (Anamuah-Mensah, et al., 2014, teacher immediacies (Tonsing, 2017; Williams, 2010), and availability of needed resources (Clark, et al., 2009)

This also tends to agree with North and Zewotir, (2006) on the fact that statistics anxiety in forms such as interpretation, tests and class, fear of statistics teachers, fear of asking for help, and statistics worth are some of the causes of behavioural and social scientists' failure in statistics courses hence needs attention for a positive discourse

Discussion for Research Question Two

Looking at the level of statistics anxiety exhibited by the postgraduate MPhil students, it was necessary or prudent to find out what factors contributed to it, hence, the question: What factors contributed to students' reported anxiety in statistics? It was seen or revealed from the quantitative results that interpretation and test and class anxiety, fear of asking for help, fear of statistics teachers, computation self-concept and worth of statistics anxiety were the determinants which explained much variance in postgraduate MPhil students' statistics anxiety.

This was further explained in the qualitative results by the postgraduate MPhil students that their sex (male/female), programme choice, worth of statistics to them, immediacies employed by statistics teachers and the availability of needed resources were the major factors that contributed to their reported level of anxiety in statistics. This explains why needed resources both human and material should be made available to arouse the interest of these students in the course thereby reducing their anxieties. Again, immediacies employed by statistics teachers both verbal and non-verbal should be looked at carefully since it tends bringing close or

moving away postgraduate MPhil students from statistics as a course thereby increasing or decreasing their anxiety (Coghlan & Brannicq, 2003).

Discussion for Hypothesis One

The research aimed to ascertain if the level of anxiety in statistics of the participants was based on their sex, hence a null hypothesis: $H_{0:}$ *There is no statistically significant difference in postgraduate students' level of anxiety in statistics based on sex* was tested. The result contributes to researches that have indicated that female students have higher levels of anxiety in statistics as compared to their male colleagues (Baloglu, 2003; Benson, 1989; Mji, 2009; Zeidner, 1991). This means that postgraduate students' level of anxiety in statistics is somehow based on or influenced by their sex. It also contradicts the assertion made by Mandap (2016) that female students rather have lower levels of anxiety in statistics as compared to male students and also Hsiao & Chiang (as cited in Eduljee & LeBourdais, 2015) indicating that students' anxiety in statistics has nothing to do with their sex. Thus, a student's level of anxiety in statistics has something to do with sex and males have lower levels as compared to females in statistics anxiety.

Discussion for Hypothesis Two

In order to find out if the level anxiety in statistics of postgraduate MPhil students was based on a programme they pursued, this study considered the null hypothesis: H_0*: There is no statistically significant difference in postgraduate students' level of anxiety in statistics based on the programme of study*. The result of this hypothesis also confirms researches that have indicated that students' anxiety in statistics has got something to do with their academic background or the programme they pursue

(North & Zewotir, 2006; Koh & Zawi, 2014; Onwuegbuzie & Wilson, 2003). Koh and Zawi and Onwuegbuzie and Wilson (as stated in Faber, *et al*, 2018) indicated specifically that students from a social sciences background seem to have higher levels of anxiety in statistics because they have less experience with numbers. This can be seen in the management education students experiencing much anxiety in statistics in the areas of fear of asking for help, verbal immediacy and non-verbal immediacy and the existence of statistics anxiety among all the students in general.

Chapter Summary

This chapter highlighted the findings of the study. The study revealed that though statistics form a major part of research study, postgraduate MPhil students in the university concerned experienced statistics anxiety. Their level of anxiety in statistics was found to be mostly mild, calling for attention to reduce it further or possibly eradicate it. It was also found that their anxiety level centred mostly around interpretation, test and class, fear of statistics teacher and fear of asking for help anxieties. The programmes the students pursue, their sex, how worthy statistics is to them, availability of needed resources and teacher immediacies were found to be contributing to their mild level of anxiety in statistics.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents the summary of the key findings resulting from the analysis of the data, the conclusions drawn from the analysis and the recommendations from the current study for future research work.

Summary

The main purpose of the study was to investigate postgraduate students' levels of anxiety to positively influence instructional discourse in statistics and also to consider if these anxiety levels are based on student's sex or the programme he or she pursues. The study was guided by the formulation of two research questions and two hypotheses. The primary research objective was the focus of the two research questions, and the two particular research objectives were the focus of the two hypotheses.

The research made use of an explanatory sequential mixed methods strategy. The reason why the study considered this design was that either quantitative or qualitative approaches would be inadequate to exhaustively answer the two research questions and to test the two hypotheses. For a better explanation, interpretation and reporting on the level of postgraduate students' anxiety in statistics, this mixed method design that capitalises on the advantages of both quantitative and qualitative designs was used.

A purposive sampling approach was used to select seven programmes whose members are fifteen (15) or more. This was to ensure enough representation

of programmes in the study. Aiming to ensure that the population was representative enough to meet the study's objectives, the Census method was also employed for data collecting, keeping in mind that there were not enough respondents in these seven programmes. In all, 151 students from the MPhil Accounting Education programme (24), MPhil Art Education programme (16), MPhil Home Economics Education programme (27), MPhil Basic Education programmes (18), MPhil Management Education programme (16), MPhil Clinical Health Psychology Education programme (17) and MPhil Mathematics Education programme (33) were used for the study. For data collection instruments, an adapted questionnaire from the STARS questionnaire developed by Cruise, Cash and Bolton (1985) and the Instructor Immediacy Scale questionnaire by Wilson (2006) were used to collect the quantitative data while a focus group discussion guide developed by the researcher after the quantitative data was collected and analysed was used to collect the qualitative data.

The thirty-one (31) adapted questionnaire items were measured on a 5 – point Likert-Scale with 1 indicating no anxiety, 2 minimal anxiety, 3 mild anxiety, 4 moderate anxiety and 5 high anxiety were processed and analysed with the SPSS programme. Descriptive statistics such as frequencies and percentages and mean scores and standard deviations were used to describe postgraduate students' anxiety levels in statistics. Principal Component Analysis (PCA) was done to identify factors contributing to postgraduate students' reported anxiety in statistics and the results were confirmed by a parallel analysis. Mann-Whitney U-test was employed

to determine whether the sex of the postgraduate students affected the amount of anxiety they experienced in statistics.

Lastly, Kruskal Wallis H-test was employed to determine whether the anxiety levels of the students varied according to the programme they chose to follow.

Findings

1. Postgraduate MPhil students of the university concerned experienced anxiety in statistics though it forms a major part of their research studies.
2. Their level of anxiety in statistics is mostly mild and, considering teacher immediacy and making statistics courses as practical as possible may lead to a reduced or no anxiety in statistics by postgraduate MPhil students in that university.
3. i) The level of anxiety of postgraduate MPhil students in the university concerned was related to the sex of the student.

   ii) The level of anxiety of postgraduate MPhil students of the university concerned was related to the programme they pursued. That is, one's level of statistics anxiety appeared to be dependent on the programme being pursued.

Conclusion

1. Statistics anxiety exists among postgraduate MPhil students of the university. This finding serves as a confirmation of existing works of literature pointing in the same direction.

2. Though statistics anxiety exists among postgraduate MPhil students, their level of anxiety is mostly mild.
3. Sex and a programme a student reads have some form of influence in determining a postgraduate MPhil student's level of statistics anxiety.

Recommendation

The following recommendations are given in light of the study's findings for postgraduate MPhil students, teachers of statistics courses at the postgraduate level, reviewers and future researchers:

1. Teachers of statistics should employ positive immediacies such as verbal praise, recognition, tangible rewards, special opportunities, written feedbacks, etc. in the statistics classroom.
2. Students should be aware of the fact that statistics anxiety exists among postgraduate students to take precautionary measures to avoid or reduce their level of anxiety as much as possible.
3. There is also the need for counselling services on study habits and how to manage stress especially those with high levels of anxiety.

Suggestions for Further Research

This study's primary focus was on postgraduate MPhil Education students. The study aimed at investigating postgraduate students' level of anxiety in statistics. The following is advised:

1. New research targeted at non-educational Postgraduate MPhil students could be conducted to find out if findings will differ.

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APPENDICES

APPENDIX A

Questionnaire

I am a postgraduate student of the Department of Mathematics and I.C.T. Education of the University of Cape Coast pursuing an MPhil Degree in Mathematics Education. I am conducting a study on the topic, “An investigation into University of Cape Coast Postgraduate Students' Experiences in Statistics”.

This questionnaire seeks to investigate the statistical experiences of postgraduate students in this institution. Your maximum cooperation in this exercise is highly expected and welcomed. Your honest response to each of the items would go a long way to help investigate the statistics experiences of postgraduate students in this institution in order to positively influence the interaction between lecturers and students in statistics.

Kindly fill in the spaces provided below with the necessary details. (At item ‘c', tick [√] appropriately)

a. Name of department:

……

b. Programme of study:

…….

c. Sex: Male [ ] Female [ ]

Please read the following carefully and tick the box against each item based on your opinion about your level of anxiety in statistics. Each item is scored from

NA (no anxiety) to HA (high anxiety). NOTE: **NA= no anxiety, MA= minimal anxiety, MiA= mild anxiety, MoA= moderate anxiety and HA= high anxiety**

No	Items	NA	MA	MiA	MoA	HA
1.	I feel anxious when interpreting the meaning of an output generated from analyses					
2.	I feel anxious whenever I have to determine whether to reject or retain a null hypothesis					
3.	I find reading reports that include statistical analyses enjoyable					

4.	Trying to decide which analysis is appropriate for a given data set is a headache					
5.	I enjoy studying for an examination in a statistics course					
6.	The thought of taking another statistics course worries me					
7.	Going over a quiz immediately after writing is not stressful for me					
8.	I am relaxed going into the classroom to take a statistics test					
9.	Finding that another student					

	in class got a different answer than I did to a statistical problem makes me uncomfortable					
10.	I feel comfortable thinking of going to meet my statistics lecturer for further explanations					
11.	I feel tense asking my statistics lecturer for help in understanding a concept					
12.	I feel comfortable seeking for					

	explanations to statistical printouts in class					
13.	It is not comfortable for me to ask a colleague for help in understanding a concept in statistics					
14.	Learning statistics stresses me					
15.	My life on campus would have been comfortable if the statistics requirement was removed from my academic programme					

16.	I don't see the need to do statistics					
17.	I feel anxious during lectures because I am too slow in my thinking to understand statistics					
18.	I worry in the statistics class because of my mathematics background					
19.	I struggled to understand SHS mathematics so the idea of doing postgraduate statistics worries me a lot					

20.	Since I have never enjoyed mathematics I do not see how I can enjoy statistics					
21.	I feel tense whenever I see my statistics lecturer					
22.	Whenever my statistics lecturer uses a terminology I don't understand, I become anxious					
23.	My statistics lecturer appears not interested in my learning which adds to my problems in that class					

24.	My statistics lecturer creates a relaxing learning environment for me					
25.	I feel worried when my statistics lecturer calls me unaware to answer questions in class					
26.	I am happy when my statistics lecturer asked me how I feel about an assignment					
27.	I am glad my statistics lecturer is ever ready to assist me whenever I ask					
28.	My statistics lecturer is					

	receptive to different viewpoints so I am able to share my views					
29.	My statistics lecturer has discussions with me about my learning in a friendly manner					
30.	My statistics lecturer gestures a lot in class which makes me anxious					
31.	My statistics lecturer's movement in the classroom while teaching worries me					

APPENDIX B

Focus Group Discussion Guide

Interpretation Anxiety

1. Can you tell me what your favourite course is? Why?

……

……

……

2. a. Do you like statistics? Yes No

b. Is it because of a perceived innate ability or lack of it in interpreting statistical analysis?

……

……

……

Test and Class Anxiety

3. a. Does your classroom environment contribute to your study of statistics?

Yes No

b. How?

……

……

……

4. How does your preparation before and after statistics test affect you?

……

……

……

Fear of Asking for Help

5. a. Are you able to ask for further explanation from your statistics lecturers?

   Yes No

   b. If not, why?

   ……

   ……

   ……

6. Do you seek assistance from colleagues so as to understand a statistical concept?

   Yes No

   b. Why?

   ……

   ……

   ……

Worth of statistics

7. a. Do you find learning statistics relevant? Yes No

   b. Why?

   ……

   ……

   ……

Computation Self-Concept

8. a. Does your performance/background in mathematics affect your understanding of statistics? Yes No

   b. Why?

   ……

   ……

   ……

   a. Do you consider yourself to have what it takes to study statistics? Yes No

   b. Why?

   ……

   ……

   ……

Fear of Statistics lecturers

9. a. Are you able to interact with your statistics lecturer closely? Yes No

   b. Why?

   ……

   ……

   ……

10. a. Do you find your statistics lecturer friendly? Yes No

    b. Why?

    ……

    ……

……

Verbal Immediacy

11. a. Does the approach or style used by your statistics lecturer affect your learning?

Yes No

b. How does that help or not help you?

……

……

……

a. Do your statistics lecturer create an avenue for different viewpoints during learning?

Yes No

b. how does that help or not help you?

……

……

……

Non-Verbal Immediacy

12. a. Do the gestures used by your statistics lecture have an impact on you?

Yes No

b. how does that help or not help you?

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13. What can be done to make statistics more enjoyable to you?

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14. What do you suggest statistics lecturers should do to arouse the interest of the student?

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