THE RELATIONSHIP BETWEEN CLASSROOM CLIMATE, STUDENT SELF-EFFICACY AND STUDENT ACHIEVEMENT

By

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DEDICATION

This dissertation is dedicated to my beloved late mother Ankamma Ramadu and my father Devadass Francis Ramadu whose love and belief in me has guided my achievements.

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CONTENTS

ABSTRACT

This study documents students' perceptions and factors within the classroom that are perceived to impact upon the learning of mathematics. The participants of the study were first, second, third and fourth year students from four universities in South Africa namely University of Kwa-Zulu Natal, Durban University of Technology, Mangosuthu University of Technology and University of Johannesburg.

The objectives of this study are:

- To discover whether students have a decrease or increase in self-efficacy, goal mastery and strategic learning within the current classroom climate.
- To discover whether classroom climate increases or decreases self-efficacy in the current classroom environment.
- To understand the student-instructor relationship within the current classroom climate with respect to achievement in mathematics.

Quantitative methods were employed to understand the students' views about their experiences with mathematics learning and mathematics classroom environment. A questionnaire to determine the objectives based on six constructs i.e. Self-Efficacy, Mastery Goal Structure, Instructors Challenges, Instructors Care, Student' Expectations and Students' Achievement was employed to solicit students' views with regards to teaching approaches in mathematical classes. The findings revealed, that there is a correlation between Mastery Goal Structure, Instructors Care, Grade Expected and Instructor Challenge with Self-Efficacy. There was no significant correlation between Gender, Name of University and Student Achievement with Self-Efficacy.

Keywords: Self-Efficacy, Construction Studies, Classroom Climate, Quantitative Methods

CHAPTER 1: INTRODUCTION

1.1 Background

Studies have revealed that the deficiency of self--efficacy related to mathematics is a significant contributor to student's lower performance in mathematics (Peters, 2013). Building a consistent and successful self-efficacy mathematics instruction will require a classroom climate or environment created by competent instructors. This can also be possible with the involvement of students in order to address properly the development of self-efficacy in many subjects in general and in mathematics particularly as it is the case for this study. The interventions of instructors must include mastery goal structures, appropriate challenges and caring. There is a very important concept that is very central to this study which is known as self-efficacy, this is in fact linked to the confidence of the student. Self-efficacy can be defined as the capacity for a student to organize and execute courses of action that is essential to generate specific accomplishments but also it can be defined as the importance of simple desire to know (Bandura, 1997; Ross, Perkins, and Bodey, 2016). It refers to beliefs related to anything students are able to accomplish, rather than the skills they believe to possess (Bandura, 1986). Self-efficacy is positively related to deep motivation, selection of career, choice of tasks, task values, and persistence. It also plays an important role in people's lives and this happens on daily basis. Numerous and diverse variables such as student, parents and instructor's involvement can influence individual's self-efficacy, particularly in mathematics (Hackett and Betz, 1989; Kung, Hsin-Yi, and Ching-Yi Lee, 2016). The attitudes of many students can be influenced by many different aspects including the views and opinions of parents, attitudes and behaviour of peers, the type of school, lecturer, and the classroom climate (Klassen and Usher, 2010). Self-efficacy has a direct effect on persistence; this means the more persistent a student can be in a subject, the more he develops high level of confidence which is the true reflection of self-efficacy (Robbins, Allen, Casillas, Petersen and Le, 2006; Schunk, Dale and Maria , 2016). As one of the affective variables, it is used to clarify in details academic success and was found to confidently affect academic achievement (Fettahloglu et al., 2011; Komarraju and Nadler, 2013). Therefore, a high self-efficacy in any subject in general and in mathematics particularly implies that the students have reached a certain level of confidence regarding their capability to be successful in the subject. Consequently, this motivates the students to face challenges with determination and boost their ambitions of being successful (Bandura, 1986). Self-efficacy can influence the choices made by people and assess the amount of effort put into the tasks, the relevant thought patterns, and the emotional reactions (Pajares, 2002; Koutsoumari, and Antoniou, 2016). Self--efficacy in mathematics would determine the level of persistence for students when completing mathematics course work effectively (Larson, et al. 2015). There are four contributing factors to self-efficacy: firstly, the mastery experiences – experiences showing that students can complete a task successfully. Secondly, vicarious experiences based on the fact that by watching other students of similar skill completing a task successfully it makes them feel they can do the same. Thirdly , the social persuasion based on the fact that when peers or mentors encourage students doing a task that they can do it , finally the emotional states – positive thinking increases self-efficacy while too much stress lessons self--efficacy. It was reported that mastery goal structure, challenge, anxiety, student attitude and instructor care significantly influenced mathematics self--efficacy (Fast et al., 2010; Kiwanuka et al., 2016 ; Hogan, 2016). Where these were present or evident students had higher levels of mathematics self--efficacy than when they were not. Individual efficacy was found to the strongest influence to student mathematics achievement (Pina-Neves et al., 2013). Self-efficacy can be achieved within a conducive

atmosphere or environment which is the classroom. It is therefore important to analyse this concept which is also a key aspect when it comes to success of students in many subjects generally but more specially in mathematics. Classroom climate was defined by Bierman (2011) as the classroom environment, the social climate, the emotional, and the physical aspect of the classroom. Patrick, Kaplan and Ryan (2011) have described it as a learning environment. The relationships student-instructor are therefore very important because if there is effective communication between the instructor and the students the success of students in mathematics or any particular subject can be a less painful process. The instructor has an obligation to create a favourable climate in the classroom through goal-setting strategy in order to stimulate the student success process. This implies that the type of climate created in the classroom by the instructor through goal--setting, appropriate challenges and empathy for the students is likely to contribute positively to student achievement which should be one of the ultimate aims for the instructor. Student efficacy or confidence is the perceived as the student capability for a specific task or subject such as mathematics as mentioned earlier. There is a strong possibility for instructors to influence student self-efficacy with the created classroom climate. This is possible by the fact instructors are seen by students as the source of knowledge, example of achievement and inspiration and raw model. Therefore, instructor interactions with students are vital to the perceptions of students. Perhaps, instructors need to be cautious to avoid making mathematics more difficult and stressful for students. It is suggested to boost their confidence and self-efficacy in mathematics than generating fear and phobia of mathematics.

1.2 Problem Statement

Traditional didactic teaching methods are commonly used in the teaching of mathematics to tertiary education students, without taking into consideration the effects of classroom climate on learners' self-efficacy and mathematical anxiety when being taught in this didactic manner.

1.3 Research Question

The study will address the following main question: Is it possible to enhance construction and engineering student's achievement in mathematics through improving the classroom climate, developing the instructor caring skills, establishing an effective mastery goal structure, despite the challenges related to mathematical fear and anxiety developed by many students?

1.4 Research Approach

This study will follow a quantitative research design with a post-modern ontology perspective. Will be conducted in four South African universities in the discipline of Construction studies.

They will be surveyed about their views and experiences of the mathematics classes. The data will be collected via a quantitative questionnaire survey comprising of a section containing 16 statements and information about four constructs, namely mastery goal structure, instructor challenge, instructor care and self--efficacy based on Fast's 2010 study with each construct comprising of four statements (Fast et al., 2010; Skaalvik and Skaalvik, 2013). Ethical considerations will be taken into account at all times, each of the statements required a scaled response of agreement. Descriptive statistics will be derived using SPSS v23 and presented including measures of central tendency and dispersion. The internal validity of scaled responses will be determined by the Cronbach's alpha co--efficient for validity.

1.5 Method and Sample Profile

The sample is made up of students in first , second , third and fourth year from the Construction studies registered at Mangosuthu University of Technology (MUT) in Umlazi, Durban University of Technology (DUT) in Durban, and University of Kwa-Zulu- Natal (UKZN), in Durban in the Kwa-Zulu Natal province; and University of Johannesburg (UJ) in Johannesburg in the Gauteng Province,

1.6 Hypotheses:

- The Classroom Climate comprising of mastery goal structure, instructors challenge and instructors care has a major effect on a students' self-efficacy when being taught mathematics in Construction Studies at the 4 universities (MUT, UKZN, UJ and DUT) {H1}
- There is a correlational relationship between student self-efficacy, student achievement, and grade expected in the course of Mathematics at the 4 universities (MUT, UKZN, UJ, and DUT) in Construction Studies. {H2}
- There is a correlational relationship between student's self-efficacy, instructor care, grade expected, mastery goal structure, and instructors challenge.
- There is no correlational relationship between self-efficacy, name of university and gender.

1.7 Objectives of the Study

- To investigate whether students have a decrease or increase in self-efficacy, goal mastery and strategic learning within their existing classroom climate.
- To discover whether classroom climate increases or decreases self-efficacy in the current classroom environment.
- To investigate the student-instructor relationship within the current classroom climate with respect to achievement in mathematics.
- To determine interventions to improve mathematics self-efficacy.

1.8 Assumptions

In this study the key assumptions were made as follows:

- The questionnaire sufficiently addressed the problem to be assessed.
- The students in the sample were competent to answer the questions in the instrument.
- The questionnaire communicated to the students in English was easily understood by the respondents, who primarily do not have high levels of English Language proficiency as this may not be their mother tongue

1.9 Limitations

- The use of correlational data in this sample did not present sufficient evidence of causality in addressing the research problem and answering the hypotheses.
- The research instrument was presented in English, and the rigor of answers might have been limited by students who do not proficiently speak, read and write English.
- The sample is homogenous with respect to bio-demographics. (More males than females as respondents', wide age range of respondents, high percentage of Black South Africa students as respondents which does not take into account cultural limitations with respect to ideologies of self-efficacy, goal mastery and achievement expectations.
- The environment in which the respondents were tasked to answer the questions may have limited authentic answers. This environment entailed the classroom that they are actually taught the subject in, and the administrator of the instrument being their lecturer, the Head of Department and the researcher who is part of the process being investigated , introducing the element of power dynamics that would have limited answers to ones that the student believed their lecturer wanted to hear.
- A further limitation relates to the concept of self-reported data, where the respondent may be subject to memory of their classes in Mathematics, a change in perception during the answering process and once the data had been collected. The answering of the questionnaire itself may have contributed to a change in perception about issues such as self-efficacy and anxiety which applies a bias to the eventual findings as being a true reflection of the constructs.
- The instrument was not sufficient to gain a deeper, multi-layered probing of the issues that surround deeply personal constructs that are behavioural in nature such as self-confidence and anxiety. These constructs warrant a process of interviews that can give more information into the hidden issues below the surface of students' perceptions of classroom climate and self-efficacy.

1.10 Significance of the Study

This study will help to fill the gap regarding the characteristics of classrooms that can lead to high self-efficacy in mathematics. However, characteristics that lead to low self-efficacy must be analysed. Therefore, instructors will be able to choose various options or actions to be undertaken in their classroom in order to boost or stimulate mathematics self-efficacy in their students and eradicate characteristics that tend to form a lower self-efficacy. Consequently, this will lead to the improvement of interest in mathematics by engineering and construction students.

1.11 Study Outline

This study is organized into five chapters:

Chapter 1 includes a statement of the problem, purpose of the study, research questions, research hypotheses, theoretical framework, significance of the study, definitions of terms, limitations, delimitations, and assumptions. **Chapter 2** includes related literature regarding self-efficacy and classroom environment in mathematics and constraints related to the previous ones. **Chapter 3** is a discussion of the research methodology. **Chapter 4** deals with the analysis of the data in details .**Chapter 5** focuses on the discussion of the findings and their implication regarding the study and its applications. The conclusion will record and summarize the main findings of the study. It will suggest some recommendations for future studies. Further research on various aspects of the topic which are not developed in this current study will be suggested.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction:

The success of many students at tertiary level depends on many factors dictated by the environment which includes the student intake criteria, the students' motivation for learning, the motivation of academics, existing support systems for better learning within the institution, the financial ability of parents to afford higher education for their children, as well as the appropriate infrastructure allowing learning process to take place adequately. Albert Bandura is credited as being the father of modern behaviourism, drawing on the theory that learning is a reciprocal process and that a learner functions more efficiently in a climate that is enabling to motivation and self-efficacy (Ertmer and Newby, 1996)

The lecturer is placed in a powerful and responsible position of being a strong supportive professional who will have a lasting bearing on a person's future (Butt and Retallick, 2009; Richards and Fultz, 2017). This task is not a light one, and should be borne with expertise and professionalism (Butt and Retallick, 2009). The challenge then, is for the lecturer of mathematics to tertiary level construction students to assume an advocacy role in order to formalise his/ her occupation within a theoretical framework. This occurs by decreasing mathematical anxiety, increasing self-efficacy, and improving the classroom climate (Lin et al., 2017 ; Warwick, J., 2017) . The factors that increase self-efficacy, (Bandura, 1994), include the normative standards (beliefs and attitudes) that are strongly influenced by the societal norms within the environment. Four constructs impacting on student self-efficacy in mathematics will be analysed in the current study. These four constructs have been found in many studies to have a direct influence on students' performance and success in various aspects of learning and subjects including mathematics (Miller et al., 2017; Hogan, K.A., 2016 ; Schiefele , 2017 ; Wentzel, 2016; Taylor, 2017, Patrick et al.,2016; Vedder-Weiss, D., 2017). These four constructs are Mathematics self-efficacy, Instructor mastery goal structure, Instructor challenge and Instructor care. They will be analysed and tested in this current study in to determine the extent at which they influence student's success and performance in mathematics. This study will focus on these constructs and establish various correlations between themselves.

2.2 Self-Efficacy

Self-efficacy as defined by Bandura (1997) is ones belief about ones capabilities to learn or perform behaviours at designated levels of performance. The study of Schunk and Pajares (1996) outlines that perceived Self-Efficacy influences academic motivation, learning and achievement. The learner who has developed a greater sense of self efficacy is thus able to strategize and plan his learning efforts more effectively than one with a poorly developed sense of belief in his capabilities. Such an effective learner is also capable of dealing with personal, environmental and normative obstacles should they arise during the process of studying. He is also confident enough to recognize his own weaknesses, and seek out help when required. Bransford and Vye (1989), as outlined in Ertmer and Newby (1996) describe an expert learner as one who is realistically able to match the requirements of a study task with his/ her own personal difficulties and constraints. The lecturer can improve the self-efficacy of a learner by first understanding the link between self-efficacy and learning. The teacher needs to help the child develop a positive and realistic self-concept. In this task, the teacher must literally "change hats" and take on the role of

counsellor, by facilitating a positive concept of the child's body image, capabilities and challenges. This can be done by the teacher by including many behavioural exercises within the formal curriculum, the social learning theories of Albert Bandura emphasizing the reciprocal relationship among cognition, behavior, and environment, for which Bandura coined the term reciprocal determinism. Therefore, not only does the environment influence the thoughts and behavior- thoughts and behavior also play a role in determining the environment.

The behaviour can influence both the environment and the person. In fact each of these **three variables**, the person, the behaviour, and the environment can have an influence on each other (Bandura, 1978; Nilsson et al., 2017). Teaching and learning in the school situation has its foundations in the behaviourist traditions which focus largely on the individual learner, rather than the context or environment of the school (Herrington et al., 2014).

The educators themselves are merely viewed as conduits who attempt to fill up the blank slate that is the learner, by effecting learning through behaviour change (Rodgers, 2016). This traditional approach, viz. the Post-Positivist Approach does have its merits, in that it allows for covering the basic facts and data that form the basis for a subject.

The school environment, as well as the normative determinants that a learner finds himself in are not traditionally considered in the approach to learning. A school is seen as simply the location where-in the process of filling up the "blank slate" occurs (Hoffmann, 2016; Bergmann and Sams, 2016). With the introduction of later cognitive psychology to the process of learning, the environment became a factor. The social, economic and supportive environments of a learner play a role in the overall performance (Rottman et al., 2017; Kweon et al., 2017; Patrick et al., 2016)

Williams-Bost and Riccomini (2006) state that in order to make instruction more effective, schools need to shift their agendas to strategies that "provide opportunities to learn by maintaining a comfortable and welcoming classroom environment" as an adjunct to traditional scholastic approaches of didactic teaching. Like-wise, they outline that the negative impacts of having a sole scholastic approach include a disconnected school environment, where there is no interaction amongst all the people that are actively engaged in the school. Cohen (1993) recommends teaching in the context of the community that the learner understands and can relate to.

The traditional scholastic approach has its merits as outlined above, but negates the principles of inter-sectoral collaboration, community participation and eventual empowerment of learners and educators. Stiggins (2002) described the teaching learning process as one that is dynamic, and where learners keep learning and remain confident that they have the ability to continue to learn despite obstacles. This perseverance and self-regulatory skill is a learned skill, and is largely tied into the psycho-dynamics of self-efficacy. Thorkilsden (2005) also outlines that a learner needs to be clearly defined about what success means to them. This will drive their motivation and learning at school. The increase in self-motivation of learners will afford them the ability to take more academic risks and to take charge of their own learning rather than be passive observers in learning that can be a lifelong skill.

2.2.1 The Effects of Self-Efficacy on Learning

Pajares (1996) and Schunk (1995) outlined in their research that Self-Efficacy affects learning by affecting academic motivation, learning and achievement. A learner's belief in his capabilities to perform a task greatly influences his effort, persistence and resilience, thus improving his learning outcomes. In contrast, the authors

agree that learners who doubt their learning capabilities feel less efficacious towards a task, participate less and have more difficulties in learning the task.

2.2.1.1 Factors that develop a learner's self-efficacy

Various factors serve to develop Self-Efficacy to improve learning the significant effect of family and peer influences play an important role in learning (Schunk and Pajares, 1996). This view is commonly shared by Bandura (1994), who stresses the importance of the family/ parents as early childhood indicators of self-efficacy modelling. According to Schunk and Perjures as well as Bandura, a learner will reinforce his belief in his capabilities by Observational Learning which grounds itself when he is a baby. The circle of influence, although commenced in childhood as Bandura highlights, ever widens as a child enters larger society. The school is an important environmental factor that plays a role in self-Efficacy. As Schunk and Pajares outline: the school as opposed to the early home environment is the key area where self-efficacy is developed. This point is stressed by Rubie-Davies et al (2006) who differ from Bandura, in that they view the larger environment as a key element in improving Self-Efficacy.

2.2.1.2 The effect of the environment on Self-Efficacy

The ethnic, cultural and socio-economic constructs that bear on a learner's Self-Efficacy is highlighted by Rubie-Davies et al., (2006). This contextual factor plays a role in how a learner will view himself as he learns, as well as highlight his confidence in his abilities based on the societal norms that are imposed on him by the school environment as opposed to the "bubble" created by the home/ family as a model. A learner who at home is culturally looked at as the success of his family and having a high self-efficacy may find his self-efficacy decreased when he enters the larger environment with various different cultures and their norms and standards(Huda et al.,2017 ; Museus et al., 2017; Hechanova-Alampay et al., 2002)

2.2.1.3 Tertiary Institutions for Cultivating Cognitive Self-Efficacy

Many social factors apart from the formal instruction, such as peer modeling of cognitive skills, social comparison with the performances of other students, motivational enhancement through goals and positive incentives, and teachers' interpretations of children's successes and failures operate in ways that reflect favorably or unfavorably on their ability also affect children's judgments of their intellectual efficacy(Brown, 2014) .

The task of creating learning environments conducive to development of cognitive skills rests heavily on the talents and self-efficacy of teachers (Mahmoee and Pirkamali, 2013).

Those who are have a high sense of efficacy about their teaching capabilities can motivate their students and enhance their cognitive development (Schwarzer, 2014). Teachers who have a low sense of instructional efficacy favor a custodial orientation that relies heavily on negative sanctions to get students to study (Denisia and Juliet, 2015; Sahile, 2013.)

Instructors operate collectively within an interactive social system rather than as isolates. The belief systems of staffs create school cultures that can have vitalizing or demoralizing effects on how well schools function as a social system (Harris, 2017; Bandura, 1990). Schools in which the staff collectively judge themselves as powerless to get students to achieve academic success convey a group sense of academic futility that can pervade the entire life of the school .Schools in which staff members collectively judge themselves capable of promoting academic success imbue their schools with a positive atmosphere for development that promotes academic attainments regardless of whether they serve predominantly advantaged or disadvantaged students. (Bandura and Wessels, 1994)

Students' belief in their capabilities to master academic activities affects their aspirations, their level of interest in academic activities, and their academic accomplishments (Bandura, 1993). There are a number of school practices that, for the less talented or ill prepared, tend to convert instructional experiences into education in inefficacy. These include lock-step sequences of instruction, which lose many children along the way; ability groupings which further diminish the perceived self-efficacy of those cast in the lower ranks; and competitive practices where many are doomed to failure for the success of a relative few (Bandura and Wessels, 1994)

Classroom structures affect the development of intellectual self-efficacy, in large part, by the relative emphasis they place on social comparison versus self-comparison appraisal (Bandura and Wessels, 1994). Self- appraisals of less able students suffer most when the whole group studies the same material and teachers make frequent comparative evaluations (St Amant, 2017). Under such a monolithic structure students rank themselves according to capability with high consensus. Once established, reputations are not easily changed. In a personalized classroom structure, individualized instruction tailored to students' knowledge and skills enables all of them to expand their competencies and provides less basis for demoralizing social comparison (Sinatra et al., 2017). As a result, students are more likely to compare their rate of progress to their personal standards than to the performance of others. Self-comparison of improvement in a personalized classroom structure raises perceived capability. Cooperative learning structures, in which students work together and help one another also tend to promote more positive self-evaluations of capability and higher academic attainments than do individualistic or competitive ones (Supanc et al.,2017)

2.3 Classroom Climate

Classroom climate was defined by Bierman (2011) as the classroom environment, the social climate, the emotional, and the physical aspect of the classroom. Patrick et al., (2011) have described it as a learning environment. Classroom climate may also refer to the predominant mood, tendency, attitudes and standards that the instructor and learners sense when they are in the classroom. A negative classroom climate can feel hostile, chaotic, and out of control. A positive classroom climate has a sense of safety, respect, it is welcoming, conducive and supportive of student learning. The relationships student--instructor (lecturer) are therefore very important because if there is effective communication between the instructor and the students the success of students in mathematics or any particular subject can be a less painful process. The instructor has an obligation to create a favourable climate in the classroom through goal- setting strategy in order to stimulate the student success process. This implies that the type of climate created in the classroom by the instructor through goal--setting, appropriate challenges and empathy for the students is likely to contribute positively to student achievement which should be

one of the ultimate aims for the instructor (Spinner and Fraser, 2005; Fraser, 2007). Student efficacy or confidence is the perceived as the student capability for a specific task or subject such as mathematics as mentioned earlier. There is a strong possibility for instructors to influence student self--efficacy with the created classroom climate. This is possible by the fact instructors are seen by students as the source of knowledge, example of achievement and inspiration and raw model. Therefore, instructor interactions with students are vital to the perceptions of students. Perhaps, instructors need to be cautious to avoid making mathematics more difficult and stressful for students. It is suggested to boost their confidence and self--efficacy in mathematics than generating fear and phobia of mathematics (Bierman, 2011; Patrick et al., 2011). Figure 1-1 represents most of the aspects which are related to the concept of classroom climate.

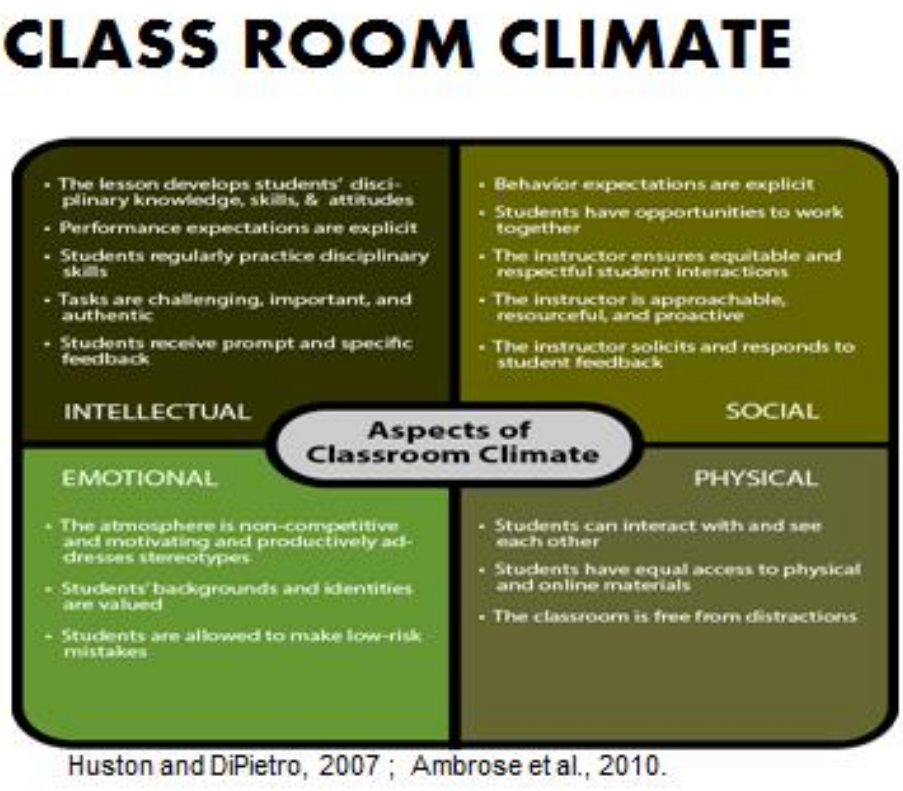

Figure 1-1: Summary of aspects related to classroom climate2.3.1 Purpose of a Positive Classroom Climate

Instructors have to guide the learners, not to alienate them. The safety of the student's well-being is very important in their development of social ties with peers and their instructor. As education becomes more inclusive, instructors have the obligation to be more aware of how to organize groups of students and how the students are arranged can lead to a favourable environment. Well-organized classrooms are an important component to classroom functions as it leads to more dialogue and formative assessment. Students with special education needs (SEN) tend to feel more excluded from the other students in the classroom (Krull et al. , 2014). SEN students include those with behaviour problems and those with learning challenges. Students who do not have

disadvantages are more inclined to participate as they feel more like they belong and have a higher belief in their academic abilities. This implies that the instructors has the task to identify the issues that can hinder the atmosphere in the classroom and address them accordingly. These include bad behaviour and attitudes but also the instructor has to consider the student's background and many other complex issues that are pertaining to the bad behaviour. Overall, the classroom climate is one of the important aspects in the sense that it linked to self-efficacy and plays an important role in the performance of the learner.

2.3.2 Classroom management

One key aspect of the classroom climate that is under the control of the instructor is the classroom management and discipline. Classroom management involves planned or spontaneous activities and interactions that can take place in a classroom. There have been a growing interest for the last decades regarding the issue of classroom management. The main focus has been on principles of learning theory and behaviour modification. Contingency management methods and the use of rewards and incentives have been used as ways of stimulating interest and motivating students (Wickens, 1994). However, it was found that the excess use of rewards and punishments has kept students externally rather than internally focused (Anderman et al., 1993). Furthermore, it was reported that the use of rewards for participation, performance, or achievement may have improved students' perceptions of classroom climate. (Anderman et al., 1993). A competent instructor understand that the best way to motivating students to manage their own behaviour keeps rewards and punishments as subtle and informative feedback mechanisms rather than controlling and coercion. Studies have suggested that when students have reported a classroom as a caring environment, with less feelings of loneliness, and fewer discipline problems (Meece and McColskey, 1997).

One constructive way or dealing with students in the classroom is requesting the instructors to pay personal attention to difficult students when they are not in trouble (Glasser, 1965; Eller et al., 2016). Getting to know students as individuals can be time-consuming and very demanding nevertheless it is beneficial in the long run (Gunter et al., 1990).

It is possible for instructors to enhance the orderly environment of the classroom through their skills in instruction and classroom management. Time management is very important in this regard. Generally, when instructors maximize their allocated time by beginning lessons promptly, they have less issues related to discipline. Instructors who gave homework and provided rewards or reinforcement for actual achievement have also had fewer discipline problems. In classrooms with few behaviour problems, instructors have used consequences but have avoided humiliation and violence toward students. Positive rewards and praise have generally outnumbered negative reinforcements (Squires et al., 1983; Bennett, 2017). Briefly, classroom management can also be considered as an ingredient that can have an impact on student achievement. It allows to maintain discipline and focus. Therefore, the classroom climate can be conducive and stimulating environment for student's success and performance. This implies that implicit and explicit system of rules and organization in a classroom environment for an effective teaching and classroom management can easily influence student achievement.

2.3.3 Classroom climate and self-efficacy

It is important to stress on the fact that the quality of the classroom environment is a major determinant of student teaching (Fraser, 1994). A positive learning environment has a positive impact on the student academic achievement and attitudes (Fisher et. al., 1995). Also, student perceptions of learning environments are an essential factor when it comes to explain their cognitive and affective outcomes (Fraser, 1994). In terms of self-efficacy and classroom climate, these perceptions of learning environments are key aspects which are very essential in the learning environment (Pitkaniemi and Vanninen, 2012). Consequently, students become more expectant which lead to students taking more math courses and pursuing a career in mathematics. These students can motivate, interact, and help their classmates and view the curriculum and teaching as meaningful and relevant. Also, they perceive their instructor as understanding and supportive while having high expectations for their learning achievement (Wang, 2012). Most school practices that promote students' mathematical self-efficacy do not only promote mathematic achievements. They also could converge the achievement gaps in mathematics as found by gender, socioeconomic status, and minority status (Bagaka, 2011). Self-efficacy can predict students' math achievement, and it is possible that the relationship between instructors' classroom behaviour and students' academic performance are also positively correlated (Weinstein and McKown, 1998). It is evident that students in many circumstances will observe the instructor's verbal and nonverbal behaviours while developing self-beliefs and academic behaviours based on these observations (Weinstein and McKown, 1998). When the instructor shows an interest in students care and concern, as well as respect for their thoughts, opinions, and ideas, the outcome supports a decrease in student depressive symptoms and an increase in self-esteem (Reddy et al., 2003). It was established that students in the age range of 8 to 18 have a desire of making a personal connection with their instructor and crave for the instructor to maintain high academic expectations (Muller et al., 1999). Also, it is important to mention that fairness is an additional characteristic that students retain from their educator in the classroom. Students identify with different ways instructors deal with students associated with success and ability (Weinstein and McKown, 1998). Generally, the great relationship that grows between the instructor and student in the classroom plays the main role in developing the emotional, motivational, and academic behaviours of the student. Instructor support correlates directly with youth adjustment, achievement, social, and motivational development. While educators have a specialized focus of specific academic content, there needs to be an equal focus on student affect and social-emotional needs (Osterman, 2000).

A supportive teaching style can positively be linked to student achievement. It was found that if instructors' academic support, academic press and mastery goal the student achievement improves when all are implemented in the classroom (Wentzel, 1994; Goodenow, 1993). Mostly, students who perceive that their math instructors take into account student relatedness and competence, and enforce positive demands on students' academic work have high success rate. Students who perceive their instructor as responsive, helpful and recognizant of good work tend to perform better than their peers who do have the opposite view.

Overall, classroom environment does have an impact on student academic self-efficacy and the many different variables that can impact these relate to students and their experiences (Weinstein and McKown, 1998).

2.3.4 Classroom climate and Instruction

Another important aspect of classroom climate is how instruction can take place to allow student success for all subjects more especially mathematic related subjects. For various lectures on different topics it was found that students attend more those with opportunities for discussion, conversation, asking questions, joking, and hands-on experiences (Ponticell, 1997). It was also reported that the use of individualized instruction, such as seatwork, was related to lower levels of perceived classroom climate (Anderman et al., 1993). Problem-solving and self-learning were more engaging. Instructors are requested to use various teaching strategies with an emphasis on support and success. Instruction has to involve flexibility and spontaneity, as well as responding to and building on students' energies and intentions. Humour and fun are needed in the classroom to make the learning environment enjoyable and to reduce the anxiety for subjects such mathematics and physical sciences. Instructors with good attitudes who smiled a lot, chatted with students, and who valued a good honest laugh are more needed by students (Ponticell, 1997). This is challenging, but yet achievable knowing that it is related the character of the instructor. Furthermore, there is need for relevance to help students to understand how skills could be applied in the real world, for instance by using technology and examples from technology during instruction (Lumsden, 1994; Zahay et al., 2017). This is very important especially for mathematics which is found very as very abstract by students. The instructor has the obligation to materialise examples with real life examples to give a picture and ease the understanding of students. Students need a stimulating pace to be motivated for learning. Curriculum needs to be student-centered, and instructions needed to be brisk and engaging. However, the instructor can combine both student centered and teacher centered philosophy. This strategy can help for quality instruction and motivation because the instructors stands as a role model and source of knowledge at the same time.

If a concept was missed, the instructor has the obligation to approach it again, but from a different, equally interesting perspective to enlighten and bring the learners on another level of understanding. Students needed to be actively involved in instruction as much as possible, and they needed to be encouraged to pursue their own personal interests beyond the classroom (Wilmore, 1992). The instructor should most of the time request feedback from the learners to make sure that the standard and level of understanding are up to his expectations. The feedback can be positive or negative, the instructor will have to act upon the situation to maintain the standard and expectations. Feedback helps to develop and perpetuate key beliefs and a winning attitude.

If the instructor fails to engage and challenge students, classroom climate and intellectual development can suffer (Wlodkowski and Ginsberg, 2017). In many cases instructors have spent more time demanding attentiveness or simply trying to maintain order, therefore losing the main focus and limiting the purpose of learning in a conducive environment to a simple issue of discipline and order.

2.4 Mastery Goal Structure

Patrick et al., (2011) reported that mastery goal orientation is strongly related to competence development. Goal theory takes up the fact that the motivation of students is influenced not only by their beliefs from their background and individual dispositions but also by the environment that they found themselves in. A mastery goal involves a perception that the real learning and understanding of students rather than memorization are valued and that success is accompanied by effort and indicated by personal improvement or by achieving absolute standards. It is also obvious that students in the same class do not share the same perception regarding instructor practices. Instructor mastery goal structure involves the degree to which the instructor wants students to learn and understand the fact and concept for a lesson or to enjoy learning process. Few Studies reported positive relations between mastery goal structure and self--efficacy and achievement (Murdock et al., 2001; Nolen, 2003; Wolters, 2004). Generally, mastery goal structure is linked with the beliefs and behaviours of students (Urdan and Midgley, 2003). Therefore, in order to create positive and learning environments the focus needs to be on creating a mastery goal structure (Patrick et al., 2011). Instructor support, respect and positive affect can be crucial factors in classrooms with high mastery goal structure. Instructors in these types of classrooms tended to encourage students to help each other and explain their reasoning. In general mastery goals is more effective because satisfaction isn't related to external indicators. Therefore there is a possibility of not giving up in challenging situations when a student have goals which are structured for a success. The perseverance is always a key ingredient in this situation. Largely, mastery goals are always just beyond reach. This makes motivation over the long term easier to maintain for a leaner who is determined to achieve sound results (Emery et al., 2017). As the curve of the line gets closer to the goal, the leaner will get closer to the goal and reach it in most cases. This is possible especially in the case of mathematics where the more the student work harder to greater his confidence in solving mathematic questions increases. There is always something to strive for leaners who reach the pinnacle of their skills rarely set performance goals. Learners will be more interested in competing with themselves than gaining external feedback and validation. This orientation allows them to compete at a higher level over a longer period of time.

2.5 Student--Instructor Relationship

Student's motivation to undertake schoolwork is certainly related to the perception they have about their instructors who are viewed to be emotionally supportive (Skaalvik et al., 2015).
A good student--instructor relationship nurtures development in confidence as well as self--efficacy (Peters, 2013). It is important to stress on the fact that emotionally supportive attitude or behaviour includes respect, care, warmth, empathy and friendliness, (Patrick et al., 2011). The relationship between students and their instructors reflects the potential of classroom interactions to boost their growth. Furthermore, positive relationship between students and instructor can positively be linked with student motivation, engagement, and well--being (Sakiz et al., 2012). Therefore, it is up to instructors to find the balance between positively challenging students and caring attitude. This can be achieved by believing in their students and assisting them in achieving their academic goals (Peters, 2013). Students who perceive their instructors to be caring and supportive tend to be more motivated by exerting greater effort and persistence. This study examines the relationships between mathematics self--efficacy, instructor mastery goal structure, instructor challenging and instructor caring.

2.6 Mathematical Anxiety versus Achievement

Mathematical anxiety is becoming a serious concern nowadays. The anxiety can destroy the self-confidence or self-efficacy and affect seriously the students output. It affects their belief system as well as their attitudes toward their success in mathematics. These attitudes may originate from various aspects in an individual's environment as well as school and home experiences (Akin and Kurbanoglu, 2011). Mathematical anxiety is defined as students' restlessness during mathematical operations. It is including their fear to fail the exams and the resulting physical stress that leads to negative mathematical attitudes characterised by the dislike of mathematics [Smith (1997)]. Mathematical anxiety is projected negatively by self-efficacy (Hackett, 1985; Pajares and Graham, 1999) and can be understood as a result of low self-efficacy, according to the social learning theory. A student who feels anxious about mathematics classes can easily feel unable of doing mathematics. The higher the level of self-efficacy, the more energetic the individual becomes. Consequently, the individual will put more effort toward the assignment and the longer he will persevere to the point of loving and enjoying mathematics; this attitude will vanish the fear and the anxiety and bring more confidence in the individual. Therefore, mathematical anxiety can be a forecaster of self-efficacy by the fact that higher anxiety in mathematics strongly related to lower levels of self-efficacy (Akin and Kurbanoglu, 2011). This is confirmed by the fact that students presenting signs of mathematical anxiety have a tendency of poor attitudes about mathematics. They have also a tendency of avoiding mathematical courses, therefore, the result is lower achievement scores (Beilcok et al., 2010).

They are five areas contribute to students' mathematical anxiety: teachers/ instructor (or lecturer) attitude, curriculum, instructional strategies, the classroom culture, and assessment (Shields, 2005). Teacher/ instructor (lecturer) attitude can greatly influence mathematical anxiety and it is the leading factor influencing student attitudes with regard to learning of mathematics (Harper and Daane, 1998; Ruffell et al., 1998). Therefore, a teacher/ instructor (lecturer) has the responsibility to help students remove the fear and phobia of mathematics in order to achieve expected results and produce critical thinkers and quality professionals.

2.7 Instructor Care and Challenge

Teaching must stimulate in student a culture of Excellency not fear or anxiety, it involves major impacts to make significant changes within any society when it comes to an education system (Stevenson and Stigler, 1992). Even with a major reform for curriculum, lasting changes would not occur without sustained professional development designed to change teachers' beliefs and attitudes (Philipp, 2007). The belief of teachers can be improved or modified by scrutinizing students' mathematical thinking, technology, curriculum, and gender (Philipp, 2007). Teachers have to play an important role in assuring that their methods of imparting mathematical knowledge are based on sound standards. It is very dangerous and could be very destructive for a student in a classroom facing a teacher with a negative attitude toward mathematics. The Consequences are such that it can be transferred into the instruction and discussion made by the teacher. Students, especially girls, pick up on these clues inadvertently given by the teacher and take it on as their own. Parents can reinforce this attitude at home in discussion with the child, as well as priorities aligned with the family (Ambrose, 2004). When attitudes are developed to negatively think about mathematics, achievement suffers but also the confidence is seriously affected and the fear and phobia of mathematics increases. Briefly, the instructors has huge responsibility in making sure that the class environment

is conducive , the students are in a better mood and motivated to learn , he has to care for any details or aspects involved in the student's success

2.8 Student Attitude and Achievement

Student achievement in mathematics is influenced by environmental factors including the emotional response to the subject such as mathematics (Sousa, 2008). Latterell (2005) in his survey using student opinions found that many of them feel much more embarrassed when they make nonmathematical mistakes than mathematical related mistakes, therefore, reducing the value of mathematic achievement and success among students. Also, in spite of the push to encourage females in the mathematical field, they still rate themselves less confident than their male peers (Morge, 2005). Studies have reported that attitudes predict performance and students with positive attitudes about what they are learning achieve more than students with poor attitudes (Singh et al., 2002).

Ma and Kishor (1997) investigated on the relationship between student attitudes toward mathematics and student achievement in mathematics. It was reported that the results were statistically significant, however, the data and the information generated from the study were not sufficient and consistent for educational practice. Furthermore, it was found that attitudes toward mathematics and success were not very convincing in the elementary level, while the junior high level had a tendency to be the most important period during which students shape their attitudes toward mathematics and then stabilize in high school (Ma and Kishor, 1997). According to Ma and Wilkins (2007) achievement is predicted by aspects including socioeconomic status, aptitude, and prior achievement. Studies have reported that there is a strong relationship between mathematics coursework and mathematics achievement (Campbell et al., 2000; Meyer, 1998; Schmidt et al., 2001). Pajares (1996) reported that students who are undervaluing their mathematic capabilities, not their lack of skill, can lead to avoidances of mathematic courses and careers, this is due to the fear and phobia of mathematics.

Many students believe that their academic performance can be caused by certain factors within themselves such as ability, effort, traits and disposition or factors outside themselves including luck, ease, difficulty of the task, and help from the teacher (Pajares, 1996).

Logically, students must attribute their success to ability rather than effort because ability is more strongly related to motivation, self-efficacy, and skill development (Schunk and Gunn, 1986). It is very important to stress on the fact that achievement can influence interest; students with great feelings of competence or capability may become more interested in the subject taught (Koller et al., 2001). Consequently, students with more mathematical accomplishments may develop have higher levels of mathematics self-efficacy than students with fewer accomplishments, this is a matter of confidence and interest toward mathematics or any other subject.

Some studies have investigated on the correlation between instructor support and its effect on students have reported that when instructors are perceived as supportive, students have greater academic achievement, higher student engagement, less problem behaviours, and more positive peer relations (Birch and Ladd, 1997; Hamre and Pianta, 2001: Skinner et al., 2008). Perceived support from instructors positively contributes to students' classroom functioning, motivation, and attitudes toward school (Wentzel, 1998). A study conducted by Malecki and Demaray (2006) focusing on 7th and 8th grade students found that perceived teacher support was strongly related to grade point average for students who were lower socioeconomic status (SES) then higher SES students.

The conclusions of the study undertaken by Malecki and Demaray (2006) can be helpful regarding the current research because more than 80% of MUT students are coming from lower socio-economic background.

2.9 Summary

The success of students can be reflected not only by the manner students are taught and achievement levels reached, but also in the learning environment, the self-efficacy, the mastery goals, the classroom climate, the instructor care and many other parameters such as the student ability and background. Therefore, the environment, the instructor and the student himself are the main actors in the process that leads to student success and performance. The environment should be comfortable, pleasant, and psychologically uplifting; should provide a physical setting that students find educationally stimulating; should produce a feeling of wellbeing among its occupants; and should support the academic process. The instructor should care and focus on the student success, be supportive and attentive to student needs in order for him to succeed. He has the mission to create climate factors conducive to creating an environment that may result in increased student achievement. This can be possible only with the cooperation and involvement of the student who at the centre of the process. The student self-efficacy or motivation, his commitment and ambitions to become the person he is willing to be in the future are the drivers for the success. As mentioned before, this study has chosen four constructs to be analysed in regard for student success and performance. The study will focus on those four constructs to establish the correlation between them and find out how they contribute to student success and performance in the study of mathematics in the specific case of MUT students.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research design and methodology employed in this study. The discussion will include the research approach, the target population sample, the research instrument, reliability and validity, procedure, data gathering, data treatment, limitations of study and ethical considerations. The approach, research design, and research question are all connected. 'Approach' means something more than the type of data used it refers to the overall orientation to research and the type of claims that will be analysed for study purposes.

3.2 Research Design

Research design is defined as a complete plan for connecting the conceptual research problem to the relevant empirical research. It has to speak to what data is required, what methods are going to be used for the collection and analysis of data. Also, it will also focus on how the research question will be addressed in order to achieve the objectives and to respond to the research question. Therefore, research design focuses on planning strategies to find out systematically on an issue with the intention that the findings will contribute to the body of knowledge (Sekaran and Bougie, 2013**)**

The design aims to produce the information in a form of data that will reflect various aspects of the research.

3.3 Research Approach

A study can be based on either quantitative or qualitative data, or on a combination of both. Quantitative research questions usually start with ‘how,’ ‘what’ or ‘why’, contain an independent and a dependent variable and examine the connections, relations or comparisons between variables. Alternately for the same situation, questions can arise such as how would overweight people describe their meal times while dieting? With qualitative research, you will usually have one central question and possibly also some sub-questions to narrow the phenomenon under study further. The sub-questions will generally be more specific. Qualitative research questions usually start with ‘what’ or ‘how ‘and to Identify the central phenomenon to be explored. The approaches to answer research questions are either quantitative or qualitative

3.3.1 Qualitative Research Approach

Burns and Grove (2003) describe a qualitative approach as "a systematic subjective approach used to describe life experiences and situations to give them meaning. Qualitative research focuses on the experiences of people as well as stressing uniqueness of the individual (Parahoo, 1997;Creswell, and Poth ,2017) . Holloway and Wheeler (2002) refer to qualitative research as "a form of social enquiry that focuses on the way people interpret and make sense of their experience and the world in which they live". Researchers use the qualitative approach to explore the behaviour, perspectives, experiences and feelings of people and emphasise the understanding of these elements.

Researchers who use this approach adopt a person-centred holistic and humanistic perspective to understand human lived experiences without focusing on the specific concepts (Field and Morse 1996:8; McCormack, 2017). The researcher focuses on the experiences from the participants' perspective. In order to achieve the perspective, the researcher becomes involved and immersed in the study. The researcher's participation in the study adds to the uniqueness of data collection and analysis (Streubert and Carpenter 1999; Creswell, and Poth ,2017). Complete objectivity is impossible and qualitative methodology is not completely precise because human beings do not always act logically or predictably (Holloway and Wheeler 2002). Table 3-1 presents the advantages and limitations of qualitative research.

Table 3-1: Advantages and Limitations of Qualitative Research

Advantages of qualitative research	**Limitations of qualitative research**
Rich, in-depth detail is possible (e.g. participants can elaborate on what they mean) Perceptions of participants themselves can be considered (the human factor) Appropriate for situations in which detailed understanding is required Events can be seen in their proper context / more holistically	Not always generalizable due to small sample sizes and the subjective nature of the research Conclusions need to be carefully hedged Accusations of unreliability are common (different results may be achieved on a different day/with different people)

3.3.2 Quantitative Research Approach

The overarching aim of a quantitative research study is to classify features, count them, and construct statistical models in an attempt to explain what is observed. Quantitative data is any measured information that is in numerical form which includes statistics and percentages (Given, 2008). There are four main types of quantitative research designs: descriptive, correlational, quasi-experimental and experimental. The difference between the four types primarily relates to the degree the researcher designs for control of the variables in the experiment. Most quantitative research falls into two areas: **studies** that describe events and **studies** aimed at discovering inferences or causal relationships. Descriptive studies are aimed at finding out "what is," so observational and survey methods are frequently used to collect **descriptive** data (Borg and Gall, 1989; Creswell and Poth, 2017; Walliman, 2017). Table 2 presents the advantages and limitations of quantitative research while Table 3-2 depicts the comparative analyses of qualitative and quantitative research.

Table 3- 2: Advantages and Limitations of Quantitative Research

Advantages of quantitative research	**Limitations of quantitative research**
Larger sample sizes often make the conclusions from quantitative research generalizable Statistical methods mean that the analysis is often considered reliable Appropriate for situations where systematic, standardised comparisons are needed	Does not always shed light on the full complexity of human experience or perceptions Can reveal *what / to what extent*, but cannot always explore *why* or *how* May give a false impression of homogeneity in a sample

Table 3-3: Comparative analyses of Qualitative and Quantitative Research

	Qualitative Research	**Quantitative Research**
Objective / purpose	To gain an understanding of underlying reasons and motivations	To quantify data and generalize results from a sample to the population of interest
	To provide insights into the setting of a problem, generating ideas and/or hypotheses for later quantitative research	To measure the incidence of various views and opinions in a chosen sample
	To uncover prevalent trends in thought and opinion	Sometimes followed by qualitative research which is used to explore some findings further
Sample	Usually a small number of non-representative cases. Respondents selected to fulfil a given quota.	Usually a large number of cases representing the population of interest. Randomly selected respondents.
Data collection	Unstructured or semi-structured techniques e.g. individual depth interviews or group discussions.	Structured techniques such as online questionnaires, on-street or telephone interviews.
Data analysis	Non-statistical.	Statistical data is usually in the form of tabulations (tabs). Findings are conclusive and usually descriptive in nature.
Outcome	Exploratory and/or investigative. Findings are not conclusive and cannot be used to make generalizations about the population of interest. Develop an initial understanding and sound base for further decision making.	Used to recommend a final course of action.

(Adapted from Neuman, 2000 Ragin, 2013; Brannen , 2017)

3.4 Research Methods

3.4.1 Qualitative Research Methods

There are a variety of instruments used in research. Qualitative research involves interviews, focus groups (Wilkinson, 2003), observation and document review (Mason, 2002).

3.4.1.1 Interviews

They are described as a discussion between two individuals, and includes an arrangement of suppositions and approvals about the circumstances which are ordered. They are used for collecting valuable data about a particular subject. The interview method is adopted when alternative research techniques are unsuitable. This is possible in situation where it is unrealistic to expect respondents with low literacy levels to finish a long survey. It has the advantage of gathering knowledge and background into a subject, participants are able to portray what is critical to them, convenient for collecting references and information. Disadvantages are that interviews are not a simple alternative, it is prone to favouritism, absorbs a lot of time, costly in comparison to other techniques and can be viewed as invasive to survey participant

3.4.1.2 Focus groups

In this type of design discussions are planned early by a panel; the interviewees will be seated opposite the panel, and interviewees are expected to answer any questions put to them by the panel. The panel's members have some idea of what counts as positive or negative responses to each of their discussion points, and interviewees are required to provide answers to these. This method is fast and simple to set up, group elements can give helpful data that individual information accumulation does not produce, helpful in gathering knowledge into a subject where it's problematic via the information gathering strategies. However, it encompasses the fact that most individuals end up feeling that they did not freely express themselves, comprehension of panels questions are not fully absorbed due to setup, process is stressful, participants feel isolated, responses are criticised, rivalry between interviewees and process is not transparent (Wilkinson, 2003).

3.4.1.3 Observation

This alludes to information creation techniques that involve analysts complexly engaging in live research surroundings with the goal of direct monitoring and understanding of the various facets linked to these surroundings (Mason, 2002). Advantages encompass the collection of information where and when an experience or project is occurring, it does not depend on individual's eagerness to supply data, and focuses on an individual's actions. Disadvantages include its vulnerability to observer bias, individuals performances are staged as they are aware of being observed - Hawthorne impact, and this technique does not provide more clarity on why individuals act the way they do .

3.4.1.4 Document Review

This is an extensive technique for social analysis, it contributes significantly and fit the information via a wide range of methods inclusive of the Internet. Examples of information gained from existing documents include acts of parliament; bank statements and the internet (Mason, 2002). It is moderately cheap, reliable pool of foundation data, low-key, highlights undisclosed background information, and identifies gaps overlooked in other methods. However, it includes concerns that data might be inappropriate, chaotic, and inaccessible or outdated, biased, fragmented, and tedious to collate and audit (Government, 2010)

3.4.2 Quantitative Research Methods

Several research methods exist to conduct quantitative research. According to Grand Canyon (2017) there are four main types of quantitative research design methods i.e. descriptive design, correlational design, quasi-experimental and experimental.

3.4.2.1 Descriptive design

This type of design seeks to describe the current status of a variable or a fact. The study does not start with a hypothesis. This is developed after the data is collected, and data collection is based mainly on observation.

3.4.2.2 Correlational design

This design type explores the relationship between variables with the use of statistical analyses. Conversely, it does not look for cause and effect, is also generally observational in terms of data collection.

3.4.2.3 Quasi-experimental

Quasi-Experimental Design focuses on a cause-effect relationship between two or more variables. Groups cannot be assigned and the independent variable cannot be manipulated. In this case control groups are identified and exposed to the variable. Results are compared with results from groups not exposed to the variable

3.4.2.4 Experimental

Known as a true experimentation, it uses the scientific method to establish cause-effect relationship among a group of variables in a research study. An effort can be made to control all variables except the one being manipulated (the independent variable). The effects of the independent variable on the dependent variable are collected and analysed for a relationship.

Quantitative research involves various information gathering techniques, of which examples include questionnaires and interviews

- Questionnaires

A well-designed questionnaire should be highly structured to allow the same type of information to be collected from a large number of people and for data to be analysed systematically (Leung, 2001). Questionnaires are a familiar method of collecting data in order to get fairly and easily the required information related to the research question. A well designed questionnaire has the ability to provide an outcome that will reflect on the accuracy of the quality of information (Brace, 2008). The questionnaire should be specifically relevant to the study objectives. There are two types of questions, there is one known as open-ended questions which are designed to encourage a full and meaningful answer using the subject's own knowledge and/or feelings. It is the opposite of a closed-ended question, which encourages a short or single-word answer , they can be answered by a simple "yes" or "no," while open-ended questions are those which require more thought and more than a simple one-word answer. Also, open-ended do not allow respondents “fill in” the survey with all the same answers without reading the question and responses thoroughly. They allow respondents to include more information, such as feelings, attitudes, and their understanding of the subject.

- Interviews

Researchers opt for the interview method for data collection when they feel the need to meet face-to-face with individuals to interact and generate ideas. Quantitative research interviews are more structured than for qualitative research. The researcher has to identify a potential source of information, and structure the interaction in a manner that will bring out relevant information from the respondent. Interviews can also be conducted over the phone, or the computer via video conferencing technology (Annum, 2017).

The Quantitative approach was employed for this study.

3.5 Design of Instrument

Research instruments are fact finding strategies, they are tools used for data collection. They include questionnaires, interviews, observations and reading. Essentially the instrument chosen must be valid and reliable. The reliability and validity of a research project greatly depends on the appropriateness of the instrument chosen therefore the procedure that one chooses to collect data must be examined to check the extent to which it is likely to produce the expected results. In this study, questionnaires were used to obtain data relevant to the study's objectives and research questions.

3.5.1 Characteristics of a questionnaire

Brink and Wood (1998:293-298) state that the following aspects characterise a questionnaire:

- Each participant enters his/her responses on the questionnaire, saving the researcher's time, compared to the time required to conduct personal interviews.
- It is less expensive than conducting personal interviews.
- Respondents feel that they remain anonymous and can express themselves in their own words without fear of identification.
- Data on a broad range of topics may be collected within a limited period.

Surveys measures opinions, knowledge, attitude, beliefs, behaviours, reactions, and attributes in response to specific questions. The questionnaire was based on the literature review (see chapter 2) and other research instruments used in similar studies.

The instrument is made up of only close ended questions.

Close Ended Questions:

- Generally exist as multiple choice questions. Closed ended questions permit a set amount of answers, ruling out the offering of extra data; they involve awareness and a decision among answer choices. Used for more prominent accuracy, consistency, less demanding review for the respondent, simpler classification and examination (Ibid).

All questions was closed ended, easy to read and understand, Students were asked to respond to a 7--point Likert scale with 1 = strongly disagree and 7 = strongly agree, and to what extent they agreed with 16 statements on student mathematics self--efficacy, perceptions of instructor mastery goal structure, perceptions of instructor challenge and perceptions of instructor caring and instructor role. In addition to completing the measure, students were required to include the gender, the grade expected and the grade achieved. A copy of this measure can be found in Annexure 1.

3.6 Population and Sample

A target population refers to the entire group of individuals or objects to which researches are interested in generalizing the conclusions and it usually has varying characteristics. Effective research requires the population of the study to be clearly defined to enable a representative sample size to be determined in order to generalizable (Sekaran and Bougie, 2009). Sampling refers to a process of choosing an appropriate number of the elements from the population to ensure that a study of the sample and an understanding of its properties or characteristics, make it possible to generalise such properties to the population elements (Sekaran and Bougie , 2013). It is imperative that the right individuals, objects or events are selected as representatives for the entire population (Ibid). There are many types of sampling which include random sampling used for large samples, it presents the best chance of unbiased representatively although it is time consuming, stratified sampling which divides the population into subcategories, it can also be time consuming. The volunteer sampling is ethically and relatively convenient if it leads to informed consent. Unrepresentatively is one of its weaknesses. Opportunity sampling is known to be quick, economical and convenient. However it is affected by the issue of poor representatively. More details are presented in Table 3-4 including their advantages and disadvantages

Table 3-4 Sampling Techniques: Advantages and Disadvantages

Technique	Descriptions	Advantages	Disadvantages
Simple random	Random sample from whole population	Highly representative if all subjects participate; the ideal	Not possible without complete list of population members; potentially uneconomical to achieve; can be disruptive to isolate members from a group; time-scale may be too long, data/sample could change
Stratified random	Random sample from identifiable groups (strata), subgroups, etc.	Can ensure that specific groups are represented, even proportionally, in the sample(s) (e.g., by gender), by selecting individuals from strata list	More complex, requires greater effort than simple random; strata must be carefully defined
Cluster	Random samples of successive clusters of subjects (e.g., by institution) until small groups are chosen as units	Possible to select randomly when no single list of population members exists, but local lists do; data collected on groups may avoid introduction of confounding by isolating members	Clusters in a level must be equivalent and some natural ones are not for essential characteristics (e.g., geographic: numbers equal, but unemployment rates differ)
Stage	Combination of cluster (randomly selecting clusters) and random or stratified random sampling of individuals	Can make up probability sample by random at stages and within groups; possible to select random sample when population lists are very localized	Complex, combines limitations of cluster and stratified random sampling
Purposive	Hand-pick subjects on the basis of specific characteristics	Ensures balance of group sizes when multiple groups are to be selected	Samples are not easily defensible as being representative of populations due to

			potential subjectivity of researcher
Quota	Select individuals as they come to fill a quota by characteristics proportional to populations	Ensures selection of adequate numbers of subjects with appropriate characteristics	Not possible to prove that the sample is representative of designated population
Snowball	Subjects with desired traits or characteristics give names of further appropriate subjects	Possible to include members of groups where no lists or identifiable clusters even exist (e.g., drug abusers, criminals)	No way of knowing whether the sample is representative of the population
Volunteer, accidental, convenience	Either asking for volunteers, or the consequence of not all those selected finally participating, or a set of subjects who just happen to be available	Inexpensive way of ensuring sufficient numbers of a study	Can be highly unrepresentative

Source: Black, T. R. (1999). Doing quantitative research in the social sciences: An integrated approach to research design, measurement, and statistics. Thousand Oaks, CA: SAGE Publications, Inc. (p. 118)

The population for this study and its size presented in table 3-5 was made up of registered students enrolled in Construction Management and Quantity Surveying programs from four universities in South Africa that had completed a module in mathematics in either their first year or first semester, namely Mangosuthu University of Technology (MUT) in Umlazi, Durban University of Technology (DUT) in Durban, and University of Kwa-Zulu-Natal (UKZN), in Durban in the Kwa-Zulu Natal province; and University of Johannesburg (UJ) in Johannesburg in the Gauteng Province,

Table 3-5: Distribution of Particles and their respective Universities (n=311)

University	Number of students	Male students surveyed	% of Male students surveyed	Female students surveyed	% of Female students surveyed
Mangosuthu University of Technology (MUT)	89	51	57.3%	38	42.7%
Durban University of Technology (DUT)	82	54	65.9%	28	34.1%
University of Johannesburgh (UJ)	94	56	59.6%	38	40.4%
University of KwaZulu Natal (UKZN)	46	24	52.2%	22	47.8%
Total	311	185	59.5%	126	40.5%

3.7 Questionnaire Administration and Response Rate

Quantitative questionnaires were given to students during normal lectures. Information about the study was communicated to students in order to make them understand the importance of the study which can be beneficial for them in the near future. They were surveyed about their views and experiences of the mathematics classes. The questionnaire was answered by students for duration of 15 minutes maximum. The questionnaire was emailed to the head of departments to assist in the conducting of surveys. The results of the survey were emailed to the researcher. The heads of department confirmed that the response rate of a 100% was achieved.

3.8 Measurement Discussion

Indexes and scales are important and useful tools in social science research. They have both similarities and differences among them. An index is a way of compiling one score from a variety of questions or statements that represents a belief, feeling, or attitude. A scale is a measure of the intensity of an attitude or emotion. Specifically, scales exist in the ordinal level of data. Usually scales are constructed using the ordinal level of measurement, which organizes items in an order in order to determine degrees of favour or disfavour, but does not provide any meaning of distance between degrees. The Likert scale is one of the most commonly used scales in the research community. The scale consists of assigning a numerical value to intensity (or neutrality) of emotion about a specific topic, and then attempts to standardize these response categories to provide an interpretation of the relative intensity of items on the scale. Responses such as “strongly agree,” “moderately agree,” “moderately disagree,” and “strongly disagree” are responses that would likely be found in a Likert scale, or a survey based upon the scale.

3.9 Reliability and Validity

The use of reliability and validity are common in quantitative research and now it is reconsidered in the qualitative research paradigm. Since reliability and validity are rooted in positivist perspective then they should be redefined for their use in a naturalistic approach. Joppe (2000) "defines reliability as the extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable." Joppe (2000) provides the following explanation of what validity is in quantitative research: Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are. In other words, does the research instrument allow you to hit "the bull's eye" of your research object? Researchers generally determine validity by asking a series of questions, and will often look for the answers in the research of others. The validity in quantitative research is known as construct validity (Wainer and Braun, 1998; London et al., 2017).The construct is the initial concept, notion, question or hypothesis that determines which data is to be gathered and how it is to be gathered. They also assert that quantitative researchers actively cause or affect the interplay between construct and data in order to validate their investigation, usually by the application of a test or other process. In this sense, the involvement of the researchers in the research process would greatly reduce the validity of a test

Validity refers to the soundness of the interpretation of scores from a questionnaire (Vosloo, 2014). In the current study the internal validity of scaled responses will be determined by the Cronbach's alpha co-efficient for validity

3.9.1 The Cronbach alpha coefficient

According to Drucker-Godard et al. (2001) the Cronbach alpha coefficient is widely used as a reliable procedure to establish how well various items are positively correlated to one another. Guidelines to interpret Cronbach's alpha reliability coefficient have been accepted by researchers (Vosloo, 2014):

- 0.90-high reliability
- 0.80-moderate reliability
- 0.70-low reliability
-

3.10 Data Analysis

The descriptive statistics technique is used in this study to organise, analyse and interpret the quantitative data and was derived using the Statistical Program for Social Sciences (SPSS) v23. However, other techniques including correlations and factor analysis are used. The data contains results involving responses from all participants, males and females depicting mean value, standard deviation and correlation between constructs.

3.11 Summary

This chapter aimed to establish the approach to be used in order to verify the hypothesis and to reach the study's objectives. The chapter involves research design, different approaches used in research, the population and sample, area or location of the research where the study was conducted, and the profile of individuals involving in the study. Variables and measurement procedures are explained as well as methods used for data analysis. Briefly, the chapter focuses on the approach to achieve the study objectives and provide answers to the research questions

CHAPTER 4: RESULTS AND DATA ANALYSIS

4.1 Demographic information of respondents

Table 4-1 shows the descriptive statistics of the respondents. The profile shows a fairly even distribution of respondents.

Table 4-1: Descriptive Statistics of the Respondents

		Frequency	Percent
University	**UKZN**	46	14.8
	UJ	94	30.2
	DUT	82	26.4
	MUT	89	28.6
Gender	**Male**	181	58.2
	Female	130	41.8
Year of Study	**First year**	16	5.1
	Second year	141	45.3
	Third year	148	47.6
	Fourth year	6	1.9

More of the respondents (59.2%) were male. Majority of the students are in the second and third year comprising 47.6% and 45.3% respectively. For the institutions that make up the sample, the proportions of students were fairly even distributed, with UKZN having the least (14.8%), and UJ having the highest (30.2%).

4.2 Conceptual Model

Figure 4-1 depicts the six constructs in this study. In order to empirically test the relationship between the study constructs, a conceptual model was developed as shown in Figure 4-1 on the grounds of the literature review relating to the six core constructs.

IJGJHV

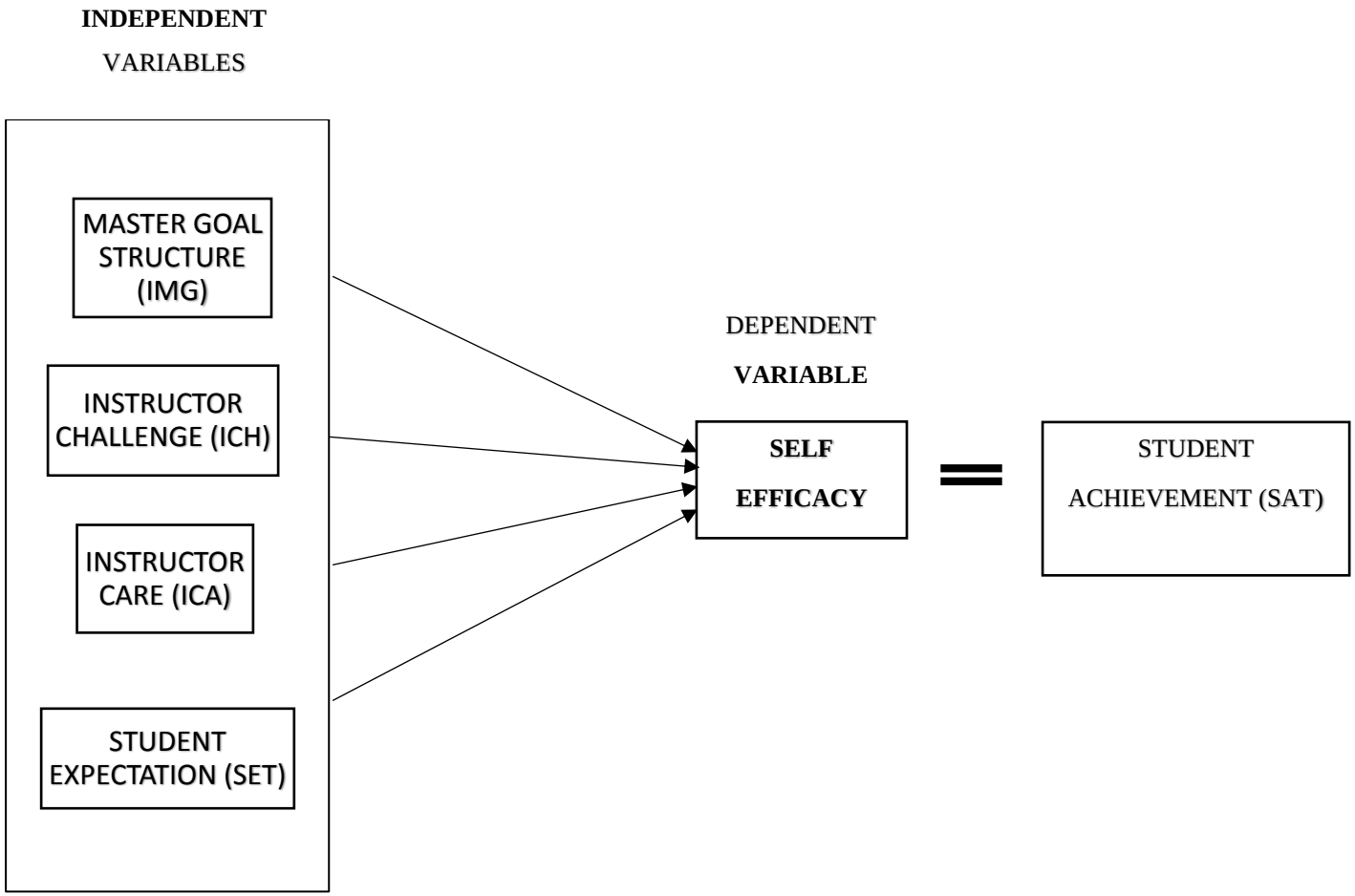

Figure 4-1: Conceptual Model

4.3 Summarized data for the 4 universities including overall results and gender

Table 4-2: Summarized data for the 4 universities including overall results and gender

Statement		**MUT** (n=89, **n=51,** *n=38*)				**DUT** (n=82, **n=54,** *n=28*)				**UJ** (n=94, **n=56,** *n=38*)				**UKZN** (n=46 , **n=24,***n=22*)			
		Mean	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**
Mathematics self--efficacy	MSE	5.34	1.16	2	H	4.72	1.40	1	M	5.46	1.20	2	H	4.73	1.24	3	M
		5.41	**1.31**	**2**	**H**	**4.62**	**1.44**	**1**	**M**	**5.45**	**1.12**	**2**	**H**	**4.83**	**1.03**	**1**	**M**
		5.24	*0.98*	*2*	*H*	*4.81*	*1.33*	*2*	*M*	*5.49*	*1.31*	*2*	*H*	*4.63*	*1.45*	*3*	*M*
I am sure I can learn everything taught in Mathematics	MSE1	5.62	1.30	2	H	4.90	1.66	3	M	5.69	1.32	2	H	4.93	1.36	3	M
		5.64	**1.54**	**2**	**H**	**4.75**	**1.75**	**3**	**M**	**5.61**	**1.34**	**4**	**H**	**5.00**	**1.10**	**1**	**H**
		5.61	*0.97*	*2*	*H*	*5.00*	*1.44*	*2*	*H*	*5.79*	*1.30*	*1*	*H*	*4.86*	*1.61*	*3*	*M*
I am sure that I can do even the most difficult work in my Mathematics class	MSE2	4.94	1.55	4	M	4.13	1.78	4	M	5.13	1.52	4	H	4.39	1.57	4	M
		5.06	**1.71**	**4**	**H**	**4.06**	**1.80**	**4**	**M**	**5.17**	**1.28**	**2**	**H**	**4.67**	**1.17**	**3**	**M**
		4.82	*1.35*	*4*	*M*	*4.08*	*1.70*	*4*	*M*	*5.08*	*1.81*	*4*	*H*	*4.09*	*1.90*	*4*	*M*
Even if a new topic in mathematics is difficult I am sure that I can learn it	MSE3	5.28	1.48	3	H	4.97	1.65	2	M	6.58	1.49	3	H	4.62	1.34	2	M
		5.40	**1.65**	**3**	**H**	**4.81**	**1.68**	**2**	**M**	**5.51**	**1.33**	**3**	**H**	**4.71**	**1.22**	**2**	**M**
		5.16	*1.26*	*3*	*H*	*5.12*	*1.56*	*3*	*H*	*5.54*	*1.71*	*3*	*H*	*4.52*	*1.60*	*2*	*M*
I am sure that I can figure out the answers to problems that my instructor gives me in class	MSE4	5.49	1.21	1	H	4.86	1.55	1	M	5.47	1.23	1	H	4.93	1.20	1	M
		5.53	**1.32**	**1**	**H**	**4.81**	**1.58**	**1**	**M**	**5.44**	**1.17**	**1**	**H**	**4.92**	**1.28**	**4**	**M**
		5.39	*1.05*	*1*	*H*	*5.08*	*1.32*	*1*	*H*	*5.54*	*1.33*	*2*	*H*	*4.95*	*1.13*	*1*	*M*

Normal font: Sample, ***Bold font: Males,*** *Italics: Female*

Table 4-2: Cont'd Summarized data for the 4 universities including overall results and gender

Statement		MUT				DUT				UJ				UKZN			
		Mean	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**
Instructor mastery goal structure	IMG	5.95	1.12	1	H	5.25	1.42	3	H	6.03	1.03	1	H	5.12	1.10	1	H
		5.81	**1.23**	**1**	**H**	**5.28**	**1.44**	**2**	**H**	**5.87**	**1.13**	**3**	**H**	**4.92**	**1.10**	**2**	**M**
		6.13	*0.97*	*1*	*H*	*5.63*	*1.36*	*3*	*H*	*6.25*	*0.84*	*1*	*H*	*5.34*	*1.08*	*1*	*H*
My instructor thinks that really understanding the material is the main goal of the class	IMG1	5.80	1.43	3	H	5.05	1.88	4	H	5.55	1.56	4	H	4.91	1.33	2	M
		5.69	**1.45**	**3**	**H**	**4.92**	**1.89**	**4**	**M**	**5.38**	**1.60**	**4**	**H**	**4.83**	**1.67**	**2**	**M**
		5.92	*1.44*	*3*	*H*	*5.46*	*1.75*	*4*	*H*	*5.79*	*1.47*	*4*	*H*	*5.00*	*1.52*	*4*	*H*
My instructor thinks it is important to understand the material and not to just memorize it	IMG2	6.29	1.36	1	H	5.68	1.51	1	H	6.40	1.28	2	H	5.59	1.27	1	H
		6.12	**1.60**	**1**	**H**	**5.57**	**1.61**	**2**	**H**	**6.22**	**1.55**	**3**	**H**	**5.42**	**1.18**	**4**	**H**
		6.47	*0.98*	*1*	*H*	*5.96*	*1.22*	*2*	*H*	*6.67*	*0.70*	*1*	*H*	*5.77*	*1.38*	*2*	*H*
My instructor thinks how much you improve in Mathematics is really important	IMG3	6.11	1.34	2	H	5.31	1.54	2	H	6.16	1.15	1	H	5.20	1.39	3	H
		6.04	**1.55**	**2**	**H**	**5.13**	**1.56**	**1**	**H**	**5.96**	**1.21**	**1**	**H**	**5.00**	**1.41**	**1**	**H**
		6.24	*1.00*	*2*	*H*	*5.81*	*1.20*	*1*	*H*	*6.31*	*1.02*	*2*	*H*	*5.41*	*1.37*	*1*	*H*
My mathematics instructor accepts nothing less than my full effort	IMG4	5.60	1.71	4	H	4.98	1.82	3	M	6.04	1.47	3	H	4.80	1.61	4	M
		5.37	**1.88**	**4**	**H**	**4.92**	**1.80**	**3**	**M**	**5.91**	**1.52**	**2**	**H**	**4.42**	**1.69**	**3**	**M**
		5.87	*1.47*	*4*	*H*	*5.27*	*1.73*	*3*	*H*	*6.24*	*1.38*	*3*	*H*	*5.23*	*1.45*	*3*	*H*

Normal font: Sample, **Bold font: Males,** Italics: Female

Table 4-2: Summarized data for the 4 universities including overall results and gender

Statement		**MUT**				**DUT**				**UJ**				**UKZN**			
		Mean	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**
Instructor challenge	ICH	5.57	1.43	4	H	4.95	1.41	2	M	5.36	1.26	3	H	4.70	1.23	2	M
		5.23	**1.39**	**4**	**H**	**4.70**	**1.47**	**3**	**M**	**5.37**	**1.07**	**1**	**H**	**4.51**	**1.10**	**3**	**M**
		5.98	*1.40*	*4*	*H*	*5.38*	*1.21*	*1*	*H*	*5.33*	*1.50*	*3*	*H*	*4.90*	*1.36*	*2*	*M*
When I have figured out how to do a mathematics problems my instructor gives me more challenging work	ICH1	5.41	1.84	2	H	4.73	1.84	3	M	5.31	1.72	4	H	4.60	1.55	3	M
		5.04	**1.94**	**3**	**H**	**4.43**	**1.91**	**3**	**M**	**5.20**	**1.60**	**4**	**H**	**4.54**	**1.35**	**3**	**M**
		5.82	*1.66*	*4*	*H*	*5.23*	*1.55*	*3*	*H*	*5.46*	*1.88*	*3*	*H*	*4.67*	*1.80*	*3*	*M*
My mathematics instructor does not let me get away with doing easy work	ICH2	5.36	1.69	3	H	4.79	1.78	2	M	5.09	1.66	3	H	4.56	1.41	2	M
		5.02	**1.64**	**4**	**H**	**4.74**	**1.84**	**2**	**M**	**5.04**	**1.58**	**3**	**H**	**4.33**	**1.27**	**2**	**M**
		5.83	*1.65*	*3*	*H*	*4.92*	*1.67*	*4*	*M*	*5.15*	*1.80*	*2*	*H*	*4.82*	*1.53*	*2*	*M*
My mathematics instructor pushes me to take on challenging work	ICH3	5.62	1.70	1	H	4.91	1.84	4	M	5.22	1.65	2	H	4.65	1.64	4	M
		5.22	**1.71**	**2**	**H**	**4.48**	**1.91**	**4**	**M**	**5.32**	**1.43**	**2**	**H**	**4.58**	**1.41**	**4**	**M**
		6.08	*1.62*	*2*	*H*	*5.62*	*1.44*	*2*	*H*	*5.08*	*1.92*	*4*	*H*	*4.73*	*1.88*	*4*	*M*
My mathematics instructor makes sure that the work I do really makes me think	ICH4	5.12	1.53	4	H	5.33	1.56	1	H	5.81	1.42	1	H	4.96	1.29	1	M
		5.66	**1.62**	**1**	**H**	**5.11**	**1.64**	**1**	**H**	**5.92**	**1.23**	**1**	**H**	**4.56**	**1.27**	**1**	**M**
		6.18	*1.41*	*1*	*H*	5.76	*1.27*	*1*	*H*	*5.67*	*1.67*	*1*	*H*	*5.36*	*1.22*	*1*	*H*

Normal font: Sample, **Bold font: Males,** Italics: Female

Table 4-2: Cont'd Summarized data for the 4 universities including overall results and gender

Statement		MUT				DUT				UJ				UKZN			
		Mean	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**	**Mean**	**Std Dev**	**Rank**	**S.L**
Instructor caring	ICA	5.10	1.37	3	H	4.15	1.64	4	M	4.52	1.58	4	M	3.62	1.60	4	M
		4.95	**1.37**	**3**	**M**	**3.94**	**1.53**	**4**	**M**	**4.66**	**1.49**	**4**	**M**	**3.71**	**1.56**	**4**	**M**
		5.32	*1.38*	*3*	*H*	*4.35*	*1.78*	*4*	*M*	*4.31*	*1.70*	*4*	*M*	*3.52*	*1.67*	*4*	*M*
My mathematics instructor take a personal interest in students	ICA1	4.43	2.03	4	M	4.16	2.02	3	M	4.35	1.87	2	M	3.27	1.97	4	M
		4.21	**2.14**	**4**	**M**	**3.88**	**1.99**	**4**	**M**	**4.62**	**1.72**	**1**	**M**	**3.08**	**1.83**	**3**	**M**
		4.73	*1.88*	*4*	*M*	*4.44*	*2.00*	*1*	*M*	*3.97*	*2.02*	*2*	*M*	*3.45*	*2.13*	*3*	*M*
My mathematics instructor cares about how I feel	ICA2	4.48	2.03	3	M	3.54	2.04	4	M	3.69	2.01	4	M	3.13	1.74	1	M
		4.36	**2.07**	**3**	**M**	**3.47**	**1.91**	**3**	**M**	**3.91**	**1.97**	**4**	**M**	**3.29**	**1.88**	**4**	**M**
		4.74	*1.97*	*3*	*M*	*3.50*	*2.32*	*4*	*M*	*3.38*	*2.04*	*3*	*M*	*3.00*	*1.62*	*1*	*M*
My mathematics instructor listens to what I say	ICA3	5.58	1.55	2	H	4.60	1.86	1	M	4.82	1.88	3	M	3.89	1.75	2	M
		5.51	**1.50**	**2**	**H**	**4.45**	**1.67**	**1**	**M**	**5.02**	**1.72**	**2**	**H**	**4.12**	**1.62**	**1**	**M**
		5.71	*1.66*	*2*	*H*	*4.65*	*2.21*	*3*	*M*	*4.56*	*2.06*	*4*	*M*	*3.63*	*1.89*	*2*	*M*
I feel that my mathematics instructor will go above and beyond to help students	ICA4	5.88	1.40	1	H	4.31	1.91	2	M	5.22	1.87	1	H	4.15	1.87	3	M
		5.69	**1.56**	**1**	**H**	**3.94**	**1.76**	**2**	**M**	**5.09**	**1.81**	**3**	**H**	**4.25**	**1.65**	**2**	**M**
		6.11	*1.18*	*1*	*H*	*4.88*	*2.07*	*2*	*M*	*5.41*	*1.95*	*1*	*H*	*4.05*	*2.13*	*4*	*M*
Grade expected		80.60	1.08			77.16	1.54			81.65	1.23			80.00	1.22		
		79.20	**1.28**			**75.10**	**1.55**			**81.07**	**1.32**			**77.50**	**1.29**		
		78.70	*1.09*			*80.91*	*1.41*			*82.37*	*1.13*			*83.13*	*1.07*		
Grade achieved		72.10	1.15			64.32	1.27			76.35	6.92			69.30	0.90		
		70.10	**3.95**			**63.33**	**1.32**			**66.81**	**1.08**			**72.78**	**0.96**		
		72.90	*1.21*			*65.91*	*1.14*			*88.16*	*10.24*			*65.33*	*0.64*		

Normal font: Sample, **Bold font: Males,** Italics: Female

4.4 Categorization of scales

Table 4-3: Categorization of scales

Mean Scales		
High (H)	**Medium (M)**	**Low (L)**
5-7	>3<5	1-3

The categorization of the means of the scaled responses is shown in Table 4-3 to assist with the interpretation of the responses of participants.

4. 5 Descriptive Analysis

This section deals with a descriptive analysis for samples used in this study. It includes all samples on a rating of high, medium, males (high and medium), and females (high and medium)

Table 4-4: Descriptive analysis for all samples on a rating of HIGH

CONSTRUCTS	STATEMENTS	MEAN			
		MUT:	DUT	UJ	UKZN
SELF-EFFICACY	I am sure I can learn everything taught in Mathematics	5.62		5.69	
	I am sure that I can do even the most difficult work in my Mathematics class			5.13	
	Even if a new topic in mathematics is difficult I am sure that I can learn it	5.28		6.58	
	I am sure that I can figure out the answers to problems that my instructor gives me in class	5.49		5.47	
Total Number of Respondents		**3**	**0**	**4**	**0**
MASTERY GOAL STRUCTURE	My instructor thinks that really understanding the material is the main goal of the class	5.8	5.05	5.55	
	My instructor thinks it is important to understand the material and not to just memorize it	6.29	5.68	6.40	5.59
	My instructor thinks how much you improve in Mathematics is really important	6.11	5.31	6.16	5.2
	My mathematics instructor accepts nothing less than my full effort	5.6		6.04	
Total Number of Respondents		**4**	**3**	**4**	**2**
INSTRUCTOR CHALLENGE	When I have figured out how to do a mathematics problems my instructor gives me more challenging work	5.41		5.31	
	My mathematics instructor does not let me get away with doing easy work	5.36		5.09	
	My mathematics instructor pushes me to take on challenging work	5.62		5.22	
	My mathematics instructor makes sure that the work I do really makes me think	5.12	5.33	5.81	
Total Number of Respondents		4	1	4	0
INSTRUCTOR CARING	My mathematics instructor take a personal interest in students				
	My mathematics instructor cares about how I feel				
	My mathematics instructor listens to what I say	5.58			
	I feel that my mathematics instructor will go above and beyond to help students	5.88		5.22	
Total Number of Respondents		**2**	**0**	**1**	**0**

- Students reported high levels of agreement with the four statements on self-efficacy follows:
  - MUT : 75% of the statements, and
  - UJ: All the statements

- Students reported high levels of agreement with the four statements on mastery goal structure as follows:
  - MUT : All the statements
  - DUT: 75% of the statements
  - UJ: All the students, and
  - UKZN: 50% of the statements

- Students reported high levels of agreement with the four statements on instructors challenge as follows:
  - MUT : All of the statements
  - DUT: 25% of the statements, and
  - UJ: All of the statements

.

- Students reported high levels of agreement with the four statements on instructors care as follows:
  - MUT :50 % of the statements, and
  - UJ: 25% of the statements

Table 4-5: Descriptive analysis of all samples on a rating of MEDIUM

CONSTRUCTS	STATEMENTS	MEAN			
		MUT:	DUT	UJ	UKZN
SELF-EFFICACY	I am sure I can learn everything taught in Mathematics		4.90		4.93
	I am sure that I can do even the most difficult work in my Mathematics class	4.94	4.13		4.39
	Even if a new topic in mathematics is difficult I am sure that I can learn it		4.97		4.62
	I am sure that I can figure out the answers to problems that my instructor gives me in class		4.86		4.93
Total Number of Respondents		**1**	**4**	**0**	**4**
MASTERY GOAL STRUCTURE	My instructor thinks that really understanding the material is the main goal of the class				4.91
	My instructor thinks it is important to understand the material and not to just memorize it				
	My instructor thinks how much you improve in Mathematics is really important				
	My mathematics instructor accepts nothing less than my full effort		4.98		4.80
Total Number of Respondents		**0**	**1**	**0**	**2**
INSTRUCTOR CHALLENGE	When I have figured out how to do a mathematics problems my instructor gives me more challenging work		4.73		4.60
	My mathematics instructor does not let me get away with doing easy work		4.79		4.56
	My mathematics instructor pushes me to take on challenging work		4.91		4.65
	My mathematics instructor makes sure that the work I do really makes me think				4.96
Total Number of Respondents		**0**	**3**	**0**	**4**
INSTRUCTOR CARING	My mathematics instructor take a personal interest in students	4.43	4.16	4.35	3.27
	My mathematics instructor cares about how I feel	4.48	3.54	3.69	3.13
	My mathematics instructor listens to what I say		4.60	4.82	3.89
	I feel that my mathematics instructor will go above and beyond to help students		4.31		4.15
Total Number of Respondents		**2**	**4**	**3**	**4**

- Students reported high levels of agreement with the four statements on self-efficacy as follows:
  - MUT : 25% of the statements
  - DUT: All of the statements, and
  - UKZN: All of the statements

- Students reported high levels of agreement with the four statements on mastery goal structure as follows:
  - DUT: 25% of the statements, and
  - UKZN: 50% of the statements

- Students reported high levels of agreement with the four statements on instructors challenge as follows:
  - DUT: 75% of the statements, and
  - UKZN: All of the statements

- Students reported high levels of agreement with the four statements on mastery goal structure as follows:
  - MUT :50 % of the statements
  - DUT: All of the statements
  - UJ: 75% of the statements, and
  - UKZN: All of the statements

Table 4-6: Descriptive analysis of male respondents of a rating of HIGH

CONSTRUCTS	STATEMENTS	MEAN			
		MUT:	DUT	UJ	UKZN
SELF-EFFICACY	I am sure I can learn everything taught in Mathematics	5.64		5.61	5.00
	I am sure that I can do even the most difficult work in my Mathematics class	5.06		5.17	
	Even if a new topic in mathematics is difficult I am sure that I can learn it	5.28		5.51	
	I am sure that I can figure out the answers to problems that my instructor gives me in class	5.49		5.44	
Total Number of Respondents		**4**	**0**	**4**	**1**
MASTERY GOAL STRUCTURE	My instructor thinks that really understanding the material is the main goal of the class	5.69		5.38	
	My instructor thinks it is important to understand the material and not to just memorize it	6.12	5.57	6.22	5.42
	My instructor thinks how much you improve in Mathematics is really important	6.04	5.13	5.96	5.00
	My mathematics instructor accepts nothing less than my full effort	5.37		5.91	
Total Number of Respondents		**4**	**2**	**4**	**2**
INSTRUCTOR CHALLENGE	When I have figured out how to do a mathematics problems my instructor gives me more challenging work	5.04		5.20	
	My mathematics instructor does not let me get away with doing easy work	5.02		5.04	
	My mathematics instructor pushes me to take on challenging work	5.22		5.32	
	My mathematics instructor makes sure that the work I do really makes me think	5.66	5.11	5.92	
Total Number of Respondents		**4**	**1**	**4**	**0**
INSTRUCTOR CARING	My mathematics instructor take a personal interest in students				
	My mathematics instructor cares about how I feel				
	My mathematics instructor listens to what I say	5.51		5.02	
	I feel that my mathematics instructor will go above and beyond to help students	5.69		5.09	
Total Number of Respondents		**2**	**0**	**2**	**0**

- Students reported high levels of agreement with the four statements on self-efficacy as follows:
  - MUT : All of the statements
  - UJ: All of the statements, and
  - UKZN: 25% of the statements

- Students reported high levels of agreement with the four statements on mastery goal structure as follows:
  - MUT: All of the statements
  - DUT: 25% of the statements
  - UJ: All of the statements, and
  - UKZN: 25% of the statements

- Students reported high levels of agreement with the four statements on instructors challenge as follows:
  - MUT: All of the statements
  - DUT: 25% of the statements, and
  - UJ: All of the statements

- Students reported high levels of agreement with the four statements on instructors care as follows:
  - MUT :50 % of the statements, and
  - DUT: 75% of the statements

Table 4-7: Descriptive analysis of male respondents of a rating of MEDIUM

CONSTRUCTS	STATEMENTS	MEAN			
		MUT:	DUT	UJ	UKZN
SELF-EFFICACY	I am sure I can learn everything taught in Mathematics		4.75		
	I am sure that I can do even the most difficult work in my Mathematics class		4.06		4.67
	Even if a new topic in mathematics is difficult I am sure that I can learn it		4.81		4.71
	I am sure that I can figure out the answers to problems that my instructor gives me in class		4.81		4.92
Total Number of Respondents		**0**	**4**	**0**	**3**
MASTERY GOAL STRUCTURE	My instructor thinks that really understanding the material is the main goal of the class		4.92		4.83
	My instructor thinks it is important to understand the material and not to just memorize it				
	My instructor thinks how much you improve in Mathematics is really important				
	My mathematics instructor accepts nothing less than my full effort		4.92		4.42
Total Number of Respondents		**0**	**2**	**0**	**2**
INSTRUCTOR CHALLENGE	When I have figured out how to do a mathematics problems my instructor gives me more challenging work		4.43		4.54
	My mathematics instructor does not let me get away with doing easy work		4.74		4.33
	My mathematics instructor pushes me to take on challenging work		4.48		4.58
	My mathematics instructor makes sure that the work I do really makes me think				4.56
Total Number of Respondents		**0**	**3**	**0**	**4**
INSTRUCTOR CARING	My mathematics instructor take a personal interest in students	4.21	3.88	4.62	3.08
	My mathematics instructor cares about how I feel	4.36	3.47	3.91	3.29
	My mathematics instructor listens to what I say		4.45		4.12
	I feel that my mathematics instructor will go above and beyond to help students		3.94		4.25
Total Number of Respondents		**2**	**4**	**2**	**4**

- Students reported high levels of agreement with the four statements on self-efficacy as follows:
  - DUT : All of the statements, and
  - UKZN: 75% of the statements

- Students reported high levels of agreement with the four statements on mastery goal structure as follows:
  - DUT: 50% of the statements, and
  - UKZN: 50% of the statements

- Students reported high levels of agreement with the four statements on instructors challenge as follows::
  - DUT: 75% of the statements, and
  - UKZN: All of the statements

  .
- Students reported high levels of agreement with the four statements on instructors care as follows:
  - MUT :50 % of the statements
  - DUT: All of the statements
  - UJ:50% of the statements, and
  - UKZN: All of the statements

Table 4-8: Descriptive analysis of female respondents of a rating of HIGH

CONSTRUCTS	STATEMENTS	MEAN			
		MUT:	DUT	UJ	UKZN
SELF-EFFICACY	I am sure I can learn everything taught in Mathematics	5.61	5.00	5.79	
	I am sure that I can do even the most difficult work in my Mathematics class			5.08	
	Even if a new topic in mathematics is difficult I am sure that I can learn it	5.16	5.12	5.54	
	I am sure that I can figure out the answers to problems that my instructor gives me in class	5.39	5.08	5.54	
Total Number of Respondents		**3**	**3**	**4**	**0**
MASTERY GOAL STRUCTURE	My instructor thinks that really understanding the material is the main goal of the class	5.92	5.46	5.79	5.00
	My instructor thinks it is important to understand the material and not to just memorize it	6.47	5.96	6.67	5.77
	My instructor thinks how much you improve in Mathematics is really important	6.24	5.81	6.31	5.41
	My mathematics instructor accepts nothing less than my full effort	5.87	5.27	6.24	5.23
Total Number of Respondents		**4**	**4**	**4**	**4**
INSTRUCTOR CHALLENGE	When I have figured out how to do a mathematics problems my instructor gives me more challenging work	5.82	5.23	5.46	
	My mathematics instructor does not let me get away with doing easy work	5.83		5.15	
	My mathematics instructor pushes me to take on challenging work	6.08	5.62	5.08	
	My mathematics instructor makes sure that the work I do really makes me think	6.18	5.76	5.67	5.36
Total Number of Respondents		**4**	**3**	**4**	**1**
INSTRUCTOR CARING	My mathematics instructor take a personal interest in students				
	My mathematics instructor cares about how I feel				
	My mathematics instructor listens to what I say	5.71			
	I feel that my mathematics instructor will go above and beyond to help students	6.11		5.41	
Total Number of Respondents		**2**	**0**	**1**	**0**

- Students reported high levels of agreement with the four statements on self-efficacy as follows:
  - MUT:75% of the statements
  - DUT : 75% of the statements,
  - UJ: All of the statements

- Students reported high levels of agreement with the four statements on mastery goal structure as follows:
  - MUT: All of the statements
  - DUT: All of the statements
  - UJ: All of the statements, and
  - UKZN: All of the statements

- Students reported high levels of agreement with the four statements on instructors challenge as follows:
  - MUT: All of the statements
  - DUT: 75% of the statements
  - UJ: All of the statements, and
  - UKZN: 25% of the statements

- Students reported high levels of agreement with the four statements on mastery goal structure as follows:
  - MUT :50 % of the statements, and
  - UJ:25% of the statements

Table 6-9: Descriptive analysis of female respondents on a rating of MEDIUM

CONSTRUCTS	STATEMENTS	MEAN			
		MUT:	DUT	UJ	UKZN
SELF-EFFICACY	I am sure I can learn everything taught in Mathematics				4.86
	I am sure that I can do even the most difficult work in my Mathematics class	4.82	4.08		4.09
	Even if a new topic in mathematics is difficult I am sure that I can learn it				4.52
	I am sure that I can figure out the answers to problems that my instructor gives me in class				4.95
Total Number of Respondents		**1**	**1**	**0**	**4**
MASTERY GOAL STRUCTURE	My instructor thinks that really understanding the material is the main goal of the class				
	My instructor thinks it is important to understand the material and not to just memorize it				
	My instructor thinks how much you improve in Mathematics is really important				
	My mathematics instructor accepts nothing less than my full effort				
Total Number of Respondents		**0**	**0**	**0**	**0**
INSTRUCTOR CHALLENGE	When I have figured out how to do a mathematics problems my instructor gives me more challenging work				4.67
	My mathematics instructor does not let me get away with doing easy work		4.92		4.82
	My mathematics instructor pushes me to take on challenging work				4.73
	My mathematics instructor makes sure that the work I do really makes me think				
Total Number of Respondents		**0**	**1**	**0**	**3**
INSTRUCTOR CARING	My mathematics instructor take a personal interest in students	4.73	4.44	3.97	3.45
	My mathematics instructor cares about how I feel	4.74	3.50	3.38	3.00
	My mathematics instructor listens to what I say		4.65	4.56	3.63
	I feel that my mathematics instructor will go above and beyond to help students		4.88		4.05
Total Number of Respondents		**2**	**4**	**3**	**4**

- Students reported high levels of agreement with the four statements on self-efficacy as follows:
  - MUT:25% of the statements
  - DUT : 25% of the statements, and
  - UKZN: All of the statements

There were no responses of female students for Mastery Goal Structure from all universities on a medium level

- Students reported high levels of agreement with the four statements on instructors challenge as follows::
  - DUT: 25% of the statements, and
  - UKZN: 75% of the statements

  - Students reported high levels of agreement with the four statements on instructors care as follows:
  - MUT :50 % of the statements
  - DUT: All of the statements
  - UJ:75% of the statements, and
  - UKZN: All of the statements

Table 4-10: Grade Expected and Grade Achieved for sample (> 60% is rated as high)

SAMPLE	MUT	DUT	UJ	UKZN
	MEANS			
Grade Expected	80.60%	77.16%	81.65%	80.00%
Grade Achieved	72.1%	64.32%	76.35%	69.30%
% Difference	8.50%	12.84%	5.30%	10.70%

The average difference between Grade Achieved and Grade Expected is 9.33% as shown in Table 4-10

Table 4-11: Grade Expected and Grade Achieved for Males respondents (> 60% is rated as high)

MALES	MUT	DUT	UJ	UKZN
	MEANS			
Grade Expected	79.2%	75.10%	81.07%	77.50%
Grade Achieved	70.10%	63.33%	66.81%	72.78%
% Difference	9.10%	11.77%	14.26%	4.72%

The average difference between Grade Achieved and Grade Expected for males is 9.97% as shown in Table 4-11

Table 4-7: Grade Expected and Grade Achieved for Female respondents (> 60% is rated as high)

FEMALES	MUT	DUT	UJ	UKZN
	MEANS			
Grade Expected	78.70%	80.91%	82.36%	83.13%
Grade Achieved	72.90%	65.91%	88.16%	65.33%
% Difference	5.80%	15.00%	-5.80%	17.80%

The average difference between Grade Achieved and Grade Expected for females is 8.25% as shown in Table 4-12.

The percentage difference between males and females is 1.72%

4. 6 Anova

Table 4-8: Anova table Comparing Means

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Name of University	Between Groups	20.770	25	.831	.782	.763
	Within Groups	265.448	250	1.062		
	Total	286.217	275			
Grade expected	Between Groups	142.074	25	5.683	4.602	.000
	Within Groups	308.748	250	1.235		
	Total	450.822	275			
Grade achieved	Between Groups	325.572	25	13.023	.810	.728
	Within Groups	4019.164	250	16.077		
	Total	4344.736	275			
Mastery	Between Groups	109.800	25	4.392	3.399	.000
	Within Groups	323.012	250	1.292		
	Total	432.812	275			
Challenge	Between Groups	110.461	25	4.418	2.504	.000
	Within Groups	441.170	250	1.765		
	Total	551.631	275			
Care	Between Groups	110.445	25	4.418	1.844	.010
	Within Groups	598.908	250	2.396		
	Total	709.353	275			
Gender	Between Groups	5.668	25	.227	.928	.566
	Within Groups	61.067	250	.244		
	Total	66.736	275			

In testing for significant differences in the mean responses across the four different Universities, the ANOVA test was employed. The null hypothesis is that there is no significant difference in the means of the four groups, in which if accepted the sample can be treated as homogenous and no need to control further for the difference in groups for subsequent analyses.

The ANOVA results with $F(3, 60) = 2.139$ is not significant ($p > 0.05$). This implies that the null hypothesis will be accepted, and it can be concluded that there is no significant difference in the means of the four groups. Therefore, the sample can be treated as homogenous

4.7 KMO and Barlett's Test

Table 4-9: KMO and Bartlett's test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.883
Bartlett's Test of Sphericity	**Approx. Chi-Square**	2347.311
	df	153
	Sig.	.000

The Kaiser-Meyer-Olkin (KMO) and Bartlett results are shown on Table 4-14. The measure of sampling adequacy (MSA) which is used to assess the factorability of the overall set of variables and individual variables was computed to be 0.883, which falls in the acceptable range (above 0.5) according to Kaiser (1974). This indicates that the sample is more than sufficient for the factor analysis.

4.8 Factor Analysis

Table 4-15: Factor Analysis

		Mean	**Item-Total Correlation**	**α value**	**C.R**	**AVE**	**Item loadings**
Self	MSE1	5.123	.755	.881	.860	.612	.853
	MSE2		.823				.916
	MSE3		.759				.850
	MSE4		.645				.732
Mastery	IMG1	5.669	.623	.815	.807	.517	.779
	IMG2		.663				.817
	IMG3		.695				.743
	IMG4		.585				.541
Challenge	ICH1	5.202	.631	.838	.831	.554	.617
	ICH2		.694				.822
	ICH3		.721				.784
	ICH4		.642				.685
Care	ICA1	4.468	.650	.848	.843	.757	.712
	ICA2		.728				.805
	ICA3		.694				.801
	ICA4		.677				.769
Grade Expected					.924		.961
Grade Achieved					.980		.990

The analysis produced six factors with all items loading on the *prior* constructs with no cross loadings when factor loadings less than 0.50 were suppressed.

After factor analysis, the resulting constructs were assessed for reliability and validity. Reliability was assessed with Cronbach's alpha and item-to-total correlations while convergent validity was assessed using composite reliability (CR) and average variance extracted (AVE) and discriminant validity was assessed using inter-construct correlations which should be less that the square root of AVE. The Cronbach's alpha for all the scales were above 0.70 and item-to-total correlations greater than 0.50 which means the scales meet the minimum criteria for acceptability, and the AVEs were above the recommended 0.50. Therefore, all items converged excellently well on the respective constructs and exhibited reasonable psychometric properties. The results are shown in the Table 4-15.

4.9 Tests for Normality

Table 4-16: Tests of Normality

Tests of Normality						
	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistic	df	Sig.	Statistic	df	Sig.
Grade expected	.163	279	.000	.904	279	.000
Grade achieved	.333	279	.000	.202	279	.000
math self-efficacy	.099	279	.000	.959	279	.000
Instructor mastery goal structure	.151	279	.000	.873	279	.000
Instructor challenge	.120	279	.000	.925	279	.000
Instructor caring	.077	279	.000	.967	279	.000
a. Lilliefors Significance Correction						

The normality tests with specific reference to Shapiro Wilks reveal that all the measured scales do not come from a normal distribution with P-values of all six variables being significant ($p<0.05$). This implies that all bivariate relationships will be assessed by Spearman rank Correlation, a non-parametric test.

4.10 Inter-Construct Correlations Matrix

Table 4-1710: Correlations of Constructs

Correlations										
			Name of University	Gender	Grade expected	Grade achiev	Self	Mastery	Challenge	Care
Spearman's rho	Name of University	Correlation Coefficient	1.000	-.027	-.033	.046	.048	.129*	.186**	.233**
		Sig. (2-tailed)	.	.634	.578	.439	.398	.023	.001	.000
		N	311	306	282	280	311	311	311	311
	Gender	Correlation Coe	-.027	1.000	.057	.099	-.005	.172**	.193**	.042
		Sig. (2-tailed)	.634	.	.344	.099	.931	.003	.001	.468
		N	306	306	279	277	306	306	306	306
	Grade expected	Correlation Coe	-.033	.057	1.000	.386**	.343**	.161**	.122*	.149*
		Sig. (2-tailed)	.578	.344	.	.000	.000	.007	.040	.012
		N	282	279	282	279	282	282	282	282
	Grade achieved	Correlation Coe	.046	.099	.386**	1.000	.341**	.219**	.124*	.193**
		Sig. (2-tailed)	.439	.099	.000	.	.000	.000	.038	.001
		N	280	277	279	280	280	280	280	280
	Self	Correlation Coe	.048	-.005	.343**	.341**	1.000	.422**	.323**	.303**
		Sig. (2-tailed)	.398	.931	.000	.000	.	.000	.000	.000
		N	311	306	282	280	311	311	311	311
	Mastery	Correlation Coe	.129*	.172**	.161**	.219**	.422**	1.000	.621**	.430**
		Sig. (2-tailed)	.023	.003	.007	.000	.000	.	.000	.000
		N	311	306	282	280	311	311	311	311
	Challenge	Correlation Coe	.186**	.193**	.122*	.124*	.323**	.621**	1.000	.586**
		Sig. (2-tailed)	.001	.001	.040	.038	.000	.000	.	.000
		N	311	306	282	280	311	311	311	311
	Care	Correlation Coe	.233**	.042	.149*	.193**	.303**	.430**	.586**	1.000
		Sig. (2-tailed)	.000	.468	.012	.001	.000	.000	.000	.
		N	311	306	282	280	311	311	311	311
* Correlation is significant at the 0.05 level (2-tailed).										
** Correlation is significant at the 0.01 level (2-tailed).										

Correlation of the summated scales was used to assess construct discriminant validity. The correlations are shown in the table above. All the inter-construct correlations are less than 0.80 indicating a good general discriminant validity because no two constructs are too strongly correlated and so each depicts a different concept. Also, all inter-construct correlations are less than the square root of the respective average variance extraction (AVE).

With reference to the correlation, Grade Achieved ($r = 0.386$, $p < 0.000$) and Self-Efficacy ($r = 0.343$, $p < 0.000$) are significantly correlated with Grade Expected.

Grade Expected ($r = 0.343$, $p < 0.000$), Grade Achieved ($r = 0.341$, $p < 0.000$), Mastery Goal Structure ($r = 0.422$, $p < 0.000$), Instructors Challenge ($r = 0.323$, $p < 0.000$), Instructors Care ($r = 0.303$, $p < 0.000$) are significantly correlated with Self- Efficacy.

Self-Efficacy ($r = 0.422$, $p < 0.000$), Instructors Challenge ($r = 0.621$, $p < 0.000$), and Instructors Care ($r = 0.430$, $p < 0.000$), are significantly correlated with Mastery Goal Structure.

Self-Efficacy ($r = 0.323$, $p < 0.000$), Mastery Goal Structure ($r = 0.621$, $p < 0.000$), and Instructors Care ($r = 0.586$, $p < 0.000$), are significantly correlated with Instructors Challenge.

4.11 Regression Analysis

Having evaluated that the research instrument for its reliability and validity, relationships among the variables were tested.

To assess how well the independent variables explain the dependent variable, a total of 12 linear regression models comprising of seven simple linear regression models and five multiple linear regression model were run.

4.12 Simple Linear Regression

Table 4-18: Self-efficacy on Gender, on Mastery, on Care, on Challenge, on Grade achieved, on Grade expected and on Name of University

Model Summaryb										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.003a	.000	-.003	1.29678	.000	.003	1	304	.957	1.903
2	.401b	.161	.158	1.18265	.161	59.179	1	309	.000	2.119
3	.303c	.092	.089	1.23020	.092	31.267	1	309	.000	2.057
4	.281d	.079	.076	1.23907	.079	26.412	1	309	.000	1.989
5	.054e	.003	-.001	1.28520	.003	.827	1	278	.364	2.012
6	.311f	.097	.093	1.21866	.097	29.912	1	280	.000	2.098
7	.056g	.003	.000	1.28892	.003	.967	1	309	.326	1.933

a Predictors: (Constant), Gender

b Predictors: (Constant), Mastery

c Predictors: (Constant), Care

d Predictors: (Constant), Challenge

e Predictors: (Constant), Grade achieved

f Predictors: (Constant), Grade expected

g Predictors: (Constant), Name of University

h Dependent Variable: Self

4.12.1 Self-efficacy on Gender

A simple linear regression was conducted with the independent variable being gender on self-efficacy being the dependent. A conceptual model was tested to find out whether the association of the independent variable on the dependent variable contributed to the significance thereof. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy. Table 18 and 19 shows a R^2 value of 0.000 and an insignificant F statistic ($p > 0.05$). This implies that there is no sufficient evidence of a significant relationship of the students' self-efficacy to gender.

4.12.2 Self-efficacy on Mastery

A simple linear regression was conducted with the independent variable being mastery goal structure on self-efficacy being the dependent variable. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy, tables 18 and 19 shows a R^2 value of 0.158 (15.8%) and a significant F statistic ($p < 0.05$). This implies that there is sufficient evidence of a significant relationship of mastery goal structure to self-efficacy.

4.12.3 Self-efficacy on Care

A simple linear regression was conducted with the independent variable being instructor care on self-efficacy being the dependent variable. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy, tables 18 and 19 shows a R^2 value of 0.092 (9.2%) and a significant F statistic ($p < 0.05$). This implies that there is sufficient evidence of a significant relationship of instructor care to self-efficacy.

4.12.4 Self-efficacy on Challenge

A simple linear regression was conducted with the independent variable being instructor challenge on self-efficacy being the dependent variable. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy, tables 18 and 19 shows a R^2 value of 0.079 (7.9%) and a significant F statistic ($p < 0.05$). This implies that there is sufficient evidence of a significant relationship of instructor challenge to self-efficacy.

4.12.5 Self- efficacy on Grade Achieved

A simple linear regression was conducted with the independent variable being grade achieved on self-efficacy being the dependent. A conceptual model was tested to find out whether the association of the independent variable on the dependent variable contributed to the significance thereof. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy. Table 18 and 19 shows a very low R^2 value of 0.003 (0.3%) and an insignificant F statistic ($p > 0.05$). This implies that there is no sufficient evidence of a significant relationship of the students' self-efficacy to grade achieved.

4.12.6 Self-efficacy on Grade Expected

A simple linear regression was conducted with the independent variable being grade expected on self-efficacy being the dependent variable. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy, tables 18 and 19 shows a R^2 value of 0.097(9.7%) and a significant F statistic ($p < 0.05$). This implies that there is sufficient evidence of a significant relationship of grade expected to self-efficacy.

4.12.7 Self- efficacy on Name of University

A simple linear regression was conducted with the independent variable being the name of university on self-efficacy being the dependent. A conceptual model was tested to find out whether the association of the independent variable on the dependent variable contributed to the significance thereof. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy. Table 18 and 19 shows a very low R^2 value of 0.003(0.3%) and an insignificant F statistic ($p > 0.05$). This implies that there is no sufficient evidence of a significant relationship of the students' self-efficacy to the name of university.

4.13 Multiple Linear Regression

Table 4-19: Self-efficacy on Care, Gender, Grade Achieved, Grade Expected, Name of University, Mastery and Challenge

Model Summaryb										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.491a	.241	.222	1.13880	.241	12.183	7	268	.000	2.138
a Predictors: (Constant), Care, Gender, Grade achieved, Grade expected, Name of University, Mastery, Challenge										
b Dependent Variable: Self										

The conceptual model was tested by jointly testing the association of the independent variable on the dependent variable. To achieve a multiple liner regression model was conducted. Self-efficacy being the dependent variable and instructors care, gender, grade achieved, grade expected, name of university mastery goal structure and instructors challenge being the independent variables. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy, Table 4-19 shows a R^2 value of 0.241(24%) and a significant F statistic ($p < 0.05$). This implies that there is sufficient evidence of a significant relationship of the independent variables to the dependent variable.

Table 4-20: Self-efficacy on Care, Mastery and Challenge

Model Summaryb											
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson	
					R Square Change	F Change	df1	df2	Sig. F Change		
1	.426a	.182	.174	1.17151	.182	22.738	3	307	.000	2.146	
a Predictors: (Constant), Care, Mastery, Challenge											HYPOTHESIS 1
b Dependent Variable: Self											

The conceptual model was tested by jointly testing the association of the independent variable on the dependent variable. To achieve a multiple liner regression model was conducted. Self-efficacy being the dependent variable and instructors care, mastery goal structure and instructors challenge being the independent variables. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy, Table 4-20 shows a R^2 value of 0.182(18.2%) and a significant F statistic ($p < 0.05$). This implies that there is sufficient evidence of a significant relationship of the independent variables to the dependent variable

Table 4-21: Self-efficacy on Grade Achieved and Grade Expected

Model Summaryb											
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson	
					R Square Change	F Change	df1	df2	Sig. F Change		
1	.309a	.096	.089	1.22530	.096	14.597	2	276	.000	2.089	
a Predictors: (Constant), Grade achieved, Grade expected											HYPOTHESIS 2
b Dependent Variable: Self											

The conceptual model was tested by jointly testing the association of the independent variable on the dependent variable. To achieve a multiple liner regression model was conducted. Self-efficacy being the dependent variable and grade achieved and grade expected being the independent variables. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy, table 4-21 shows a R^2 value of 0.096(9.6%) and a significant F statistic ($p < 0.05$). This implies that there is sufficient evidence of a significant relationship of the independent variables to the dependent variable

Table 4-22: Self-efficacy on Care, Grade Expected, Mastery and Challenge

Model Summaryb											
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson	
					R Square Change	F Change	df1	df2	Sig. F Change		
1	.489a	.240	.229	1.12412	.240	21.809	4	277	.000	2.168	
a Predictors: (Constant), Care, Grade expected, Mastery, Challenge											HYPOTHESIS 3
b Dependent Variable: Self											

The conceptual model was tested by jointly testing the association of the independent variable on the dependent variable. To achieve a multiple liner regression model was conducted. Self-efficacy being the dependent variable and instructors care, grade expected, mastery goal structure and instructors challenge being the independent variables. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy, Table 4-22 shows a R^2 value of 0.24(24%) and a significant F statistic ($p < 0.05$). This implies that there is sufficient evidence of a significant relationship of the independent variables to the dependent variable.

Table 4-23: Self-efficacy on Gender and Name of University

Model Summaryb											
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson	
					R Square Change	F Change	df1	df2	Sig. F Change		
1	.054a	.003	-.004	1.29702	.003	.445	2	303	.641	1.907	
a Predictors: (Constant), Gender, Name of University											HYPOTHESIS 4
b Dependent Variable: Self											

The conceptual model was tested by jointly testing the association of the independent variable on the dependent variable. To achieve a multiple liner regression model was conducted. Self-efficacy being the dependent variable and gender and name of university being the independent variables. Using the coefficient of determination (R^2) as a measure of goodness of the fitted model, and the F statistic as the measure of model adequacy, Table 4-23 shows a R^2 value of 0.003 (0.3%) and a significant F statistic ($p > 0.05$). This implies that there is insufficient evidence of a significant relationship of the independent variables to the dependent variable.

4.14 Conclusion

A conceptual model was constructed and analyzed involving dependent and independent variables. The analysis incorporated the following predictors: Instructor Caring, Instructor Mastery Goal Structure, Instructor Challenge, Gender, Name of University and Student Expectations with Self-Efficacy being the dependent variable. SPSS v24 was used to generate data for the 6 constructs. The analysis indicates that there is a correlation between Mastery Goal Structure, Instructors Care, Grade Expected and Instructor Challenge with Self-Efficacy. There was no significant correlation between Gender, Name of University and Student Achievement with Self-Efficacy.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The current study was focused on the relationship between classroom climates, student self-efficacy and student achievement in mathematics. Four universities (MUT, DUT, UJ and UKZN) were chosen to conduct this research in order to explore the influence and impact of various constructs within the construction discipline. Mathematics has always been a very important component of the curriculum for students to be successful in the construction and engineering industry. However, many challenges have been accounted and this study has focused on some aspects related to these challenges. This study will assist instructors to improve the teaching method and create a conducive environment to improve student's mathematics performance. Many respondents (59.2%) were males. Majority of the students are in the second and third year comprising 47.6% and 45.3% respectively. For the institutions that make up the sample, the proportions of students were fairly even distributed, with UKZN having the least (14.8%), and UJ having the highest (30.2%).

5.2 Problem Statement

The problem statement was:

Traditional didactic teaching methods are commonly used in the teaching of mathematics to university construction students, without taking into consideration the various degrees of student self-efficacy about mathematics and the impacts of mastery goal structure, lecturer challenge, and lecturer care and classroom climate on their achievement in mathematics.

5.3 Hypotheses

- The hypotheses [HI, H2,H3 , and H4] the study sought to test were:
- The Classroom Climate has strong effect on a students' self-efficacy when being taught mathematics in Construction Studies at the 4 universities (MUT, UKZN, UJ and DUT) {H1}
- There is a correlational relationship between student self-efficacy, student achievement, and grade expected in the course of Mathematics at the 4 universities (MUT, UKZN, UJ, and DUT) in Construction Studies. {H2}
- There is a correlational relationship between student's self-efficacy, instructor care, grade expected, mastery goal structure, and instructors challenge. {H3}
- There is no correlational relationship between self-efficacy, name of university and gender. {H4}

5.4 Objectives

The main objective of this study is to ascertain whether Classroom Climate affects a student's level of Self Efficacy and Mathematical Achievement in Construction studies for all 4 universities. To achieve this main objective, specific objectives are described as follows:

- To discover whether students have a decrease or increase in self-efficacy, goal mastery and strategic learning within the current classroom climate.
- To discover whether classroom climate increases or decreases self-efficacy in the current classroom environment.
- To understand the student-instructor relationship within the current classroom climate with respect to achievement in mathematics.

5.5 Hypotheses Testing:

The classroom climate comprising of mastery goal structure, instructors challenge and instructors care has strong effect on a students' self-efficacy when being taught mathematics in Construction Studies at the four universities (MUT, UKZN, UJ and DUT) {H1}

Evidence from the study indicated that classroom climate was significantly associated with students self efficacy. This is confirmed by the analysis conducted related to self-efficacy on intructor's care , mastery goal structure and intructor challenge.

This is supported by multiple regression analysis using a model revealing the significance between the constructs R^2 value of 0.24(24%) and a significant F statistic ($p < 0.05$) were generated . This implies that there is sufficient evidence of relationship between the independent variables and the dependent variable

Similar conclusion has been found in the reviewed literature and from previous studies dealing with the same types of constructs(Pitkaniemi and Vanninen, 2012 ; Weinstein and McKown, 1998 ; Wentzel, 1994; Goodenow, 1993) , Therefore, the hypothesis that the Classroom Climate has strong effect on a students' self-efficacy when being taught mathematics in Construction Studies at the four universities (MUT, UKZN, UJ and DUT) cannot be rejected

There is a correlational relationship between student self-efficacy, grade expected, and grade achieved in the course of Mathematics at the 4 universities (MUT, UKZN, UJ, and DUT) in Construction Studies. {H2}

This is supported by multiple regression analysis using a model revealing the significance between the constructs whereby R^2 value of 0.24(24%) and a significant F statistic ($p < 0.05$) were generated. This implies that there is sufficient evidence of relationship between the independent variables and the dependent variable.

Evidence from the current study revealed that student achievment and grade achieved was significantly associated with students self efficacy. This is confirmed by the analysis conducted.

Similar conclusion has been found from previous studies dealing with the same types of constructs(Campbell et al., 2000; Meyer, 1998; Schmidt et al., 2001; Singh et al., 2002) , Therefore, this hypothesis cannot be rejected.

There is a correlational relationship between student's self-efficacy, instructor care, grade expected, mastery goal structure, and instructors challenge. {H3}

Evidence from the current study revealed that student's self-efficacy , instructor care , grade expected , mastery goal structure and instructor's challenge was significantly associated. This is confirmed by the analysis conducted.

This is supported by multiple regression analysis using a model revealing the significance between the constructs whereby R^2 value of 0.24(24%) and a significant F statistic ($p < 0.05$). This implies that there is sufficient evidence of a significant relationship of the independent variables to the dependent variable

Previous studies dealing with the same types of constructs have confirmed (Fast et al. (2010; Nolen, 2003; Singh et al., 2002), Therefore, this hypothesis cannot be rejected.

There is no correlational relationship between self-efficacy, name of university and gender. {H4}

Evidence from the current study revealed that student's self-efficacy , name of the university and gender was not significantly associated. This is confirmed by the analysis conducted. There was no literature available to prove otherwise when combined self-efficacy , name of univeristy and gender to support or contradict this findings. Therefore, this hypothesis cannot be rejected.

This is supported by multiple regression analysis using a model revealing the significance between the constructs whereby R^2 value of 0.003 (0.3%) and a significant F statistic ($p > 0.05$). This implies that there is insufficient evidence of a significant relationship of the independent variables to the dependent variable.

5.6 Conclusions / Findings

Studies confirmed that there was a positive correlation between mathematics self--efficacy and mastery goal structure, instructor challenge and instructor care as found by Fast, et al. (2010) in their study when they compared the same constructs. Further, the study suggested that student instructor relationships in the form of these constructs influenced their mathematics efficacy. The findings of the studies by Murdock, Hale and Weber (2001), Nolen (2003) and Wolters, 2004 were also confirmed in this study.

In particular, mathematics self--efficacy was positively correlated with grade expectation and grade achievement despite the grades expected being substantially higher than the actual grades achieved. For all samples there was no correlation between mathematics self--efficacy, name of university, gender and student achievement. There was a positive correlation between mathematics self-efficacy and instructors care, grade expected, mastery goal structure and instructors challenge.

The findings of this study suggest that if instructors focus on creating learning classroom environments for mathematics through goal setting, appropriate challenges and empathy, student's Achievement in mathematics will improve. Instructor care was the construct that students least agreed with indicative of the opportunity for instructors to improve their relationships with their students characterized by warmth, friendliness, respect, empathy and care. In so doing it is likely that the student mathematics self--efficacy will improve commensurately with improved achievement the outcome.

5.7 Limitation of the Study

While the study has some practical and theoretical contributions, it was limited in some ways and so some future research avenues are suggested. Firstly, the data were collected from four universities and the sample size of 311 is relatively small in relation to South Africa having 23 universities and mathematics module is offered in other programs and faculties. Therefore, the study recommends that future studies can be extended to a larger geographical area of the country and the instruments tested with other populations.

5.8 Recommendations for Future/Further Studies

In regards with the findings from this study ,there are many areas to be investigated in order to get a better undertanding on aspects related to self-efficacy in mathematics. The main recommendation for future studies needs to be extended to a larger geographical area of the country and the instruments tested with other populations. It is also recommended that:

Universities should create a centre for mathematics support to increase student self-efficacy, the centre will provide mentorship for all students more particularily to ''at risk students''

The lecturer-student ratio requires to be conducive to create a friendly learning environment

The learning of mathematics should be using visual intruments to facilatate the undertanding of mathematics.

Mathematics should be compulsary for all disciplines at basic level.

APPENDIX

This survey is designed to measure the relationship between classroom climate, student self-efficacy and achievement in mathematics at university

Please indicate to what extent you agree with the following statements with 1= strongly disagree and 7=strongly agree:								
NO:	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	I am sure I can learn everything taught in Mathematics							
2	I am sure that I can do even the most difficult work in my Mathematics class							
3	Even if a new topic in Mathematics is difficult, I am sure that I can learn it							
4	I am sure that I can figure out the answers to problems that my instructor gives me in class							
5	My instructor thinks that really understanding the material is the main goal of the class							
6	My instructor thinks it is important to understand the material and not just to memorize it							
7	My instructor thinks how much you improve in Mathematics is really important							
8	My Mathematics instructor accepts nothing less than my full effort							
9	When I have figured out how to do a Mathematics problem my instructor gives me more challenging work							
10	My Mathematics instructor does not let me get away with doing easy work							
11	My Mathematics instructor pushes me to take on challenging work							
12	My Mathematics instructor makes sure that the work I do really makes me think							
13	My Mathematics instructor takes a personal interest in students							
14	My Mathematics instructor cares about how I feel							
15	My Mathematics instructor listens to what I say							
16	I feel that my Mathematics instructor will go above and beyond to help students							

Level of Study	
First year	
Second year	
Third year	
Fourth year	

Discipline	
Construction Management	
Civil Engineering	
Quantityt Surveying	
Property Development	

Gender	
Male	
Female	

Mathematics Module:

Grade Expected:

Grade Achieved:

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