AN EXAMINATION OF THE PREDICTIVE FACTORS ON STUDENTS' MOTIVATION FOR SUCCESS IN UNDERGRADUATE INTRODUCTORY MATHEMATICS COURSES IN THE UAE

دراسة تحليلية للعوامل التنبؤية على حوافز الطلبة للنجاح في مساقات الرياضيات التمهيدية المطروحة ضمن درجات البكالوريوس في دولة الإمارات العربية المتحدة

by

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Abstract

The purpose of the study is to examine whether there is a significant relationship between students' motivation to succeed in introductory mathematics courses offered by universities in the UAE as the dependent variable of the research and another five independent variables including cognitive mathematics self-concept, affective mathematics self-concept, extrinsic motivation as expectations of future career and income, students' age, and the number of mathematics courses taken by students. The rationale of the study is based on the significance of mathematics achievements for students and academic institutions in particular, as well as for the society in general.

The study is designed based on a mixed research methodology that employs an explanatory approach. The sample includes a total of 685 students who were registered in different introductory mathematics courses at four academic institutions of higher education in the UAE and participated in completing a survey questionnaire. The quantitative correlation analysis among students' motivation, cognitive mathematics self-concept, affective mathematics self-concept, extrinsic motivation, students' age, and the number of mathematics courses taken by students reveals theoretically consistent interrelationships. The quantitative multiple regression analysis indicates that the five independent variables explain 71.3% of the variation in students' motivation to succeed in introductory mathematic courses. The qualitative analysis of 17 semi-structured interviews is used to refine, enhance, and expand on the quantitative findings. The qualitative findings are discussed in a relationship with several theories and are based on their implications on teaching and learning of mathematics.

ملخص

تهدف هذه الدراسة إلى بيان و تحليل العلاقة بين تحفيز الطلبة للنجاح في مساقات الرياضيات التمهيدية المطروحة في الجامعات بدولة الإمارات العربية المتحدة كالمتغير التابع للبحث من جهة، و خمسة متغيرات مستقلة تشتمل على مفهوم الذات الإداركي في الرياضيات، و مفهوم الذات العاطفي في الرياضيات، و التحفيز الخارجي متمثلاً بالتوقعات المستقبلية للوظيفة و الدخل، و عمر الطلبة، و عدد مساقات الرياضيات التي قام الطلبة بدراستها من جهة أخرى؛ و يستند الأساس المنطقي لهذه الدراسة على أهمية الإنجازات في الرياضيات لكل من الطلبة و المؤسسات الأكاديمية على وجه الخصوص، وكذلك المجتمع على وجه العموم.

صُمّمت الدراسة من خلال استخدام منهج البحث المندمج القائم على أسلوب تفسيري. اشتملت عينة البحث على 685 طالباً و طالبة كانوا مسجلين في مساقات الرياضيات التمهيدية بأربع مؤسسات للتعليم العالي بدولة الإمارات العربية المتحدة قاموا باستكمال استبانة الدراسة. و لا يخفى أن تحليل الارتباط الكمي يكشف عن وجود علاقات متبادلة و متناسقة من ناحية نظرية بين تحفيز الطلبة من جهة و مفهوم الذات الإدراكي في الرياضيات، و مفهوم الذات العاطفي في الرياضيات، و التحفيز الخارجي، و عمر الطلبة، و عدد مساقات الرياضيات التي قام الطلبة بدراستها من جهة أخرى. كما أن تحليل الانحدار الكمي المتعدد يدل بأن المتغيرات المستقلة الخمسة ساهمت في تعليل التباين في تحفيز الطلبة للنجاح في مساقات الرياضيات التمهيدية بنسبة 71.3%. وقد تم استخدام التحليل النوعي من خلال 17 مقابلة شبه منظمة لتحسين و تعزيز و توسيع النتائج الكمية. وقد تمت مناقشة النتائج بالاعتماد على نظريات متعددة و بيان آثارهم في تعليم و تعلم الرياضيات.

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CHAPTER ONE: INTRODUCTION

1.1 Personal Statement

I have been working in the field of higher education for the past eight years through which I taught undergraduate introductory mathematics and statistics courses, and I also tutored students in other postgraduate quantitative courses. During my eight years, I observed that most of first year undergraduate students usually need special attention in order to adapt with the transitional period from school life to college life. Moreover, I got the opportunity to interact with three different groups of students. The first group includes students who were very good at introductory mathematics courses and successfully managed to enrol in programmes that require high levels of mathematics. The second group includes students who substantially struggled with their introductory mathematics courses and barely managed to scrape through. The third group includes students who suffered with their introductory mathematics courses and ultimately failed, dropped out, changed their desired majors, or quitted their education.

Although I was extremely glad in the success of those students who managed to make it through, I also sympathised with the mischance of other students who could not make it through. In spite of the fact that the percentage of students who succeed in my courses is quite higher than the percentage of those who could not make the grade, my attention and time have been constantly allocated to assist my suffering students. I have spent unlimited number of hours attempting to find out techniques to support my suffering students through offering additional tutorial assistance, encouraging suffering students to ask for help when needed, planning lessons and in-class activities in an interactive approach that engages students, and using real-life applications that allow students to become life-long learners. Although my endeavors and initiatives were not fruitful sometimes to enhance the outcomes of suffering students, I was passionate to find out what differentiates between students who work hard and succeed and students who struggle to work hard and still do not make it.

Based on my review of the literature on success and failure in mathematics and based on my interaction with students, I believe that the most significant factor of success in mathematics courses is motivation. Teaching and helping students who are motivated to do mathematics is not very difficult regardless of the source or reason of their motivation and whether their motivation is intrinsic or extrinsic. For instance, students who possess the motivation to attend classes, work on homework assignments, study for exams, and ask questions are relatively not very complicated students to teach in general.

On the other hand, students who are resistant to attend classes, work on homework assignments, study for exams, and ask questions are those students who do not get the help they need and often do not make it. Students who exhibit such behaviour of no show-up are considered to be at risk students and they usually do not do well or often fail. For this reason, the decision has been made to deeply examine the concept of motivation to succeed in undergraduate introductory mathematics courses and the predictive factors related to it. Therefore, if a relationship between students' motivation to succeed in mathematics and students' personal beliefs about themselves is established, it will definitely contribute to the efforts of researchers and instructors in the domain. Once the predictive factors of students' motivation to succeed in undergraduate introductory mathematics courses are identified, it would be very useful to incorporate these predictive factors with the instructional designs and strategies of mathematics in order to support all students who want to study mathematics and enhance their performance.

1.2 Statement of the Problem

Mathematics has been known as a major and indispensable foundation in the field of education which is integrated with many and diverse disciplines such as science and technology; engineering and architecture; business and management; social sciences; art and music; and physics, chemistry, and statistics (Yushau & Omar 2007; House 2000; Barber 1995; Wright 2009). In spite of the important role of mathematics and the increasing need for mathematics, college students' success rates in introductory mathematics courses in the UAE are not promising (UAEU 2015). For example, the analyses of graduation, attrition, and time-to-degree rates at the United Arab Emirates University (UAEU), which is considered as one of the oldest and largest federal universities in the United Arabic Emirates (UAE), evidence this trend. The graduation rates were calculated for the cohorts starting from the academic year 2005-06 to the academic year 2008-09 in all undergraduate degree programmes at the UAEU with exception to the programmes offered by the College of Medicine and Health Sciences (UAEU 2015). The percentage of undergraduate students who graduated within one-and-half nominal lengths of the programme was 81% which is a quite high percentage. For example, students in engineering, information technology, and education programmes needed five to seven years to graduate. Moreover, 31% of students could not graduate and were still in their programmes beyond the nominal length of the programme. It is reported that the majority of admitted freshmen at the UAEU needs remedial support in English, mathematics, and Arabic. Consequently, the colleges were advised to develop pertinent improvement plans in order to enhance first year students' success rates in the introductory courses of English, mathematics, and Arabic (UAEU 2015).

The issue of low success rates in introductory mathematics courses is a serious issue at not only the regional level, but also it is an existing issue at the international level. MacNamara and Penner (2012) indicate that students at post-secondary academic institutions in British Columbia at the United States experience high failure rates in first-year mathematics courses and this became a well-known phenomenon which was worthy to be evaluated. Twigg (2009) reports that about 60% of students fail to complete their undergraduate degrees within five years at public academic institutions in the United States, and half of these students withdraw during the first year due to the difficulty faced in quantitative courses, particularly introductory mathematics courses. Watt et al. (2012) express that there is a scarcity in the number of qualified individuals to meet the high demand for the needed careers in Science, Technology, Engineering, and Mathematics (STEM) fields. It is proposed by Yousef (2011) that quantitative courses are considered by the majority of business students in the UAEU as the most difficult courses and the phenomenon of negative attitudes towards quantitative courses is not only restricted to students at the UAE, but it is a common attitude amongst students across-the-board. Gresham (2007) points out that some students suffer from certain feelings such as tension, panic, helplessness, mental disorganisation, and paralysis whenever they are asked to perform a mathematical operation or solve a problem. This phobia from mathematics creates negative attitudes towards mathematics and inhibits students' motivation to learn and succeed which eventually results in poor academic achievement of students in mathematics courses. Artelt (2005) indicates in a research study which was held at an international level that motivated students have good opportunities to learn and perform better than other students. It is emphasised by Anthony (2000) that motivation has been frequently viewed by various researchers to influence students' success in mathematics; however, it is challenging to quantify students' motivation alone without taking into consideration the importance of other factors such as students' perceptions of their abilities to succeed in mathematics.

1.3 Purpose of the Study

The purpose of this research study is to examine the relationship between certain predictive factors and students' motivation to succeed in undergraduate introductory mathematics courses offered by universities in the UAE. Therefore, the major research question of the thesis is: what are the predictive factors of students' motivation to succeed in undergraduate introductory mathematics courses at universities in the UAE?

1.4 Research Questions

The following three sub-questions have been articulated to address the major research question of the thesis:

1. Is there any significant relationship between students' motivation to succeed in undergraduate introductory mathematics courses and students' mathematics self-concept including its two components, cognitive and affective self-concept?
2. Is there any significant relationship between students' motivation to succeed in undergraduate introductory mathematics courses and students' expectations of future career and income?
3. Is there any significant relationship between students' motivation to succeed in undergraduate introductory mathematics courses and students' demographic information including students' age and the number of mathematics courses taken by students?

1.5 Rational and Significance

The rationale behind the research study stems from its endeavor to identify a significant area in research on students' motivation to succeed in undergraduate introductory mathematics courses and then fill the gap. Thus, the rationale is based on the significance of mathematics achievements for students and academic institutions in particular, as well as for the society in general. The thesis is expected to benefit both students and administrations of academic institutions of higher education which are considered the two major stakeholders involved in the process of education in the UAE. Students will be able to achieve their future goals and desires through the gained knowledge on the predictive factors that enhance students' motivation to succeed in mathematics courses. The success of students in introductory mathematics courses has a significant impact on students' persistence to obtain degrees in mathematics, science, and engineering disciplines. Moreover, students' success in mathematics enhances students' problem solving skills and fosters students' rigorous and logical thinking skills (Vorderman et al. 2011). For example, the use of mathematical word application problems improves students' ability to logically analyse different situations in life by following certain series of steps in a specific order in order to reach the proper solution. On the other hand, administrations of academic institutions will be able to improve the quality of their offered education by promoting students' motivation to succeed in mathematics courses which ultimately improves students' retention rates, students' graduation rates, and students' engagement. The findings of this thesis are expected to raise the awareness of administrations and instructors at academic institutions of higher education on the predictive factors that motivate students to succeed in undergraduate introductory mathematics courses. Accordingly, administrations may be able to improve students' learning experience as well as performance, and instructors may be able to take the necessary actions to enhance the academic performance of all students and in particular weak students.

Moreover, much of the research studies about students' attitudes toward mathematics have been held in Western societies, and there is an evitable necessity and need to extend this area of research to non-Western societies including the UAE and the Arab world in order to decide if there exists a cross-national generalisation regarding the impact of mathematics self-concept on students' motivation to succeed in mathematics. Vorderman et al. (2011) suggest that mathematics contributes in the development of the culture and civilisation of all societies. According to Niss (1994), mathematics is known for its constant integration with the new areas and trends that enhance the development of our societies. For instance, one of the most significant impacts of mathematics on societies is evidenced through the evolution and dissemination of computers. The functions of various sectors of societies such as economic, political, family, religious, and education sectors rely heavily on using computers on a daily basis. Mathematics is considered the fundamental requirement for the designs and functions of all computers' hardware and software and computers would hardly exist in our societies without mathematics. One of the fundamental forces that drives this research study is the confession that literacy in the field of mathematics influences economic productivity of societies. In order to successfully develop the economy of the UAE, it is very essential to improve world-class competence in mathematics. The gained knowledge on the predictive factors of students' motivation to succeed in undergraduate introductory mathematics courses will improve students' ability to interpret and use mathematics in many various applications and situations of life which ultimately promotes students' participation in the development of the UAE society. Therefore, the thesis is anticipated to have positive implications on the society of the UAE.

1.6 Definitions of Terms

The following definitions of terms are provided for the purpose of this research study. Furthermore, comprehensive in-depth definitions and analysis are offered in the theoretical framework and literature review chapter.

Motivation

Motivation has been defined in general and specific in the pedagogical research. Motivation is defined in general as the cognitive and affective psychological processes that supply individuals' behaviour with goal, direction, and power and it is accountable for producing differences in outcomes among different individuals (Mwangi & McCaslin 1994).

Students' Motivation

Students' motivation is defined as the cognitive and affective processes that trigger students to participate in learning activities and perform academic tasks (Lumsden 1994; Slavin 1990).

Students' Motivation in Mathematics

Students' motivation to succeed in mathematics courses is defined as a process which entails making sense of a mathematical activity, understanding its information in relation to previous knowledge, and mastering the mathematical skills it supports (Brophy 1999; Brophy 2013).

Self-Concept

Self-concept has also been defined from different aspects. Self-concept is defined in general as the perceptions of individuals about themselves that are developed as a result of individuals' interaction and experience with the environment (Shavelson et al. 1976).

Academic Self-Concept

Academic self-concept is defined by O'Mara et al. (2006) as the self-perceptions of students about their academic abilities and skills which are influenced by students' previous experiences and interactions with the academic environment.

Mathematics Academic Self-Concept

Mathematics academic self-concept is defined as the evaluation of students of their self-perceived possession of mathematical abilities, skills, reasoning capabilities, enjoyment, and interest in mathematics which is made-up of both cognitive and affective components (Marsh 1990).

Cognitive Mathematics Self-Concept

Cognitive mathematics self-concept is defined as students' awareness of their own knowledge in mathematics such as the ability of students to identify their strengths and weaknesses in mathematics, build relationships between the diverse areas of the subject, and use their abstraction processes (Tanner & Jones 2000).

Affective Mathematics Self-Concept

Affective mathematics self-concept is defined as the internal believe system of students to succeed in mathematics such as students' belief about the nature of mathematics understanding, students' self-esteem as learners of mathematics, and students' potential to learn and succeed in mathematics (Tanner & Jones 2000).

Introductory Mathematics Courses

Introductory mathematics courses are the courses which can be registered by students during their first year at college. These courses include College Mathematics, Mathematics for Science and Technology, Mathematics for Business, Calculus I, Calculus II, Algebra, College Algebra, Trigonometry, Introduction to Linear Algebra, Engineering Math, and Differential Equations. Students are expected to succeed in introductory mathematics courses, which are considered as prerequisite, before moving into more advanced mathematics courses.

Student Demographics

The sample includes 685 students which are made up of 319 male students and 366 female students, and the age of students ranged from 18 to 42 years old.

Number of Mathematics Courses Taken

The number of mathematics courses taken by students varied based on the offered programmes by each academic institution and students' majors. The sample includes students from the UAEU, the Abu Dhabi University (ADU), the Al Ain University of Science and Technology (AAU), and the Al Khawarismi International College (KIC). Students from the UAEU were registered in Algebra (MUTU 1415), College Algebra (MUTU 1425), Trigonometry (MUTU 1435), Calculus I (MATH 105), Calculus II (MATH 110), and Linear Algebra I (MATH 140). Students from the ADU were registered in College Mathematics (MTG 100), Mathematics for Science and Technology (MTT 101), Calculus I (MTT 102), Calculus II (MTT 200), Introduction to Linear

Algebra (MTT 204), and Differential Equations (MTT 205). Students from the AAU were registered in Calculus I (0107101), Linear Algebra (0107102), Calculus II (0107104), Engineering Math (0107202), and Mathematics for Business (0509102). Students from the KIC were registered in Business Mathematics (MAT 101) and Mathematics and Statistics for IT (BIT 111).

1.7 Conclusion

It has been clarified in the previous sections that motivation is the single most significant drive in which individuals are propelled to militate and succeed in whatever they are doing. Several factors including cognitive constructs, demographics, and environmental factors influence motivation. The purpose of this research study is to examine the variations in students' motivation to succeed in undergraduate introductory mathematics courses and to find out if the variations are influenced by certain predictive factors using both quantitative and qualitative analyses. Therefore, the research question, sub-questions, and related hypotheses will be answered through the quantitative and qualitative analyses of data. A detailed explanation of the definitions provided in this chapter will be discussed and their implications on the research questions. The second chapter reviews both theoretical and empirical literature in order to find out what has been done and reported in the literature and to contextualise the current research study. The third chapter presents the employed research approach and methodology in the thesis. Then, the quantitative information is analysed in chapter four and the qualitative information is analysed in chapter five. Finally, the light is shaded on the most important findings, conclusions, recommendations in chapter six of the thesis.

CHAPTER TWO: THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 Introduction

The reviewed literature in this chapter covers both theoretical and empirical research studies which are employed to identify and synthesise pertinent theoretical materials to students' motivation, students' mathematics self-concept, and the relationship between students' motivation to succeed in mathematics courses and students' mathematics self-concept. Figure 2.1 provides a brief summary for the theoretical framework of the thesis. The four corners of Figure 2.1 are related to each other, and all of them influence the centre of Figure 2.1 which is represented by students' motivation to succeed in undergraduate introductory mathematics courses.

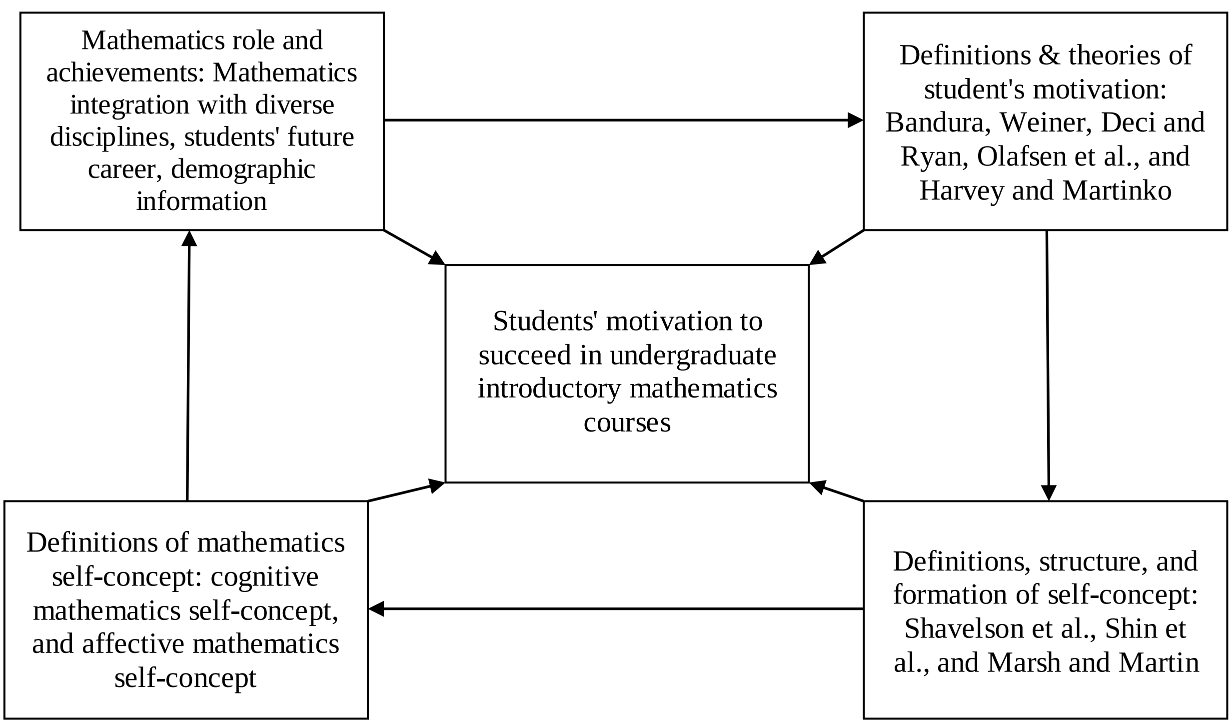


Figure 2.1: Theoretical Framework Summary

The research study adopts a psychological approach which is placed in a context of mathematics education. The thesis employs theories of students' motivation such as the self-efficacy theory (Bandura 1977), the attribution theory (Weiner 1985), and the self-determination theory (Deci & Ryan 1985) which are used to demonstrate both students' intrinsic motivation and students' extrinsic motivation. Moreover, students' mathematics self-concept of Shavelson et al. (1976) has been utilised in the research study. The information gathering in the theoretical framework and literature review chapter relies purely on using secondary sources of information such as textbooks, articles, journals, periodicals, and other materials. The utilised secondary sources of information are available as hardcopies in several libraries and bookshops, and as electronic copies which are accessed through the internet and other online databases such as ScienceDirect, Pro-Quest, EBSCO, and ERIC. The theoretical information on the role of mathematics and mathematics achievements; definitions of motivation; theories of students' motivation; definitions of self-concept; structure and formation of self-concept; definitions of academic and mathematics self-concept; and motivation and students' self-concept have been discussed and presented in this chapter. Moreover, the empirical and practical literature on mathematics self-concept and academic motivation has been reviewed and analysed in this chapter.

2.2 Mathematics Role and Achievements

Nowadays, various accredited academic institutions of higher education at the international level offer bachelor degree programmes which imply students' fulfilment of minimum one course of mathematics in order to satisfy the study plan requirements (House 2000). Consequently, the successful completion of mathematics courses is a necessity for students to earn their desired degrees. Throughout history, mathematics has been considered a major cornerstone which is integrated with many and diverse disciplines such as science and technology; engineering and architecture; business and management; social sciences; art and music; and physics, chemistry, and statistics (Yushau & Omar 2007; House 2000; Barber 1995; Wright 2009). Thus, the role of mathematics in different disciplines cannot be overemphasised. Furthermore, mathematics plays a significant role in the daily life of human beings, and it is applied and exercised directly or indirectly in human beings' careers, professions, and endeavors. House (1993) suggests that many career opportunities can only and only be occupied by students who have mastered outstanding skills in mathematics and completed advanced mathematics courses. The importance of students' mathematics achievements as a critical filter in determining the future career aspirations is affirmed by Shapka et al. (2006), since the findings reveal that poor performers in mathematics are aspired to low prestige future careers and good performers in mathematics are aspired to high prestige future careers. Forawi (2014) studied the career aspirations of 5320 male and female students who were drawn from middle and secondary schools at the UAE. The findings of Forawi (2014) reveal that the top five preferred future jobs determined by students were engineer, police officer, physician, pilot, and military. It can be deduced that aspirations of students at the UAE to become engineers of the future might act as an extrinsic source of motivation and this source can be employed ultimately to enhance students' understanding of the importance of completing mathematics courses successfully which are considered as the base to earn their desired degrees in engineering disciplines. The research study of Piotrowski and Hemasinha (2012) explored the anticipated job-related preferences, exclusive employment skills, and future education plans of undergraduate students in mathematics majors. The findings indicate that half of the students planned to find a career opportunity and continue their postgraduate studies simultaneously.

Examples of the most preferred entry level jobs include high school mathematics teacher; college-level teacher; and jobs in governmental, engineering, and financial domains.

Due to the important role of mathematics in human life, scholars and researchers have taken extensive time to analyse students' performance in mathematics courses and students' behaviours in taking mathematics courses at the level of both schools and colleges. Most of the research studies aimed at examining the variations in students' performance in mathematics courses, explaining the reasons for such variations in students' performance in mathematics courses, and finding techniques to handle the variations in students' performance in mathematics courses. At the school level, House and Telese (2008) indicate that there is a significant correlation between the positive beliefs of adolescent students in their mathematics ability and the higher algebra achievements in the United States and Japan. In another study which was held in France and Italy by Corbiere et al. (2006), the results disclose that there is a positive and significant relationship between academic self-concept, academic interest, and academic achievement of students in mathematics. At the college level, the academic performance of students in mathematics was examined by Gupta et al. (2006) at the University of Southern Maine in the United States. The findings propose that older male students who had missed fewer classes and possessed positive attitudes towards mathematics were more likely to achieve higher results in entry-level undergraduate mathematics courses.

Seidman (2005) points out that students' academic and social backgrounds and institutions' academic and social characteristics are positively correlated. The academic success of students can be highly promoted whenever there is high similarity between students' backgrounds and institutions' characteristics. Anthony (2000) attempted to examine the factors that influence the academic success of first-year college students in mathematics from students’ perspective and professors’ perspective. The results show that both students and professors agree on motivation to be an important factor which promotes students’ success in mathematics. However, there is a disagreement between students’ views and professors’ views on certain factors of academic success in mathematics. For example, students’ views are in favor of factors such as course materials, professors' teaching styles, and lecture conditions than any other factors. While professors' views are in favor of the factors which attribute failure to students than any other factors. Awofala (2016) emphasises that students will be ill-prepared to acquire the mathematical knowledge and skills needed to function meaningfully and contribute to societal debates in mathematical orientations without students' possession of the needed motivation to learn mathematics and develop the positive attitudes towards the learning of mathematics. Anthony (2000) reports that the quality of aid offered to help students understand the coursework; the need for students to realise the tangible benefits of mathematics; and the positive classroom behaviours such as lectures attendance, note taking, and paying attention are other factors than motivation that promote students’ success in mathematics. The variation in students’ views and professors’ views is shaped by the locus of control which influences students' achievement and engagement in higher level of mathematics and sciences (Mido et al. 2007).

It is reported in several research studies that mathematics anxiety negatively influences students’ motivation and achievement in mathematics courses (Fiore 1999). It has been argued by Narwood (1994) that several reasons account for mathematics anxiety such as poor mathematics self-concept of students; parents’ and teachers’ attitudes toward mathematics; difficulty to deal with frustration; and concentration on teaching mathematics through root memorising without understanding. Mathematics anxiety has been described by Hodge (1983) as the sickness that results in emotional and cognitive dismay of mathematics. The research study of Zettle (2003) reveals that mathematics anxiety was a dominant phenomenon among students in the course of college algebra at Wichita State University in the United States. The course is a general education requirement for students in all undergraduate majors. It is clarified by Zettle (2003) that the avoidance behaviour and lack of motivation to register in the course of college algebra and its prerequisite courses was due to the elevated levels of mathematics anxiety amongst students. Zettle (2003) discloses that the percentage of female students who consider themselves as mathematics anxious was 60% and the percentage of male students who consider themselves as mathematics anxious was 44%. Ashcraft and Moore (2009) demonstrate that the correlation between mathematics anxiety and certain measures of students' attitude towards mathematics is strongly negative. For example, the correlation between mathematics anxiety and motivation in mathematics is -0.64, between mathematics anxiety and enjoyment of mathematics in precollege samples is -0.75, between mathematics anxiety and self-confidence in mathematics in precollege samples is -0.82, and between mathematics anxiety and ratings of the usefulness of mathematics is -0.37 (Ashcraft & Moore 2009).

Lazarus (1974) proposes that mathematics anxiety can be transferred from the parents who possess mathematics anxiety to their children and from the teachers who possess mathematics anxiety to their students. Rozek et al. (2017) assessed the long-term effects of a theory-based intervention developed to assist parents in conveying the importance of mathematics and science courses to their high-school children. It is found by Rozek et al. (2017) that motivational intervention with parents may have significant impacts on STEM preparation and engagement of children at high school. Ashcraft and Moore (2009) indicate that students experience mathematics anxiety in various occasions such as formal settings, mathematics classrooms or when taking standardised mathematics exams, or in the daily settings. Foley et al. (2017) clarify several factors that contribute to the development of students’ mathematics anxiety such as the poor early mathematics skills of students, the quantity and quality of parents' and teachers' mathematics input, societal pressure, and stereotypes. It is illustrated by Williams (1988) that the reasons of most mathematics anxiety are rooted in instructors and the teaching methods of mathematics. It is emphasised by Tobias (1978) that mathematics anxiety may result from a bad experience with an instructor of mathematics. Greenwood (1984) advocates that the occurrence of mathematics anxiety is heavily influenced by the way in which the subject matter is presented inside the classroom more than the subject matter itself. Fiore (1999) clarifies that any negative experience of students while doing mathematics is called mathematics abuse which can be verbal or physical. The verbal mathematics abuse of students includes using insulting words that reduce students’ motivation to learn by showing them that they are stupid, if they cannot solve a mathematical problem. On the other hand, the physical mathematics abuse happens as a result of striking students who give wrong answers to mathematical problems. It has been proposed by Foley et al. (2017) that when parents and teachers contribute to students' mathematics anxiety, the best way to prevent the intergenerational transmission of mathematics anxiety is to understand the mechanism through which parents' and teachers' anxiety impacts performance of students in mathematics. Accordingly, the effort spent by parents and teachers on motivating students to succeed in mathematics courses and combating mathematics anxiety will definitely enhance students’ achievement in mathematics courses.

It is argued by Hootstein (1994) that students’ feeling of boredom inside the classroom minimises students’ attention, decreases their academic achievements, and is a possible reason for students’ withdrawal from universities. Consequently, professors and administrations of academic institutions of higher education have to come up with educational strategies in order to combat students’ boredom and promote students’ motivation. The research study of Jacob et al. (2017) included 307 teachers of mathematics who were asked about their criteria to achieve success in teaching mathematics. The findings of Jacob et al. (2017) reveal that students' mathematical skills, students' engagement, students' social skills, cognitive activation and structured presentation of the learning content, structured organisation of the learning environment, and feedback contribute to achieve success in teaching mathematics. The impact of personalisation of instruction on the motivation to learn mathematics word problems of 450 senior secondary students in Nigeria was examined by Awofala (2016). The data were analysed through independent samples t-test and one-way ANOVA and findings indicate the existence of a significant major effect of personalisation of instruction on students' motivation to learn mathematics word problems and personalised treatment of students contributed in reducing the problem of lack of students' motivation towards mathematics word problems (Awofala 2016). Therefore, the use of interest-based instruction has implications for instructors of mathematics to make a mindful and intentional effort to learn about their students' interests and preferences and involve them regularly into their mathematics instruction. Crump (1995) suggests several strategies that can be used by professors at the college level in order to enhance students' motivation, and make students' learning experience interesting and relevant. Raffini (1993) explains that the adequate satisfaction of students’ biological needs for food, water, sleep, and temperature regulation has a major influence on students’ motivation and interest to engage in a learning activity such as the division of fractions or the rhyme scheme of a Shakespearean sonnet. Therefore, the interaction of instructors with students inside the classroom is considered as an effective strategy to enhance instructors' awareness of the physiological needs of students which are not satisfied. For example, instructors may do simple actions such as adjusting the thermostat inside the classroom which may assist in attracting the attention of students and enhance students' satisfaction inside the classroom. Moreover, instructors may have one-to-one discussions with sleepy students inside the classroom and this will make students aware that instructors can notice students' physiological conditions inside the classroom and instructors are concerned. Berdeaux and Borden (1984) emphasise that students should not be treated as numbers or mob and students need individual attention inside the classroom which eventually promotes students' learning experience. The individual attention to each student is highly needed especially in mathematics courses in order to ensure that students have learnt the necessary skills to solve mathematical problems. Crump (1995) indicates that instructors have to learn about students' backgrounds, motivations, personal attributes, and abilities in order to raise their awareness of students' physiological needs.

It is explained by Raffini (1993) that students cannot focus their attentions on learning inside the classroom without the feeling of being safe from physical and psychological harms or threats. Thus, instructors have to avoid resorting to shouting, ridiculing, and intimidating inside the classroom, since students usually respond by either withdrawing from the course or retaliating with unexpected reactions. Marshall (1986) proposes that students have to be challenged without having recourse to intimidation or deception. It is suggested by Crump (1995) that students may suffer from the fear of being asked by instructors and not getting the right answer, being embarrassed in front of classmates, and being exposed to ridicule by instructors or peers inside the classroom. This fear may make students feel that they are not secured and safe which ultimately hinders students' motivation to learn. Accordingly, creating a supportive environment by instructors inside the classroom is a fruitful strategy to minimise students' feelings of fear and insecurity and to promote students' motivation and learning experience. Brophy et al. (1983) clarify that the expressed beliefs or attitudes of instructors about academic activities have influence on developing similar beliefs or attitudes of students about themselves. For instance, the creation of an effective learning environment may become very plausible, if instructors tend to be patient and supportive by making students feel comfortable during academic activities. It is postulated by Crump (1995) that instructors and students will be able to jointly share a productive and successful learning experience inside the classroom, if instructors become aware of the needs of students. The instructors' knowledge and understanding of students' needs facilitates selecting and adopting various motivation strategies. Furthermore, students' motivation can be enhanced through immediacy which is defined as the communication behaviour that develops the psychological and physical relationships between instructors and students (Frymier 1993). The communication of instructors with students can be enhanced by using verbal or nonverbal means of communication which eventually develop students' motivation to learn. Awofala (2016) illustrates that personalisation in teaching word mathematics problems stimulates inherent interest of students and enhances personal meaning of new content. Awofala (2016) clarifies that through transmutation of written information to contain familiar referents, students can gain significant personal information about their competence with respect to the strategies enacted to engage in problems and this is often considered as a major source of motivation to learn. Frymier (1993) suggests certain examples of verbal means of communication such as the use of students' first names and humor inside the classroom by instructors which may improve the communication with students. Frymier (1993) also proposes several examples of nonverbal means of communication such as smiling, eye contact, positive use of gestures, variety of voice, and relaxed position of body.

Crump (1995) suggests that developing mutual relationships between students inside the classroom is a useful tool to enhance students' motivation to learn. Raffini (1993) clarifies that students are forced by instructors sometimes to compete against each other and this competition may hinder developing relationships between students. Crump (1995) explains that students need to have the feeling of belongingness and need to identify themselves as members in large groups in order to acquire social affiliations. Weiner (1985) illustrates that social affiliations are considered a predominant source of motivation amongst college students. Consequently, one of the useful strategies that can be utilised by instructors is to implement a collaborative learning process inside the classroom in which students can exchange knowledge, develop relationships, become motivated to learn, and enjoy their learning experience. Marilla and McKeachie (2013) propose that group activities, discussions led by students, fruitful classroom debates, and peer tutoring are examples of collaborative learning that can be employed inside the classroom by instructors.

Fredricks et al. (2004) illustrate that students’ engagement has recently attracted an increasing attention of researchers due to its possible impact on academic motivation and achievement. The findings of the research study held by Watt et al. (2017) indicate that students’ engagement in mathematics is influenced by the learning climate of classrooms, teachers’ enthusiasm, and school caring. It has been reported by Watt et al. (2017) that master focused classrooms, enthusiastic teachers, and caring school environment are experienced mostly by engaged students in mathematics. Baroody et al. (2016) propose that engagement is a significant factor that can be used by mathematics educators and researchers to intervene, especially to assist students who perform below the grade level in mathematics. It has been clarified by Baroody et al. (2016) that the day-to-day experiences of instructors of mathematics inside classrooms often involve reflections upon their students' engagement. Therefore, exploring the factors that contribute in mathematics engagement such as peer engagement and parent or teacher expectations and examining the methods in which students express mathematics engagement will be a useful approach while designing methods to enhance engagement of students in mathematics classes. Crump (1995) identifies another method that can be used by instructors to develop the social affiliations between students inside the classroom. The incorporation of simulation games into curricula is recommended by Crump (1995), since it allows instructors to build on the knowledge and skills brought to the classroom by students. Most of the college students enjoy the entertainment of playing, active engagement, and suspense about games' outcomes. The motivation of students to play games is expected to enhance students' motivation to learn in order to win the game. Therefore, students' motivation to learn develops with the use of games, but instructors have to relate the games to the learning objectives which are part of the taught curricula. Chao et al. (2016) emphasise that students' engagement and motivation to succeed in mathematics can be enhanced through the use of technology-based resources which are used to spark students' interest in learning mathematics and develop greater confidence in mathematical problem solving. According to Chao et al. (2016), the technology-based resources can be employed by instructors of mathematics in various methods, ranging in complexity and cost from repurposing commercially available television programmes to utilising computer games. Hence, mathematics educators may foster students' engagement in mathematics through the use of technology such as textbooks with courseware like MyMathLab (MML), WileyPLUS, and Assessment and Learning in Knowledge Spaces (ALEKS). Furthermore, the use of social media websites might be ustilised as an effective tool to enhance students' learning experience. Mazer et al. (2007) report in their experimental study that the access of students to their instructors' Facebook websites facilitates higher levels of students' motivation and affective learning as well as more positive classroom climate. Thus, the use of social media websites may be employed to enhance students' engagement and learning experience by developing social affiliations between instructors and their students.

Several research studies have examined the impact of placement test scores on predicting students' success in mathematics. It is found by Armstrong (2000) that students' dispositional variables such as behaviour and previous experience are more significant predictors of mathematics success when compared with the placement test scores. Tolley et al. (2012) clarify that college students' performance in mathematics is influenced by variables such as socio-economic status, race, gender, and education of students' parents. It has been pointed by Follette et al. (2017) that gender and race are considered the most widely studied demographic variables in the area of mathematics and science education. In spite of the fact that several decades of research studies reveal an achievement gap in mathematics performance of students based on gender and race, this gap has diminished in recent decades (Leahey et al. 2013; Voyer & Voyer 2014). The existence of a minor but significant advantage amongst female students in course achievement across all subjects including mathematics has been reported in large-scale research studies; however, the performance of male students remains as an advantage in standardised tests of mathematics which is attributed to male students' attitudinal and psychosocial factors instead of ability (Bridgeman & Wendler 1991; Correll 2001; Voyer & Voyer 2014). The developmental gender differences in mathematics are examined in the research study of Steward et al. (2017) and the multiple ANOVA findings indicate that female and male mean scores were not significantly different across four error factors including mathematics calculation, geometric concepts, basic mathematics concepts, and addition. Awofala (2016) examined the influence of gender on the motivation of 450 senior secondary students in Nigeria to learn mathematics word problems which was measured by the mathematics word problems questionnaire. The findings of Awofala (2016) indicate that there is no significant major impact of gender on the motivation of students to learn mathematics word problems. It is proposed by Jurik et al. (2014) that the interaction of teachers with students through asking deep-reasoning questions is positively related with students' intrinsic motivation to learn. On the other hand, Foley-Peres and Poirier (2008) argue that specific mathematics placement tests are better indicators of students' success in mathematics when compared with generalised content aptitude tests. The study of Smith and Schumacher (2005) aimed at examining the impact of mathematics Scholastic Aptitude Test (SAT), verbal SAT scores, percentile rank in high school graduation class, and the percentage score in college mathematics placement exam on predicting students' success in mathematics courses. It is found by Smith and Schumacher (2005) that verbal SAT scores are more significant in predicting the success of male students than female students and SAT scores are better in predicting students' success in mathematics than other factors.

In order to minimise failure and withdrawal rates in undergraduate mathematics courses, many colleges and universities have tried to develop systems that assist in predicting which students are more likely to succeed and which students might be subject to the risk of failure through the use of certain placement tests designed for specific courses. Cook and Borkovitz (2017) interviewed students in intermediate and advanced inquiry-based mathematics courses at the undergraduate level. It is found by Cook and Borkovitz (2017) that many students entered college with a fear of mathematics, but later on students gained confidence from a required introductory mathematics course and decided to pursue a major in mathematics for teaching. Therefore, the success of students in introductory mathematics courses is considered as the foundation which promotes students' confidence to sustain and study advanced courses of mathematics and pursue their desired degrees. It is demonstrated by some research studies that placement tests generally lack validity and have inconsistent results in predicting the academic success of students (Armstrong 2000). The reasonable doctrine that can be drawn from the information on mathematics placement tests is that using solely placement tests as a single measure to determine the eligibility of students to register in mathematics courses might be subjective. However, the placement tests may be helpful in identifying students' potential of success or failure, if they are used within a portfolio of information such as students' perception of mathematical ability, interest, discipline, persistence, and study skills. Based on the reviewed literature on mathematics role and achievements, it can be concluded that there is an extensive and diversified number of potential factors which influence students' success or failure in mathematics. These factors rang from personal, demographic, psychological, pedagogical, social, dispositional, environmental, and situational.

2.3 Definitions of Motivation

The concept of motivation has been implicitly addressed in the previous research studies. The concept of motivation is multi-faceted and composite. Motivation has been used in different contexts and dimensions such as students' motivation or academic motivation (Brophy 2013; Weiner 2004), teachers' motivation (Lourmpas & Dakopoulou 2014), and social motivation (Weiner 1992). According to Mwangi and McCaslin (1994), motivation is viewed as a psychological process of imparting human behaviour with aim, direction, and power. As a result, motivation is considered to be accountable for producing differential work outputs among different human beings. Ryan and Deci (1985) illustrate motivation as the motive to perform something or to undertake and achieve a specific task. Motivation is explained by Wlodkowski (1986) as the process of triggering the willingness to examine behaviour, allocating directions and goals to the behaviour, allowing the behaviour to preserve, and leading the selection or preference of a specific behaviour. A motivated person is viewed by Ryan and Deci (2000) to be driven to do something. Accordingly, absence of enthusiasm and inspiration to act indicates that the person is unmotivated. Dweck (2002) indicates that the characteristics of individuals are shaped at an early age through two motivational systems which are inclusive of traits and process. The focus of the contemporary research has been on the motivational traits, since they are helpful in predicting future learning orientation and success of individuals. However, the motivational traits alone are not very helpful to understand the reasons that explain why a specific student puts huge efforts into certain activities and not into other activities.

The definition of motivation has been widely articulated in several ways by different scholars. Harmon-Jones and Harmon-Jones (2010) define motivation as the phase that triggers the entire process of decision making. Schmidt et al. (2010) view motivation as the strength of individuals' willingness to persist on attaining a predetermined goal. Rakes and Dunn (2010) describe motivation as the process which promotes individuals' instigation and sustainability on achieving a goal-oriented task and through this process the needs and wants of individuals are set in motion. Johnson and Johnson (2003) define motivation as the degree of individuals' commitment and allocation of efforts to obtain goals which are considered as worthwhile and meaningful. Mayer (2011) suggests that motivation is the internal state that influences the initiation and maintenance of the goal-oriented behaviours. Consequently, motivation occurs personally within individuals, activates and instigates individuals' actions, energises and fosters intensity and persistence, and aims to achieve individuals' goals. According to Thijs (2011), motivation is achieved when the three essential innate psychological needs of competence, relatedness, and autonomy are successfully fulfiled. Schmidt (1993) considers motivation as a type of curiosity or intrinsic interest which controls individuals' behaviours and actions.

The research on students' motivation has become an extremely vital area and it has been noticed that motivation plays a central role in students' academic learning. Students' motivation has been defined by Lumsden (1994) as the willingness of students to take part in the learning process and the reasons or objectives which stimulate students' participation or non-participation in academic activities. Students' motivation involves also determining how much students have learnt from an academic activity. Crump (1995) defines students' motivation as supplying students' minds with the excitement to receive and understand instructions. The essential elements of students' motivation are inclusive of enthusiasm, enjoyment, and interest to learn. Brewer and Burgess (2005) propose that students' motivation is a joint responsibility which requires collaborative efforts from students and instructors. Therefore, it is very important for instructors to know how students can be motivated to enhance students' engagement in the learning process. Lumsden (1994) suggests three forms of students' motivation which include intrinsic motivation, extrinsic motivation, and motivation to learn. The intrinsic motivation inspires students to take part in an academic activity due to the gained value, information, and enjoyment of such activity. On the other hand, the extrinsic motivation encourages student to take part in an academic activity because of the external factors such as activity's rewards or punishments. The motivation to learn is the willingness of students to take part in an academic activity regardless whether this willingness is generated from intrinsic or extrinsic sources of motivation. Pintrich and De Groot (1990) point out that the concept of motivation is inclusive of goal orientation, cognitive strategies utilisation, sustained cognitive engagement, self-efficacy, and self-regulation.

Students' motivation occurs through the interaction among certain factors such as learners' goals, values, beliefs, and emotions which all play a significant role in different and many learning processes (Brophy 2013). Thus, the different and many learning processes can be called domain-specific, such as the motivation of students to learn and succeed in mathematics, science, or English (Brophy 1999). Students' motivation to succeed in mathematics is a cognitive process which entails making sense of a mathematical activity, understanding its information in relation to pervious knowledge, and mastering the mathematical skills it supports (Brophy 1999; Brophy 2013). It is clarified by Hannula (2006) that students' motivation to succeed in mathematics is the prospective behaviour which is evidenced through cognition, behaviour, and emotion. For instance, the motivation of students to solve a mathematical task might be influenced by students' beliefs about the importance of the mathematical task which represents cognition, students' persistence on achieving the mathematical task which represents behaviour, and students' anger or sadness of failure in the mathematical task which represents emotion. To promote students' motivation in order to learn and succeed in mathematics and to enable students gain mathematical knowledge that lasts for the long-term rather than the short-term, educators should make students understand the values of learning mathematics for its potentials on self-actualisation and life-application which ultimately allow students to make sense of mathematics (Weiner 1992; Brophy 2013). Accordingly, students will be inspired to learn and succeed in mathematics, as well as enjoy the learning process of mathematics.

2.4 Theories of Students' Motivation

Based on the reviewed literature on the definitions of students' motivation, it is concluded that students' motivation is a complex process which happens through the interaction of both cognitive and affective factors. Graham and Golan (1991) indicate that there is a higher tendency for motivated students to employ their higher-order cognitive processes for the purpose of learning, absorbing, and retaining more from an academic subject. According to Brophy (2013), there is an effort exercised by motivated students in order to understand subject matters, enhance performance, look for challenges, and preserve at tasks in the face of failure. Brewer and Burgess (2005) suggest that students' motivation has been distinguished as an essential portion of teaching and learning. Educators, teachers, and professors play a very paramount and leading role in creating an appropriate learning environment to enhance students' motivation to learn; reduce students' anxiety; communicate coveted objectives and expectations such as inquisitiveness, mastery of critical thinking skills, and implementation of learning outside the classroom; provide students with constructive feedback; provide students with enthusiasm; and assist students with meta-cognitive knowledge of objectives and meta-cognitive control of plans and strategies (Slavin 1990; Brophy 2013).

There are various theories which were constructed to enhance the understanding of recent approaches on students' motivation. These theories include the self-efficacy theory (Bandura 1977), the self-worth theory (Covington 1984), the attribution theory (Weiner 1985), and the self-determination theory (Deci & Ryan 1985). The most influential theory is the self-determination theory, since it implies a dichotomous motivation which is divided into intrinsic motivation and extrinsic motivation (Deci et al. 2017; Olafsen et al. 2017). According to Middleton and Spanias (1999), academic intrinsic motivation is defined as the readiness and drive that trigger students to engage in any learning process for its own sake. Consequently, intrinsically motivated students tend to engage in an academic activity because of the gained enjoyment and value from such an academic activity like the satisfaction derived from learning mathematics. Ryan and Deci (2000) propose that the existence of intrinsic motivation produces high quality of education and creative learning environment. Ames and Archer (1988) indicate that intrinsic academic motivation concentrates on the learning goals which can be achieved through students' ability to understand and master mathematical concepts; persist in the face of failure; monitor and process comprehension; select more challenging tasks; take risk; become more creative and innovative; select deep and effective performance; and pursue learning strategies and activities in absence of extrinsic rewards. Richardson et al. (2012) propose that intrinsic motivation promotes the optimal learning of students, since it is accomplished and maintained through stimulating and challenging task engagement in which students feel competent and autonomous.

In order to enhance the understanding of students' motivation, the self-determination theory of Deci and Ryan (1985) has been commonly utilised in the process of improving the quality of education at institutions of higher education. The self-determination theory of Deci and Ryan (1985) provides a tremendous assistance in identifying the best learning and teaching methods which enhance intrinsic motivation such as experiential learning and assessment systems that promote conceptual understanding (Deci et al. 2017; Olafsen et al. 2017). The use of the self-determination theory in education has been emphasised in the research study of Shillingford and Karlin (2013) which provides useful information to administrations of institutions of higher education on how to develop programmes that cater the needs of college students and smoothen attainment of college degrees.

Deci and Ryan (1985) clarify that the behaviours in which individuals engage in an academic activity in order to gain the feelings of competency and self-determination are intrinsically motivated behaviours. Shillingford and Karlin (2013) propose three subtypes of intrinsic motivation including the intrinsic motivation to know, the intrinsic motivation to accomplish things, and the intrinsic motivation to experience stimulation. Ryan and Deci (2000) postulate that the intrinsic motivation to know implies working on a task because of the gained enjoyment and satisfaction from the task while learning, discovering, and attempting to understand new things. Bong and Skaalvik (2003) clarify that reading a textbook is an example which makes students intrinsically motivated to know because of the absolute pleasure that is experienced by students while learning something new. Bong and Skaalvik (2003) suggest that the intrinsic motivation to know has a huge tradition in educational research and it is related to various constructs such as curiosity, exploration, intrinsic intellectuality, learning goals, and the intrinsic motivation to learn. The intrinsic motivation to accomplish things entails engaging in a task due to the gained enjoyment and experience from the task while trying to achieve and create new things (Ryan & Deci 2000; Deci et al. 2017; Olafsen et al. 2017). It has been illustrated by Bong and Skaalvik (2003) that the intrinsic motivation to accomplish has been studied in developmental psychology and educational research under certain concepts such as mastery motivation. Bong and Skaalvik (2003) demonstrate that the work and effort spent by students on a term paper beyond the requirements is an example of students' intrinsic motivation to accomplish, since students experience the pleasure and satisfaction of accomplishments. Ryan and Deci (2000) propose that the intrinsic motivation to experience stimulation includes engaging in a task for the sake of experience stimulating sensations from the task such as sensory pleasure, frolic, and excitation. Bong and Skaalvik (2003) explain that students are intrinsically motivated to experience stimulation in education, if students go to class in order to experience the pleasure of stimulating class discussions, or if students read textbooks for the intense feelings of cognitive excitement obtained from the enjoyable and passionate texts within the book.

The cognitive evaluation theory was developed by Deci and Ryan (1985) in order to clearly identify the factors in social contexts that generate variations in intrinsic motivation. Deci and Ryan (2000) postulate that the cognitive evaluation theory is considered to be a sub-theory of the self-determination theory. The cognitive evaluation theory proposes that the intrinsic motivation of individuals can be enhanced through the interpersonal events and structures such as feedback, rewards, and communication which result in creating feelings of competence when certain actions are performed by individuals (Abuhamdeh et al. 2015). Therefore, interpersonal events and structures permit the satisfaction of individuals' basic psychological needs for competence which ultimately promote individuals' intrinsic motivation. It is specified by the cognitive evaluation theory that intrinsic motivation of individuals will not be enhanced unless feelings of competence are accompanied by a sense of autonomy (Abuhamdeh et al. 2015). Thus, individuals have to experience their behaviours to be self-determined in addition to their perceived competence in order to maintain and enhance high level of intrinsic motivation. Deci and Ryan (2000) indicate that the major doctrine of the cognitive evaluation theory is to focus on the needs for competence and autonomy which are developed to combine the results of initial studies on the impacts of rewards, feedback, and other external factors on intrinsic motivation.

From another side, academic extrinsic motivation has been defined by Deci and Ryan (1985) as the desire of students to engage in learning activities for contributory reasons such as attainment of a college degree in mathematics and seeking a future career opportunity in science or engineering disciplines. Ames and Archer (1988) point out that academic extrinsic motivation encourages students to engage in learning because of students' expectation of rewards or punishments. Examples of rewards are students' expectations of good grades or instructors' approval. Examples of punishments are students' desire to avoid getting bad grades or instructors' disapproval. Accordingly, extrinsically motivated students show engagement in a learning activity because of activity-unrelated factors such as the expectation of rewards or punishments (Ames 1992). The positive impact of extrinsic motivational factors has been affirmed by Skinner el al. (1990), since implementing extrinsic motivational factors promotes college engagement, enhances students’ performance, reduces students' drop-out rates, provides students with high quality of education and enjoyable learning experience (Vallerand et al. 1993; Deci et al. 2017; Olafsen et al. 2017).

Gagne and Deci (2005) suggest four subtypes of extrinsic motivation which include external regulation, introjected regulation, identified regulation, and integrated regulation. The external regulation is the behaviour which is regulated via external factors such as rewards or punishments. The associated processes with the external regulation include prominence of extrinsic rewards or punishments, compliance, and reactance. Bong and Skaalvik (2003) clarify an example of external regulation is when students study the night before exams because of their parents’ force to them. The introjected regulation happens when individuals start to internalise their actions. The associated processes with the introjected regulation contain ego involvement and focus on approval from self or others. Bong and Skaalvik (2003) explain an example of introjected regulation is when students study the night before exams because of students’ belief that this is what good students are supposed to do. The identified regulation occurs when the actions become very internalised to the extent that the actions are perceived as important to individuals. The associated processes with the identified regulation are inclusive of conscious valuing of activity and self-endorsement of goals. Bong and Skaalvik (2003) illustrate an example of identified regulation is when students study the night before exams because of students’ belief that this is something important for them. The integrated regulation is the behaviour which is cohesive with the internal goals and values of individuals. The associated processes with the integrated regulation involve hierarchical synthesis of goals and congruence (Ryan & Deci 2000; Deci et al. 2017; Olafsen et al. 2017).

Gagne and Deci (2005) emphasise the distinction between amotivation and motivation through the self-determination theory. The amotivation is lack of motivation and it entails absence of intention to act, where as motivation includes intentionality. Bong and Skaalvik (2003) clarify that individuals become amotivated whenever they do not perceive contingencies between outcomes and their own actions. Consequently, individuals are neither intrinsically nor extrinsically motivated individuals. Bong and Skaalvik (2003) indicate that when students become amotivated, they start to ask themselves why schools exist in the world and why they go to schools. Ultimately, amotivated students may stop participating in academic tasks and activities. It is explained by Gagne and Deci (2005) that the self-determination theory distinguishes between autonomous motivation and controlled motivation. The intrinsic motivation is an example of autonomous motivation, since it induces the volitional acceptance and engagement in any activity. In contrast, extrinsic motivation represents controlled motivation because the behaviours of individuals are controlled by an external sense of pressure. The self-determination theory is a chain that ranges from amotivation to intrinsic motivation. The concepts of autonomous motivation, controlled motivation, amotivation present the relationship between an individual with a specific activity. The amotivation completely lacks self-determination, while intrinsic motivation is invariantly self-determined. The four types of extrinsic motivation range between amotivation and intrinsic motivation. The external regulation is considered the least self-determined type, while introjected regulation, identified regulation, and integrated regulation are considered to be progressively more self-determined (Gagne and Deci 2005).

The taxonomy of motivation and its relationship with the degree of self-determination, self-regulation, and locus of causality is illustrated by Deci and Ryan (2000). As indicated in Figure

2.2, intrinsic motivation is located at the far right end, since it is the prototype of self-determined activity that is used as a standard against which the qualities of extrinsically motivated behaviours can be contrasted to identify their degrees of self-determination. The vertical line that separates between intrinsic motivation and integrated regulation is intended in order to affirm that fully internalised extrinsic motivation will not typically become intrinsic motivation. The amotivation is placed at the far left end of Figure 2.2, since it implies lack of motivation and results in non self-determined behaviours. The extrinsic motivation is shown on the centre of Figure 2.2 between amotivation and intrinsic motivation.

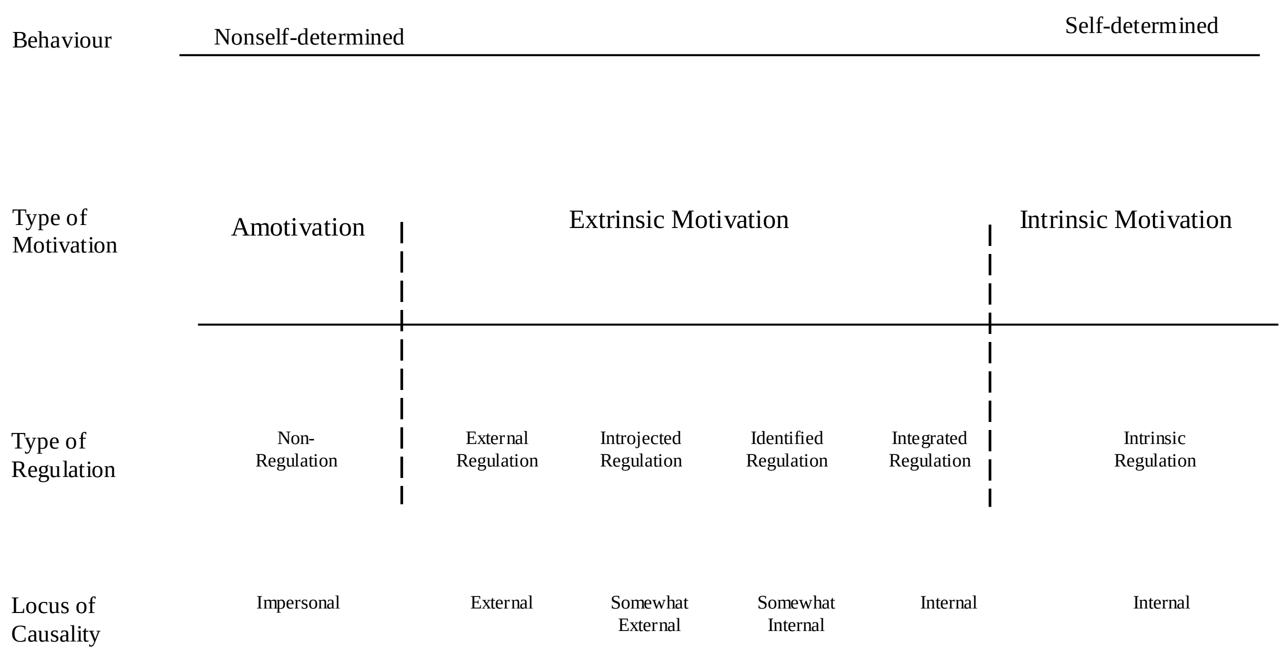


Figure 2.2: Taxonomy of Motivation
(Deci & Ryan 2000, p. 237)

According to the self-determination theory of Deci and Ryan (1985), individuals integrate two versions of self which are social self and innate self. The social self is the mixture produced from social influences. The innate self is the innate major engine that is not influenced by the social world. The social self is the major producer of extrinsic motivation. On the other hand, the innate self is the main generator of intrinsic motivation. The innate self is considered to be more powerful than the social self in terms of influence. However, Ryan and Deci (2000) indicate that the leaning process cannot be boosted in the presence of intrinsic motivation alone and absence of extrinsic motivation. The role of social influence has been acknowledged by Ryan and Deci (2000) who agree that extrinsic sources of motivation play a vital role as intrinsic sources of motivation to pursue any task in particular if the task is recognised to be not intrinsically enjoyable and interesting, but it is important to achieve.

2.5 Definitions of Self-Concept

Several scholars in the field of psychology, personality, math education, and sociology have been influenced by the significant impact of perceptions and beliefs on the learning and growth of students such as Shavelson et al. (1976), Marsh and Martin (2011); Shin et al. (2016), Kinch (1963), and Rosenberg (1979). Bong and Skaalvik (2003) suggest that these perceptions and beliefs about self are shaped by the historical accomplishments and reinforcements of individuals. There are various theories and models which were developed in order to explain perceptions and beliefs of students in a learning context such as self-concept and self-efficacy. According to Bong and Skaalvik (2003), self-concept is defined as the general perception of someone about herself or himself to function in a specific domain. While, self-efficacy is defined as the expectation and contentedness of someone about herself or himself on what can be accomplished in a specific situation. In spite of the similarity between self-concept and self-efficacy in terms of their predictive role in a relationship with motivation, accomplishments, and emotions, there is a difference which exists between both terminologies. Self-concept is concerned with the past-related perceptions of someone's self, but self-efficacy is concerned with the future-related perceptions of someone's self. Since this research study aims to explicate the influence of self-concept and other demographic variables on students' motivation to succeed in undergraduate introductory mathematics courses, it is substantial to review the theoretical definitions of self-concept, its dimensions, formation, composition, and implications on students' motivation to succeed in mathematics courses.

In addition to the aforementioned general definitions of self-concept, Kinch (1963) defines self-concept as the perceptions of students about themselves in terms of their academic abilities, in particular their knowledge and feelings about their skills and abilities. Rosenberg (1979) views self-concept as the total collection of all thoughts, impressions, and feelings possessed by individuals about themselves as objects. In other words, it is the arrangement of qualities which individuals attribute to themselves. Based on Shavelson's et al. (1976) definition, self-concept is seen as individuals’ perceptions about themselves which are constructed through individuals’ interaction and experience with the environment. Therefore, self-concept is very significant and helpful to explain and predict how individuals act. It is concluded that the definition of self-concept by Shavelson et al. (1976) is considered the most theoretical basis in the contemporary literature on self-concept without any doubt, since it determines how individuals predict their abilities which ultimately affects individuals’ perceptions of themselves. Since self-concept is developed through individuals' experiences with the environment, the developed perceptions or self-concept by individuals ultimately influence the trends in which individuals act and in turn individuals' acts influence the trends in which individuals perceive themselves.

There are seven features identified by Shavelson and Bolus (1982) which are crucial to clarify the theoretical foundation of Shavelson's et al. (1976) definition of self-concept. The seven features of self-concept are organised or structured, multi-faceted, hierarchical, stable, developmental, evaluative, and differentiable. The first feature indicates that self-concept is organised or structured, since individuals group the massive information accumulated about themselves into categories and develop relationships between the formulated categories. Shavelson et al. (1976) suggest that the knowledge of individuals about themselves is shaped by all their diversified experiences. In order to minimise the complexity of the diversified experiences, individuals recode them into simple formats or categories. The second feature proposes that self-concept is multi-faceted and the organised or structured categories, espoused by a specific individual or shared by a group, are reflected by the particular facets of self-concept. The third feature clarifies that self-concept is hierarchical, since the behaviours of individuals are perceived starting from the base moving towards the interfaces about self in hierarchical subcategories. For instance, self-concept starts from the base subcategories such as English self-concept, science self-concept, mathematics self-concept, particular emotional status, or physical appearance. Then, self-concept moves to the categories of academic self-concept or non-academic self-concept. Finally, it moves to the general self-concept. Shavelson et al. (1976) indicate that the correspondence between the self and observer diminishes as individuals move up in the self-concept hierarchy. The fourth feature states that the general self-concept of individuals is stable; however, the general self-concept becomes more specific to the situation and less stable as it moves downward in hierarchy. Shavelson et al. (1976) propose that self-concept changes greatly at the base of hierarchy with the variation in situations. In addition to that, the conceptualisations at the higher levels of the self-concept hierarchy are likely to weaken the changes at the lower levels of hierarchy which ultimately make self-concept resistant to change. Thus, several situation-specific instances which are inconsistent with the general self-concept are required to change the general self-concept. The fifth feature illustrates that self-concept is developmental, since self-concept becomes more multi-faceted with the growth and development of individuals from the stage of infancy to the stage of adulthood. Shavelson et al. (1976) explain that infants tend not to distinguish themselves from their environment and as infants grow, mature, and learn from their growing store of experiences, infants start to differentiate themselves from their environment. The sixth feature suggests that self-concept is evaluative as it is inclusive of a descriptive and evaluative dimension in which individuals may describe themselves such as I am delighted and evaluate themselves such as I perform well in college. It is emphasised by Shavelson et al. (1976) that not only individuals construct descriptions of themselves in a particular situation or class of situations, but individuals also develop evaluations of themselves in these situations. However, the evaluative dimension may differ in significance for various individuals as well as for various situations. The seventh feature shows that self-concept is differentiable, since it is possible to differentiate self-concept from other constructs such as academic success and achievement. Shavelson et al. (1976) indicate that there is a possibility to point out the direction taken by individuals in determining how self-concept is differentiable from, and relevant to, other constructs.

2.6 Structure and Formation of Self-Concept

The reviewed literature on the definition of self-concept indicates that the most important feature of self-concept is its organisation or structure. Individuals cluster the huge amount of information accumulated about themselves into categories. Then, individuals use the formulated categories to predict how they behave or how they perceive themselves in a specific situation. According to Shavelson and Bolus (1982), the general self-concept is structured in a hierarchical manner and it is made up of two major categories which are academic self concept and non-academic self-concept. The general self-concept structure is presented in Figure 2.3. As indicated in Figure 2.3, the academic self-concept presents all the specific academic subjects in an educational context. It is domain-specific or subject-specific such as English self-concept, history self-concept, mathematics self-concept, and science self-concept. One the other hand, the non-academic self-concept includes three major subcategories which are social self-concept, emotional self-concept, and physical self-concept. The social self-concept is made up of two subareas which are peers and significant others. The emotional self-concept includes particular emotional states only. The physical self-concept embodies two subareas which are physical ability and physical appearance.

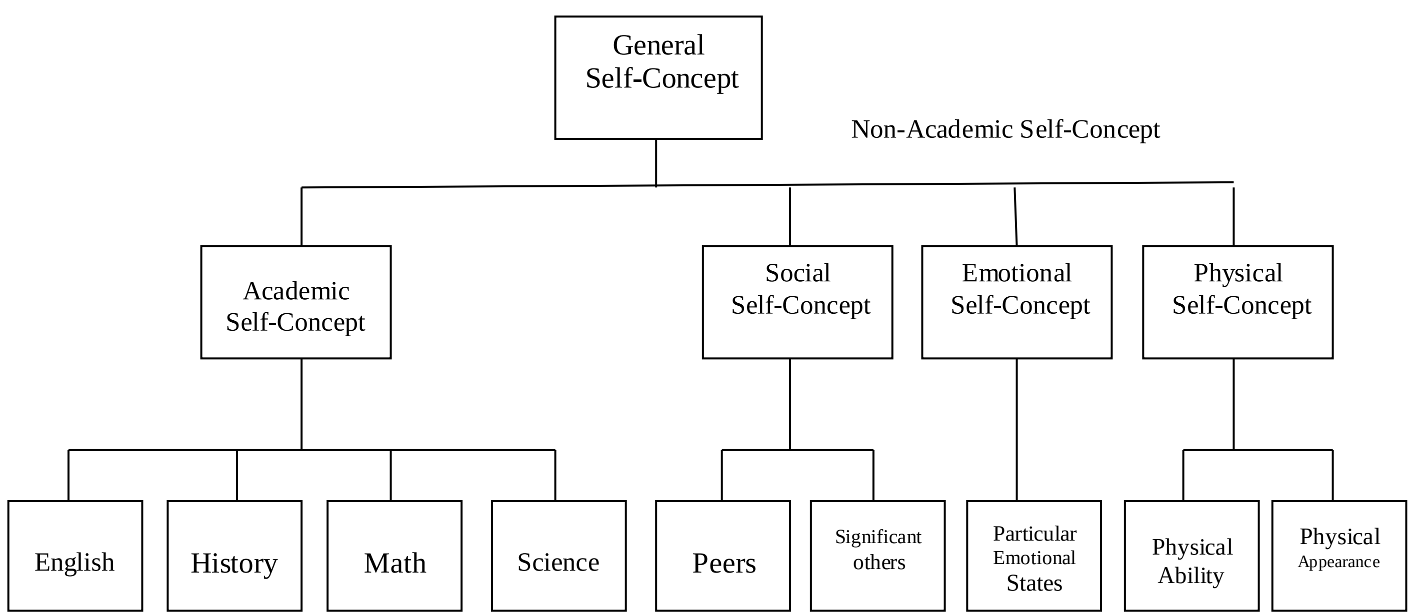


Figure 2.3: General Self-Concept Structure
(Shavelson & Bolus 1982, p. 2)

As expressed by Shavelson et al. (1976), the formation of self-concept happens through the interaction and experience of individuals with the environment. There are several hypothesised environmental and social factors by various theories of self-concept which influence the formation of self-concept. Bong and Skaalvik (2003) point out that frames of reference, causal attributions, reflected appraisals from significant others, mastery experience, and psychological centrality are among the hypothesised environmental and social factors. Each of the five factors has been explained by Bong and Skaalvik (2003). Frames of reference are the employed criteria by individuals to evaluate their beliefs and achievements. Causal attributions include the factors used by individuals to attribute their successes or failures. Reflected appraisals from significant others are adopted by individuals to view themselves based on how significant others view them. Mastery experiences of the past experiences of individuals in a specific domain contribute in creating individuals' self-schemas. Bandura (1986) clarifies that past experiences are processed through self-schemas which support the formulation of individuals' self-concept. Psychological centrality is explained by Rosenberg (1979) as the perceived beliefs which are psychologically central by individuals and contribute to the development of individuals' self-esteem.

It is explained by Marsh (1986, 1987) that frames of reference play an essential role in creating the academic self-concept. Frames of reference are the standards against which individuals judge their own achievements and characteristics. The most powerful source of information on self-concept can be obtained through social comparisons. For instance, institutions of higher education employ their own institutional standards of Grade Point Average (GPA) and achievements in the academic courses against which students can judge their GPA and academic performance in a particular course. The existence of the standard GPA is very significant, since it allows students to realise how good or bad results have been achieved in comparison to the established standards.

According to Bong and Skaalvik (2003), individuals specifically in the educational systems tend to attribute their successes and failures to certain factors which are hypothesised by the theories of self-concept to influence the descriptive and affective aspects of individuals' self-concept. It is illustrated by Tennen and Herzberger (1987) that the relationship between self-concept and causal attributions is reciprocal as reported in the findings of several research studies. Stipek (1993) clarifies that the nature of causal attributions made to attribute previously achieved successes or failures by individuals affect subsequent self-concept. Accordingly, the former self-concept influences later causal attributions.

Shavelson et al. (1976) propose that the most important feature to identify the development of self-concept is reflected appraisals from peers and significant others. The research on self-concept indicates that individuals tend to view themselves based on individuals' beliefs of how significant others view them. Rosenberg (1979) advocates that reflected appraisals from peers and significant others are the most critical and influential sources of information for individuals about themselves. It can be concluded that some students might be heavily influenced by certain significant others such as parents or teachers. Consequently, the reflected appraisals from significant others such as parents and teachers may strongly motivate or demotivate the academic performance of students.

It is clarified by Bong and Skaalvik (2003) that self-concept is individuals' collective perceptions about self which are shaped by individuals' experience, interpretation, and interaction with the environment. Therefore, the concept of experience is considered to be another important and crucial factor in the formation of self-concept. The past or mastery experiences of individuals become integrated with individuals' self-concept and smoothen the formation of self-schemas (Stipek 1993; Tennen & Herzberger 1987; Marsh & Martin 2011; Shin et al. 2016). The developed self-schemas subsequently participate in processing the past experiences and relative information to support the formation of self-concept similar to the support provided by self-schemas in the formation of self-efficacy (Bandura 1986; Lewis et al. 2016).

Based on several research studies, it has been reported that the formation of self-concept is heavily influenced by the perceived sense of self-esteem and self-worth. The self-esteem is explained by Rosenberg (1979) as the personal characteristics that individuals attribute to themselves which are inclusive of a sense of competence, achievement, power, and the ability to cope with individuals' environment. Bong and Skaalvik (2003) view self-esteem as individuals' evaluation of their worthiness, importance, successfulness, and capability. Thus, self-esteem is an integrated part of individuals' self-concept and it is assumed to be significant and psychologically important in the development of self-concept. From another side, self-worth consists of the sense of morality and ethical values which are instiled in the principles and norms of behaviour. It is explained by Bandura (1986) that the standards of competence and cultural values are internalised into self-concept in the shape of evaluative standards.

2.7 Definitions of Academic and Mathematics Self-Concept

The concept of general self-concept has been thoroughly reviewed in the previous section; however, the general self-concept might be characterised to be ambiguous in terms of its theoretical and operational conceptualisation and its influence on academic achievement of students. Bong and Skaalvik (2003) suggest that the reason of vagueness is because of using certain composite scores to measure the general self-concept. The composite scores are based on the sum of responses from standardised instruments towards different aspects of life which make the measurement of the general self-concept practically unfruitful. Bandura (1986) explains that the global nature of the general self-concept is broad and less influential to explain certain behaviours of students such as academic achievement and performance, since the general self-concept does not give sufficient attention to the significant distinctions students make about the specific domains of the general self-concept. Shavelson et al. (1976) indicate that students' self-perceptions of particular behaviours affect the specific domains or subareas of self-concept such as English self-concept, history self-concept, mathematics self concept, and science self-concept. It is reported in several research studies that the relationships between academic self-concept and academic achievement range from moderate to strong (Byrne & Gavin 1996; Skaalvik & Hagtvet 1990; Skaalvik & Rankin 1990; Marsh & Martin 2011; Shin et al. 2016). In order to gain a practical insight into the real and direct explanatory characteristics of self-concept in relation to students' motivation and academic performance, it is worthy to deeply evaluate the domain-specific aspects of the concept such as academic self-concept and mathematics self-concept.

This section aims at illustrating the impact of general self-concept on students’ academic performance and particularly in mathematics. The general self-concept has been defined in different ways and its successor academic self-concept has also been defined in different ways by various researchers. The academic self-concept is defined by Wigfield and Eccles (1992) as the perceptions and knowledge of individuals about themselves in academic situations. Bong and Skaalvik (2003) view academic self-concept as the perceived capability of an individual in a specific academic domain such as mathematics. Lent et al. (1997) indicate that academic self-concept is constructed when self-beliefs and self-feelings are combined together through general academic functions. The academic self-concept is conceived by Nagy et al. (2010) to be domain-specific, since it mirrors the evaluation of individuals of their abilities in a specific domain or an academic area.

The general definition of academic self-concept is articulated by O'Mara et al. (2006) as students' self-perceptions of their academic capabilities taking into consideration that these self-perceptions are shaped by students' prior experiences and interactions with the environment. Although several researchers agree on the general definition of academic self-concept, it has been argued by Valentine et al. (2004) that academic self-concept is multidimensional and changes depending on the academic subject. Shavelson and Bolus (1982) advocate the distinction of academic self-concept based on its domain such as mathematics self-concept, science self-concept, history self-concept, and English self-concept. Yeung et al. (2002) express that students are more comfortable with the domain-specific presentation of academic self-concept.

The detailed structure of academic self-concept is presented in Figure 2.4. As shown in Figure 2.4, the academic self-concept is made up of two subareas which are math/academic self-concept and verbal/academic self-concept. The math/academic self-concept consists of five primary subareas and two secondary subareas. The five primary subareas of math/academic self-concept include mathematics self-concept, physical science self-concept, biological science self-concept, economic business self-concept, and school self-concept. The two secondary subareas of math/academic self-concept consist of geography self-concept and history self-concept. The verbal/academic self-concept is made up also from five primary subareas and two secondary subareas. The five primary subareas of verbal/academic self-concept contain English self-concept, foreign languages self-concept, history self-concept, geography self-concept, and school self-concept. The two secondary subareas of verbal/academic self-concept consist of economics business self-concept and biological science self-concept.

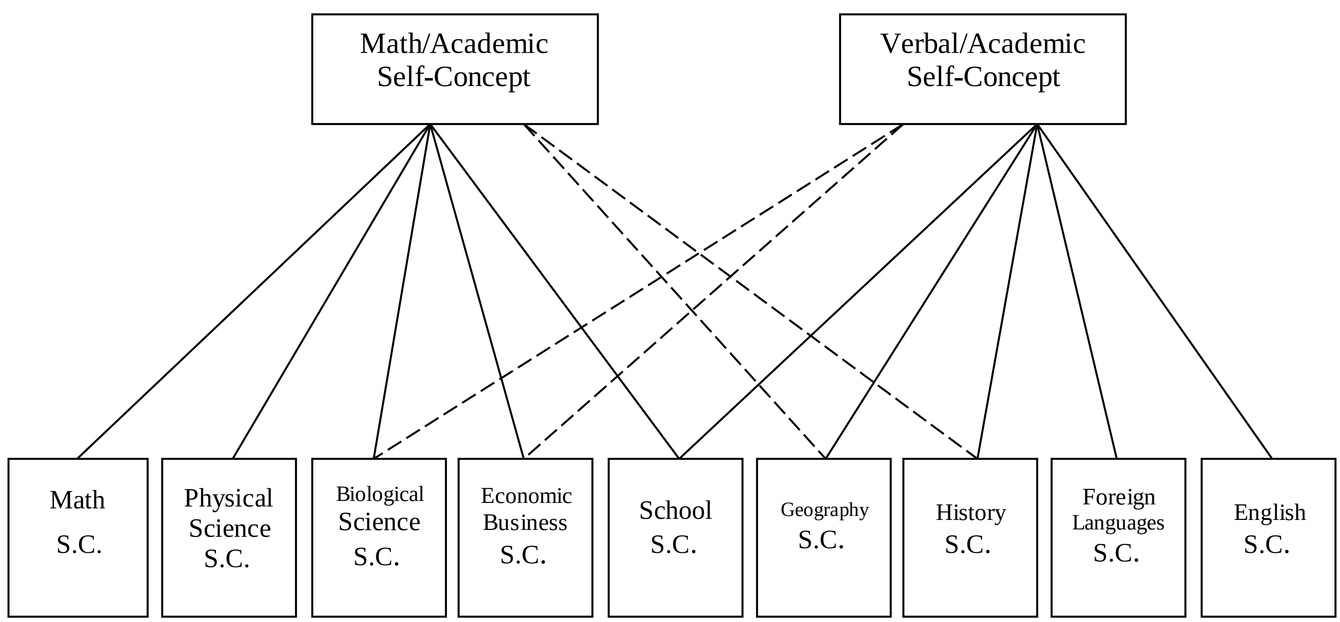


Figure 2.4: Academic Self-Concept Structure
(S.C. is Self-Concept)
(Marsh & Shavelson 1985)

Since this thesis is concerned with analysing the predictive factors to motivate students' success in mathematics courses, it is worthy to deeply evaluate the domain-specific mathematics self-concept. Marsh (1990) defines mathematics self-concept as students' assessment of their self-perceived personal ownership of mathematical capabilities, skills, reasoning abilities, excitement, and interest in mathematics. It is emphasised by Marsh (1986, 1988) that students' achievement of desirable learning outcomes in mathematics can be facilitated through students' positive perception of their mathematical abilities and skills. Some of the desirable learning outcomes in mathematics include students' persistence on mathematical tasks, academic efforts, selection of mathematics courses, and completion of college degrees (Marsh 1990; Parker et al. 2014). The findings of several research studies affirm the positive relationship between students' mathematics self-concept and students' motivation to learn and succeed in mathematics. Marsh (1986) underscores that students' positive mathematics self-concept enhances students' motivation to succeed in mathematics which is achieved through the promoted interest of students to learn mathematics, students' perception of mathematics and its relevance, and the perceived probabilities of success in learning mathematics. Accordingly, it can be concluded that any effort spent to enhance students' mathematics self-concept is expected to have a positive impact on students' motivation to learn and succeed in mathematics (Parker et al. 2014). Based on the notion of success generates success, it can be concluded that enhancing mathematics self-concept of students might be expected to promote students' abilities, interests, and persistence at mathematical tasks which ultimately improves students' achievements in mathematics and strengthens students' ability to select mathematics-related courses at the college level and mathematics-related careers later on at the professional level of life.

Marsh (1990) suggests several ways to improve students' mathematics self-concept such as identifying the target group of students; putting specific goals; evolving teaching materials; and implementing relevant learning activities, educational experiences, pedagogical methods, and objective evaluation procedures. It is explained by Bong and Clark (1999) that academic self-concept is multidimensional like its predecessor, the general self-concept. Bong and Clark (1999) clarify that academic self-concept consists of cognitive components and affective components. The academic self-concept is made up of the cognitive description of individuals' characteristics and the affective evaluation of these characteristics in a comparative relationship with others. Consequently, mathematics self-concept also contains both cognitive and affective components. Tanner and Jones (2000) emphasise that the cognitive component of mathematics self-concept implies students' awareness of their own knowledge in mathematics such as the ability of students to identify their strengths and weaknesses, build relationships between diverse areas of the subject, and use their abstraction processes. The cognition is the process in which individuals acquire information and understanding, store, address, and retrieve the acquired information and knowledge. On the other hand, the affective component of mathematics self-concept includes the internal belief system of students to succeed in mathematics such as students' belief about the nature of mathematics understanding, students' self-esteem as learners of mathematics, and students' potential to learn and succeed in mathematics (Tanner & Jones 2000; Parker et al. 2014).

It is argued by Bong and Skaalvik (2003) that there are different views among researchers whether cognitive or affective or both components should be involved in academic self-concept. The components of academic self-concept tend to reflect diverse aspects of self which include a type of cognitive evaluations and affective reactions (Bong & Skaalvik 2003; Parker et al. 2014). For instance, the Self-Description Questionnaire developed by Marsh and O' Neil (1984) integrates between the cognitive and affective aspects of academic self-concept. Examples of the items that can be used to measure the cognitive component of mathematics self-concept include "I do bad in exams of mathematics" and "I am sure that I will do bad in the problems and tasks assigned for the mathematics course". Examples of the items that can be used to measure the affective components of mathematics self-concept are like "I hate mathematics" and "I never want to take another mathematics course". Choi (2005) indicates some of the dissimilarities between self-concept and self-efficacy. The nature of self-concept is multidimensional, since it is inclusive of both cognitive and affective components. While, self-efficacy is unidimensional in its nature, since it is made up mainly from the cognitive components.

Table 2.1 provides a summary for the major elements of the theoretical and operational definitions of mathematics self-concept which have been discussed thus far. The summary simulates the developed comparison by Bong and Skaalvik (2003) in order to contrast between academic self-concept and academic self-efficacy. As indicated in Table 2.1, mathematics self-concept is the knowledge and perceptions of someone about herself or himself in mathematics achievement situations and it is made up of cognitive and affective component. Mathematics self-concept is inclusive of the cognitive descriptions of individuals' characteristics and the affective evaluations of these characteristics in a comparative relationship with others. The central element of mathematics self-concept is based on the perceived competence of students in mathematics. Mathematics self-concept is characterised to be normative, domain-specific, multidimensional, hierarchical, part-oriented, and stable. The predictive outcome of mathematics self-concept is students' motivation and emotions which ultimately influence students' performance in mathematics courses (Bonk & Skaalvik 2003; Parker et al. 2014; Shin et al. 2016).

Table 2.1: Elements of Academic (Mathematics) Self-Concept	
Elements	**Description**
1- Working definition	Knowledge and perceptions about oneself in mathematics achievement situations
2- Central element	Perceived competence in mathematics
3- Composition	Cognitive and affective appraisal of self in mathematics achievement situations
4- Nature of competence evaluation	Normative and positive
5- Judgment specificity	Domain-specific (mathematics)
6- Dimensionality	Multidimensional
7- Structure	Hierarchical
8- Time-orientation	Past-oriented
9- Temporal stability	Stable
10- Predictive outcomes	Motivation, emotions, and performance
(Bong & Skaalvik 2003, p. 10)	

2.8 Motivation and Students' Self-Concept

It has been recognised that students' motivation to learn is primarily influenced by students' self-perceptions (Asmus 1986; Harvey & Martinko 2009). It is suggested by Wolff (2004) that one of the vital reasons to enhance learning is to measure the way students think about themselves, so any improvement of students' self-image is expected to improve students' achievements in other domains. It has been concluded by Eccles (2005) that students' self-concept about their ability and difficulty of tasks is a fundamental factor which affects students' motivation, achievement, and learning experience. The ability of students and difficulty of tasks have been described by Weiner (1985) as one of the dimensions of the attribution theory on students' motivation.

It is reported by Gecas (1982) that two literatures in social psychology are related to the self-consistency motive. The first literature involves motivation as the sociological literature on identities. The second literature is inclusive of self-concept as the psychological literature on cognitive organisation of knowledge and beliefs. In the former literature, consistency is the harmony between identities and role behaviours. In the latter literature, consistency refers to the cognitive organisation of attitudes about the self. The integration between both aforementioned literatures happens through organising self-relevant information into specific domains which can motivate individuals to act according to the values, perceptions, beliefs, and norms implied by identities to which students become committed (Foote 1951; Harvey & Martinko 2009).

Based on the attribution theory, Weiner (1985) suggests that the extent to which students are motivated to learn academic subjects is determined by students' reactions to academic successes and failures. Students' successes and failures are explained by Weiner (1985) in terms of locus, stability, and controllability. The locus explains if the reasons for successes or failures are within the students themselves such as students' skills, willingness, or both; or if the reasons for successes or failures are from other sources such as assistance from others or difficulty of subject. The stability indicates how stable are the attributions or reasons that influence students' success over time. In general, students' motivation is heavily influenced by stable attributions or reasons more than unstable attributions or reasons. Moreover, stable and positive attributions last longer than unstable attributions and are expected to provide additional success in the future. For instance, success of students in first-year mathematics will motivate them to take second year mathematics and succeed in it. The controllability is the ability of students to control their invested efforts to succeed in an academic subject. The existence of positive, stable, and controllable attributions lead to success in an academic subject which at the end motivates students for further success in advanced academic subjects (Harvey & Martinko 2009). Therefore, it can be assumed that what students attribute to be the causes of success or failure in a particular achievement task will affect the way students approach the same task in the future. Hunter and Barker (1987) emphasise that the attribution theory has implications on both students and instructors. The attribution theory can be utilised by educators in order to assist students to succeed and to enhance the ways instructors respond to their students' performance.

Hunter and Barker (1987) indicate that the locus is inclusive of certain feelings such as self-esteem, shame, or guilt which are based on students' perception of the location of the cause. The locus can be either internal or external. The internal locus happens when causes of successes or failures are attributed to internal reasons such as native ability or effort. On the other hand, the external locus occurs when the causes of successes or failures are attributed to external reasons such as task difficulty or luck. It is clarified by Hunter and Barker (1987) that whenever students attribute their successes or failures to internal locus, students become the organisers of what happens rather than pawns controlled by forces from outside. Thus, students as organisers will become proactive instead of being reactive to the external environment. Wong and Weiner (1981) explain that students' attribution of success to internal locus such as ability and effort results in enhanced self-esteem of students; however, students' attribution of failure to internal locus results in students' guilt such as lack of effort or results in students' shame such as lack of ability.

Hunter and Barker (1987) illustrate the implications of the locus of causality in order to determine students' academic self-esteem. Students are considered to have positive self-concept, if students believe that they have the ability and can achieve success with effort. However, students are considered to have negative self-concept, if students believe that no matter how hard students try, they will not be successful. For instance, students' self-esteem will not be enhanced, if students believe they successfully can succeed because of instructors' tolerance or luck. Hunter and Barker (1987) also clarify the implications of locus on instructors' teaching methods. It is very significant that instructors diagnose how students' learning needs can begin and continue. For example, if the learning that should be accomplished is very easy or extremely difficult, students' effort becomes irrelevant. The instructors' rigorous diagnosis and effective teaching as well as the efforts spent by students have to bring success, since students feel that the locus of causality is within themselves and students become aware that they can control success. Barker and Graham (1987) propose that students' ability might be influenced by instructors' elated praise or impatient criticism. For instance, praises for students' success as a result of little effort may teach students not to work hard. Moreover, criticisms for students' failure on tasks which could have been achieved with effort may communicate to students that they have the ability to succeed and they have to put additional effort. Accordingly, creating an academic environment that promotes students' motivation and their learning experience is a mutual responsibility which implies efforts from both students and instructors.

It is proposed by Hunter and Barker (1987) that the stability of causality includes the expectations of the future which are based on whether the cause is perceived as stable or subject to change. The attributions which are based on native ability or task difficulty are considered to be stable; however, the attributions which are based on effort or luck are considered to be unstable. The only attributions that will never change and are deemed the most stable in the eyes of perceivers are the attributions which are based on native and genetic ability. Due to the perception of students about their ability, task difficulty can be viewed as a stable cause. Examples of stable attributions are like the perceptions of some students that they have been always dud in mathematics and they will never understand it or the perceptions of some students that they have no artistic ability, and there is no reason for them to study art, music, or drama. Consequently, students have a stable cause that mathematics, music, or art will always be easy or will always be difficult. Hunter and Barker (1987) indicate that whenever students attribute their successes or failures to stable causes, students' expectations about the future and the past are the same; however, whenever students attribute their successes or failures to unstable causes, students' expectations may change.

Hunter and Barker (1987) explain the implications of the stability of causality on students, since it encourages them to think that either the future is pre-determined or it can be changed with efforts. This means that if students succeed in an academic task because they tried hard. Then, if students continue to try hard, they will succeed again. If students' achievement was because of students' natural ability, they do not have to work hard. If students' success or failure was because of external factors, students will not be willing to try. Hunter and Barker (1987) emphasise that students have the ability to accomplish success, if they spend effort, and students should anticipate less success, if they do not try or put effort. However, if students try hard and fail, it can be concluded that students do not have the ability and students' self-esteem is expected to diminish. Furthermore, the implications of stability of causality on instructors have been discussed by Hunter and Barker (1987). The instructors play a vital role in influencing the beliefs of students that their ability to be successful is stable and that they can control the effort necessary for success. For instance, instructors may convey to students that success can be achieved through the existence of both ability and effort by encouraging students to do their academic tasks and ensuring that students can do the tasks if they try.

Hunter and Barker (1987) demonstrate that the controllability of causality is students' feelings of power to influence the outcome by controlling the cause. The attributions of students which are based on their effort are considered to be controllable; however, the attributions of students which are based on ability, task difficulty, or luck are deemed to be not controllable. Therefore, the only causal attribution that can be controlled by students is effort. For example, students tend to put their efforts on studying, if they think that the studying efforts will influence their grades, but students may be reluctant to put any efforts on studying, if they believe that their grades are the results from instructors' compassion, type of exam, or mere luck. It has been reported by Hunter and Barker (1987) that successful students and high achievers in mathematics, science, business, art, sport, or music have to spend tremendous effort. Thus, students should believe that they have to put effort which is completely controlled by students, if they want to experience success. However, if students believe that successes or failures are the pure results of ability, task difficulty, or luck, there is no need for students to put forth a lot of effort.

The implications of the controllability of causality on students have been illustrated by Hunter and Barker (1987). Through the controllability of causality, students feel that they are the commanders of their own fate. For instance, when students know that their success depends on them, it might be scary, but students are in charge of success and control it. But, when students cannot influence what happens to them, they become pawns of others. Accordingly, students should either become resigned to their fate or despair. Hunter and Barker (1987) indicate that what happens to students is the result of what they do and if students change their actions, they most likely can change the outcomes. Hunter and Barker (1987) also demonstrate the implications of the controllability of causality on instructors. The way instructors respond to students' successes or failures sends signals to students whether the instructors believe that students are in control of successes or failures.

The research on attribution aims at asking students about their perceptions of the causes of a specific outcome and examining the perceived causes or attributions used by students to explain certain events such as the causes or attributions that motivate students to succeed in undergraduate introductory mathematics courses (Marsh 1984; Harvey & Martinko 2009). The perceived causes of success or failure have significant implications and have been vastly used and applied in educational settings. Weiner (1979) clarifies that the individual variations in the causes or attributions like ability, effort, and luck which are used by students to attribute their outcomes are related to certain factors such as academic performance, mathematics self-concept, and academic behaviours.

Marsh (1984) indicates that the attribution researchers employ dispositional studies or situational studies and in both types students are typically presented with stimuli describing success or failure and students are requested to assess the probability of success or failure through a series of possible causes such as ability, effort, luck, and difficulty of the task. The dispositional studies emphasise traits and ask students to make self-attributions about their own behaviours. In general, little information is provided to students about the cause of the outcome in the stimulus in dispositional studies. For instance, students in dispositional studies are only informed that they did poorly in a mathematics exam and students are asked to judge the likelihood of different subjects. The effects of these dispositional traits which generalise across students are usually sought in dispositional studies. On the other hand, the situational studies emphasise state and assess how systematic manipulations in the context change attributions. The situational studies usually look for attributions about a hypothetical other student and detailed information are provided to students about the cause of the outcome in the stimulus. For example, students in situational studies are told that another hypothetical student did poorly in a mathematics exam taking into consideration that the student is clever, the exam was easy, and the student did not prepare well and study hard for the exam. The elements of the stimulus in situational studies are systematically various such as the hypothetical student was smart or was not smart, the exam was easy or difficult, and the hypothetical student did study hard or did not study hard for the exam. The effects of these situational manipulations that generalise across students are usually described in situational studies. It is reported that the attribution process is influenced by both situational and dispositional factors and neither approach is inherently superior (Marsh 1984).

Marsh et al. (1984) illustrate the existence of a relationship between attributional tendencies and self-concept which is frequently assumed in self-concept research. Marsh (1984) demonstrates that ability and effort as perceived causes of success are consistent with the favorable self-concept of students. However, lack of effort in particular without lack of ability as dispositional attributions of failure are not consistent with the self-concept of students. Therefore, Marsh et al. (1984) report a substantially positive correlation between students' success and students' ability as well as students' success and students' effort. Meanwhile, Marsh et al. (1984) indicate that the correlation is substantially negative between students' failure and students' ability and less substantially negative between students' failure and students' effort. Moreover, the magnitude of the correlations is largest when self-attributions and self-concept include the same area of academic content such as mathematics (Marsh et al. 1984; Harvey & Martinko 2009).

The attribution theory (Weiner 1985) supports the self-determination theory (Deci & Ryan 1985) which dichotomises motivation into intrinsic motivation and extrinsic motivation. Consequently, the implication of both theories happens through the fact that students' perceptions about themselves in a specific subject influence students' intrinsic motivation to succeed. Eccles et al. (1993) demonstrate that motivation patterns are learnt by students, and this process of learning becomes part of students' self-concepts. For instance, students' motivation to learn and succeed in mathematics becomes integrated with students' mathematics self-concepts. Because of the tangible relationship between students' intrinsic motivation to succeed in mathematics and students' mathematics self-concept, it is possible to hypothesise that students' motivation to succeed in undergraduate introductory mathematics courses is directly related to students' mathematics self-concept and it is worthy to examine the relationship between both factors.

Motivation is a complex process that happens through the interaction of cognitive and affective factors. Students' motivation to succeed in the areas of mathematics and sciences can be enhanced by promoting various elements such as interest, achievement goals, experience, and classroom engagement (Shernoff & Hoogstra 2001). It is emphasised by Jones et al. (2010) that several motivational factors are significant predictors of first-year academic success and study persistence. According to MacNamara and Penner (2012), the academic success of students in undergraduate introductory mathematics courses can be achieved through three key aspects. The first aspect is the cognitive entry skills and Intelligence Quotient (IQ) which accounts for 50% of students' success. The second aspect is the quality of instruction which results in 25% of students' success and depends of instructors' teaching methods, curricula's design, textbooks, alignment between students and instructors' teaching styles, and supplementary tutorials. The third aspect is the affective factors which represents the last 25% of students' success and includes students' mathematics self-concept, study skills, time management skills, exam-taking skills, students' perception of success in mathematics, locus of control, students' attitude towards mathematics, and the level of students' engagement in the learning process. Schiefele et al. (1992) found a positive relationship between students' interest and academic achievement in a meta-analysis of 56 research studies with a correlation coefficient of 0.32 between interest and achievement in mathematics. The variation in academic achievement is influenced by students' interest with an average of 10 percent.

The findings of several research studies indicate that students’ motivation is influenced by academic self-concept and both are directly and indirectly related to the academic achievements of students (Awan et al. 2011; Tella 2007; Abouserie 1995). It has been proven by Abouserie (1995) that there is a correlation between academic self-concept and students’ motivation. The positive academic self-concept is expected to make a positive contribution to students’ achievement, since students with high motivation perform better than students with low motivation (Tella 2007). Thus, students’ learning approaches are substantially influenced by their academic self-concept and their motivation. Students at the college level encounter various challenges in chasing their educational goals and if students’ experiences are perceived to be negative, these negative experiences may have adverse effects on students’ motivation and academic achievement (Covington 1984; Weiner 1985; Struthers et al. 2000).

The research study of Van Soom and Donche (2014) aimed at profiling the relationship between academic achievement, autonomous motivation, and academic self-concept of first-year students in the STEM programmes. The results disclose the existence of a significant positive correlation between academic achievement and autonomous motivation with a correlation coefficient of 0.10 and a significant correlation between autonomous motivation and academic self-concept with a correlation coefficient of 0.15. The findings of Follette et al. (2017) indicate that remediation of students' attitudes regarding mathematics is a significant factor and equivalent in importance to remediation of students' numerical skills in order to produce quantitatively literate population of college students. It is reported by Wink (1970) that there is a strong positive relationship between academic self-concept and students’ ability and achievement in music courses at the college level. Wolff (2004) indicates that the use of musical learning can be employed as a reward to reinforce learning of mathematics. MacNamara and Penner (2012) examined the academic success predictors of over 300 students in three different first-year mathematics courses at the Kwantlen University College in Canada and found that strengthening students' study skills and motivation is a fruitful tool to promote the academic performance of students in undergraduate introductory mathematics courses. The meta-analysis of Richardson et al. (2012) assessed the psychological correlates of first-year students' academic achievement and the review of 13 years of research revealed that performance self-efficacy is the strongest correlate of students' academic achievement.

Students' academic self-concept as a predictor of academic motivation and achievement has substantial theoretical and practical implications and has been the attention of considerable research studies (Marsh et al. 2005). For instance, several research studies revealed the existence of a strong relationship between students' academic self-concept and a number of motivational and performance variables such as students' interest (Byrne 1996), students' academic engagement and effort (Lazarides & Watt 2015), students' persistence on tasks (Skinner et al. 1990), students' aid-seeking behaviours (Bong & Skaalvik 2003; Harter 1982; Marsh 1990; Meece et al. 1988), students' course selection patterns (Marsh 1990), students' intrinsic and extrinsic motivation (Bong & Skaalvik 2003; Marsh et al. 2005), and students' academic achievement (Marsh & O' Neil 1984; Marsh 1986; Bong & Skaalvik 2003; Marsh el al. 2005; Shavelson & Bolus 1982).

Choi (2005) examined the relationship between self-constructs including self-concept and self-efficacy and the academic performance of 230 undergraduate students registered in four general education classes at the Southeastern University in the United States. The results disclose that both academic self-concept and specific self-concept are statistically significant predictors of academic performance. However, neither general self-efficacy nor specific self-efficacy is significant to predict the academic performance of students. The findings of Choi (2005) are consistent with the results of Lent's et al. (1997) research study which included 205 college students and aimed at measuring three variables of self-efficacy and two variables of self-concept at different degrees of specificity. Lent et al. (1997) found a significant path coefficient (β=0.31) from the academic self-concept to a relatively global measure of academic performance through students' Cumulative Grade Point Average (CGPA). Meanwhile, the specific self-efficacy did not have any significant impact on the grades of math-related courses.

Marsh et al. (1988) suggest large and systematic patterns of relationships between mathematics self-concept and academic achievement in mathematics. For instance, Marsh and Craven (2006) illustrate that mathematics self-concept is strongly and positively related to mathematics grades (0.71). Several research studies found moderate to strong relationships between academic self-concept and academic achievement (Byrne & Gavin 1996; Skaalvik & Hagtvet 1990; Skaalvik & Rankin 1990). The detected relationships between academic self-concept and academic achievement reveal frequent correlations ranging from 0.4 to 0.6 (Skaalvik & Valås 1999). The research study held by Guay et al. (2003) attempted to evaluate the developmental trends between academic self-concept and academic achievement for a sample of 385 students selected from 10 elementary schools. The results disclose that there is a strong relationship between academic self-concept and academic achievement of students. Pinxten et al. (2013) assessed the causal ordering between the general academic self-concept and academic achievement of 2834 students from grade 7 to grade 12 in 50 secondary schools. The findings indicate that the previous academic self-concept has a positive influence on the consequent academic achievement and the previous academic achievement has a positive influence on the consequent academic self-concept.

2.9 Conclusion

In conclusion, the theoretical and empirical literature on students' motivation and self-concept has been reviewed from various perspectives such as theories, conceptualisations, hypotheses formulations, empirical modelings, and explorations. This chapter has comprehensively reviewed, synthesised, and challenged the relevant literature on mathematics role and achievements, definitions of motivation, theories of students' motivation, definitions of self-concept, structure and formation of self-concept, definitions of academic and mathematics self-concept, and motivation and students' self-concept. The understanding of diverse levels of motivation and other psychological processes which promote academic achievement and performance has been enhanced through the reviewed theories. However, most of the reviewed empirical literature aimed at investigating the relationships between academic self-concept and academic achievement. Guay et al. (2010) indicate that few research studies examined the relationship between academic self-concept and intrinsic motivation since both of them were analysed independently in most of the reviewed research studies. Therefore, this current research study is a useful tool which attempts to resolve some of the deficiencies in the empirical research literature by examining the relationship between students' academic intrinsic and extrinsic motivation to succeed in mathematics, students' mathematics self-concept, and students' demographic variables.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter aims at employing the reviewed theories in chapter two to explain the rationale for the type of research design selected to study the predictive factors of students' motivation to succeed in undergraduate introductory mathematics courses. Moreover, the relationship between the dependent and independent variables of the research study and its theoretical framework is rationalised. The three articulated research sub-questions in the introduction of chapter one reveal that students' motivation to succeed in undergraduate introductory mathematics courses is the core interest and attention of the thesis. Accordingly, a number of hypotheses have been formulated through a deductive approach in order to examine how students' motivation to succeed in undergraduate introductory mathematics courses is influenced and shaped by various predictive factors. The roots of studying students' academic motivation in mathematics are instilled in several psychological and educational theories which include the self-efficacy theory (Bandura 1977), the self-determination theory (Deci & Ryan 1985), and the attribution theory (Weiner 1985). Therefore, the research study is constructed based on a psychological approach which is placed in a context of math education. The discussion in this chapter starts with the research approach, followed by the analytical model and its assumptions, the research hypotheses, and the data collection process of the thesis.

3.2 Research Approach

The research is based on a mixed research approach which adopts an explanatory design. Fraenkel et al. (2014) indicate that qualitative methods are used to refine and expand on the findings of quantitative methods when an explanatory design is used. The thesis is constructed based on a pragmatic research philosophy and the three articulated research sub-questions in the introduction of chapter one are the most significant determinants for the selection of this research philosophy. The use of a mixed research methodology is considered the most appropriate strategy to answer the research question and sub-questions under investigation. The quantitative information is used to answer the three research sub-questions of the thesis in order to determine whether there is a significant relationship between students' motivation to succeed in undergraduate introductory mathematics courses as the dependent variable of the research study at one hand and students' cognitive mathematics self-concept, students' affective mathematics self-concept, students' expectations of future career and income, students' age, and the number of mathematics courses taken by students as the independent variables at another hand. Therefore, the quantitative information is utilised in order to assess the predictivity of the five independent variables on students' motivation to succeed in undergraduate introductory mathematics courses. Furthermore, the qualitative information is included in the thesis in order to refine the three research sub-questions by exploring the relationship between students' motivation to succeed in undergraduate introductory mathematics courses and students' cognitive mathematics self-concept, students' affective mathematics self-concept, students' expectations of future career and income, students' age, and the number of mathematics courses taken by students. Moreover, the qualitative information is employed in order to expand on the quantitative findings and answer the general research question by exploring any other potential factors in addition to the five independent variables that might predict students' motivation to succeed in undergraduate introductory mathematics courses.

The quantitative part of the thesis is developed based on a correlational research approach. Students' motivation to succeed in undergraduate introductory mathematics courses is assigned as the dependent variable of the study and the impact of another five independent variables is examined on students' motivation to succeed in undergraduate introductory mathematics courses. The quantitative information has been gathered through the use of survey questionnaires. On the other hand, the qualitative part of the thesis is constructed through using a descriptive research approach. Students' motivation to succeed in undergraduate introductory mathematics courses is studied as a phenomenon and the predictive factors which influence this phenomenon have been analysed through conducting interviews with students. The details on the survey questionnaires and interviews design are provided in the research methodology section. The proposed relationships between the research study variables are presented in a diagrammatic format as shown in Figure 3.1 which depicts the analytical model of the thesis.

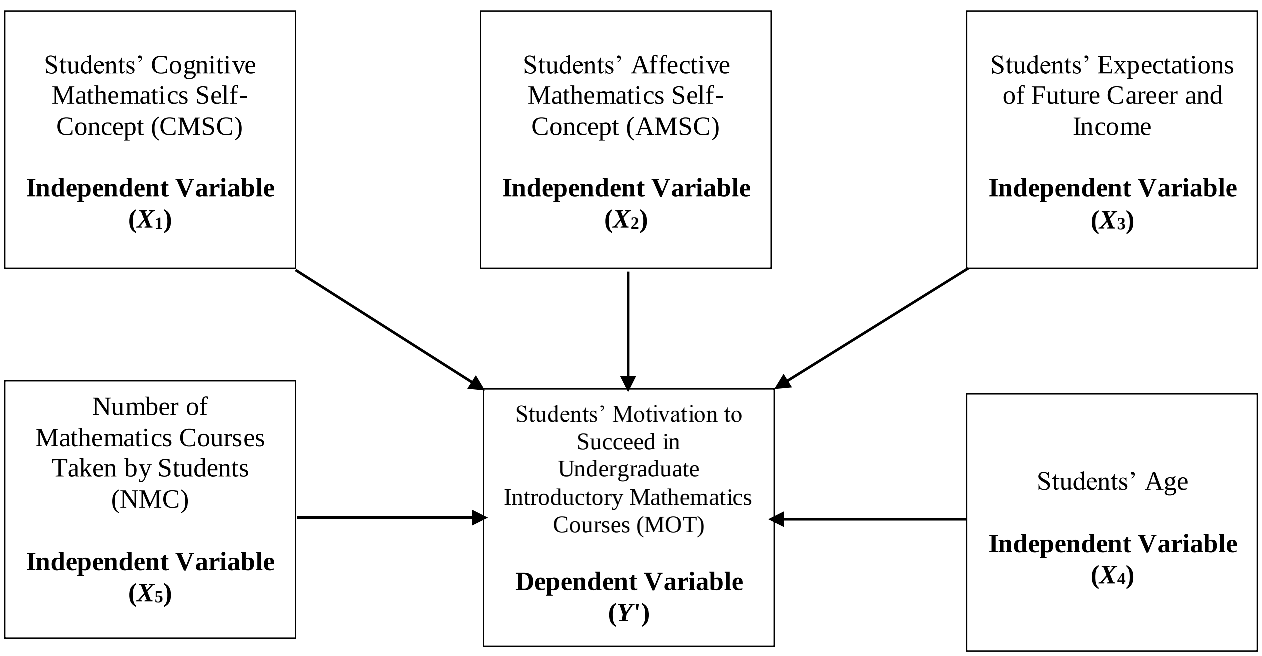


Figure 3.1: Thesis Analytical Model

3.3 The Analytical Model

The following four subsections provide information about students' motivation and mathematics self-concept; students' mathematics self-concept; students' expectations of future income; and students' demographic information which all illustrate how the proposed hypotheses and the dependent and independent variables are related to the theoretical framework of the thesis. Therefore, the theoretical and empirical information about the dependent variable of students' motivation to succeed in undergraduate introductory mathematics courses are discussed in the first subsection. In addition to that, the theoretical and empirical information about all the other independent variables of students' cognitive and affective mathematics self-concept; students' expectations of future income; and students' demographic information including age, gender, and number of mathematics courses taken are reviewed in the other three subsections.

3.3.1 Students' Motivation and Mathematics Self-Concept

Weiner (1985) explains through the attribution theory that the extent of students' motivation to learn academic subjects is decided by students' reactions to academic successes or failures which all are explained in terms of locus, stability, and controllability. The locus explains if the reasons for students' successes or failures are within the students themselves such as students' skills or willingness; or if the reasons for students' successes or failures are from other external sources. The stability demonstrates how stable are students' attribution for successes or failures over time. The controllability refers to students' ability to control their invested efforts in an academic subject. It is emphasised by Kloosterman (1988) that students can control their efforts in an academic subject; however, they cannot control their abilities and skills. Positive, stable, and controllable attributions and causes drive students to succeed in an academic subject which later on motivate students for additional success in advanced academic subjects. The attribution theory (Weiner 1985) is complemented by the self-determination theory (Deci & Ryan 1985) which dichotomises motivation into intrinsic motivation and extrinsic motivation. The self-determination theory suggests that intrinsic motivation to succeed is related to students' perceptions of themselves in relation to a specific academic subject. Eccles et al. (1993) clarify that the inclusion of these theories happens through students' motivation to learn and succeed in an academic subject which is at the end integrated with students' mathematics self-concept. Based on the theories of students' motivation and mathematics self-concept as well as the diverse empirical work proofing and clarifying the consistency of the proposed relationship between both concepts, it can be hypothesised that students' motivation to succeed in undergraduate introductory mathematics courses may be related to students' mathematics self-concept which is the outcome of attitudes and feelings developed by students about mathematics. In mathematical expressions,

MOT = f (MSC)

Where:

MOT presents students' motivation to succeed in undergraduate introductory mathematics courses

MSC presents students' mathematics self-concept

3.3.2 Students' Mathematics Self-Concept

The research on self-concept is clearly evidenced through the efforts exercised by Shavelson and Marsh (Shavelson et al. 1976; Shavelson & Bolus 1982; Marsh 1986, 1988, 1990) which are considered as the most significant basis for many current theories and models (Ames & Archer 1988; Bandura 1977, 1986; Bong & Clark 1999; Bong & Skaalvik 2003; Rosenberg 1979; Weiner 1985, 2004). It is clarified by Shavelson et al. (1976) that the general self-concept is characterised to be multi-faceted comprising from academic self-concept and non-academic self-concept. The academic self-concept is distinguished to be domain-specific such as English self-concept, history self-concept, science self-concept, and mathematics self-concept (Shavelson & Bolus 1982). Mathematics self-concept refers theoretically to the knowledge and perceptions possessed by students about themselves in mathematics achievement situations which all are related to diverse motivational and performance indicators such as students' persistence on tasks, students' engagements and efforts, students' course selection patterns, and students’ aid-seeking behaviours (Lazarides & Watt 2015; Bong & Skaalvik 2003; Harter 1982; Marsh 1990; Meece et al. 1988; Skinner et al. 1990). The implication of these theories is that the motivation of students to learn and succeed in an academic subject such as mathematics becomes an integrated part with students' mathematical self-concept. It has been indicated that mathematics self-concept is by nature and implication multidimensional, since it is inclusive of both cognitive and affective components (Fennema & Sherman 1976; Bong & Clark 1999; Bong & Skaalvik 2003). Consequently, there is a reasonable probability to propose and empirically examine the relationship between students' motivation to succeed in undergraduate introductory mathematics courses and students' mathematics self-concept including its cognitive component and affective component. The proposed relationship entails that the level of motivation to succeed in undergraduate introductory mathematics courses might be higher for those students with positive mathematics self-concept when compared with those students with negative mathematics self-concept. This also suggests that any improvements in students' cognitive and affective mathematics self-concept are expected to enhance students' motivation to succeed in undergraduate introductory mathematics courses. In mathematical expressions,

MOT = f (CMSC, AMSC)

Where:

MOT presents students' motivation to succeed in undergraduate introductory mathematics courses

CMSC presents students' cognitive mathematics self-concept

AMSC presents students' affective mathematics self-concept

3.3.3 Students' Expectations of Future Career and Income

The previous relationship between students' motivation and mathematics self-concept might not be sufficient without taking into consideration that students' motivation may also be affected by contextual and social variables. It is emphasised by Ryan and Deci (2000) that the presence of intrinsic motivation variables alone in absence of extrinsic motivation variables might not be adequate, in particular if a specific task is recognised to be not enjoyable or interesting in its nature. Several frameworks of motivation have been developed to explain the role of extrinsic motivation such as utility value of a task (Eccles 2005), possible selves (Markus & Nurius 1986), time perspective (Nuttin 2014), and future orientation (Raynor 1981). The expectancy-value model of Wigfield and Eccles (2000) suggests that several academic activities can be motivated intrinsically and extrinsically. Hence, it can be hypothesised that students who study mathematics or any other academic subject are not only intrinsically motivated and enjoy studying mathematics, but they are also extrinsically motivated because of the potential future career opportunities with good incomes for those students who succeed in mathematics. Therefore, the extrinsic variable of motivation is students’ expectations of future income which is predicted to influence students’ motivation to succeed in undergraduate introductory mathematics courses. In mathematical expressions,

MOT = f (CMSC, AMSC, EFCI)

Where:

MOT presents students' motivation to succeed in undergraduate introductory mathematics courses

CMSC presents students' cognitive mathematics self-concept

AMSC presents students' affective mathematics self-concept

EFCI presents students' expectations of future career and income

3.3.4 Students' Demographic Information

In addition to examining the impact of students’ mathematics self-concept and students’ expectations of future income, three demographic variables including age, gender, and number of mathematics courses taken have been included to analyse their influence on students’ motivation to succeed in undergraduate introductory mathematics courses. It is reported in several research studies that age contributes positively in motivating students to succeed in mathematics courses, and there is a reasonable sense of commitment to learn which is shown by older students when compared with younger students (Gupta et al. 2006; Kasworm & Pike 1994; Richardson 1994). Hence, the maturity of students is measured by the variable of age which is predicted to have a positive relationship with students’ motivation. Thus, it can be hypothesised that students' motivation to succeed in undergraduate introductory mathematics courses may be related to students' maturity which is represented by students’ age. The variable of students’ gender has not been directly included in the hypotheses analysis, since students can be either male or female and it is possible to examine if there exist any gender differences in terms of the impact of the independent variables on students' motivation to succeed in undergraduate introductory mathematics courses. The variable of the number of mathematics courses taken by students has been used to measure the experience of students in mathematics. Several research studies indicate that students' mathematical skills can be enhanced by advancing their experience in mathematics which is achieved through taking more mathematics courses (Berry 2003; Hoffman et al. 2009; Bressoud 2009). Accordingly, it can be hypothesised that the number of mathematics courses taken by students might be a significant predictor of students' motivation to succeed in undergraduate introductory mathematics courses. In mathematical expressions, the following functional relationship is proposed for the complete analytical model:

MOT = f (CMSC, AMSC, EFCI, Age, NMC)

Where:

MOT presents students' motivation to succeed in undergraduate introductory mathematics courses

CMSC presents students' cognitive mathematics self-concept

AMSC presents students' affective mathematics self-concept

EFCI presents students' expectations of future career and income

Age presents students' age

NMC presents the number of mathematics courses taken by students

The complete analytical model including the prediction equation has been articulated using the following specific mathematical expressions:

$Y' = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + u$

Y' = students' motivation to succeed in undergraduate introductory mathematics courses which is the dependent variable or criterion variable.

X_1 = students' cognitive mathematics self-concept which is the first independent variable or the first predictor variable.

X_2 = students' affective mathematics self-concept which is the second independent variable or the second predictor variable.

X_3 = students' expectations of future income which is the third independent variable or the third predictor variable.

X_4 = students' age which is the fourth independent variable or the fourth predictor variable.

X_5 = the number of mathematics courses taken by each student which is the fifth independent variable or the fifth predictor variable.

a = the intercept of the equation, where $Y = a$ or the mean if the values of all Xs equal zero.

b_1 = the effect of cognitive mathematics self-concept on students' motivation to succeed in undergraduate introductory mathematics courses.

b_2 = the effect of affective mathematics self-concept on students' motivation to succeed in undergraduate introductory mathematics courses.

b_3 = the effect of expected future income which is an extrinsic factor on students' motivation to succeed in undergraduate introductory mathematics courses.

b_4 = the effect of age on students' motivation to succeed in undergraduate introductory mathematics courses.

b_5 = the effect of the number of mathematics courses taken on students' motivation to succeed in undergraduate introductory mathematics courses.

u = the stochastic error term which accounts for the effect of any unspecified independent variables or probable factors. The stochastic error term is not included in this model based on the assumptions of normal distribution and homoscedasticity.

All the values of Xs represent the independent or predictor variables. All the values of bs are the coefficients or parameters to be estimated from the model which present the strength of association between all the X values and MOT and measure the effect of each of the independent variables on students' motivation to succeed in mathematics courses.

3.4 The Model Assumptions

The model of this research study has been developed based on the following seven assumptions of classical linear regression models (Poole & O'Farrell 1971; Johnston & DiNardo 1973):

1. The regression model is linear in coefficients, is correctly specified, and has an additive error term.
2. The error term has a zero population mean for all possible sets of given values of X_1, X_2, X_3, X_4, and X_5: $(u_i| = 0$ for i = 1, 2, 3, 4, 5).
3. All explanatory variables are uncorrelated with the error term. The error term u_i is independent of each of the X independent variables X_1, X_2, X_3, X_4, and X_5: E $(X_i\ u_i = 0)$ for all i = 1, 2, 3, 4, 5.

4. The observations of the error term are uncorrelated with each other (no serial correlation). Thus, any two error terms are independent.
5. The error term has a constant variance or homoscedasticity. That is, $V|u_i| = \sigma^2$ for all i = 1, 2, 3, 4, 5. This means, there is no heteroscedasticity in the model.
6. No explanatory variable is a perfect linear function of any other explanatory variable or variables. This implies no perfect multicollinearity or severe imperfect multicollinearity.
7. The error term is normally distributed with a mean of zero and constant variance: $u_i \sim N[0, \sigma^2]$.

3.5 Research Hypotheses

The following five hypotheses have been articulated in order to address the three previously articulated research sub-questions in the introduction:

Ho_1: There is no relationship between students' cognitive mathematics self-concept and students' motivation to succeed in undergraduate introductory mathematics courses ($b_1 = 0$).

Ho_2: There is no relationship between students' affective mathematics self-concept and students' motivation to succeed in undergraduate introductory mathematics courses ($b_2 = 0$).

Ho_3: There is no relationship between students' expectations of future income and students' motivation to succeed in undergraduate introductory mathematics courses ($b_3 = 0$).

Ho_4: There is no relationship between students' age and students' motivation to succeed in undergraduate introductory mathematics courses ($b_4 = 0$).

Ho_5: There is no relationship between the number of mathematics courses taken by students and students' motivation to succeed in undergraduate introductory mathematics courses ($b_5 = 0$).

3.6 Data Collection

This section aims at delineating the ethical considerations; participants and sampling methods; instrumentation; procedures; subscales' reliabilities and items' descriptive statistics; and operational definitions. In order to speculate the model and employ the speculated results to test all the postulated hypotheses, joint efforts were made by the researcher with the assistance of mathematics instructors to gather information through survey questionnaires about students' motivation to succeed in undergraduate introductory mathematics courses and students' mathematics self-concept at different academic institutions of higher education in the UAE.

3.6.1 Ethical Considerations

This research study has been conducted according to the ethical principles espoused by the British University in Dubai (BUiD). The research proposal and the research ethics form were examined by the Research Ethics Committee before launching the research study. The proposed study was considered to be low risk research and had met the standards of ethical treatments of participants. Therefore, the study was approved by the Research Ethics Committee. In order to maintain the ethical standards of the BUiD, the following procedures were followed. Firstly, several academic institutions of higher education in the UAE were contacted and invited to participate in the research study. A copy of the universities' recruitment letter is provided in Appendix D. Secondly, the requests for ethical approvals were submitted to the concerned parties at the academic institutions of higher education, and the ethical clearance to hold the study was granted. Thirdly, the departments of mathematics and instructors of mathematics at the academic institutions of higher education were contacted and provided with the information about the purpose and nature of the research study. The instructors were approached by either the administrations of their academic institutions or the researcher, and they were asked to allow students complete the survey questionnaires in class or hand out the survey questionnaires in class and collect them at a later date. The primary researcher also made the effort and time to introduce, hand out, administer, and collect the survey questionnaires directly in class based on instructors' desires. The students were given questionnaires that are numbered, and were not asked to provide their names in order to ensure their anonymity. The students who completed the survey questionnaires were invited to participate in an optional interview by completing an optional section on the bottom of the survey questionnaires. The optional section requested the names and contact information including email and phone number of those students who were interested to participate in the interview.

3.6.2 Participants and Sampling

The participants in the study are students in undergraduate introductory mathematics courses who provided the required primary information. Hence, the academic institutions of higher education are considered to be the most appropriate sites which have been utilised in order to approach students who are the targeted subjects in this research study. Fraenkel et al. (2014) explain that the population to which a researcher will be able to generalise is called the accessible population. Consequently, the accessible population in this research study includes the academic institutions of higher education in the UAE which were willing to participate in the study. For this purpose, the academic institutions of higher education which agreed to participate in the research study are the UAEU, the ADU, the AAU, and the KIC.

The participants were drawn using simple random sampling techniques and they were asked to participate in a survey questionnaire. Fraenkel et al. (2014) point out that each single member of the population has equal and independent chance of being selected when a simple random sampling is used. The total number of participants in the survey questionnaires is 685 students out of 800 distributed survey questionnaires, resulting in a response rate of 85.6%. The 685 students were made up of 319 male students and 366 female students. A total of 17 students had been selected to participate in the semi-structured interviews in order to gather the qualitative information which is used to support the quantitative information. The distribution of the sampled students and their responses at each institution of higher education is presented in Table 3.1.

Table 3.1: Distribution of Sampled Students in Introductory Mathematics Courses

				Response	
				No.	%
	MUTU 1415	Algebra	50	46	5.8
	MUTU 1425	College Algebra	50	49	6.1
	MUTU 1435	Trigonometry	50	47	5.9
	MATH 105	Calculus I	50	48	6.0
	MATH 110	Calculus II	25	20	2.5
	MATH 140	Linear Algebra I	25	19	2.4
	MTG 100	College Mathematics	70	70	8.8
	MTT 101	Mathematics for Science & Technology	70	67	8.4
	MTT 102	Calculus I	45	42	5.3
	MTT 200	Calculus II	30	24	3.0
	MTT 204	Introduction to Linear Algebra	20	11	1.4
	MTT 205	Differential Equations	15	10	1.3
	0509102	Mathematics for Business	50	44	5.5
	0107101	Calculus I	45	41	5.1
	0107102	Linear Algebra	25	17	2.1
	0107104	Calculus II	25	19	2.4
	0107202	Engineering Math	15	9	1.1
	MAT 101	Business Mathematics	80	66	8.3
	BIT 111	Mathematics and Statistics for IT	60	36	4.5
Total			800	685	85.6

3.6.3 Instrumentation

In order to gather the quantitative information, a 55-item survey instrument has been tailored by compiling items from the Motivated Strategies for Learning Questionnaire (MSLQ), Intrinsic Motivation Inventory (IMI), Self-Description Questionnaire (SDQ), Attitude Toward Mathematics Inventory (ATMI), and supplementary items designed by the researcher.

The MSLQ is a manual which has been developed by Pintrich et al. (1991) to assess the motivational directions of college students and their use of diverse learning strategies in a particular course at the college level. Richardson et al. (2012) clarify that the MSLQ includes constructs such as intrinsic motivation, academic self-efficacy, performance approach motivation, and learning goals orientation. All the items of the MSLQ have shown adequate evidence of conformity with the validity and reliability standards (Pintrich & De Groot 1990; Pintrich et al. 1991). The IMI is a multidimensional instrument which has been designed to measure the subjective experience of participants toward a targeted activity. The IMI has been employed in multiple studies about intrinsic motivation and self-regulation (Deci et al. 1994; Plant & Ryan 1985; Ryan et al. 1983; Ryan et al. 1990; Ryan et al. 1991). The validity and reliability of the IMI have been reported in several studies and the findings indicate the existence of a valid and reliable scale (McAuley 1989; Tsigilis & Theodosiou 2003). The tailored instrument includes 35 items that are sufficient to measure students' motivation to succeed in undergraduate introductory mathematics courses through four subscales which are importance and necessity of mathematics; perception of success in mathematics; enjoyment of mathematics; and expectations of future career and income. The first three subscales are intrinsic motivational subscales and the last one is an extrinsic motivational subscale. The distribution of the 35 items among the motivational subscales is presented in Table 3.2.

Table 3.2: Distribution of Items on Motivational Subscales		
Subscale	Number of Items	Percentage %
Importance and Necessity of Mathematics	10	28.6
Perception of Success in Mathematics	10	28.6
Enjoyment of Mathematics	11	31.4
Expectations of Future Career and Income	4	11.4
Total	35	100.0

The SDQ is developed by Marsh and O' Neil (1984) and it aims at measuring 13 factors of self-concept which all have shown high level of reliability (median alpha = 0.89). The SDQ is deemed as one of the best instruments of self-concept and its validity and reliability have been confirmed is several research studies (Marsh 1990; Byrne & Gavin 1996). The ATMI is widely recognised for its possession of the psychometric properties which are used to measure students' attitudes toward mathematics (Fennema & Sherman 1976; Tapia & Martha 2004). Based on examining the validity and reliability of the ATMI in several research studies which were held in different countries, it can be concluded that the scale of the ATMI is valid and reliable (Tapia & Marsh 2002; Tsao 2004; Abdul Majeed et al. 2013; Afari 2013; Palacios et al. 2013). The designed instrument for this research study embodies 20 items that are intended to measure students' mathematics self-concept through two subscales which are cognitive mathematics self-concept and affective mathematics self-concept. The distribution of the 20 items among the two subscales of mathematics self-concept is shown in Table 3.3.

Table 3.3: Distribution of Items on Mathematics Self-Concept Subscales		
Subscale	Number of Items	Percentage %
Cognitive Mathematics Self-Concept	16	80.0
Affective Mathematics Self-Concept	4	20.0
Total	20	100.0

As indicated in Table 3.2 and Table 3.3 previously, the tailor-made instrument contains a collection of 55 items which are compiled from formerly validated items and new items designed to serve the purpose of this research study. The choices of all the 55 items are prepared based on 5-point Likert scale with response options of strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The designed draft of the 55-item survey instrument is shown in Appendix A in both English and Arabic languages. To ensure the validity and reliability of the Arabic version, the English version had been translated into Arabic by the researcher. Then, the Arabic version had been translated again into English by a mathematics instructor. After that, the translated version into English by the mathematics instructor had been compared with the original English version prepared by the researcher. The comparison of both versions in English facilitated detecting any translation mistakes and strengthened the validity and reliability of the survey instrument in Arabic. Finally, the Arabic version of the survey questionnaire had been proofread by an instructor of Arabic to detect any grammatical or typo mistakes.

In order to clarify the distribution of the survey instrument's items in Appendix A among the aforementioned subscales, a diagrammatic summary model has been depicted in Figure 3.2. It is indicated in Figure 3.2 that there are three major variables which are students' demographic information, students' motivation to succeed in undergraduate introductory mathematics courses, and students' mathematics self-concept. Each variable is associated with a number of subscales and each subscale is associated with a number of items which are used to measure that subscale.

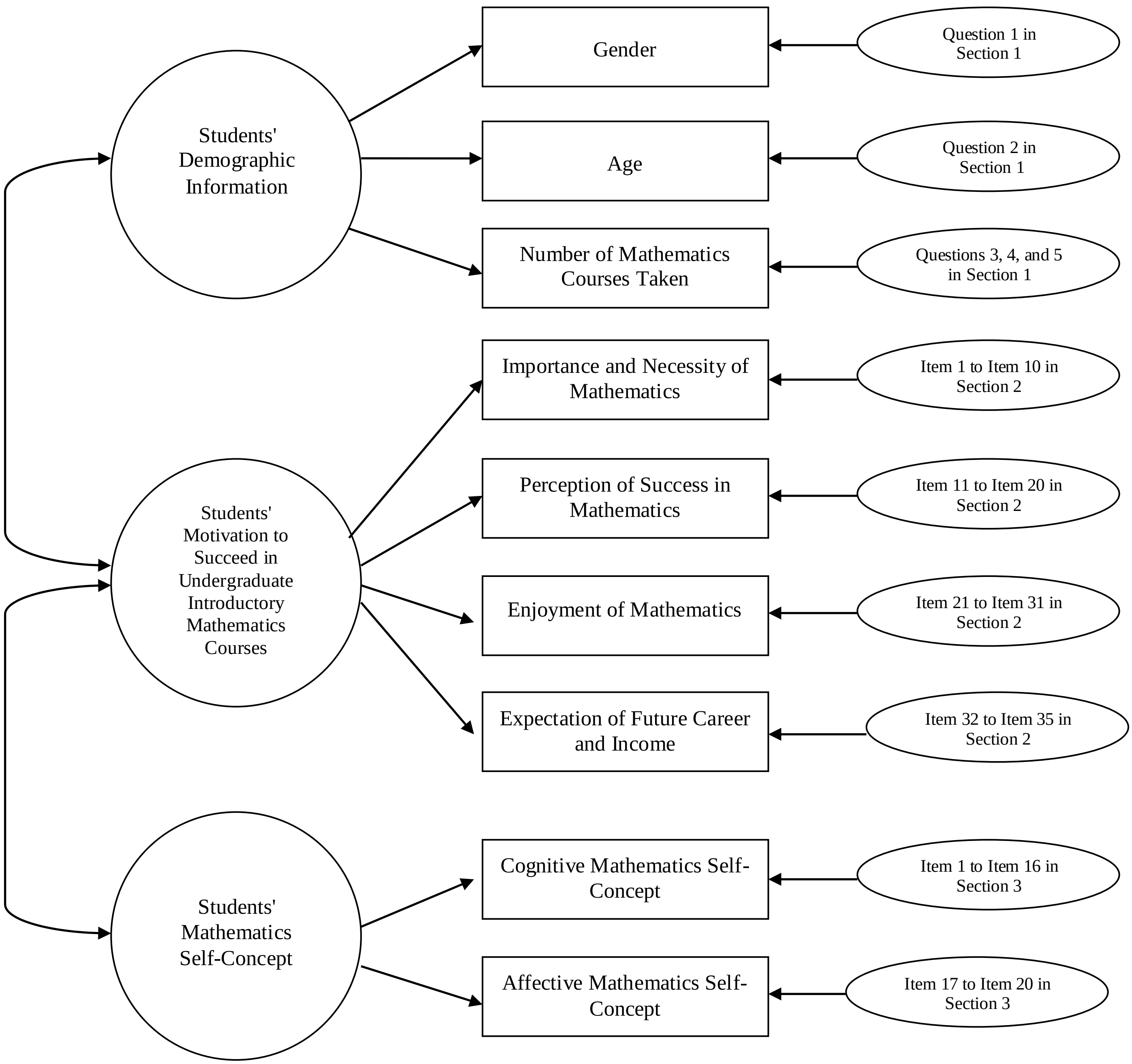


Figure 3.2: Items Distribution on Subscales Model

3.6.4 Procedures

The survey questionnaire was administered by the instructor of each course of mathematics at the four academic institutions of higher education or by the primary researcher who also made the effort and time to administer the instrument directly in class based on the instructor's preference. The students were informed that the purpose of the survey is to gather information from them about their motivations to succeed in undergraduate introductory mathematics courses and their self-beliefs, perceptions, and attitudes towards undergraduate introductory mathematics courses. The students were informed that their participation is optional and their responses will be kept strictly confidential. The students were informed that the instrument is prepared in both languages English and Arabic, and students were given the freedom to select their desired language. The instrument was administered in class by either the instructor or the researcher and students completed the instrument in 15 to 20 minutes. The completed survey questionnaires by students were filtered in order to clean the gather quantitative data by excluding the questionnaires that were not filled in an appropriate and objective manner. For example, few questionnaires were filled in a biased or subjective manner, i.e., the same response option for all the 55 items or a lot of incomplete items and these questionnaires were not included in the study. After conducting the data cleaning process, a total of 685 out of 800 distributed survey questionnaires were included in the sample of this research study resulting in a response rate of 85.6%.

About 25 students from all the students, who left their contact information on the survey questionnaire, were contacted and invited to participate in the semi-structured interviews. In the survey questionnaire, students were asked about their final grade in the latest completed course of mathematics. The students who were contacted to participated in the semi-structured interviews included students were very successful in mathematics courses and managed to pass their latest completed courses in mathematics successfully. Furthermore, students, who struggled and failed in their latest completed courses of mathematics, were also contacted to participate in the semi-structured interviews. The inclusion of good and weak students at mathematics in the semi-structured interview is consider to be useful approach, since it provided an opportunity to compare between the factors that contribute in motivating students to succeed in mathematics courses from good students' perspective as well as weak students' perspective. A total of 17 students were interviewed out of 25 who agreed to participate; this represents a response rate of 68% in the qualitative data collection process. The quantitative data have been analysed in chapter four through the use of correlation analysis and multiple regression analysis in order to examine the relationship between students' motivation to succeed in mathematics and the other five independent variables. The qualitative data have been analysed in chapter five through the use of a descriptive research approach in which students' motivation to succeed in mathematics courses has been studies a phenomenon and the predictive factors that influence this phenomenon were explored. In order to maintain the confidentiality of the participants in the semi-structured interviews, imaginary names and identity codes have been assigned to them. Each identity code is made up of two letters representing the researcher's initial and numbers representing the order through which the participants were interviewed. Then, all the interviews were transcribed and notes were written. Later on, the data were reviewed in order to identify common, recurrent, or emergent themes by entering the responses in a template used for data collection based on the semi-structured interview questions' number. The responses were coded based on three main broad themes including students' motivation to succeed in mathematics courses, students' mathematics self-concept, and facilitating factors. The responses within each of the themes were further analysed in order to create sub-categories for the similar traits between respondents who present the same themes.

3.6.5 Subscales Reliabilities and Items' Descriptive Statistics

The software of SPSS 20.0 has been used to run the quantitative analysis. The variables have been defined and created for all the items of the survey questionnaire in Appendix A and the variables of negatively worded items were recoded. Four negatively worded items were included in the survey questionnaire in order to ensure that the respondents had read the survey questionnaire carefully and had paid attention to the negatively worded items. The four negatively worded items in the survey questionnaire in Appendix A include item 7, item 8, and item 27 in section 2; and item 7 in section 3.

In spite of the fact that the items of the instrument were previously employed and validated in multiple research studies as mentioned earlier, the effort to conduct exploratory factor analysis had been undertaken and included in the thesis in order to uncover the underlying relationship between the items and explore how the items will load into their factors. Therefore, Principle Axis factor analysis with a Promax (oblique) rotation was performed. Factor analysis is a method which is used to examine and identify interrelationships amongst a number of variables with minimal possibility of losing information. This method aims at measuring which groups of variables tend to empirically consolidate together.

In order to decide if the factor analysis is appropriate for the dataset of this research study, the Kaiser-Meyer-Olkin (KMO) values and p-values of Bartlett's Test of Sphericity have been calculated. The four motivational subscales have KMO value that is equal to 0.947 and p-value for the Bartlett's Test of Sphericity that is less than 0.001. Moreover, the two mathematics self-concept subscales have KMO value that is equal to 0.926 and p-value for the Bartlett's Test of Sphericity that is less than 0.001. Since the KMO values of all the subscales is greater than 0.6 and the p-values of the Bartlett's Test of Sphericity is less than 0.001, the factor analysis is considered to be appropriate for the four motivational subscales and two mathematics self-concept subscales of this research study.

Table 3.4 shows the loading of the 35 motivational items through the use of an exploratory factor analysis As indicated in Table 3.4, a total of six factors with Eigen values greater than one were found. The cumulative percentage explained by the six motivational factors is 55.248. The six motivational factors explain the majority of variance in the dataset which is deemed to be good.

Table 3.4: Factor Analysis Loading of 35 Motivational Items

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	13.435	38.385	38.385	13.051	37.289	37.289	11.468
2	2.784	7.955	46.339	2.338	6.681	43.970	7.007
3	1.640	4.684	51.024	1.248	3.564	47.534	8.066
4	1.564	4.467	55.491	1.140	3.258	50.792	8.923
5	1.328	3.795	59.286	.859	2.454	53.246	8.187
6	1.179	3.368	62.653	.701	2.002	55.248	2.577
7	.940	2.685	65.339				

8	.882	2.519	67.858				
9	.861	2.460	70.318				
10	.792	2.263	72.581				
11	.719	2.053	74.634				
12	.680	1.944	76.578				
13	.670	1.914	78.492				
14	.585	1.670	80.162				
15	.561	1.602	81.764				
16	.522	1.492	83.255				
17	.490	1.400	84.655				
18	.469	1.339	85.995				
19	.437	1.250	87.244				
20	.405	1.158	88.402				
21	.388	1.108	89.510				
22	.375	1.071	90.581				
23	.356	1.017	91.598				
24	.346	.990	92.587				
25	.336	.960	93.547				
26	.315	.901	94.448				
27	.293	.836	95.284				
28	.270	.772	96.056				
29	.266	.761	96.817				
30	.234	.669	97.486				
31	.211	.602	98.088				
32	.196	.559	98.647				
33	.174	.498	99.145				
34	.160	.456	99.601				
35	.140	.399	100.000				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

Table 3.5 shows the loading of the 20 mathematics self-concept items through the use of an exploratory factor analysis. As indicated in Table 3.5, the cumulative percentage explained by the four mathematics self-concept factors is 53.172. The four mathematics self-concept factors explain also the majority of variance in the dataset which is also considered to be good.

Table 3.5: Factor Analysis Loading of 20 Mathematics Self-Concept Items							
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	8.152	40.762	40.762	7.772	38.859	38.859	7.131
2	2.183	10.917	51.680	1.581	7.907	46.766	6.387
3	1.177	5.885	57.565	.679	3.396	50.162	2.956
4	1.045	5.224	62.789	.602	3.009	53.172	1.264
5	.971	4.854	67.643				
6	.875	4.376	72.019				
7	.697	3.485	75.505				
8	.589	2.947	78.452				
9	.574	2.872	81.323				
10	.521	2.605	83.928				
11	.498	2.491	86.419				
12	.450	2.252	88.671				
13	.421	2.103	90.773				
14	.339	1.695	92.468				
15	.322	1.612	94.080				
16	.295	1.473	95.553				
17	.263	1.315	96.868				
18	.236	1.181	98.049				
19	.212	1.059	99.108				
20	.178	.892	100.000				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

As it is expected, 35 items from the four motivational subscales loaded onto their own factors with a loading of 0.3 or more. Furthermore, 20 items from the two mathematics self-concept subscales loaded onto their own factors with loading of 0.3 or more. The value of 0.3 or more for the communalities indicates that a specific item fits well with the other items in its factor. The factor analysis has been conducted in an exploratory fashion in order to uncover the underlying relationship between the items and explore how the items will load into their factors.

To measure the cohesiveness and homogeneity between the items of each subscale, a reliability test was performed for each of the six subscales. The test aims at measuring how each subscale is reliable and how the items of each subscale are cohesive and homogeneous by looking at the responses and providing an alpha value about the cohesiveness and homogeneity. The higher the value of alpha is the better. For this purpose, the Cronbach alpha reliability coefficients were calculated for both motivational subscales and mathematics self-concept subscales in Table 3.6 and Table 3.7.

Table 3.6: Cronbach Alpha Reliability Coefficients of Motivational Subscales

Subscale	Number of Items	Cronbach (α)
Importance and Necessity of Mathematics	10	0.867
Perception of Success in Mathematics	10	0.787
Enjoyment of Mathematics	11	0.895
Expectations of Future Career and Income	4	0.850
Total: Students' Motivation	35	0.939

Table 3.7: Cronbach Alpha Reliability Coefficients of Mathematics Self-Concept Subscales

Subscale	Number of Items	Cronbach (α)
Cognitive Mathematics Self-Concept	16	0.865
Affective Mathematics Self-Concept	4	0.837
Total: Mathematics Self-Concept	20	0.905

As indicated in Table 3.6, the Cronbach alpha reliability coefficients of the motivational subscales of importance and necessity of mathematics, perception of success in mathematics, enjoyment of mathematics, and expectations of future career and income are above 0.75 proofing acceptable internal consistencies and reliabilities for the items' scores. As also shown in Table 3.7, the Cronbach alpha reliability coefficients of the mathematics self-concept subscales of cognitive mathematics self-concept and affective mathematics self-concept are above 0.80 indicating also acceptable internal consistencies and reliabilities for the items' scores.

The mean and standard deviation have been calculated for each item of the motivational subscales and mathematics self-concept subscales. Table 3.8 to Table 3.13 present the mean and standard deviation of all the items of the six subscales. The mean and standard deviation are presented for the overall sample and for each gender in the following tables.

Table 3.8: Mean and Standard Deviation of Importance and Necessity of Mathematics Items

	Male			Female			Male and Female		
	Mean	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**
Item1 -- Mathematics is necessary for high school graduation	4.23	319	0.92	4.13	365	1.03	4.18	684	0.98
Item 2 -- Mathematics is necessary for attaining a college degree	4.01	318	0.99	3.80	365	1.09	3.90	683	1.05
Item 3 -- Mathematics is necessary for securing a bright future career	3.69	318	1.10	3.65	365	1.11	3.67	683	1.11
Item 4 -- Mathematics is important in our daily life	3.85	319	0.93	3.95	366	0.90	3.90	685	0.91
Item 5 -- Mathematics is a needed and worthwhile course/subject	3.90	315	0.92	3.88	366	0.92	3.89	681	0.92
Item 6 -- I take mathematics courses because I want to develop my mathematical skills	3.55	314	1.10	3.51	362	1.09	3.53	676	1.10
Item 7 -- I take mathematics courses because they are mandatory requirements for college degree completion	3.99	318	1.02	3.97	363	0.95	3.98	681	0.98
Item 8 -- Mathematics is one of the most significant courses to study	3.77	316	1.07	3.72	362	0.98	3.74	678	1.02

Item 9 -- I usually use and apply mathematics outside the classroom	3.16	316	1.15	3.27	363	1.08	3.22	679	1.11
Item 10 -- I usually use what I learn in mathematics courses in other courses than mathematics	3.42	317	1.10	3.37	361	1.09	3.40	678	1.09

Table 3.9: Mean and Standard Deviation of Perception of Success in Mathematics Items									
	Male			**Female**			**Male and Female**		
	Mean	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**
Item 1 -- Mathematics is primarily about facts and operations	3.68	314	0.90	3.70	359	0.91	3.69	673	0.91
Item 2 -- Mathematics is a method to think about problems and numbers	4.16	316	0.75	4.14	353	0.78	4.15	669	0.77
Item 3 -- Mathematics is a very accurate and exact course/subject	4.14	314	0.81	4.15	361	0.84	4.15	675	0.83
Item 4 -- Things are either right or wrong in mathematics	3.76	314	0.97	3.77	358	0.93	3.76	672	0.95
Item 5 -- Mathematics is almost about making relationships and connections	3.30	316	0.98	3.35	360	1.02	3.33	676	1.00
Item 6 -- Solving a lot of practice problems is the best approach to do well in mathematics	4.23	318	0.92	4.20	361	0.96	4.21	679	0.94
Item 7 -- Memorising mathematical facts such as multiplication tables is the best approach to do well in mathematics	3.71	318	1.09	3.84	361	1.02	3.78	679	1.06
Item 8 -- Memorising formulas is the best approach to do well in mathematics	3.72	318	1.09	3.79	362	1.02	3.76	680	1.05
Item 9 -- Mathematics is mainly about understanding rather than root memorising	4.33	318	0.85	4.34	365	0.91	4.34	683	0.88
Item 10 -- Mathematics courses require less hours of private study at home in comparison with other courses	2.87	319	1.29	3.11	365	1.29	3.00	684	1.29

Table 3.10: Mean and Standard Deviation of Enjoyment of Mathematics Items									
	Male			Female			Male and Female		
	Mean	N	SD	Mean	N	SD	Mean	N	SD
Item 1 -- I usually enjoy studying mathematics courses	3.32	319	1.20	3.55	365	1.20	3.44	684	1.20
Item 2 -- I take mathematics courses because they are fun	3.03	319	1.19	3.28	365	1.19	3.16	684	1.19
Item 3 -- I take mathematics courses because they are easy	2.63	316	1.15	3.07	363	1.13	2.87	679	1.16
Item 4 -- I take mathematics courses because of my general interest and the opportunity to learn new things	3.19	314	1.21	3.31	365	1.08	3.25	679	1.15
Item 5 -- Mathematics courses are very interesting	3.15	316	1.22	3.37	364	1.17	3.27	680	1.20
Item 6 -- Mathematics courses are challenging	3.74	316	1.16	3.89	364	1.00	3.82	680	1.08
Item 7 -- Mathematics courses are boring and dull	2.71	311	1.27	2.70	362	1.12	2.70	673	1.19
Item 8 -- I feel happier in mathematics courses than any other courses	3.08	316	1.26	3.32	362	1.20	3.21	678	1.23
Item 9 -- I feel comfortable answering questions in mathematics courses	3.65	319	1.14	3.76	361	1.05	3.71	680	1.10
Item 10 -- I prefer working on an assignment in mathematics than writing an essay	3.44	316	1.33	3.66	362	1.19	3.56	678	1.26
Item 11 -- I actually like mathematics courses	3.31	318	1.29	3.47	361	1.19	3.39	679	1.24

Table 3.11: Mean and Standard Deviation of Expectations of Future Career and Income Items									
	Male			Female			Male and Female		
	Mean	N	SD	Mean	N	SD	Mean	N	SD
Item 1 -- Some career opportunities can only be occupied by individuals who successfully complete mathematics courses	3.55	319	1.11	3.67	363	0.98	3.61	682	1.04
Item 2 -- The earnings of individuals who successfully complete mathematics courses are quite good	3.38	317	1.05	3.42	364	0.95	3.40	681	1.00
Item 3 -- My success in mathematics courses will pave my way for a prestigious future career opportunity	3.44	319	1.17	3.44	364	1.04	3.44	683	1.10
Item 4 -- My success in mathematics courses will affect my future earnings/income	3.39	319	1.16	3.30	366	1.07	3.34	685	1.11

Table 3.12: Mean and Standard Deviation of Cognitive Mathematics Self-Concept Items									
	Male			Female			Male and Female		
	Mean	N	SD	Mean	N	SD	Mean	N	SD
Item 1 -- I believe I am good at solving problems at mathematics	3.54	319	1.02	3.62	365	0.96	3.58	684	0.99
Item 2 -- I learn mathematics easily	3.44	317	1.09	3.61	360	1.03	3.53	677	1.06
Item 3 -- I have always been good at mathematics	3.45	313	1.14	3.67	362	1.03	3.57	675	1.09
Item 4 -- I usually get excellent grades in mathematics courses	3.28	318	1.15	3.58	361	1.06	3.44	679	1.11
Item 5 -- I was good in mathematics when I was young in comparison with now	3.65	314	1.12	3.60	362	1.14	3.62	676	1.13
Item 6 -- Mathematics was easier in earlier grades in comparison with now	3.76	315	1.02	3.64	359	1.06	3.69	674	1.05
Item 7 -- I usually get average grades in mathematics courses	3.24	317	1.04	3.17	364	1.52	3.20	681	1.32
Item 8 -- I have the confidence in my ability to learn advanced mathematics courses	3.68	316	1.03	3.71	365	0.99	3.70	681	1.01
Item 9 -- I have the willingness to take more than the required number of mathematics courses	3.23	315	1.28	3.25	363	1.25	3.24	678	1.26
Item 10 -- I have the ability to solve very difficult problems in mathematics	3.11	316	1.17	3.17	362	1.14	3.14	678	1.16
Item 11 -- During my education, I plan to take as much mathematics courses as I can	2.99	315	1.25	2.94	364	1.23	2.97	679	1.24
Item 12 -- If I don't understand something immediately in mathematics, I prefer to figure it out by myself	3.24	318	1.17	3.40	365	1.10	3.32	683	1.13
Item 13 -- If I don't understand something immediately in mathematics, I prefer to have someone explains it to me	3.63	317	1.09	3.77	362	0.98	3.71	679	1.03
Item 14 -- The ability of individuals to do well in mathematics is directly related to how much they solve problems	3.75	319	0.96	3.90	363	0.87	3.83	682	0.92
Item 15 -- Individuals who are good at mathematics are also good problem solvers	3.46	317	1.05	3.58	366	1.02	3.53	683	1.03
Item 16 -- Some individuals are innately good at mathematics	3.91	316	0.99	4.07	365	0.90	4.00	681	0.95

Table 3.13: Mean and Standard Deviation of Affective Mathematics Self-Concept Subscale									
	Male			Female			Male and Female		
	Mean	N	SD	Mean	N	SD	Mean	N	SD
Item 1 -- I like to explore new concepts in mathematics	3.45	319	1.12	3.39	366	1.12	3.42	685	1.12
Item 2 -- I like to solve new problems in mathematics	3.40	316	1.15	3.43	362	1.14	3.42	678	1.14
Item 3 -- I like being given a formula by my mathematics instructor and being asked to compute problems	3.70	316	1.16	3.78	362	1.00	3.74	678	1.08
Item 4 -- I like being given challenging work by my mathematics instructor	3.47	316	1.27	3.61	363	1.14	3.55	679	1.20

3.7 Operational Definitions of Students' Motivation and Mathematics Self-Concept

Several theories and conceptualisations of students' motivation and mathematics self-concept have been reviewed and utilised in this chapter in order to propose an analytical model for the examination of the relationship between students' motivation to succeed in undergraduate introductory mathematics courses and students' mathematics self-concept. Furthermore, the chapter presented information about the methods of data collection, sources employed to compile the items of the survey questionnaire, the descriptive statistics of the items of each subscale, and the internal consistencies and reliabilities of the items. The scores of all items were found to meet the acceptable standards of reliability. Therefore, the data are assumed to be reasonably reliable and consistent for use in the proposed analytical model to examine the relationships between students' motivation to succeed in undergraduate introductory mathematics courses, mathematics self-concept, and demographic information. In order to make a proper use of the data, there is a necessity to offer operational definitions of the variables implicated in the data. These operational definitions are provided in the following paragraph.

For an analytical purpose, students' motivation to succeed in undergraduate introductory mathematics courses was operationally defined as a composite variable which is represented by the mean scores of students' responses from 1 to 5 for a total of 35 items that appropriately covered the four subscales of importance and necessity of mathematics, perception of success in mathematics, enjoyment of mathematics, and expectations of future career and income. The subscales of importance and necessity of mathematics, perception of success in mathematics, and enjoyment of mathematics have been combined together into a single composite variable to measure students' intrinsic motivation and the subscale of expectations of future career and income is employed to measure students' extrinsic motivation. Students' mathematics self-concept was defined as a composite variable which is represented by the mean scores of students' responses from 1 to 5 for a total of 20 items that adequately covered the two subscales of students' cognitive mathematics self-concept and students' affective mathematics self-concept.

3.8 Conclusion

The light has been comprehensively shaded in this chapter on the research approach; analytical model for analysing students' motivation to succeed in undergraduate introductory mathematics courses; research hypotheses; participants and sampling; instrumentation; procedures; factor analysis; reliability analysis; and operational definitions of key concepts in order to prepare for estimating the model, analysis, and interpretation of the estimated results.

The use of a mixed research methodology is deemed to be appropriate and consistent with the major research question of the thesis, since it is inclusive of both quantitative and qualitative research methods. The quantitative part is expected to assist in clarifying and explaining if there exist any relationships between students' motivation to succeed in undergraduate introductory mathematics courses and students' cognitive mathematics self-concept, students' affective mathematics self-concept, students' expectations of future income, students' age, and number of mathematics courses taken by students. From another side, the qualitative part is expected to support in exploring the relationships in-depth between students' motivation to succeed in undergraduate mathematics courses and other predictive variables.

The factor analysis has been conducted in an exploratory fashion in this research study and the items of the six subscales loaded into their factors. The Cronbach alpha coefficients have been calculated for the four motivational subscales which include importance and necessity of mathematics subscale, perception of success in mathematics subscale, enjoyment of mathematics subscale, and expectations of future career and income subscale. The results have shown acceptable internal consistencies and reliabilities for the items' scores of the four motivational subscales. Moreover, the Cronbach alpha coefficients have been calculated for the two mathematics self-concept subscales which include cognitive mathematics self-concept subscale and affective mathematics self-concept subscale. The results have also shown acceptable internal consistencies and reliabilities for the items' scores of the two mathematics self-concept subscales. The descriptive statistics including the mean and standard deviation have been calculated for the items of both genders together and for the items of each gender separately. The findings in this chapter support providing a context to undertake the analysis of the quantitative information which is performed in the next chapter.

CHAPTER FOUR: ANALYSIS OF QUANTITATIVE INFORMTION

4.1 Introduction

The purpose of this chapter is to analyse the data in order to answer the main research question and other research sub-questions of the thesis which aim at investigating the relationship between students' motivation to succeed in undergraduate introductory mathematics courses and students' mathematics self-concept, expectations of future career and income, and other demographic information. Moreover, the statistical analysis illustrates the inter-correlations between the factors and how significantly and strongly the factors account for the variation in students' motivation to succeed in mathematics courses.

This chapter starts by presenting the descriptive statistics of the employed variables and subscales to assess the analytical models. Then, several diagnostic tests have been performed on the specifications of the analytical models with respect to any violation of the assumptions of classical linear regression models. After that, the analysis of the inter-correlations between the variables is conducted and presented. Last but not least, the chapter sheds the light on a comprehensive analysis of the regression models in order to examine the functional relationship between the dependent variable and the independent variables of the research study. In order to support the findings of this study, the findings of previously held empirical studies are included and cited.

4.2 Descriptive Statistics

Table 4.1 presents the descriptive statistics of the dataset which includes the mean and standard deviation of all the variables and subscales for the overall sample and for each gender separately.

Table 4.1: Descriptive Statistics of Variables and Subscales

	Male			Female			Male and Female		
	Mean	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**
Importance and Necessity of Mathematics Subscale	3.76	317	1.03	3.73	364	1.02	3.74	681	1.03
Perception of Success in Mathematics Subscale	3.79	317	0.96	3.84	361	0.97	3.82	678	0.97
Enjoyment of Mathematics Subscale	3.20	316	1.22	3.40	363	1.14	3.31	679	1.18
Intrinsic Motivation Variable	3.57	317	1.08	3.65	362	1.05	3.61	679	1.06
Expectations of Future Career and Income Subscale (Extrinsic Motivation Variable)	3.44	319	1.13	3.46	364	1.01	3.45	683	1.06
Motivation Global Variable (Intrinsic and Extrinsic)	3.56	317	1.08	3.63	363	1.04	3.59	680	1.06
Cognitive Mathematics Self-Concept Subscale	3.46	316	1.10	3.54	363	1.08	3.50	679	1.09
Affective Mathematics Self-Concept Subscale	3.51	317	1.17	3.55	363	1.10	3.53	680	1.14
Mathematics Self-Concept Global Variable	3.47	316	1.11	3.54	363	1.08	3.51	679	1.10
Age	1.89	315	1.09	1.95	365	1.09	1.92	680	1.09
Number of Mathematics Courses Taken	2.94	317	1.47	2.80	365	1.41	2.87	682	1.44
Highest Level of Mathematics Courses	2.55	294	1.31	2.28	327	1.17	2.41	621	1.24

As indicated in Table 4.1 above, the mean of the importance and necessity of mathematics subscale is virtually the same for both male students (3.76) and female students (3.73); the mean of the perception of success in mathematics subscale is also the same for male students (3.79) and female students (3.84); the mean of the enjoyment of mathematics subscale is also almost the same for male students (3.2) and female students (3.4). The mean of the overall intrinsic motivation variable is almost the same for male students (3.57) and female students (3.65) which reflects that no gender differences exist in the measurement of students’ intrinsic motivation and its subscales within the sample.

Furthermore, the mean of the cognitive mathematics self-concept is almost the same for male students (3.46) and female students (3.54); the mean of the affective mathematics self-concept is virtually the same for both male students (3.51) and female students (3.55). The mean of the overall mathematics self-concept variable is almost the same for male students (3.47) and female students (3.54) which reflects that no gender differences exist in the measurement of students’ mathematics self-concept and its subscales.

The mean of the expectations of future career and income subscale is practically the same for both male students (3.44) and female students (3.46) which indicates that no gender differences exist in the measurement of students’ expectations of future career and income as an extrinsic motivational factor.

The age of students ranges from 18 to 42 years old and the mean of students’ age is almost the same for male students (1.89) and female students (1.95) reflecting no major gender differences in terms of students’ age. The mean of male and female students' age is from 21 to 24 years old.

The mean of the number of mathematics courses taken by students is the same for male students (2.94) and female students (2.8) which indicates that no gender differences exist in the number of mathematics courses taken by male students and female students. The mean of the number of mathematics courses taken by male and female students is two courses of introductory mathematics.

The mean of the highest level of mathematics courses taken by students is the same for male students (2.55) and female students (2.28) reflecting no major gender differences in the highest level of mathematics courses taken by male and female students. The mean of the highest level of mathematics courses taken by male and female students is 100 level mathematics courses which are the introductory courses of mathematics.

4.3 Diagnostic Tests

This section contains several diagnostic tests which have been performed on the estimated models to identify any misspecification errors that may demoralise the interpretation of the estimated results and to employ the results in making deductions. Therefore, the performed tests include the normality of residuals, heteroscedasticity and multicollinearity among the predictor variables in order to check if the Ordinary Least Squares (OLS), minimising the sum squared residuals, are the best linear unbiased estimators of the developed model. The estimators should have the minimum variance in order to make use of the data in the most efficient way.

The underlying assumptions of the specified model are the assumptions of the classical linear regression model which include independence and normally distributed residuals and homoscedastic and serially uncorrelated error term. The following diagnostic tests are conducted in order to check if the model of this research study complies with the seven assumptions of the classical linear regression models reported in the previous chapter.

4.3.1 Skewness and Kurtosis Tests for Normality

In order to test whether the main variables of students' MOT and MSC are normally distributed, the skewness and kurtosis tests are used in which two numerical outputs and three visual outputs have been examined. The first numerical output includes the skewness and kurtosis z-values and the second numerical output is the Shapiro-Wilk test p-value. On the other hand, the first visual output contains the histograms and frequency distribution curves of the data, the second visual output includes the normal Quantile-Quantile (Q-Q) plot, and the third visual output is the box-and-whisker plot.

It has been indicated in the literature that the skewness and kurtosis measures should be as close to zero as possible; however, in reality data are often skewed and kurtotic. Thus, a small departure from zero is not a problem, as long as the measures are not too large compared to their standard errors (Cramer 1998; Cramer & Howitt 2004; Doane & Seward 2011). The measures, standard errors, and z-values of skewness and kurtosis are computed and presented in Table 4.2 for the variables of students' MOT and MSC.

<table>
<tr><th colspan="7">Table 4.2: Skewness and Kurtosis Test for Normality</th></tr>
<tr><th rowspan="2"></th><th colspan="3">Skewness</th><th colspan="3">Kurtosis</th></tr>
<tr><th>Measure</th><th>Standard Error (SE)</th><th>z-value</th><th>Measure</th><th>Standard Error (SE)</th><th>z-value</th></tr>
<tr><td>MOT</td><td>-0.416</td><td>0.102</td><td>-4.078</td><td>0.133</td><td>0.204</td><td>0.652</td></tr>
<tr><td>MSC</td><td>-0.434</td><td>0.099</td><td>-4.384</td><td>0.490</td><td>0.197</td><td>2.487</td></tr>
</table>

The z-values of skewness and kurtosis are calculated by dividing each measure by its standard error. It has been reported in the literature that the z-values of skewness and kurtosis should be greater than -1.96 and less than +1.96 in order to assume normality, if the sample size is small (Cramer 1998; Cramer & Howitt 2004; Doane & Seward 2011). Although the sample size of 685 for this research study is quite large, it can be concluded from the values in Table 4.2 that the data are moderately skewed and a little kurtotic, but it does not differ significantly from the standards of normality.

It has been clarified in the literature also that the null hypothesis of the Shapiro-Wilk test of normality assumes that the data are normally distributed and the null hypothesis is rejected if the p-value is below 0.05 (Cramer 1998; Cramer & Howitt 2004; Doane & Seward 2011). The p-value of the Shapiro-Wilk test of normality is below 0.05; however, it is clarified by Elliott and Woodward (2007) that the Shapiro-Wilk test is usually recommended for a small sample size of less than 50, and the sampling distribution commonly tends to be normal in large samples regardless of the shape of the data, and visual methods tend to be the best methods to test the normality of large samples.

Since it is commonly known that a picture may speak for thousands of words, the decision has been made to include and examine any visual output whenever it is possible while performing any diagnostic test or statistical analysis. Figure 4.1 shows the histogram and frequency distribution curve of students' MOT and Figure 4.2 shows the histogram and frequency distribution curve of students' MSC as the first visual outputs to examine the skewness and kurtosis of the data.

Figure 4.1: Students' MOT Histogram

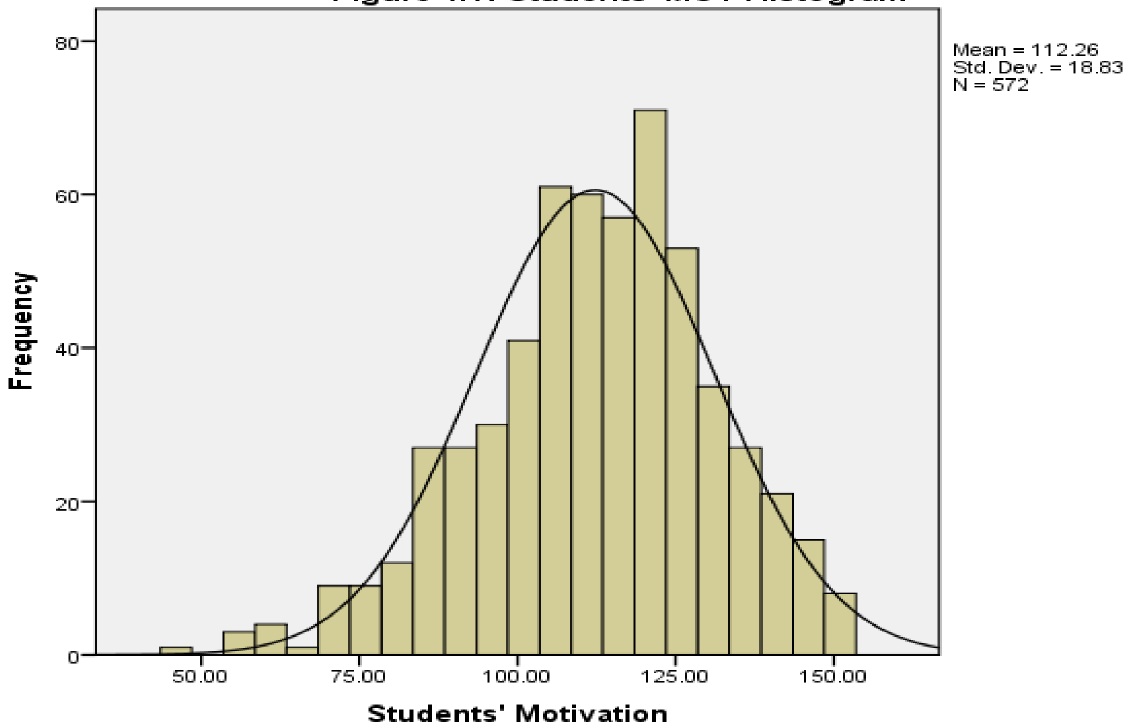
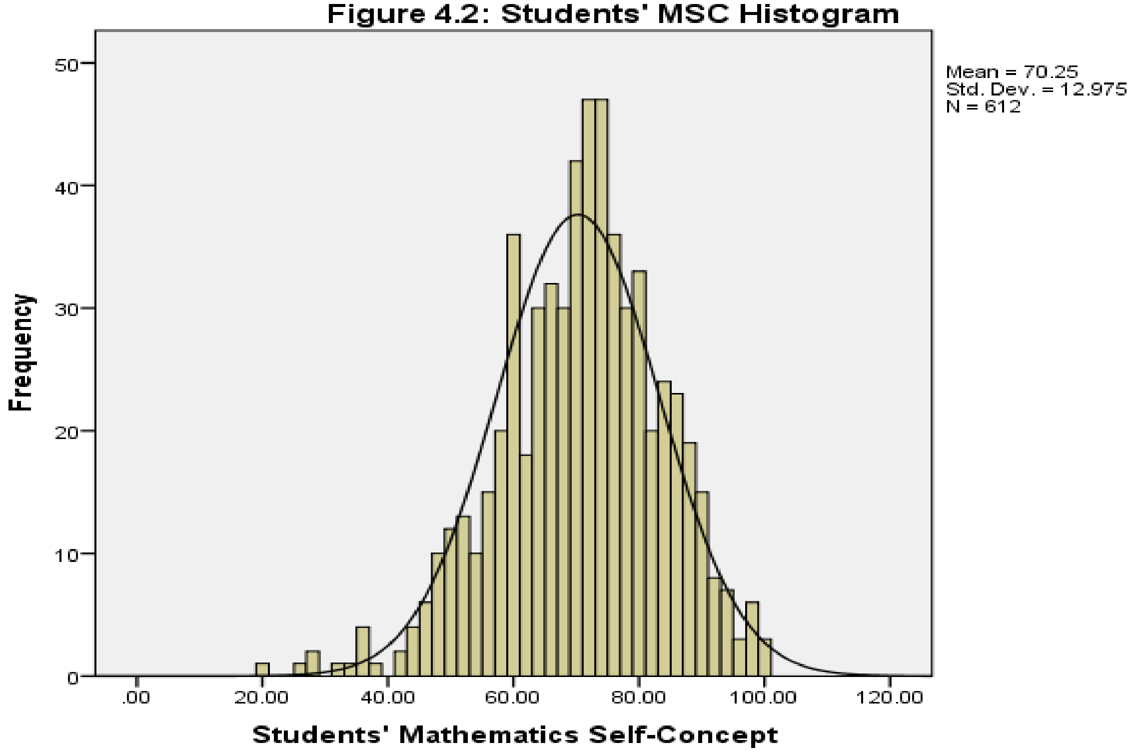


Figure 4.2: Students' MSC Histogram



The second visual outputs are presented in the following two graphs. Figure 4.3 shows the normal Q-Q plot of students' MOT and Figure 4.4 shows the normal Q-Q plot of students' MSC.

Figure 4.3: Normal Q-Q Plot of Students' MOT

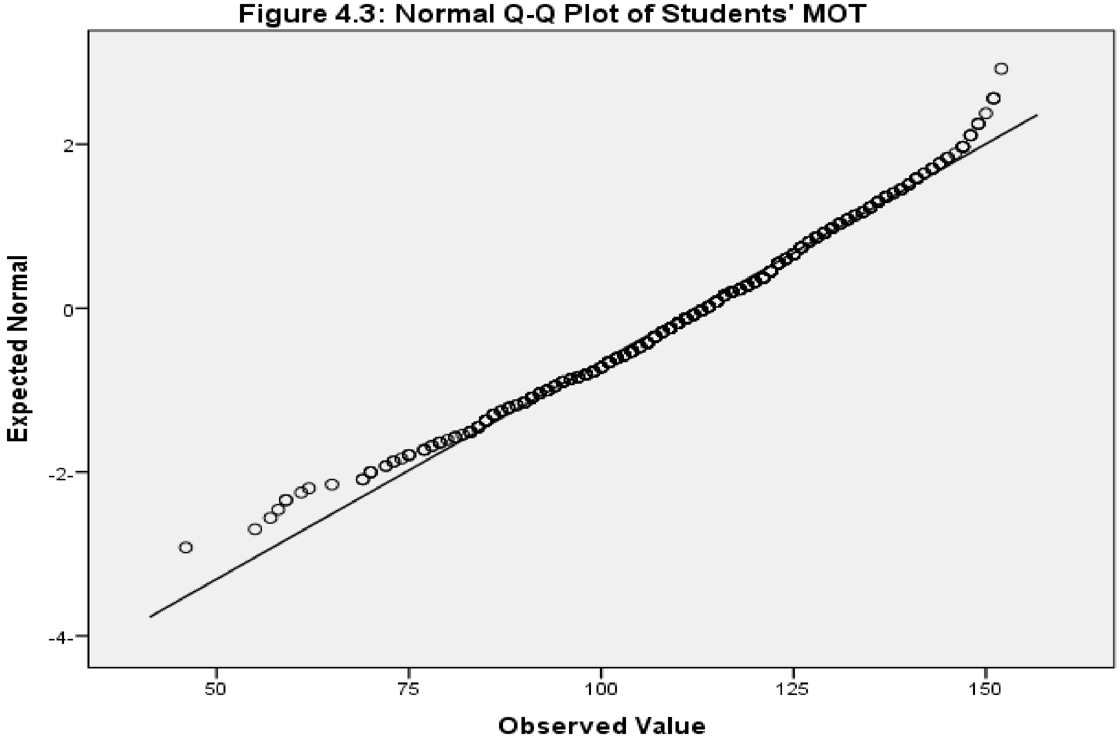


Figure 4.4: Normal Q-Q Plot of Students' MSC

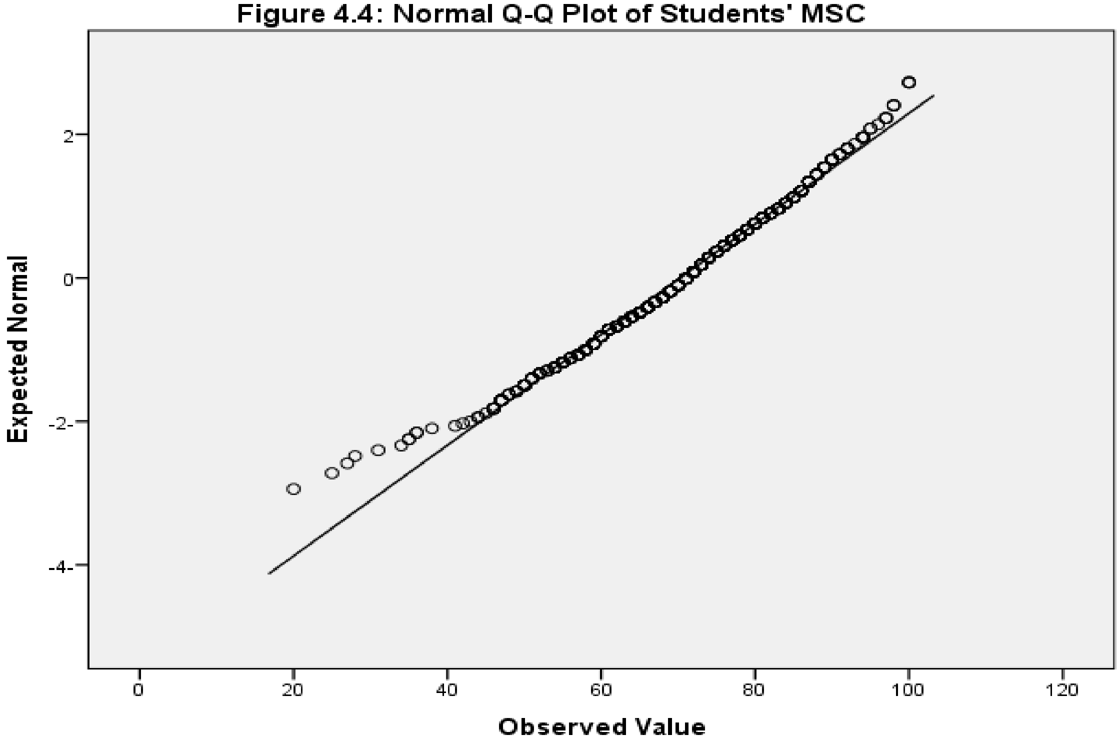


Figure 4.5 shows the box-and-whisker plot of students' MOT and Figure 4.6 shows the box-and-whisker plot of students' MSC as the third visual outputs.

Figure 4.5: Box-and-Whisker Plot of Students' MOT

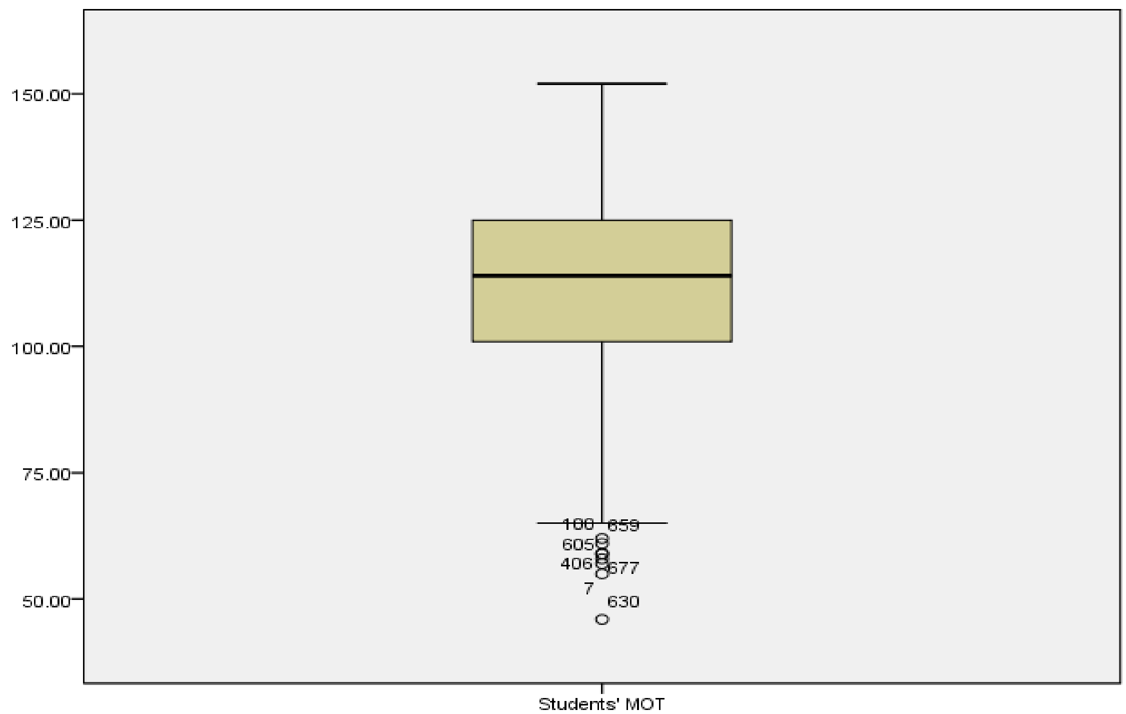


Figure 4.6: Box-and-Whisker Plot of Students' MSC

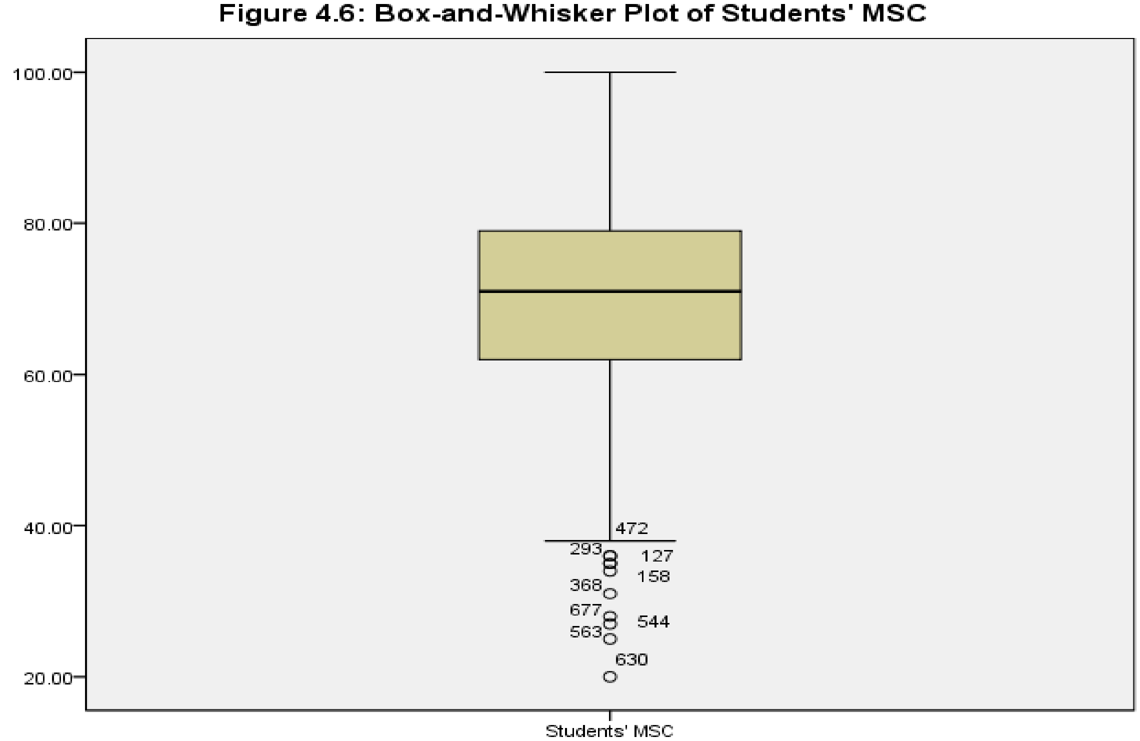
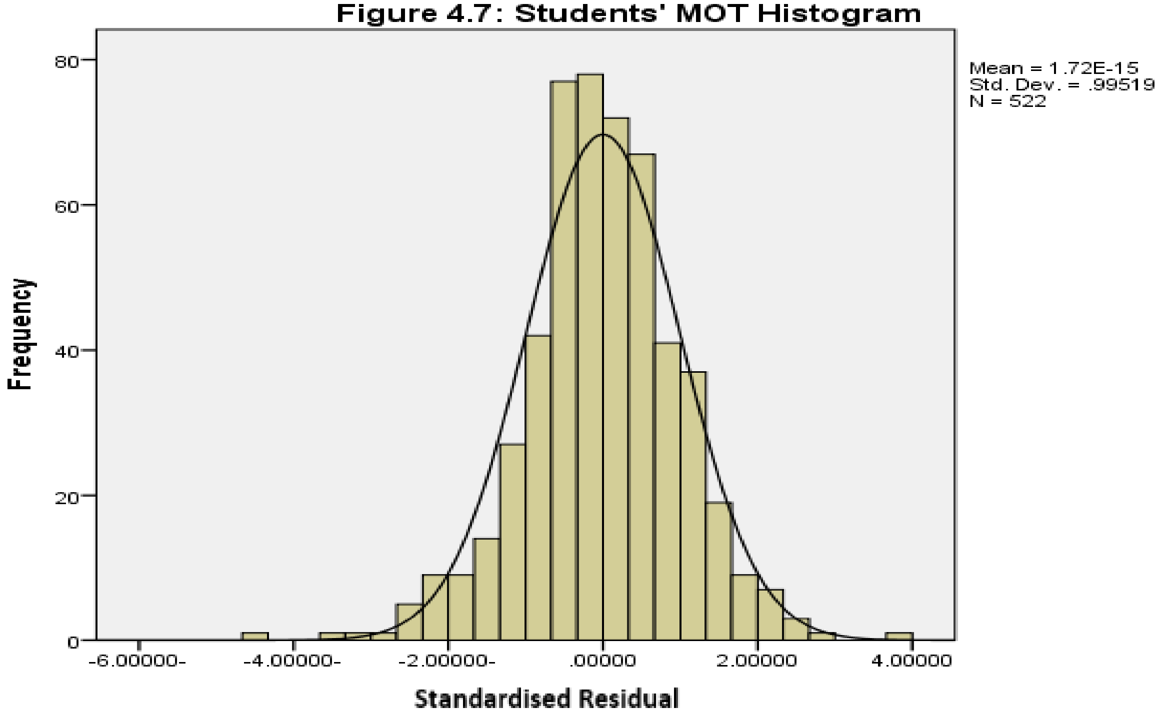


Figure 4.7 below shows the histogram and frequency distribution curve of the standard residuals of students' MOT.

Figure 4.7: Students' MOT Histogram



Since the sample size of this research study is made up of 685 respondents, it is considered to be a large sample. Hence, the visual methods are deemed to be the most appropriate tools that have been utilised in order to make the critical decision about the shape of the data distribution. Figure 4.1 and Figure 4.2 indicate that the histograms and frequency distribution curves of both students' MOT and MSC have the approximate shape of a normal distribution curve. Moreover, the Q-Q plots in Figure 4.3 and Figure 4.4 show that the dots go along with the line and this reflects that the quantiles in students' MOT and MSC fit well with the theoretically ideal normal distribution. Furthermore, Figure 4.5 and Figure 4.6 demonstrate that the data of both students' MOT and MSC are symmetric, since the box of each box-and-whisker plot is divided nearly into two equal parts and the whiskers have roughly equal lengths. Also, Figure 4.7 shows that the standard residuals of students' MOT have the shape of a normal distribution curve. Therefore, the assumption has been made that the data is approximately normally distributed for both students' MOT and MSC.

4.3.2 Heteroscedasticity

Heteroscedasticity is another issue which occurs when the variance of the standard error residuals is not constant (Poole & O'Farrell 1971; Johnston & DiNardo 1973). This means that the variance of the dependent variable is not the same for different values in the dataset when heteroscedasticity exists. The error residuals of students' MOT are calculated by finding the difference between the actual or observed values of students' MOT and the predicted values of students' MOT, and whenever the residuals are standardised, they are called the standard error residuals. On the other hand, homoscedasticity occurs when the variance of the standard error residuals of the dependent variable remains constant and there is a quite little variability in the dependent variable. In order to check if the current data violate the standards of homoscedasticity, the scatter plot of students’ MOT is presented in Figure 4.8 below which shows the relationship between the values of the dependent variable of the research study and the values of the standard error residuals by placing the prediction made by the model on the x-axis and the accuracy of the prediction made on the y-axis. Moreover, the scatter plot which illustrates the relationship between the actual and predicted students' MOT is shown in Figure 4.9 below by placing the predicted values of students' MOT on the x-axis and the actual or observed values of students' MOT on the y-axis.

Figure 4.8: Scatterplot

Dependent Variable: Students' MOT

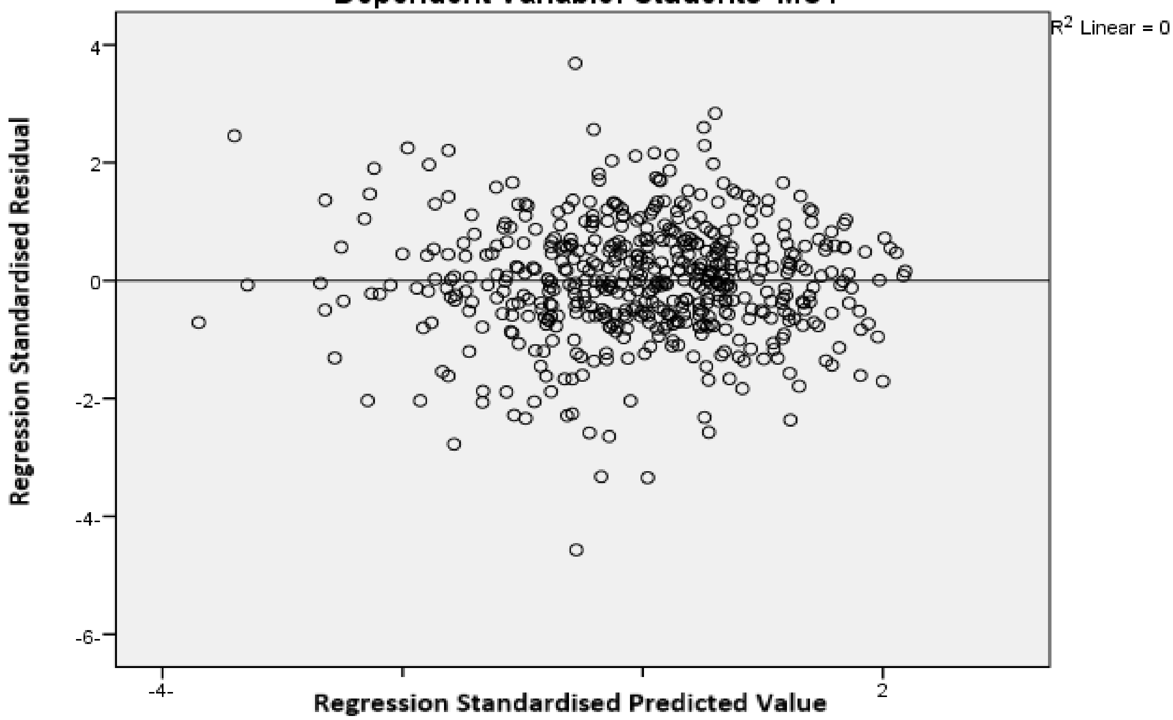
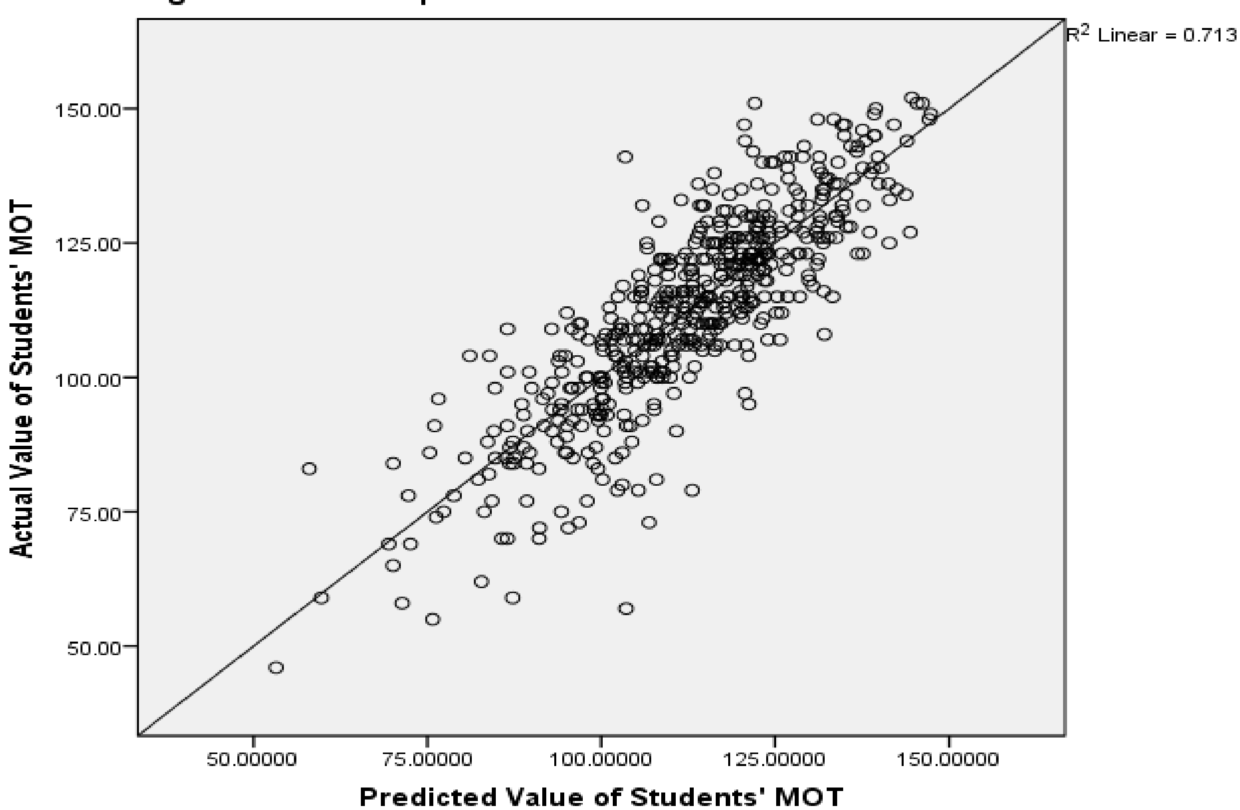


Figure 4.9: Scatterplot of Actual and Predicted Students' MOT



As indicated in Figure 4.8 above, there is a consistent relationship among most of the data which shows the associations between the values of the dependent variable of students' MOT and the values of the standard error residuals. Moreover, the linear fit line is very flat which indicates that the variance is approximately constant with varying values in the predicted variable. The distance from the fit line at zero indicates how bad the prediction is for a specific value. The data in Figure 4.8 are pretty symmetrically distributed, tend to cluster towards the middle of the scatter plot, and most of the data are clustered around the lower single digits of the y-axis between -1.5 and 1.5. On the other hand, Figure 4.9 shows that there is a strong correlation between the model's predicted values of students' MOT and the actual or observed values of students' MOT. In general, the results indicate the existence of homoscedasticity and show no strong evidence of heteroscedasticity.

4.3.3 Multicollinearity

Multicollinearity exists amongst the independent variables in classical linear regression models, if the variables are dependent on each other or are collinear (Poole & O'Farrell 1971; Johnston & DiNardo 1973). Multicollinearity is a problem that occurs in a dataset, if at least one simple correlation coefficient between the independent variables is at least 0.8. The correlation matrix for the independent variables is shown in Table 4.13 at the end of this chapter. The simple correlations between the independent variables do not show any evidence of multicollinearity, because all the inter-correlations are less than 0.8 and statistically significant.

Multicollinearity can be also measured through another two main approaches, namely, tolerance and Variance Inflation Factor (VIF) and both approaches are closely related to each other. Both aforementioned approaches measure the impact of collinearity among the Xs in a regression model on the precision of the estimation (Poole & O'Farrell 1971; Johnston & DiNardo 1973). The tolerance is the percentage of variance in one independent variable which is not accounted for by the other independent variables. The tolerance values of 0.1 or less are considered to be problematic and indicate the presence of multicollinearity. The VIF presents the degree to which the standard errors are inflated due to the levels of collinearity. The VIF values are calculated by computing the reciprocal of tolerance. The VIF values of 10 or greater are often cited as indicative of problematic collinearity. The computed values of tolerance and VIF for the five independent variables are shown in Table 4.3. As indicated in Table 4.3 below, the tolerance values of all the independent variables are greater than 0.1 and the VIF values of all the independent variables are less than 10 which indicate no strong evidence of multicollinearity among the independent variables.

Table 4.3: Multicollinearity Test for the Independent Variables

Variable	Tolerance	VIF
CMSC	0.357	2.797
AMSC	0.414	2.416
EFCI	0.643	1.555
Age	0.950	1.052
NMC	0.918	1.089

In general, the diagnostic tests did not reveal any strong evidence of misspecification in the model because of problems with the data. Hence, it can be safely assumed that the model was correctly specified and the estimated parameters are sound and can be used for further inferential analysis. However, a careful attention should be paid while interpreting the analysis, findings, and conclusions in case it was difficult to predict or detect all the misspecification errors.

4.4 Regression Analysis

4.4.1 Introduction

This section aims at describing the performance of the model in order to confirm its relevance as a foundation for a similar research in the future. Therefore, the performance of the model has been assessed by employing several regression statistics.

The predictive validity of the model is assessed by the value of the coefficient of determination, R^2 which indicates how well a regression line predicts or estimates actual values. The value R^2 tells what percentage of total variation in the dependent variable (Y) is described by the variation in the independent variables (Xs) and it measures the proportion of total variation in the dependent variable associated with or explained by the variation in the complete set of independent variables. A lot of variation in the dependent variable (Y) is described by the variation in the independent variables (Xs), if the value of R^2 gets close to one, which also makes sense and indicates that the regression line is a good fit. The adjusted coefficient of determination or adjusted R^2 indicates the proportion of the dependent variable variance in a relationship with the mean square error and the number of degrees of freedom for the model and error. The negative values of adjusted R^2 reflect that the regression line is an ill-fit.

Moreover, the global regression test has been employed in order to examine how the behaviour of the dependent variable (MOT) is explained by the independent variables (Xs). It is worthy to check if the dependent variable can be estimated by relying on the independent variables. Therefore, the test aims at examining if it is possible that all the independent variables (Xs) have zero regression coefficients ($b = 0$). In other words, the test investigates if the amount of explained variations R^2 occurs by mere chance or based on the influence of the independent variables. The following null hypothesis and alternative hypothesis have been articulated in order to test whether the five independent variables of CMSC, AMSC, EFCI, Age, and NMC effectively estimate students' motivation to succeed in introductory mathematics courses.

Ho: $b_1 = b_2 = b_3 = b_4 = b_5$ (all the regression coefficients are zero)

H: Not all the values of bs are zero

To test the null hypothesis, the F distribution has been utilised. The F-value is formed from the ratio of estimated model variance and estimated error variable, and a large F-value implies a stronger model and its associated p-value rejects the null hypothesis if the p-value is less than 0.05.

Furthermore, the individual regression coefficient tests have been performed and the validity of the separate predictor variables included in the model has been ascertained by examining the t-value and its associated p-value. The significance of this test is that if the regression coefficient for a particular independent variable is zero, this independent variable is considered to be of no value in explaining the variation in the dependent variable. Hence, the null hypothesis and the alternative hypothesis of the regression coefficient are as the following:

Ho: $b = 0$

H: $b \neq 0$

In addition to that, the multiple correlation coefficient, R has been calculated in order to evaluate the strength of the degree of association between the dependent variable and the independent variables. The value of R ranges from 0 which indicates no linear relationship to 1 which reflects a perfect linear relationship. The association is considered to be strong, if the value of R is greater than or equal 0.6. The association is considered to be moderate, if the value of R is greater than 0.4 and less than 0.6. The association is considered to be weak, if the value of R is less than or equal 0.4.

The estimated results of the model include two coefficients which are the slope coefficient and the standardised beta coefficient. The slope coefficient associated with each variable is given in terms of the units of that particular variable. The slope coefficient presents the estimated average change in the dependent variable when the independent variable increases by one unit. The standardised beta coefficient presents the estimated average change in the standard deviation units and shows the strength of the influence of each independent variable on the dependent variable. The independent variable with the highest absolute standardised beta coefficient has the strongest effect.

4.4.2 The Relationship between Students' Motivation and Mathematics Self-Concept

The main goal of this research study is to find out if there is a significant relationship between students' motivation to succeed in undergraduate introductory mathematics courses and students' mathematics self-concept. Therefore, the proposed regression model that identifies the functional relationship between students' motivation (MOT) and mathematics self-concept (MSC) has been estimated for the whole sample in Table 4.4. As indicated in Table 4.4, mathematics self-concept is a positive and statistically significant predictor of students’ motivation (MOT) to succeed in introductory mathematics courses ($b = 1.181$, $t = 31.316$, $p < 0.01$) which accounts for 65% of the variance in students' motivation ($F(1, 529) = 980.711$, $p < 0.01$, $SE = 11.15999$). The adjusted R^2 indicates that only 0.1% of the variance is explained due to chance. The multiple correlation coefficient ($R = 0.806$) shows that students' motivation is very strongly correlated with students' mathematics self-concept. The standardised beta coefficient (standardised $b = 0.806$) indicates that the impact of mathematics self-concept on students' motivation to succeed in mathematics is very strong. This result is consistent with the findings of Shavelson et al. (1976) which propose that self-concept is significant as both an outcome and a mediating variable that assist in explaining other outcomes. In this research study, mathematics self-concept supports in explaining the variance in students' motivation to succeed in undergraduate introductory mathematics courses. Furthermore, it has been shown in the empirical research that mathematics achievement is substantially correlated with mathematics self-concept (Marsh et al. 1988).

Table 4.4: The Relationship between Students' Motivation and Mathematics Self-Concept (Male and Female)

Variables	Estimated Coefficient	Standard Error	t-value	Significance Level	Standardised Coefficient
Constant	29.291**	2.699	10.851	0.000	
Mathematics Self-Concept	1.181**	0.038	31.316	0.000	0.806
R-square		0.650			
Adjusted R-square		0.649			
Multiple Correlation Coefficient R		0.806			
The Standard Error of the Estimate		11.15999			
F (1, 529)		980.711	p-value < 0.01		
** Significant at p-value < 0.01		* Significant at p-value < 0.05			

In order to explore the gender differences in terms of the impact of students' mathematics self-concept on students' motivation to succeed in mathematics courses, the model is estimated for each gender separately. The results are presented in Table 4.5 for male students and in Table 4.6 for female students. As shown in Table 4.5 and Table 4.6 below, both equations have well performance, although the R^2 for male (0.744) is greater than the R^2 for female (0.561). Furthermore, the impact of mathematics self-concept on students' motivation is stronger for male students (standardised b = 0.863) than female students (standardised b = 0.749) which reflects a slight gender differences in terms of the influence of students' MSC on students' MOT.

Table 4.5: The Relationship between Students' Motivation and Mathematics Self-Concept (Male)

Variables	Estimated Coefficient	Standard Error	t-value	Significance Level	Standardised Coefficient
Constant	28.326**	3.161	8.962	0.000	
Mathematics Self-Concept	1.193**	0.045	26.629	0.000	0.863
R-square		0.744			
Adjusted R-square		0.743			
Multiple Correlation Coefficient R		0.863			
The Standard Error of the Estimate		9.63601			
F (1, 244)		709.110	p-value < 0.01		
** Significant at p-value < 0.01	* Significant at p-value < 0.05				

Table 4.6: The Relationship between Students' Motivation and Mathematics Self-Concept (Female)

Variables	Estimated Coefficient	Standard Error	t-value	Significance Level	Standardised Coefficient
Constant	30.509**	4.441	6.869	0.000	
Mathematics Self-Concept	1.165**	0.061	19.015	0.000	0.749
R-square		0.561			
Adjusted R-square		0.559			
Multiple Correlation Coefficient R		0.749			
The Standard Error of the Estimate		12.35583			
F (1, 283)		361.557	p-value < 0.01		
** Significant at p-value < 0.01	* Significant at p-value < 0.05				

4.4.3 The Relationship between Students' MOT, CMSC, and AMSC

The second main goal of this research study is to find out if there is a significant relationship between students' motivation to succeed in undergraduate introductory mathematics courses and the two components of mathematics self-concept which are students' cognitive and affective mathematics self-concept. Therefore, the proposed regression model that identifies the functional relationship between students' motivation (MOT), cognitive mathematics self-concept (CMSC), and affective mathematics self-concept (AMSC) has been estimated for the whole sample in Table 4.7. As indicated in Table 4.7 below, both components of mathematics self-concept are positive and statistically significant predictors of students' motivation (MOT) to succeed in introductory mathematics courses (CMSC $b = 0.881$, $t = 11.686$, $p < 0.01$; AMSC $b = 2.049$, $t = 10.546$, $p < 0.01$) which account for 66.3% of the variance in students' motivation ($F(2, 528) = 519.009$, $p < 0.01$, $SE = 10.95752$). The multiple correlation coefficient ($R = 0.814$) indicates the two components of mathematics self-concept are strongly correlated with students' motivation to succeed in undergraduate introductory mathematics courses.

Table 4.7: The Relationship between Students' Motivation and Cognitive and Affective Mathematics Self-Concept (Male and Female)

Variables	Estimated Coefficient	Standard Error	t-value	Significance Level	Standardised Coefficient
Constant	33.786**	2.828	11.945	0.000	
CMSC	0.881**	0.075	11.686	0.000	0.456
AMSC	2.049**	0.194	10.546	0.000	0.411
R-square	0.663				
Adjusted R-square	0.662				
Multiple Correlation Coefficient R	0.814				
The Standard Error of the Estimate	10.95752				
F (2, 528)	519.009	p-value < 0.01			
** Significant at p-value < 0.01	* Significant at p-value < 0.05				

It has been mentioned earlier that the standardised coefficient indicates the estimated average change in the standard deviation units and shows the strength of the impact of each independent variable on the dependent variable. Based on the comparison between the standardised coefficient of CMSC and AMSC, it can be shown that the cognitive component of mathematics self-concept (CMSC standardised b = 0.456) has a stronger impact on students' motivation than the affective component of mathematics self-concept (AMSC standardised b = 0.411). In other words, the cognitive mathematics self-concept (CMSC) is slightly a stronger predictor of students' motivation to succeed in introductory mathematics courses than the affective mathematics self-concept (AMSC) within the sample of this research study.

Furthermore, Table 4.8 and Table 4.9 below present the estimated model of male students and female students in order to explore any gender differences in terms of the impact of students' cognitive and affective mathematics self-concept on students' motivation to succeed in mathematics courses. The results indicate that the CMSC (standardised b = 0.573) is a stronger predictor of students' motivation amongst male students in the sample than the AMSC (standardised b = 0.341). On the other hand, the AMSC (standardised b = 0.476) is a stronger predictor of students' motivation amongst female students than the CMSC (standardised b = 0.344). The results show that both equations have well performance, although the R^2 for male (0.747) is greater than the R^2 for female (0.590). The multiple correlation coefficients of male students and female students illustrate that the two components of mathematics self-concept are strongly correlated with students' motivation to succeed in undergraduate introductory mathematics courses. However, the multiple correlation coefficient of male students (R = 0.865) is slightly higher than the multiple correlation coefficient of female students (R = 0.768).

Table 4.8: The Relationship between Students' Motivation and Cognitive and Affective Mathematics Self-Concept (Male)					
Variables	**Estimated Coefficient**	**Standard Error**	**t-value**	**Significance Level**	**Standardised Coefficient**
Constant	30.422**	3.355	9.068	0.000	
CMSC	1.045**	0.093	11.203	0.000	0.573
AMSC	1.624**	0.244	6.666	0.000	0.341
R-square		0.747			
Adjusted R-square		0.745			
Multiple Correlation Coefficient R		0.865			
The Standard Error of the Estimate		9.59203			
F (2, 243)		359.435	p-value < 0.01		
** Significant at p-value < 0.01	* Significant at p-value < 0.05				

Table 4.9: The Relationship between Students' Motivation and Cognitive and Affective Mathematics Self-Concept (Female)					
Variables	**Estimated Coefficient**	**Standard Error**	**t-value**	**Significance Level**	**Standardised Coefficient**
Constant	37.909**	4.607	8.228	0.000	
CMSC	0.709**	0.118	6.005	0.000	0.344
AMSC	2.466**	0.297	8.303	0.000	0.476
R-square		0.590			
Adjusted R-square		0.587			
Multiple Correlation Coefficient R		0.768			
The Standard Error of the Estimate		11.96119			
F (2, 282)		202.896	p-value < 0.01		
** Significant at p-value < 0.01	* Significant at p-value < 0.05				

It has been indicated in the literature that mathematics self-concept is multidimensional, since it includes both cognitive and affective components (Fennema & Sherman 1976; Bong & Clark 1999; Tanner & Jones 2000; Bong & Skaalvik 2003). This study is bound to make a significant contribution to mathematics self-concept and students' motivation literature as it shows that the CMSC is a stronger predictor of students' motivation than AMSC for both genders, the AMSC is a stronger predictor of students' motivation than CMSC for female students, and the CMSC is a stronger predictor of students' motivation than AMSC for male students.

4.4.4 The Relationship between Students' Motivation, Mathematics Self-Concept, Extrinsic Motivation, and Demographic Information

The three research sub-questions in the introduction of this research study aim at examining if there is a significant relationship between students' motivation to succeed in introductory mathematics courses and the two components of mathematics self-concept, extrinsic motivation represented by students' expectations of future career and income, and the demographic information of students. In order to answer the research sub-questions and test the hypotheses, a comprehensive model is proposed which regresses students' motivation on students' cognitive mathematics self-concept, students' affective mathematics self-concept, students' expectations of future career and income, students' age, and the number of mathematics courses taken by students. The complete model has been initially estimated for the whole sample and for each gender individually. Table 4.10 below shows the complete estimated model for the whole sample.

Table 4.10: The Relationship between Students' MOT, CMSC, AMSC, EFCI, Age, and NMC (Male and Female)

Variables	Estimated Coefficient	Standard Error	t-value	Significance Level	Standardised Coefficient
Constant	30.356**	2.829	10.731	0.000	
CMSC	0.634**	0.077	8.263	0.000	0.326
AMSC	1.851**	0.183	10.121	0.000	0.371
EFCI	1.446**	0.157	9.230	0.000	0.271
Age	-0.358	0.419	-0.856	0.392	-0.021
NMC	0.300	0.325	0.921	0.375	0.023
R-square		0.713			
Adjusted R-square		0.711			
Multiple Correlation Coefficient R		0.845			
The Standard Error of the Estimate		10.19060			
F (5, 516)		256.798	p-value < 0.01		
** Significant at p-value < 0.01	* Significant at p-value < 0.05				

As indicated in Table 4.10 above, several goodness of fit indicators have been employed to examine this comprehensive model in Table 4.10. The model provides a practically very strong fit to the data as, measured by the coefficient of determination ($R^2 = 0.713$) which explained 71.3% of the variance in students' motivation to succeed in introductory mathematics courses. The adjusted coefficient of determination (adjusted $R^2 = 0.711$) indicates that only 0.2% of the variance of the model is explained due to chance. The large F-value also shows a strong fit to the data ($F(5, 516) = 256.798$, $p < 0.01$, SE = 10.19060). The estimated multiple correlation coefficient ($R = 0.845$) indicates that the dependent variable of students' MOT is very strongly correlated with all the other independent variables together.

Moreover, the model diagnostic tests have no indications to any serious problems with normality of the residuals, heteroscadesticity or multicollinearity. All the model's effects (bs) in Table 4.10 are statistically significant at 0.01, 0.05, or 0.5 levels as indicated by their t-values and p-values and are consistent with the prior expectations. This indicates that students' cognitive mathematics self-concept (CMSC $b = 0.634$, $p < 0.01$), students' affective mathematics self-concept (AMSC $b = 1.851$, $p < 0.01$), students' expectations of future career and income (EFCI $b = 1.446$, $p < 0.01$), students' age (Age $b = -0.358$, $p < 0.5$), and the number of mathematics courses taken by students (NMC $b = 0.300$, $p < 0.5$) are all significant predictors of students' motivation to succeed in undergraduate introductory mathematics courses. Based on the value of standardised coefficient, it is indicated that the affective mathematics self-concept has the strongest predictive effect on students' motivation to succeed in introductory mathematics courses (AMSC standardised $b = 0.371$), followed by the cognitive mathematics self-concept (CMSC standardised $b = 0.326$), and expectations of future career and income (EFCI standardised $b = 0.271$).

In order to explore gender differences in terms of the predictive ability of the independent variables, the full model is estimated for male students only in Table 4.11 and for female students only in Table 4.12. In general, both equations fit the data very well similar to the model of the whole sample. For male students, cognitive mathematics self-concept (CMSC b = 0.817, $p < 0.01$), affective mathematics self-concept (AMSC b = 1.543, $p < 0.01$), and expectations of future career and income (EFCI b = 1.075, $p < 0.01$) are statistically very significant predictors of male students' motivation to succeed in undergraduate introductory mathematics courses. For female students, cognitive mathematics self-concept (CMSC b = 0.462, $p < 0.01$), affective mathematics self-concept (AMSC b = 2.129, $p < 0.01$), and expectations of future career and income (EFCI b = 1.831, $p < 0.01$) are also statistically very significant predictors of female students' motivation to succeed in undergraduate introductory mathematics courses.

Furthermore, the results indicate that the strongest predictor of male students' motivation is cognitive mathematics self-concept (CMSC standardised b = 0.448) followed by affective mathematics self-concept (AMSC standardised b = 0.324). On the other hand, the strongest predictor of female students' motivation is affective mathematics self-concept (AMSC standardised b = 0.409) followed by cognitive mathematics self-concept (CMSC standardised b = 0.221). Another interesting result is that the expectations of future career and income (EFCI standardised b = 0.323) is a stronger predictor of female students' motivation than even their cognitive mathematics self-concept (CMSC standardised b = 0.221). It is noticed that amongst the three estimated equations, the male equation performs better than the female equation and the whole sample equation. The male equation has the highest coefficient of determination (R^2 =

0.776) which explains 77.6% of the variation in male students' motivation. Also, the male equation has the highest multiple correlation coefficient (R = 0.881).

Table 4.11: The Relationship between Students' MOT, CMSC, AMSC, EFCI, Age, and NMC (Male)					
Variables	**Estimated Coefficient**	**Standard Error**	**t-value**	**Significance Level**	**Standardised Coefficient**
Constant	28.494**	3.504	8.131	0.000	
CMSC	0.817**	0.099	8.220	0.000	0.448
AMSC	1.543**	0.235	6.560	0.000	0.324
EFCI	1.075**	0.200	5.376	0.000	0.215
Age	0.190	0.549	0.347	0.729	0.011
NMC	0.196	0.419	0.471	0.638	0.015
R-square		0.776			
Adjusted R-square		0.772			
Multiple Correlation Coefficient R		0.881			
The Standard Error of the Estimate		9.15791			
F (5, 235)		163.196	p-value < 0.01		
** Significant at p-value < 0.01	* Significant at p-value < 0.05				

Table 4.12: The Relationship between Students' MOT, CMSC, AMSC, EFCI, Age, and NMC (Female)					
Variables	**Estimated Coefficient**	**Standard Error**	**t-value**	**Significance Level**	**Standardised Coefficient**
Constant	31.573**	4.484	7.042	0.000	
CMSC	0.462**	0.116	3.988	0.000	0.221
AMSC	2.129**	0.274	7.765	0.000	0.409
EFCI	1.831**	0.238	7.681	0.000	0.323
Age	-1.043	0.624	-1.671	0.096	-0.061
NMC	0.610	0.498	0.046	0.22	0.049
R-square		0.665			
Adjusted R-square		0.659			
Multiple Correlation Coefficient R		0.816			
The Standard Error of the Estimate		10.89376			
F (5, 235)		163.196	p-value < 0.01		
** Significant at p-value < 0.01	* Significant at p-value < 0.05				

4.4.5 Variables Inter-Correlations

The held regression analysis above provided an opportunity to examine the relationship between the dependent variable and independent variables of the research study and how the independent variables added to the explanation of variance in the dependent variable. This research study aimed at exploring if there exist significant correlations between students' motivation subscales, mathematics self-concept subscales, expectations of future career and income, students' age, and number of mathematics courses taken by students. The Pearson Product Moment Correlation has been employed in this section to examine the simple correlations amongst the variables of this research study in order to explain how the independent variables interact to predict the dependent variable. The calculated correlations for the whole sample including male and female students are presented in Table 4.13 at the end of this chapter.

As indicated in Table 4.13 below, there are strong and significantly positive correlations amongst students' intrinsic motivation subscales which are importance and necessity of mathematics subscale and perception of success in mathematics subscale ($r = 0.615$, $p < 0.001$); importance and necessity of mathematics subscale and enjoyment of mathematics subscale ($r = 0.659$, $p < 0.001$); and perception of success in mathematics subscale and enjoyment of mathematics subscale ($r = 0.560$, $p < 0.001$), reflecting that the three subscales support each other in their determination of the overall students' motivation to succeed in undergraduate introductory mathematics courses. It is deduced that students' appreciation of the importance and necessity of mathematics is possibly helpful in promoting students' positive perception of mathematics and enhancing the enjoyment that students derive from mathematics.

There is a significant and positive correlation between the three intrinsic motivation subscales and extrinsic motivation subscale of students' expectations of future career and income. The correlations between importance and necessity of mathematics subscale and expectations of future career and income subscale ($r = 0.543$, $p < 0.001$); perception of success in mathematics subscale and expectations of future career and income subscale ($r = 0.432$, $p < 0.001$); and enjoyment of mathematics subscale and expectations of future career and income subscale ($r = 0.628$, $p < 0.001$), indicating that extrinsic motivation is a potential predictor of importance and necessity of mathematics, perception of success in mathematics, and enjoyment of mathematics. The significant and positive correlations between the three intrinsic motivation subscales of importance and necessity of mathematics, perception of success in mathematics, and enjoyment of mathematics and extrinsic motivation subscale of students' expectations of future career and income reflect that extrinsic motivation reinforces and enhances the effectiveness of the three subscales to determine the overall students' motivation to succeed in introductory mathematics courses. Therefore, students who understand the importance and necessity of mathematics, have positive perceptions of success in mathematics, and drive enjoyment in perusing mathematics would be more interested in the expectation that their success would place them in excellent career opportunities with bright prospects including income.

The cognitive mathematics self-concept is strongly and positively correlated with all the three motivation subscales of importance and necessity of mathematics ($r = 0.612$, $p < 0.001$), perception of success in mathematics ($r = 0.565$, $p < 0.001$), and enjoyment of mathematics ($r = 0.779$, $p < 0.001$). Thus, the positive cognitive mathematics self-concept assists in identifying the importance and necessity of mathematics, perception of success in mathematics, and the enjoyment derived from mathematics as contributing subscales to the overall students' motivation to succeed in introductory mathematics courses.

There is a strong and statistically significant correlation between cognitive mathematics self-concept and affective mathematics self-concept ($r = 0.762$, $p < 0.001$). The possession of positive cognitive mathematics self-concept assists students to develop a positive affective mathematics self-concept. The prediction of students' motivation to succeed in introductory mathematics courses is facilitated by the positive reinforcement and interaction among the two components of mathematics self-concept. Hence, it is significant for the two components of mathematics self-concept to be correlated, although both components may not be at the same level in every individual student as indicated above.

The cognitive mathematics self-concept subscale is strongly and positively correlated with students' expectations of future career and income as a result of succeeding in mathematics courses ($r = 0.595$, $p < 0.001$). This suggests that cognitive mathematics self-concept and expectations of future career and income as extrinsic motivation factor reinforce each other in boosting and predicting students' motivation to succeed in introductory mathematics courses.

There is no statistically significant correlation between students' cognitive mathematics self-concept and students' age ($r = -0.034$, $p > 0.001$) implying that cognitive mathematics self-concept is unrelated to age in the sample. The negative correlation between students' cognitive mathematics self-concept and age reflects that older students are less effective in cognitive mathematics self-concept or in predicting students' motivation to succeed in introductory mathematics courses. On the other hand, students' cognitive mathematics self-concept is significantly and positively correlated with the number of mathematics courses taken by students ($r = 0.144$, $p < 0.001$) implying that the more experienced a student becomes, the more effective the student's cognitive mathematics self-concept or student's competence to predict student's motivation to succeed in introductory mathematics courses.

There is a strong and statistically significant correlation between affective mathematics self-concept and the three motivation subscales of importance and necessity of mathematics ($r = 0.600$, $p < 0.001$); perception of success in mathematics ($r = 0.508$, $p < 0.001$); and enjoyment of mathematics ($r = 0.748$, $p < 0.001$). Thus, the positive affective mathematics self-concept is very helpful in identifying the importance and necessity of mathematics, the perception of success in mathematics, and the enjoyment derived from mathematics as contributing subscales to the overall students' motivation to succeed in introductory mathematics courses.

The affective mathematics self-concept subscale is strongly and positively correlated with the expectations of future career and income as a result of succeeding in introductory mathematics courses ($r = 0.503$, $p < 0.001$). This suggests that expectations of future career and income as extrinsic motivation factor reinforces affective mathematics self-concept in identifying and predicting the overall students' motivation to succeed in introductory mathematics courses. Therefore, the expectation of future career and income subscale is very helpful in strengthening the influence of affective mathematics self-concept on students' motivation.

There is no statistically significant correlation between students' affective mathematics self-concept and students' age ($r = -0.060$, $p > 0.001$) implying that the affective mathematics self-concept is unrelated to age in the sample. On the other hand, students' affective mathematics self-concept is significantly and positively correlated with the number of mathematics courses taken by students ($r = 0.103$, $p < 0.01$) implying that the more experienced a student becomes, the more effective the student's affective mathematics self-concept.

One of the most important findings of this research study is the very strong and statistically significant correlation between the overall mathematics self-concept and students' motivation to succeed in introductory mathematics courses ($r = 0.806$, $p < 0.001$) which reflects that students' motivation to succeed in introductory mathematics courses is very strongly related to students' mathematics self-concept. The individual mathematics self-concept subscales are strongly correlated with students' motivation as shown in Table 4.13 reflecting that cognitive mathematics self-concept is strongly correlated with students' motivation ($r = 0.770$, $p < 0.001$) as well as affective mathematics self-concept is strongly correlated with students' motivation ($r = 0.739$, $p < 0.001$). This entails that students' motivation is equally strongly related to affective and cognitive mathematics self-concept and each subscale has the independent ability without the other subscale to predict students' motivation to succeed in introductory mathematics courses.

Furthermore, another interesting finding is that the correlation between the cognitive mathematics self-concept and the overall mathematics self-concept ($r = 0.982$, $p < 0.001$) is stronger than the correlation between the affective mathematics self-concept and the overall mathematics self-concept ($r = 0.870$, $p < 0.001$) reflecting that the cognitive mathematics self-concept is a more effective measure of the overall mathematics self-concept than the affective mathematics self-concept. This emphasises the regression findings that the standardised coefficient of the cognitive mathematics self-concept (standardised $b = 0.456$) is greater than the standardised coefficient of the affective mathematics self-concept (standardised $b = 0.411$) in the sample of this research study.

In order to explore if different patterns of inter-correlation might exist amongst male students and female students, the correlations matrix of each gender has been calculated and tested in order to detect significant differences between the strength of the correlations found for male students and female students. The correlations matrix of male students is shown in Table 4.14 and the correlations matrix of female students is shown in Table 4.15. In general, the pattern of inter-correlation seems to be quite similar amongst male students and female students and none of the differences is statistically significant at a 0.001 level.

Nonetheless, there are few minor gender differences which have been already highlighted in the regression analysis. Among female students, age is only significantly correlated with perception of success in mathematics subscale ($r = -0.122$, $p < 0.05$), whereas among male students, age is not significantly correlated with any of the motivation subscales which implies that age is significant for female students' motivation to succeed in introductory mathematics courses, whereas age is not significant for male students' motivation to succeed in introductory mathematics courses. From another aspect, the number of mathematics courses taken by students is not significantly correlated with students' motivation to succeed in introductory mathematics courses ($r = 0.092$, $p > 0.01$) for female students, whereas the number of mathematics courses taken by students is significantly correlated with students' motivation to succeed in introductory mathematics courses ($r = 0.163$, $p < 0.01$) for male students. This implies that mathematics experience is significant among male students whereas mathematics experience is not significant among female students in the sample of this research study.

4.5 Conclusion

This chapter started by evaluating the measures of students' motivation and mathematics self-concept based on the self-reported instrument scores on a 5-point Likert scale. The individual mean scores have been used in order to measure students' motivation and its subscales and mathematics self-concept and its subscales. Based on the examination of the mean scores, no significant differences have been detected in students' motivation subscales and mathematics self-concept subscales. Moreover, the findings do not reveal any gender differences in terms of the mean scores.

Then, the multiple regression model has been proposed in this chapter to analyse the relationship between students' motivation to succeed in mathematics, cognitive mathematics self-concept, affective mathematics self-concept, expectations of future career and income, students' age, and the number of mathematics courses taken by students. The proposed model fits the data very well and explains more than 71% of the variance in the dependent variable of students' motivation to succeed in introductory mathematics courses. In addition to that, the estimated results indicate a very strong correlation between students' motivation to succeed in introductory mathematics courses and the set of independent variables included in the research study.

It has been clearly indicated in the results of the quantitative analysis that mathematics self-concept is a very significant predictor of students' motivation to succeed in introductory mathematics courses. The regression and correlation analysis shows that mathematics self-concept alone explains 65% of the variance in students' motivation to succeed in introductory mathematics courses. Furthermore, the analysis shows that the other independent variables are statistically significant contributors to the explanation of the variance in students' motivation to succeed in introductory mathematics courses which include students' extrinsic motivation represented by expectations of future career and income, students' age, and the number of mathematics courses taken by students.

The two subscales of mathematics self-concept including cognitive mathematics self-concept and affective mathematics self-concept are both statistically significant predictors of students' motivation to succeed in introductory mathematics courses. The joint contribution of cognitive mathematics self-concept subscale and affective mathematics self-concept subscale to the explanation of variance in students' motivation (66.3%) is slightly higher compared to the explanation of the overall mathematics self-concept (65.0%). The regression analysis examining gender differences among the impacts of the variables indicates that cognitive mathematics self-concept is the strongest predictor of male students, whereas affective mathematics self-concept is the strongest predictor of female students. Moreover, the findings indicate that students' age as a measure of students' maturity is significantly correlated with perception of success in mathematics subscale of the motivation among female students, whereas the number of mathematics courses taken by students is significantly correlated with students' motivation to succeed in introductory mathematics courses. The analysis which examines the gender differences in the inter-correlation among variables discloses only minor variations related to gender. However, these variations are not sufficient enough to propose that male and female students have different patterns of relationships with the variables included in this research study.

In spite of the fact that the results of the quantitative analysis reveal insights into the relationships between students' motivation to succeed in introductory mathematics courses, cognitive mathematics self-concept, affective mathematics self-concept, expectations of future career and income, students' age, and the number of mathematics courses taken by students, it is thought that the qualitative information from the semi-structured interviews are expected to enlighten, enhance, and expand on the quantitative findings. The predictive utility of mathematics self-concept, extrinsic motivation, and demographic information in relation to students' motivation has been examined in limited number of studies. Therefore, a sub-sample of 17 students from the sample has been selected and included in an in-depth interview study to collect the qualitative information. The examination of the qualitative interview is expected to provide significant theoretical and practical information to support the quantitative findings.

Table 4.13: Inter-Correlations of Students' Intrinsic Motivation Subscales, Mathematics Self-Concept Subscales, Extrinsic Motivation, and Demographic Information (Male and Female)										
	MOT	Importance and Necessity of Mathematics	Perception of Success in Mathematics	Enjoyment of Mathematics	CMSC	AMSC	MSC	EFCI	Age	NMC
	1 572									
	.884** .000 572	1 651								
	.788** .000 572	.615** .000 599	1 623							
	.900** .000 572	.659** .000 618	.560** .000 593	1 645						
	.770** .000 537	.612** .000 596	.565** .000 578	.779** .000 594	1 620					
	.739** .000 566	.600** .000 643	.508** .000 616	.748** .000 638	.762** .000 612	1 677				
	.806** .000 531	.645** .000 588	.582** .000 571	.816** .000 587	.982** .000 612	.870** .000 612	1 612			
	.629** .000 567	.543** .000 644	.432** .000 617	.628** .000 636	.595** .000 614	.503** .000 669	.603** .000 607	1 676		
	-.056- .181 567	-.058- .142 646	-.081-* .045 618	-.025- .523 640	-.034- .397 617	-.060- .118 672	-.035- .386 609	-.044- .250 671	1 680	
	.122** .004 569	.114** .004 648	.093* .021 620	.114** .004 642	.144** .000 617	.103** .007 674	.146** .000 609	.003 .939 673	.222** .000 678	1 682

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.14: Inter-Correlations of Students' Intrinsic Motivation Subscales, Mathematics Self-Concept Subscales, Extrinsic Motivation, and Demographic Information (Male)										
	MOT	Importance and Necessity of Mathematics	Perception of Success in Mathematics	Enjoyment of Mathematics	CMSC	AMSC	MSC	EFCI	Age	NMC
	1 270									
	.880** .000 270	1 304								
	.765** .000 270	.593** .000 285	1 297							
	.897** .000 270	.650** .000 286	.520** .000 281	1 299						
	.837** .000 249	.681** .000 277	.621** .000 273	.804** .000 272	1 288					
	.747** .000 267	.610** .000 301	.501** .000 294	.751** .000 296	.774** .000 285	1 316				
	.863** .000 246	.706** .000 274	.631** .000 270	.834** .000 269	.984** .000 285	.876** .000 285	1 285			
	.640** .000 269	.528** .000 303	.451** .000 295	.636** .000 297	.630** .000 287	.521** .000 314	.631** .000 284	1 317		
	-.065- .295 266	-.058- .316 300	-.034- .564 293	-.024- .678 295	-.049- .411 286	-.071- .214 312	-.048- .417 283	-.100- .076 313	1 315	
	.163** .007 268	.144* .012 302	.169** .004 295	.126* .030 297	.167** .005 286	.094 .095 314	.164** .006 283	.038 .502 315	.157** .005 313	1 317

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.15: Inter-Correlations of Students' Intrinsic Motivation Subscales, Mathematics Self-Concept Subscales, Extrinsic Motivation, and Demographic Information (Female)										
	MOT	Importance and Necessity of Mathematics	Perception of Success in Mathematics	Enjoyment of Mathematics	CMSC	AMSC	MSC	EFCI	Age	NMC
	1 302									
	.894** .000 302	1 347								
	.808** .000 302	.638** .000 314	1 326							
	.903** .000 302	.683** .000 332	.593** .000 312	1 346						
	.701** .000 288	.549** .000 319	.518** .000 305	.753** .000 322	1 332					
	.734** .000 299	.592** .000 342	.518** .000 322	.753** .000 342	.751** .000 327	1 361				
	.749** .000 285	.590** .000 314	.543** .000 301	.797** .000 318	.981** .000 327	.864** .000 327	1 327			
	.619** .000 298	.560** .000 341	.419** .000 322	.628** .000 339	.557** .000 327	.485** .000 355	.574** .000 323	1 359		
	-.052- .366 301	-.057- .287 346	-.122-* .028 325	-.035- .522 345	-.024- .663 331	-.052- .324 360	-.026- .639 326	.008 .877 358	1 365	
	.092 .111 301	.085 .116 346	.032 .560 325	.118* .029 345	.130* .018 331	.114* .030 360	.136* .014 326	-.031- .564 358	.283** .000 365	1 365

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Definitions of used acronyms:

MOT: Students' Motivation

CMSC: Cognitive Mathematics Self-Concept

AMSC: Affective Mathematics Self-Concept

MSC: Overall Mathematics Self-Concept

EFCI: Expectations of Future Career and Income

NMC: Number of Mathematics Courses

CHAPTER FIVE: ANALYSIS OF QUALITATIVE INFORMTION

5.1 Introduction

This chapter aims at analysing the qualitative data gathered from interviews with the purpose of linking the analysis to the research question of the thesis. This qualitative data, generated from in-depth semi-structured interviews will help clarify the phenomenon of students' motivation to succeed in undergraduate introductory mathematics courses. About 25 students from all the students, who left their contact information on the survey questionnaire, were contacted and invited to participate in the semi-structured interviews. In the survey questionnaire, students were asked about their final grade in the latest completed course of mathematics. The students who were contacted to participated in the semi-structured interviews included students were very successful in mathematics courses and managed to pass their latest completed courses in mathematics successfully. Furthermore, students, who struggled and failed in their latest completed courses of mathematics, were also contacted to participate in the semi-structured interviews. The inclusion of good and weak students at mathematics in the semi-structured interview is consider to be useful approach, since it provided an opportunity to compare between the factors that contribute in motivating students to succeed in mathematics courses from good students' perspective as well as weak students' perspective. A total of 17 students were interviewed out of 25 who agreed to participate; this represents a response rate of 68% in the qualitative data collection process. Mason (2010) examined a sample size of 560 Ph.D. studies which all employed qualitative interviews as the research methodology of their data collection process. The findings of Mason's (2010) research study indicate that the mean sample size is 30;

however, the guiding principle of the sample size in qualitative research should be the concept of saturation. This entails ending the interview whenever the new information becomes redundant to the point of saturation. The guidelines of the actual sample size have been clarified by Guest et al. (2006, p. 61) indicating that the sample size of phenomenology qualitative research approach ranges from five to 25, and the sample size of all different types of qualitative research is 15 which is considered the smallest acceptable sample size.

The 17 students were made up of 7 female and 10 male students ranging from 18 to 24 years old. The students were drawn from the UAEU, the ADU, the AAU, and the KIC, and all the students have completed mathematics courses including College Mathematics, Mathematics for Science and Technology, Mathematics for Business, Calculus I, Calculus II, Algebra, College Algebra, Trigonometry, Introduction to Linear Algebra, Engineering Math, and Differential Equations. The grade of each student in the latest taken mathematics course was obtained and reported in Appendix I. The importance and necessity of mathematics courses have been recognised by all the respondents.

The 17 students were interviewed separately through either a telephonic interview or a face-to-face interview depending on student’s preference and availability. The duration of each interview ranged between one hour to two hours and interview notes were taken by the researcher. It is demonstrated by Merriam (2009) that semi-structured interviews include flexible questions without any predetermined wording or order and these questions are usually used to gather specific data required from all respondents. Since semi-structured interviews were employed, no structured interview questionnaires were used. However, the procedure was to have a list of questions in hand which were not followed in a systematics manner by the researcher. A copy of the list of questions is provided in Appendix B. After asking the first question, the other questions were not asked directly, and each question was asked depending on the respondent's answer to the previous question. Therefore, the subsequent questions allowed gathering in-depth information in relation to the answers provided in the previous questions. In some cases, the respondents were given the opportunity to express themselves by disclosing all the information they have in relation to the questions in hand.

Each interviewee received a copy of the consent form in Appendix E. Through the consent form, interviewees were given a brief description of the research study and they were able to know their involvement as participants in the research process. Furthermore, the participants were given the guarantee to maintain their anonymity and confidentiality and they were fully aware of their right to withdraw at anytime. Before conducting any interview, the three basic ethical principles of respect for person, beneficence, and justice were clearly shared with the participants. The provided answers by the participates were recoded and later transcribed. In order to ensure the accuracy and validity of the responses, each answer was transcribed several times. The responses were coded and categorised into themes that represent students' motivational subscales and mathematics self-concept subscales. It has been emphasised by Merriam (2009) that data analysis in qualitative research implies breaking down the data and searching for codes and categories which can be categorised and organised into themes.

5.2 Introduction to the Participants in Interviews

In order to briefly shed the light on the opinions of the participants in the semi-structured interviews about their motivation and mathematics self-concept, the gathered information from students have been presented in Appendix I. The presented information in Appendix I is based on interviews' transcripts and it is descriptive in its nature. In order to maintain the confidentiality of the participants in the semi-structured interviews, imaginary names and identity codes have been assigned to them. Each identity code is made up of two letters representing the researcher's initial and numbers representing the order through which the participants were interviewed. Then, all the interviews were transcribed and notes were written. Later on, the data were reviewed in order to identify common, recurrent, or emergent themes by entering the responses in a template used for data collection based on the semi-structured interview questions' number. The responses were coded based on three main broad themes including students' motivatiol to succeed in mathematics courses, students' mathematics self-concept, and other facilitating factors. The responses within each of the themes were further analysed in order to create sub-categories for the similar traits between respondents who present the same themes. The participants' opinions and views about motivation and mathematics self-concept are presented, consolidated, re-classified, and discussed deeply in Appendix I.

The responses of respondents to the questions and their free expressions about themselves were conveniently organised into three major themes in spite of the fact that the questions about the pre-determined themes were not asked directly to the respondents. The three major themes are inclusive of 'students' motivational concepts', 'students' mathematics self-concepts', and 'facilitating factors'. Grouping students' motivational themes into the four subscales which were used in the quantitative research approach was uncomplicated; however, grouping students' mathematics self-concept themes into the two subscales which were used in the quantitative research approach was not simple. It has to be acknowledged that the qualitative conceptualisations of themes richly support, lighten, refine, and expand on the quantitative analysis as well as the theoretical and empirical literature.

5.3 Students' Motivational Themes

Students' motivation was defined earlier as the cognitive and affective psychological processes that supply individuals' behaviour with goal, direction, and power and it is accountable for producing differences in outcomes among different individuals (Mwangi & McCaslin 1994). Students' motivation is inclusive of several dimensions such as importance, enjoyment, perception of success, relevance, expectation of success, and satisfaction (Ryan & Deci 2000; Bong & Skaalvik 2003). The four subscales of importance and necessity of mathematics, perception of success in mathematics, enjoyment of mathematics, and extrinsic motivation, which were identified in students' responses to the survey questionnaire, were summarised and employed to produce measures of students' motivation. The responses obtained through the semi-structured interviews are filled with phrases and terms that reflect the four motivational subscales. Therefore, the references made by students through the semi-structured interviews supported the four motivational subscales that were employed in the quantitative research.

5.3.1 Importance and Necessity of Mathematics

The respondents articulated several terms and expressions during the semi-structured interviews which clearly reflect the importance and necessity of mathematics. These terms and expressions are summarised in the following: *mathematics is the base and centre of all sciences and mathematics is needed to solve and understand problems in many major courses (MH01); I must know how to deal with numbers, because there are many things in my daily life which are represented by numbers such as money and banking (MH01); mathematics is important for my desired career in the future, since my major is accounting and it is all about numbers and dealing with numbers (MH01); mathematics is the most reliable tool a professional can use to solve real world problems at the professional level (MH02); mathematics helps me to generalise complex world problems into simple equations (MH02); I feel that mathematics class is like a soccer field where I can be creative and excel in all areas of mathematics (MH02); I am fascinated by how simple trigonometric equations may change the beauty of the world, and I think that everything involves shapes, dimensions, and trigonometry has made it much easier for professionals to build beautiful buildings, architectures, etc (MH02); I have the passion in automotive engineering which implies the use of mathematics; calculations involving aerodynamics, weight distribution, gears, and fluid mechanisms are various aspects of auto engineering major which requires immense use of mathematics which is a vital choice for my future career (MH02); mathematics is important, because it plays a serious role at college level, personal level, and professional level (MH03); I use mathematics to perform many different daily tasks such as telling time, counting change, or making strategic decisions in my personal life or work life (MH03); almost every profession uses some form of mathematics (MH03); mathematics has nothing to do with my* *future desired career, because I plan to work as a translator (MH03); mathematics is important at different levels and all types of sciences depend on mathematics (MH04); mathematics is involved in almost everything in the world and it is a very important subject (MH05); my major is information technology and mathematics courses are important for my desired career in the future (MH05); mathematics is important for me, since life will be difficult without mathematics (MH06); I use mathematics in my daily life when I am going to pay for something in order to know the amount of change that I should receive (MH06); I am studying translation and I think my future career does not require knowledge about mathematics (MH06); mathematics is an important thing that has been always around me not just only in the college and professional environments, but also in my personal environment (MH07); I take mathematics courses to help me in both my personal life as well as my professional life, but mainly in my professional life as the world is continuously evolving mathematics and this fact will remain unchanged (MH07); my dream job is to become an accountant and I believe that it is very important for me to be knowledgeable in mathematics, if I want to fulfil my dream (MH07); mathematics courses are important for everyday life in terms of regular calculations and evaluations made on a daily basis at businesses and other jobs besides its necessity when it comes to certain majors such as engineering, medicine, etc (MH08); it is the key to enter any other major course or major study (MH08); mathematics is important for future careers depending on the desired careers of students (MH08); mathematics is important at the college level, because it is needed to pass the courses (MH09); mathematics is important at the personal level, since I pass through situations that require from me to use some basic knowledge in mathematics (MH09); mathematics is not important at the professional level as the calculations can be done by using computers (MH09); mathematics is important for my desired career in the future, in particular the basic course of* *mathematics is important for business majors (MH09); mathematics is important at the college, personal, and professional levels, because mathematics has been used in everything, specially technology (MH10); mathematics is important for my desired career in the future, because architectural engineers have to perform certain calculations and all are related to the basics in mathematics (MH10); mathematics is very important at all the different levels of my daily life and without mathematics nothing is going to work in a good way (MH11); I take mathematics courses, because I am a business student majoring in accounting and I want to learn the concepts related to calculating money and without having the knowledge about the basic of mathematics, it may be difficult for me to succeed in my major (MH11); mathematics is very important for my desired career in the future as my dream is to become an accountant and the major of accounting implies having the knowledge about the basics of mathematics (MH11); mathematics is needed in my daily life and academic life and without mathematics, I will not be able to do simple life tasks (MH12); my desired career in the future is to work in the field of engineering and engineers need mathematics in order to be able to do their job (MH12); mathematics is not important, because I do not use it in my daily life (MH13); I do not believe that mathematics is important for my desired career in the future (MH13); I need mathematics in my daily life when it comes to personal issues (MH14); I use mathematics in order to know how much I need for my priorities per day (MH14); most professions need mathematics such as physicians who need to have knowledge in mathematics in order to do calculations for several medical things (MH14); I am an electrical engineering student and I need mathematics courses for my major and my desired career, because electrical engineering is all about measurements such as the length and the current flowing through a wire with a certain dimension (MH14); mathematics is important specially at the school level, since it provides students with the basics needed for them to succeed* *in the future (MH15); mathematics is very important and helpful for me in my simple everyday life, because I use it in a daily basis such as in the grocery store or even if I am buying a new shirt (MH16); I take mathematics courses, because I am doing my undergraduate degree in civil engineering and mathematics courses are compulsory courses for me (MH16); mathematics is important for my desired career in the future, because as a civil engineering student, I need mathematics for my future career (MH16); mathematics is important at the college, personal, and professional levels, since it is required at every field and everywhere and it is called the mother of science (MH17); I am a computer engineering student and I think mathematics is important for my desired career in the future, since in every computer programme, there is a need for mathematics and it is not possible to run any programme without mathematics (MH17).*

Based on the above expressions and terms, the subscale of importance and necessity of mathematics as one dimension that motivates students to succeed in undergraduate introductory mathematics courses has been deeply elaborated. The expressions made by respondents reflect their awareness of the important and substantial role of mathematics at the personal level, college level, and professional level which is ultimately behind the urge and desire of students to study and succeed in mathematics courses. Moreover, it has been indicated that mathematics is closely connected with several disciplines such as sciences, civil engineering, mechanical engineering, electrical engineering, computer engineering, architecture, information technology, medicine, accounting, banking, finance, business administration, and day-to-day living. The perceived importance and necessity or value of mathematics has been related to the perceived value of a task (Bong 1996). There is a positive correlation between the perceived value of a mathematical task and students' motivation. Therefore, students should be enlightened about the purpose and value of mathematical theories and how these theories might be applied in solving real-life problems in order to promote their value to students. It has been expressed by the students in the interviews that understanding the practical and applied aspect of the mathematical theories makes more sense to students and develops their understanding.

It has been shown in research that students' motivation to succeed in mathematics is facilitated or inhibited by enhancing students' understanding of the value of mathematics and its instrumental worth (Dowson & McInerney 2004). This is well advocated by the expectancy-value theory (Wigfield & Eccles 2000) that includes the utility value of a task as a significant element of motivation (Eccles 2005) which proposes that the importance of an activity is due to a future goal such as advancing someone's career prospects. The respondents admitted during the interviews about the instrumental value of mathematics as a significant prerequisite for various majors and professions such as sciences, civil engineering, mechanical engineering, electrical engineering, computer engineering, architecture, information technology, medicine, accounting, banking, finance, and business administration. Therefore, the awareness of students about the instrumental value of mathematics motivates them to succeed in undergraduate introductory mathematics courses.

5.3.2 Perception of Success in Mathematics

Several terms and expressions have been articulated by the respondents during the semi-structured interviews which clearly reflect how they perceive mathematics and success in mathematics. These terms and expressions are summarised in the following: *mathematics teaches* *me logical and reasonable thinking skills and everything about numerical facts (MH01); the accurate reading and analysis of mathematical problems motivates me to succeed in mathematics courses (MH01); the careful reading and understanding of mathematical problems is almost half of the solution (MH01); thinking about solutions while I am solving questions and putting in my mind that I want to find the solution motivates me and challenges me to succeed in mathematics courses (MH01); my passion for mathematics and my good understanding of the topics motivates me to succeed in mathematics courses (MH01); mathematics is a sport for my brain and I am already passionate about the subject (MH01); the human brain is more developed at the college level and it requires harder questions to think about compared to my level at school (MH01); mathematics is like a puzzle and whenever I discover something new in mathematics, another puzzle soon follows it (MH02); I like to discover new concepts and formulas and mathematics provides me with a great environment to achieve that (MH02); I feel that I am in the other world whenever I am inside the classroom of mathematics, because mathematics has its own dimension to be exact (MH02); the best approach to do well in mathematics is to practice and solve many mathematical problems in real life applications (MH02); I use mathematics equations to calculate speed, acceleration, and distance to travel from one city to another city inside the UAE (MH02); learning the concepts of trigonometry has immensely motivated me to succeed in mathematics (MH02); mathematics is like solving a puzzle for me and once I succeed in solving it, I will reach the best enjoyable feelings (MH02); mathematics has been always a subject that motivates me to be more creative (MH02); I take mathematics courses, because they are college requirements and I have to take them (MH03); presenting a challenge to students motivates them to succeed in mathematics courses, because when students are challenged intellectually, nearly most of them react with enthusiasm (MH03); recreational mathematics may motivate students to* *succeed in mathematics courses (MH03); I have to pass the class so that I can move on and never take a mathematics course again (MH03); mathematics is a factual subject. For example, the sum of 1 + 1 will never change. It equals two today and it will remain two forever (MH04); mathematics courses help me to solve complex issues and problems in a very short time, because it helps in converting word problems into simple equations (MH04); one of the useful approaches to motivate students succeed in mathematics is to understand how mathematics is powerful in solving real life applications (MH04); the best approach to do well in mathematics is to understand why the mathematical theories and equations have been developed and to apply them in my daily life in a decent way through intensive practice and one-to-one discussion with the instructors (MH04); I was recently motivated to learn the concept of fundamental theory in calculus, because it provided me with the opportunity to see the function in its future with infinity and to know its behaviour in a very short time which is zero (MH04); students should not be asked to memorise mathematical formulas, but they should be taught how to apply and use mathematical formulas to solve real life applications, because if a student does not understand why and how to use a specific mathematical formula, the student will not be able to use the formula even if the formula is provided to the student (MH04); the negative suggestions or word-of-mouth from negative people towards mathematics can lead me to become afraid from mathematics or demotivated to succeed in mathematics courses (MH06); understanding the practicality of mathematics motivates me to succeed in mathematics courses (MH07); the best approach to do well in mathematics is to understand its practice in the real world and how it can be used in different circumstances (MH07); I was recently introduced to learn probability and how to calculate the chances of different event outcomes and this was to me a very interesting subject, because I personally always like challenges, puzzles and this lesson includes puzzles and* *games that motivate me to succeed (MH07); mathematics is more like games with numbers and clues but in form of a problem solving (MH08); mathematics courses can be expressed in forms of games, face-to-face challenges, oral tests, and even daily brain exercises (MH08); I take mathematics courses, because of my belief that I should know the basics of mathematics and because taking mathematics courses is a requirement for me, not an option (MH09); I take mathematics courses, because my major depends on mathematics which will help me later on (MH10); I take mathematics courses in order to use the gained skills in my life (MH11); I take mathematics courses, because they are part of my major requirements (MH12); teaching students about the importance of mathematics and its significance in real life applications is the best approach to do well in mathematics courses (MH12); showing students how to enjoy solving mathematical problems motivates me to succeed in mathematics courses (MH12); I take mathematics courses, because I am forced to take mathematics at school and college (MH13); challenging students in understanding a concept or in solving a question is a useful approach that motivates students to succeed in mathematics courses (MH14); the challenge approach is the best approach for me to do well in mathematics, because this approach always encourages me to figure out how something is done or how it happens (MH14); I enjoy my time when I am given a mathematical formula and when I use the formula to solve the real life application problem and interpret the solution (MH14); students should be taught how to understand the use of mathematical formulas instead of memorising them, because formulas will not be useful for students even when they are given to students, if students do not understand how to use the formulas (MH14); I take mathematics courses, because they help me to become smarter (MH15); my major is engineering and I believe that mathematics is important for my desired career in the future (MH16); I feel comfortable inside the classroom of mathematics and I understand well* *depending on who is teaching and how the subject is taught (MH16); I take mathematics courses, because I am an engineering student and I am interested in mathematics (MH17); mathematics is the base in the field of engineering and everything is strictly connected with mathematics (MH17).*

The previous expressions and terms reflect students' perceptions of mathematics and perceptions of success in mathematics which make perfect sense to students and shape one dimension of their motivation to succeed in undergraduate introductory mathematics courses. The perceptions of students have also implications on teaching and learning of mathematics. For instance, the perceptions of some students about mathematics are based on using numbers to solve problems and the motivation of these students to learn and succeed in mathematics may boost and preserve as long as more numbers are used or different methods are created to connect numbers with the area of mathematics taught to them. This group of students believes that mathematics is about numbers or numerical facts which supply them with the excitement and motivation to succeed in mathematics courses. Moreover, students, who perceive success in mathematics as understanding how to use mathematical formulas instead of memorising them, will create their own techniques to excel in mathematics. Applying and learning mathematical formulas does not only instil the formulas in students' memories, but also the intensive practice supports in developing students' memory capabilities.

Furthermore, some students perceive mathematics as a magic which provides them with the necessary quantitative methods to understand and solve the secrets and puzzles of the world. This group of students will be motivated whenever new concepts, formulas, and theories are introduced to them because of their confidence that this approach will pave the way for them to explore and understand the hidden secrets of the world. Being mesmerised with the magic of mathematics is easy; however, such mesmerisation may crystallise into ideas and knowledge which can be applied in various courses, if it is appropriately comprehended and appreciated. Mathematics plays a distinguished role in other courses and subjects at the college level, since it is an entry requirement to many majors.

The above students' perceptions of success in mathematics have a lot of implications on the instructors inside the classroom. This implies finding out how the instructors can accommodate all these diverse perceptions into one consistent motivation for the delivery of the lesson, and whether the instructors will be able to motivate different students in the same way and at the same level while they teach mathematics. Therefore, it is worthy to shed the light on the role of the instructor as a facilitating or inhibiting factor inside or outside the classroom. The students who possess the perception about mathematics as an application of theory will be expecting to get exposed to more methods of applying every theory taught to them. The comprehension and appreciation of these students is subject to the number of application problems delivered and solved during the mathematics lesson. Some respondents articulated that understanding mathematical theories can be facilitated by solving real life application problems which definitely fosters students' motivation to understand and succeed in other future mathematics topics. The students who possess the perception about mathematics as a sport that stimulates their brain will be expecting to be challenged and accomplish something important during their learning process. The students who possess the perception about mathematics as a right or wrong experience will have good feelings whenever they solve the mathematical problems correctly. Some respondents expressed that they become confused and frustrated when they get wrong solutions.

5.3.3 Enjoyment of Mathematics

The respondents articulated several terms and expressions during the semi-structured interviews which clearly reflect their enjoyment of mathematics. These terms and expressions are summarised in the following: *I feel excited inside the classroom of mathematics, because I like mathematics and love solving problems that require thinking (MH01); I enjoy understanding mathematics and its applications in real life, but I do not enjoy memorising mathematical formulas (MH01); mathematics courses are interesting and enjoyable and I enjoy dealing with numbers (MH01); I enjoy learning new ideas and tips from my enthusiastic instructors and I learn new things day by day (MH02); mathematics courses are interesting, because they provide me with a challenging environment to squeeze my mind both mentally and physically (MH02); I feel anxious when I am inside the classroom of mathematics and I cannot wait until the class is over (MH03); I sometimes feel sleepy and bored, because I hate mathematics; mathematics courses are boring (MH03); I feel that I am looking to the world from different angles or from another planet whenever I am inside the classroom of mathematics (MH04); mathematics courses are very interesting for me, because they are powerful and useful (MH04); I take mathematics courses, because they are fun courses for me that I like them so much (MH05); I feel happy inside the classroom of mathematics (MH05); mathematics courses are enjoyable, because I can understand them well and because they do not rely on memorising (MH05); mathematics courses are interesting for me, since they provide me with the opportunity to learn new things*

(MH05); I feel very comfortable and relaxed inside the classroom of mathematics (MH06); mathematics courses are interesting and enjoyable, especially while I am answering questions and I am confident about my answers (MH06); it is very hard for me to describe my feelings when I am in a mathematics class, because my feelings are always on a roller coaster ride especially in mathematics classes (MH07); most of the time mathematics courses are interesting and enjoyable (MH07); sometimes, there are some lessons that do not make sense to me and I do not see their practical value, so I find them very less interesting (MH07); there are other times when questions come up in the form of puzzles and I always love good challenges (MH07); I get a little bored as a student inside the classroom of mathematics, because I have to pay full attention at the professor while explaining a certain point (MH08); I have always had fun in doing mathematics and putting my efforts into it, since it does not only measure my intelligence, but also identifies my perspectives and points of view (MH08); I think mathematics courses are interesting and enjoyable (MH08); I feel bored when I am inside the classroom of mathematics (MH09); mathematics courses are neither interesting nor enjoyable (MH09); I actually enjoy my time inside the classroom of mathematics, since I love calculations and solving problems (MH10); mathematics courses are interesting, because they rely on understanding and they do not have anything to do with memorising (MH10); for me, the class of mathematics is interesting, since I get the chance to answer, participate, and engage in the discussion (MH11); mathematics courses are interesting, since they give me a room to participate more in the classroom activities (MH11); I do not have any specific feelings toward mathematics classes; sometimes, I feel bored and sometimes the topic may interest me (MH12); I love mathematics and enjoy solving mathematical problems and I think mathematics courses are interesting and enjoyable (MH12); I feel confused inside the classroom of mathematics due to the difficulty of the subject (MH13); I

do not think mathematics courses are interesting and enjoyable all the time, it depends on the lesson (MH13); my feelings inside the classroom of mathematics depend on the topic explained by the instructor and whether I understand it or not (MH14); when I face no trouble understanding the concept of a topic, I enjoy the class of mathematics (MH14); mathematics courses are interesting and enjoyable, because I find that solving a question is as interesting as cracking a code (MH14); I feel so good inside the classroom of mathematics and I am all the time focused and concentrated; I like mathematics as it is a fun subject for me and I think mathematics courses are interesting and enjoyable, because they are more like mind games (MH15); mathematics courses are interesting, but they were never enjoyable for me (MH16); I hate memorising mathematical formulas, because I usually forget all the formulas after I finish the course (MH16); mathematics courses are interesting and enjoyable, because I like mathematics (MH17).

It has been indicated through the previous expressions and terms that the majority of students find mathematics interesting and enjoyable, and this constitutes another dimension of students' motivation to succeed in undergraduate introductory mathematics courses. The expressions indicate that motivated students to learn mathematics have enjoyment and interest in doing mathematics as well as strong belief in the usefulness of mathematics in their education and their future careers and endeavors. It has been clarified through the self-determination theory of Deci and Ryan (1985) that intrinsically motivated students experience enjoyment and interest, and they are more likely to spend persistence and effort on their desired activities. Schiefele et al. (1992) emphasise that students' attributions of high value to a specific subject area usually allow the motivational variable of enjoyment and interest to be instiled in students' minds. For instance, some of the students expressed during the interviews that they enjoy learning mathematics, because of several reasons such as they love to calculate and solve problems, they are good at mathematics, mathematics courses are fun courses, mathematics courses rely on understanding instead of memorising, and mathematics courses provide them with a challenging environment to squeeze their minds mentally and physically. Other students enjoy mathematics for other reasons such as being taught by good and enthusiastic instructors and getting the opportunity to get exposed to the real-life applications of mathematics. The success of students in mathematics is strongly predicted by the quality of their experience in mathematics class, which is mainly and strongly predicted by the enjoyment and interest of students in mathematics (Schiefele et al. 1992).

The three measures of students' intrinsic motivation which are importance and necessity of mathematics, perception of success in mathematics, and enjoyment of mathematics have been discussed above, and the plausibility of these three measures was neither questioned nor assumed to be ambiguous during the in-depth interviews with students.

5.3.4 Extrinsic Motivation

Ryan and Deci (2000) argue that the existence of intrinsic motivation variables only might not be sufficient without the existence of extrinsic motivation variables, especially if a particular activity is considered to be not interesting or enjoyable. It has been indicated in the literature that many learning activities are intrinsically and extrinsically motivated (Eccles et al. 1993; Wigfield & Eccles 2000). This implies that students may take mathematics or work on a specific mathematical activity due to their interest in the subject and their enjoyment of solving mathematics problems as well as due to being extrinsically motivated to excel in their exams. Therefore, the intrinsic and extrinsic motivation processes are simply not opposite to each other. However, the extrinsic motivation process complements in reality the intrinsic motivation process and both processes have proven to be reasonably correlated (Wigfield & Eccles 1992, 2000).

Various terms and expressions have been articulated by the respondents during the semi-structured interviews which clearly reflect how students are extrinsically motivated. These terms and expressions are summarised in the following: *mathematics is very important for my major and I try to work hard to do well and pass mathematics courses with high grades and this motivates me in mathematics (MH01); I have the passion to work in the academia as a professor and researcher in science in the field of physics and I cannot achieve my dream without mathematics (MH04); I may consider taking mathematics courses, if they are needed for my graduation (MH07); I believe that reducing the number of classes, reducing the amount of lessons, and lowering the passing grade are useful approaches that motivate students to succeed in mathematics courses (MH09); knowing that I have to finish mathematics courses in order to graduate and work motivates me to pass these courses (MH12); getting good marks motivates me to succeed in mathematics (MH13).*

The previous expressions affirm the steady relationship between extrinsic motivators and the process of learning mathematics, and explain how grades and other incentives play a role in influencing students' motivation to succeed in introductory mathematics courses. The qualitative results have not only enlightened and expanded on the quantitative analysis, but they have also added value to the current knowledge about students' motivation factors. Therefore, mathematics instructors and administrations of academic institutions have to understand that grades are not only used by students to reap the fruits of their labour and evaluate their performance in mathematics, but they also serve as extrinsic motivators for students.

It is not only that the behaviours in specific academic courses are influenced by the perceived extrinsic motivating factors, but also the general behaviours of the academic institution such as persistence in college. It has been clarified by Dowson and McInerney (2004) that facilitating or inhibiting students' motivation to achieve or persist at the college determines the level of how much students value the college for its instrumental worth. It has been mentioned earlier that the expectancy-value theory (Wigfield & Eccles 2000) includes the utility value of a task as a significant element of motivation (Eccles 2005) which proposes that the importance of an activity is related to a future goal such as advancing someone’s career prospects. The expectancy-value theory also explains that students, who are confident in their ability to succeed in mathematics courses, are not likely to invest effort in studying mathematics courses, if they do not value and appreciate taking mathematics courses or the rewards that successful completion may bring to them such as good grades or good career opportunities (Eccles et al. 1993; Wigfield & Eccles 1992, 2000). Hence, it is very significant to address the intrinsic value aspects and the extrinsic expectancy aspects of students' motivation in order to promote students' motivation to succeed in undergraduate introductory mathematics courses. In other words, the two aspects of motivation complement each other and both aspects should be given proper attention to work in harmony with each other.

5.4 Mathematics Self-Concept Themes

It has been mentioned earlier that self-concept is defined in general as the perceptions of individuals about themselves which are developed as a result of individuals' interaction and experience with the environment, and they are influenced by evaluations and reinforcements of significant other individuals (Shavelson et al. 1976; Shavelson & Bolus 1982). According to Rosenberg (1979), self-concept is made up of self-esteem, self-confidence, stability, and self-crystallisation which all reflect the belief of someone about her or his ability to produce outcomes and results, achieve objectives and goals, or perform tasks competently. It has been discussed that the general self-concept is global in its nature and it is made up of academic self-concept and non-academic self-concept. The specific behaviours and self-perceptions in the academic self-concept influence its subareas such as mathematics self-concept, English self-concept, science self-concept, or history self-concept.

The semi-structured interviews aimed at providing the respondents with an opportunity to indicate how they perceive themselves in relation to their confidence and ability to succeed in undergraduate introductory mathematics courses. The terms and expressions that reflect the mathematics self-concept of students are summarised in the following: *I am good at mathematics, because I like solving problems related to mathematics (MH01); I plan to take more courses in mathematics, because I like to have a greater knowledge about mathematics and I like hard challenges (MH01); my prior performance in mathematics at the school level is the base for mathematics at the college level, and the good understanding of the basics at the school level supports me to perform well in mathematics at the college level (MH01); my perception that I am good at mathematics motivates me to focus more and work harder to succeed in mathematics* *courses at the college level (MH01); I am an average student in mathematics and I have a long path to walk in order to be good at mathematics (MH02); mathematics at the college level is easier than mathematics at the school level, since at school I had to learn from the very basic to complex mathematics equations, unlike at university where I just have to practically apply the concepts learnt at school and research them (MH02); I do not prefer to take mathematics courses more than the required mathematics courses for my major (MH02); I prefer to take algebra and calculus separately because calculus requires me to spend many hours on practicing algebra in order to do well in calculus (MH02); I have been always positive about mathematics and I think that having a strong foundation in mathematics at the school level will be a key to my success in mathematics at the college level (MH02); my mathematical abilities influence my motivation to succeed in mathematics courses (MH02); I am not good at mathematics, because I hate mathematics and I do not expect myself to be good at mathematics (MH03); mathematics was harder for me when I was at school compared to the college, because the materials taught at school was hard, more complicated, and takes more time to be understood (MH03); I do not plan to take more mathematics courses than required at the college level, because I do not like mathematics (MH03); my performance in mathematics at school was terrible, I believe that my performance at college maybe the same (MH03); some past events may influence my ability to control what happens to me in the future (MH03); having a bad experience with mathematics at school can affect my ability to understand mathematics and be good in it at college (MH03); I got 100 in mathematics at high school and when it comes to linear equation, multi variable calculus and differential equations, I just can understand them perfectly (MH04); mathematics at the college level is the same at the school level; however, at the college level I can apply what I learn in mathematics by working on research studies and projects (MH04); I do not plan to take more* *mathematics courses than the required at the college level, because I plan to take only the necessary courses for me to graduate (MH04); mathematics is a language and I rely on what I learnt at school as the foundation which influences my performance in mathematics at the college level (MH04); my perceptions about my abilities in mathematics influence my motivation to succeed in mathematics courses and this was obvious for me when I passed the mathematics placement test and that impacted positively my motivation to succeed in the calculus course (MH04); my latest results in mathematics courses were good so I believe I am good at mathematics (MH05); I have finished one course of mathematics at the college level so far and I feel that mathematics at the college level is not difficult compared with mathematics at the school level (MH05); I plan to take more mathematics courses than required, because I am good at mathematics and I find mathematics to be enjoyable and fun subject which is very important even after my graduation from the college (MH05); my perceptions influence my motivation to succeed in mathematics courses because if I tell myself that I am not good at mathematics, I will not be able to understand anything; but, if I believe in my abilities, I will work harder to understand what I find it to be difficult (MH05); the mathematics course was easy for me and I did not face difficulties during the course (MH06); I am good at mathematics, because sometimes I solve mathematical problems and puzzles and I feel excited while solving them (MH06); mathematics at the college level is easy, simple, and not complicated in comparison to mathematics at the school level (MH06); the taught materials at school are huge in quantity and were not taught properly which makes mathematics hard for students (MH06); I have no plans to take more mathematics courses than the required, because I do not need them for my major and I already know the important things about mathematics and no need for me to go in-depth at mathematics (MH06); my prior performance in mathematics at the school level does not influence my* *perceptions about my performance in mathematics at the college level, because mathematics at the college level is taught in an easy way to understand (MH07); I am good at mathematics, because I always pass with good grades in mathematics courses and I also tend to use the gained knowledge from mathematics and apply it as much as I can in my daily life (MH08); I think mathematics at the college level is more difficult than mathematics at the school level not because I am taught something new, but mainly because the knowledge I gained at school was very basic (MH08); I do not plan to take additional mathematics courses, if they are not required, because I want to finish my college studies faster (MH08); the mathematics basics I learnt at school give me the leading edge in college studies at mathematics over my college colleagues (MH08); the basics in mathematics are the keys to success and will be used at all levels of mathematics courses (MH08); my perceptions about my mathematical abilities matter and influence my motivation to succeed in mathematics courses (MH08); students have different perceptions and that is why if a problem is given to a group of students, the final solution to the problem might be found in different ways and styles by different students (MH08); if I develop a perception about myself by looking at the question and saying this is an easy question, I will be very willing to attempt solving the question with great confidence (MH08); if I develop a perception that the question is very complicated and I do not have the ability to solve it, I will not even attempt to solve the question in order to save my time (MH08); I never was an A student at mathematics, neither a B student (MH09); I am an average student at mathematics, because I have been told that I am more of a theoretical person not very much involved with calculations, logic, and problem solving (MH09); mathematics at the college level is more brief and applied compared to mathematics at the school level, since it carries this sort of ease that does not get me confused (MH09); I do not intend to take more courses of mathematics if they are not required;*

however, I never stop playing games related to mathematics and calculations, because I get so much benefit from them (MH09); I did not used to do well in mathematics at school and that did not affect my performance at college, since I try to have positive perceptions about myself at college (MH09); my perceptions about my mathematical abilities influence my motivation to succeed in mathematics, because I believe that all it takes from a student to like a subject and have the desire to succeed at it is to have positive perceptions; otherwise, students will not be motivated to succeed or do any good, if what all they do is complaining about mathematics (MH09); I am not really good at mathematics, because I usually forget everything and how to solve when the semester is over (MH09); I believe that mathematics is more difficult at school, because students at school are taught everything in mathematics in contrary to mathematics taught at college which concentrates on the important things related to student's major (MH09); I do not want to take mathematics courses, if they are not required, because I do not like mathematics (MH09); my prior performance in mathematics at the school level influences my perceptions about my performance in mathematics at the college level, because I am always at the same level and what I get in the college is like what I used to get in school (MH09); my perceptions about my mathematical abilities influence my motivation to succeed in mathematics courses as when I feel that something is difficult, it makes it difficult for me to study it (MH09); I am good at mathematics, since I personally enjoy understanding this subject (MH10); mathematics is the same at the school level and at the college level and the difficulty will be something that helps students in their majors (MH10); I do not plan to take any additional mathematics courses, if they are not required, because my university will ask me to take only the courses that I absolutely need in my major (MH10); I am so good at mathematics, because I like this subject; mathematics taught at the school level was basic and easy, but it is taught in-depth *at the college level (MH11); I do not plan to take additional mathematics courses, if they are not required as part of my major (MH11); as long as I have positive perceptions about my mathematical abilities and I learn mathematics, it becomes easier and I become more motivated and interested in it (MH11); I always get good grades in mathematics courses and I think I am good at mathematics (MH12); mathematics is more difficult at the college level compared to the school level, because it is inclusive of more specific information (MH12); I do not want to take any mathematics courses which are not required from me at the college level, because I want to graduate quickly (MH12); I am an average student at mathematics and I need more practice (MH13); mathematics is difficult at both the school level and the college level, because the material of mathematics is the same at all levels (MH13); I have no plans to take additional mathematics courses, if they are not required (MH13); I am good at mathematics as I enjoy it (MH14); mathematics is more difficult at the college level compared to the school level, because the amount of materials taught at school is similar to the amount of materials taught at college, but the material is taught at school over a longer period of time; the material taught at the college level is an advanced level of mathematics (MH14); I have no plan to take mathematics courses, if they are not required, because I would like to graduate as soon as possible (MH14); I may take more mathematics courses after I graduate (MH14); succeeding in mathematics depends on how I feel about the subject; if I ever keep in mind that the subject is hard, I will actually suffer in succeeding in it (MH14); I am good at mathematics, because it is my favourite subject (MH15); mathematics is a little bit difficult at the college level in comparison with the school level, since it contains more details at the college level (MH15); I plan to take additional courses of mathematics, if they are not required, because they are always helpful (MH15); the information taught at school is different from the information taught at college; therefore, the* *student's performance in mathematics at school may not influence student's performance in mathematics at college (MH15); I cannot say I am good at mathematics, but I can just say that I am not bad at it (MH16); mathematics is more difficult at the college level compared to the school level, because at the college level, mathematics is way detailed and it prepares students to the real life job such as civil engineers and this is why it has to be more difficult (MH16); I do not plan to take mathematics courses, if they are not required, because I personally do not enjoy doing mathematics (MH16); my prior performance in mathematics at the school level influences my perceptions about my performance in mathematics at the college level, because if my background about mathematics was not built in the right way at school, I would find difficulties in understanding what is given in the lecture at university (MH16); my perceptions about my mathematical abilities influence my motivation to succeed in mathematics courses, since whenever I do something I do not like, I never give everything to it; but, once I do the things I like and prefer, I would give my full potential and be the best at it in the field (MH16); I am good at mathematics, because I am interested in mathematics and I got good scores in mathematics courses (MH17); everything including mathematics is easy for me, if I work hard and I have interest in the subject (MH17); I plan to take more courses of mathematics , because they are more needed at the college level and will be helpful for me (MH17).*

The previous expressions and terms reflect that students' experiences and interactions with the environment have shaped their self-perceptions of academic ability, confidence, effort, competence, like, dislike, fear, societal stereotypical notion, goal, and achievement which all are related to students' motivation to succeed in introductory mathematics courses (Valentine et al. 2004; O'Mara et al. 2006). The previous expressions and terms do not only constitute the themes of mathematics self-concept, but they also lie behind some of the features of the attribution theory of motivation (Weiner 1985) to the learning process of mathematics.

It is worthy to say that students' self-confidence in learning college mathematics is the most significant of these features. For many years, self-confidence has been a key variable in the study of mathematics, and it is indicated in the above expressions that self-confidence in the ability to learn mathematics was mentioned more than any variable of the other aforementioned variables. The responses reveal that students, who are confident about their mathematical abilities, are more comfortable when they are confronted by mathematical problems. This implies that assisting students to develop self-confidence in mathematics is not only significant for its own moral virtues, but will also support in promoting students' motivation to succeed in mathematics. Therefore, students who possess high level of self-confidence are highly motivated to succeed in mathematics when compared with students who possess low level of self-confidence. Several obvious expressions have been articulated by confident students to describe themselves such as being always good at mathematics, being confident about their abilities to learn mathematics, and having positive attitudes toward mathematics.

Based on the previous terms and expressions, it has been realised that the effort made by students to learn mathematics is another variable of mathematics self-concept which is related to self-confidence. It has been indicated by some of the responses that students have a feeling of their ability to control their success in mathematics. The students feel that their success in mathematics is conditional to their actions such as the effort exerted by them to learn mathematics. Weiner (1985) proposes that the persistence of successful students in their efforts to learn mathematics is due to students' feeling that efforts end up with success. Thus, effort is very significant for its own value and its positive influence on learning mathematics.

Mathematics ability and mathematics talent are also another two features of mathematics self-concept which were mentioned by students during the semi-structured interviews. It has been expressed by some students that mathematics ability and talent provide them with an opportunity to achieve quick learning of mathematics and confrontation of complicated mathematics problems with ease. Students feel that mathematics ability and mathematics talent are divinely granted for only some people. This feeling advocates without any doubt the close relationship between innate ability and quick learning which is found by the research study of Dweck (2002). On the other hand, some students believe that not every student has the talent; however, every student has the ability to study and succeed in mathematics. These students adopt in general an incremental instead of entity view of mathematics ability and the incremental theory of mathematics ability explained by Dwech (2002) as the theory in which the mathematical skills of students can be improved overtime and with hard work and persistence.

It has been expressed by students that there is a close relationship between students' effort and students' ability in mathematics. The students believe that a little effort to succeed in mathematics is needed from students with high ability in mathematics; meanwhile, more effort to succeed in mathematics is required from students who have low ability in mathematics. The students think that effort and ability are pliable, since they can be increased or decreased; however, they feel that talent is fixed. The concept of mathematics ability is translated into students' belief in themselves that they can succeed in mathematics courses and they can solve all the mathematical problems given to them. Brophy (1999) illustrates that the translation of mathematics ability into positive perceptions of success in mathematics courses is subject to effort-outcome covariation, internal locus of control, concept of self, sense of efficacy, competence, incremental concept of ability, and attribution of successful results to internal and controllable causes. Therefore, a sufficient effort should be exerted to support students, who are unconfident of passing introductory mathematics courses, in acquiring expectations, attitudes and attributions which are relevant to success before they can take mathematics courses with consistent goal-directed efforts.

It has been recognised through the interviews that the general fear of mathematics in the society is another significant self-perception of students. Some students feel that the majority of students have the potential to learn and succeed in mathematics, but the general fear of mathematics and the negative word-of-mouth about mathematics restricts this potential of students. The students' expectations of failure and anxiety tend to diminish students' motivation to succeed in mathematics even if mathematics is at an intermediate or low level of difficulty. Hence, most of the respondents have no plans and are reluctant to take additional courses of mathematics, if they are not required from them as part of their plan of study. Jackson and Leffingwell (1999) suggest that the insensitive and uncaring attitudes of teachers and instructors from elementary school through college result sometimes in this epistemological dimension of mathematics anxiety. The role of instructors in the process of teaching and learning mathematics is elaborated below.

5.5 Facilitating Factors Themes

The responses of students during the semi-structured interviews indicate that students' academic cognition, affect, behaviour, and achievement in mathematics are considerably influenced by their internally referenced motivation variables, personal goals, and expectations. This finding is supported by the quantitative analysis of this research study and the reviewed literature (Dowson & McInerney 2004). In spite of the fact that the internal motivations of respondents such as their goals and expectations are expected to develop positive academic behaviours and achievements, the external factors of students' social environment may assist in facilitating or inhibiting the conversion of these internal motivations into actual behaviours (McInerney et al. 2005). The plausibility of the previous deduction is high, since it was affirmed by various social and environmental factors which were expressed by respondents to influence their motivation and success in mathematics. Therefore, the light was shaded through the semi-structured interviews on various social, environmental, and contextual factors which influence students' motivation at their homes or colleges.

Based on the qualitative results, these factors are inclusive of parents and family influence, college environment, instructors, curriculum, educational resources, peers, friends, classmates, and other factors. The expressions and terms articulated by students provide an insight into the role of these factors in the development of students' motivation to succeed in introductory mathematics courses and students' mathematics self-concept, although these factors were not included in the quantitative analysis. The expressions are summarised and organised under their proper facilitating factors such as significant others including parents and family, peers and friends, instructors, and other factors.

5.5.1 Parents and Family Members

Several terms and expressions have been articulated by the respondents during the semi-structured interviews which clearly reflect the influence of parents and other family members on their mathematics self-concept and their motivation to succeed in mathematics courses. These terms and expressions include the following: *when I do not understand something immediately in mathematics, I prefer trying to understand it more than one time, if I still do not understand it, I ask for a help from my brother who is good at mathematics and I want to be like him (MH06); I am an average student at mathematics, because I have been told by my parents and school teachers that I am more of a theoretical person not very much involved with calculations, logic, and problem solving (MH08); if I do not understand something immediately in mathematics, I always seek the help of my father who is a teacher of mathematics, and he always emphasises the importance of mathematics and motivates me (MH10).*

The previous expressions reflect the role of parental and sibling influence in the formation of students' mathematics self-concept and students' motivation to succeed in mathematics courses, although parental and sibling influence was not included in the quantitative analysis in a solid measurement context. The qualitative expressions support the fact that students' behaviours and motivations to succeed in mathematics can be facilitated or inhibited by parental and sibling influence. Grolnick et al. (1991) postulate that the learning and success of students is significantly predicted by the general parental involvement of parents in the education of their children. It has been clarified by Aunola et al. (2003) that parents' beliefs in the general school competence enhance the task-focused behaviours of children at school, and parents' beliefs in the competence of children in mathematics is a direct contributor of children's higher performance in mathematics. Hence, it is believed that the involvement of parents and siblings in their children's education promotes children's social behaviours and their interactions with peers and develops the formation of self-concept.

Parents, siblings, and other family members are the first point of reference in children's social development and they are considered as role models for children. Thus, it can be said that the charity starts at home. In general, there is a belief that some of the characteristics of children are inherited from their parents. In specific, if a parent has some talent in a special area such as mathematics, the children of that parent are expected by the society to succeed in mathematics and this was admitted by some students. From another side, some parents may instil negative perceptions in the minds of their children which ultimately inhibit the learning process and achievement of children and this was acknowledged by one of the students.

5.5.2 Peers and Friends

The responses of students also reflect the role played by peers and friends on students' mathematics self-concept and students' motivation to succeed in mathematics. The relevant propositions and findings are captured in few expressions during the interviews and they include the following: *inside the classroom, I ask my colleagues for help sometimes (MH02); I usually study at my friend's house after I take the lecture of mathematics with the professor, since I understand and learn faster when I am alone with a person or two, not a group of people (MH08); I was recently motivated to succeed in mathematics when I studied with a group of my colleagues (MH09); I usually study with my friends in groups, if I do not understand something* *immediately in mathematics (MH11); I usually seek the help from my friends whenever I do not understand something immediately in mathematics (MH13); I ask help from a friend to understand difficult things in mathematics (MH14); I was recently motivated to succeed in mathematics by my friends who helped me to prepare for exams (MH16); if I do not understand something immediately in mathematics, I ask my friend (MH17).*

It is obvious that there is a constant interaction between classmates and college mates in general and when they need help from each other in some courses in particular. Fredericks et al. (2004) illustrate that the quantity and quality of interactions amongst peers may have significant impact on the academic performance of students and the culture and behaviour of schools. Therefore, the perceived emotional and social support from peers has positive effects on students' motivation to succeed in mathematics. The above terms and expressions are additional findings from the semi-structured interviews on students' mathematics self-concept and students' motivation, since this research study was not designed to particularly examine the impact of peer interactions on learning and succeeding in introductory mathematics courses.

5.5.3 Instructors

The formation of students' mathematics self-concept and student's motivation to succeed in mathematics is influenced by certain significant others such as teachers, instructors, and professors who play a significant role in supporting students to acquire the knowledge or skills that an academic activity is designed to develop. The instructors act like a chain that connects between students' mathematics self-concept and students' motivation to succeed in mathematics. At one end of the chain, instructors are the most prominent source that provides students with feedback about their academic proficiency and self-concept (Stipek 1993) and at the other end of the chain, instructors are the most prominent environment of socialisation that promotes students' motivation to learn (Brophy 1999, 2013). Hence, a powerful influence on the formation of students' academic perceptions and aspirations, and the development of academic behaviours can be exerted by instructors.

Numerous terms and expressions have been articulated by the respondents during the semi-structured interviews which clearly reflect the influence of instructors on their mathematics self-concept and their motivation to succeed in mathematics courses. These terms and expressions include the following: *I directly ask my instructors to repeat for me or I ask my instructors during their office hours for help, if I do not understand something immediately in mathematics (MH01); I always stay in touch with my instructors to discuss with them my questions and get reliable answers (MH02); I ask my instructors who have the ability to answer my questions properly (MH04); the teaching style of mathematics at high school depends on memorising; however, it depends more on understanding at the college level (MH04); I always ask my instructors, if I do not understand something in mathematics (MH04); I prefer mathematics courses more than other courses, especially if the instructors of mathematics have excellent teaching skills (MH05); I am usually motivated to succeed in mathematics courses whenever the instructors are enthusiastic, make the class interesting to students, do not make students feel that mathematics is complicated and hard to understand, and try to make some interesting activities that students can enjoy and make them feel mathematics is easy (MH06); I am an average student at mathematics, because I have been told by my parents and school teachers that I am more of a theoretical person not very much involved with calculations, logic, and problem solving (MH08);*

the instructor's teaching style depends on talking and explaining only (MH09); when I do not understand something in mathematics, I usually ask my instructors for further explanation (MH09); the best approach to do well in mathematics courses depends on the instructor's teaching style, because good instructors should force students to understand the mathematical concepts rather than memorising them (MH10); I usually seek my instructor's help, if I do not understand something immediately in mathematics (MH11); I was recently motivated to succeed in mathematics by my instructor who helped me to prepare for exams (MH16); I feel happy and good whenever I am inside the classroom of mathematics, if the instructor is good and can explain the concepts easily; but, if the instructor does not have full control on the subject and the class, the course of mathematics becomes very boring for me (MH17); the best approach to do well in mathematics courses is to have an appropriate and quite classroom environment and skilled instructors in teaching mathematics (MH17); if I do not understand something immediately in mathematics, I visit the instructor during office hours, who is always approachable (MH17).

The previous expressions indicate that the existence of good instructors, clear and simplified teaching style, and instructors' support and engagement in the college environment does not only assist in developing a positive mathematics self-concept of students, but also enhances students' motivation to learn and succeed in introductory mathematics courses. The responses of students reflect that the instructor is viewed as a significant factor in the process of learning mathematics regardless of instructors' experiences. It has been shown by Harter et al. (1992) that there is a strong relationship between the perceived support and encouragement of instructors and the responsible behaviours, intrinsic values, academic aspirations, and enhanced self-concept of students. Furthermore, Op’t Eynde et al. (2006) propose that the positive beliefs of students about their instructors are associated with more positive beliefs about mathematics such as students' confidence in their mathematical abilities.

On the other hand, the formation of students’ mathematics self-concept and motivation to succeed in mathematics can be inhibited by instructors’ negative attitudes, poor teaching, lack of motivation, and pervasive carelessness. It has been indicated in the previous expressions that students’ motivation to succeed in mathematics might be impacted by how much students like or dislike their instructors’ teaching styles. The academic achievement of students is related with students' negative perceptions of instructors and their teaching style in particular subjects such as mathematics, science, and language (Middleton & Spanias 1999; Meyer 2011). Furthermore, students’ mathematics self-concept and students’ motivation to learn mathematics can be inhibited by lack of caring and encouragement from instructors.

The previous points of views indicate that the accountability is placed on the shoulders of teachers, instructors, and professors when it comes to developing students’ motivation to succeed in mathematics. At the first stage, instructors have to create a new culture amongst students in which students can appreciate and value learning mathematics for its potential on self-actualisation and life-application. It has been emphasised by Brophy et al. (1983) that instructors should be able to do two major things in order to motivate students. Firstly, instructors have to create a promising learning environment inside the classroom of mathematics by modeling motivation to learn; minimising students’ performance anxiety; and communicating desirable expectations and attributions such as curiosity, mastery of mathematical skills, understanding of mathematical concepts, and application of mathematical knowledge in daily life situations. Secondly, instructors have to stimulate students' motivation to succeed in mathematics by implementing learning activities that project enthusiasm, embrace task interest and appreciation, make abstract mathematical contents personal and concrete, formulate learning goals, provide informative feedback, and assist students to learn mathematics with meta-cognitive recognition of goals and meta-cognitive control of strategies. Therefore, the educational implications of the role of instructors have to be explored in order to identify the characteristics that students are looking for in a good teacher and whether these characteristics should include instructional skills, emotional support, or some combination of affective and cognitive elements. Since the instructors of mathematics always seek to find methods to accommodate the abundant expectations of students inside the classroom of mathematics, they are the best individuals who should be able to determine what motivates their students to succeed in mathematics.

5.5.4 Learning Resources

The academic achievement and learning of students can be facilitated by the resources used in teaching and learning which play a significant role in promoting students' mathematics self-concept and students' motivation to succeed in mathematics. The relevant findings are captured in several terms and expressions during the interviews which include the following: *I use mathematics in AutoCAD software to simulate the crash test of cars, which if it is done in reality, it might be both dangerous and expensive (MH02); if I do not understand something immediately in mathematics, I try to use online resources like Khan Academy and some online databases (MH02); using the calculator facilitates my learning of mathematics (MH02); the best approach* *that motivates me to succeed in mathematics courses includes watching YouTube videos that illustrate different ways of explanation that can be understood, if I do not understand from my instructor (MH05); I try to watch videos on YouTube and practice more online examples, if I do not understand something immediately in mathematics (MH05); I always use online learning resources such as YouTube and Khan Academy when I do not understand something in mathematics, because this approach is very helpful and usually works out (MH07); if I do not understand something in mathematics, I usually start by looking it up in the notebook and try to understand it alone (MH12); I might also look in the internet for a better explanation (MH14); some useful approaches that motivate students to succeed in mathematics courses include using technology such as the internet and other online resources to understand and clarify doubts (MH16); if I do not understand something immediately in mathematics, I try to search the internet and solve as much examples as I can until I get the idea; in case none of this works out, I visit the Learning Support Centre at my university and ask the mentors (MH16); I sometimes search for online help by using Google and YouTube (MH17); I was recently demotivated to succeed in a mathematics course because of two issues. The first issue is the class size which was too large and the instructor could not help everyone sufficiently. The second issue is the class time which was from 7 pm to 9 pm, and during this time, I usually become tired and sleepy (MH17).*

Based on the previous terms and expressions, it can be concluded that various resources such as textbooks, calculators, tutorials, notes, class size, class time, learning support centre, and other online resources including YouTube, Khan Academy, and Google play a significant role on students' motivation to succeed in mathematics and students' mathematics self-concept. Thus, administrations of academic institution and instructors of mathematics may make use of the aforementioned learning resources in order to promote students' motivation to succeed in mathematics courses.

5.5.5 Other Factors

Several terms and expressions have been articulated by the respondents during the semi-structured interviews which clearly reflect the implications of other factors in facilitating or inhibiting students' motivation to learn and succeed in mathematics. These terms and expressions include the following: *the best approach to do well in mathematics courses requires attending classes on a regular basis, being involved in the class, reviewing the old material notes, and previewing the new lesson materials (MH02); I usually get a tutor to teach me, if I do not understand something immediately in mathematics (MH02); the best approach that motivates me to succeed in mathematics courses includes reading my notes and trying to understand them well and practicing more examples (MH05); the best approach for me to do well in mathematics is to review the notes before the class and practice and solve more problems which make me more confident and feel the exam is easy (MH06); my feelings in mathematics classes depend on three main aspects which are the classroom environment, the taught lesson, and the way it is taught (MH07); before any mathematics lesson, I personally tend to look at the practical side which not only helps me understand the lesson, but also motivates me to succeed (MH07); the best approach for me to do well in mathematics is to pay attention and ask as many questions as I can about any problem solving in order to improve my abilities and become better at mathematics-related major courses (MH08); solving practice questions constantly and taking private lessons* *is the best approach to do well in mathematics courses (MH09); I believe listening to music is a useful approach that motivates students to succeed in mathematics courses (MH10); I usually listen to music while solving mathematical problems and this approach increases my concentration, saves my energy, and helps me enjoy the learning process (MH10); being active inside the classroom is a useful approach that motivates me to succeed in mathematics courses (MH11); the best approach for me to do well in mathematics courses is to study on a regular basis, never accumulate the materials, ask questions, and solve problems (MH11); solving more practice problems is a useful approach that motivates students to succeed in mathematics courses (MH13); the best approach to do well in mathematics is to study on a daily basis (MH14); studying hard and getting tutor are useful approaches that motivate students to succeed in mathematics courses, if students face difficulties in mathematics (MH15); the best approach for me to do well in mathematics courses is to study on a daily basis (MH15); some useful approaches that motivate students to succeed in mathematics courses include taking down notes and revising what is learnt inside the classroom immediately in the same day (MH16); the best approach in my opinion to do well in mathematics is to concentrate inside the classroom and take down notes as much as possible, because mathematics is not like any other subjects, it requires understanding the concepts in order to solve problems (MH16); studying at home on a regular basis and reviewing the materials immediately after the lecture are useful approaches that motivate students to succeed in mathematics courses (MH17).*

The above expressions reflect that students' perceptions of certain other factors also influence their motivation to learn and succeed in introductory mathematics courses. These other factors include solving practice problems on a regular basis, attending classes regularly, paying attention, taking notes, being active inside the classroom, listening to music while solving problems, and integrating the previous knowledge with the current learning in order to improve the likelihood of succeeding in mathematics. It was not possible to integrate the other factors as well as the factors related to the social and college contexts with the quantitative analysis in a solid measurement context. The role of these factors was discussed only through the in-depth dialogue with students who participated in the semi-structured interviews. The research study of McInerney et al. (2005) is considered the closest study which examined these facilitating factors in a solid measurement context. The findings of the study of McInerney et al. (2005) indicate the existence of positive correlations between all the five constructs of value construct, affect construct, peer construct, parent construct, and teacher construct as well as positive correlations between the five constructs and students' GPA which reflect that these positive facilitating factors are also potential predictors of students' academic achievement. The inclusion of these facilitating factors in the current research study in a solid measurement context would have been appropriate; however, their inclusion in this qualitative form is anticipated to enlighten, expand, and enhance the quantitative findings.

5.6 Conclusion

The current research study aimed at examining whether or not there is a relationship between students' mathematics self-concept and students' motivation to succeed in undergraduate introductory mathematics courses. In other words, the thesis attempts to decide whether the motivations of students to succeed in introductory mathematics courses are related to the self-perceptions of students about themselves in relation to learning and succeeding in introductory mathematics courses. This chapter started by scanning and evaluating the qualitative information gathered from the semi-structured interviews with a sample of 17 students. Then, the themes of students' motivation, students' mathematics self-concept, and facilitating factors were identified. It has been shown by the qualitative findings that students enter colleges with several motivations which included engagement in the educational process and development of themselves at the personal level. The self-concept of students and their perceptions about themselves in terms of their motivation to pursue and succeed in all the courses of their majors are crystallised by their motivation to develop and grow through experiences with the environment and interactions with significant other persons. The motivation of students to succeed in introductory mathematics courses is only one of the several motivations of students to engage in the educational process, and the mathematics self-concept of students is only one of numerous self-perceptions of students in relation to all courses they expect to take in order to earn their desired degrees.

The qualitative analysis of the themes defining students' mathematics self-concept shows that the qualitative information enhances the definition and measurement of mathematics self-concept in the quantitative analysis. The qualitative analysis also indicates that students' motivational themes obtained from the qualitative information are relevant to the motivational subscales measured in the quantitative analysis. The hypothesis of students' mathematics self-concept as a significant predictor of students' motivation to succeed in introductory mathematics courses was found in the quantitative analysis. More importantly, this hypothesis was also confirmed by the qualitative analysis that provided additional insights to several aspects which can facilitate or inhibit students' motivation to learn and succeed in introductory mathematics courses. These aspects include social or college environment context such as relationships with classmates or peers; pre-existing relationships with family members such as influence of parents and siblings;

support of instructors; and other facilitating factors such as textbooks, online resources, calculators, and additional tutorials. The integration between the quantitative and qualitative findings was very appropriate for the purpose of this research study, since it allowed for better understanding and perspective of the complex phenomenon of students' motivation to succeed in mathematics and students' mathematics self-concept.

Based on the qualitative analysis, some of the differences in students' motivation to succeed in introductory mathematics courses can be interpreted by students' identification of their mathematics instructors and the perceived support and encouragement students receive from their instructors. Therefore, it might be suggested to tailor certain academic activities inside the classroom of mathematics in order to accommodate students' individual variations so that students' motivation to succeed in introductory mathematics courses can be promoted by integrating social factors with stimulation, control, and interest factors (Middleton & Spanias 1999).

Furthermore, there have been little attempts made by researchers in the personal construct paradigm in order to explain the relationship between extrinsic motivators and the learning process of mathematics. However, the quantitative and qualitative findings of this current study have shown a significant correlation between extrinsic motivators such as mathematics grades, expectations of future career and income, instructors' encouragements and praises from one side, and students' motivation to succeed in mathematics courses from another side. Moreover, the qualitative findings show the value of tutorials and other resources in helping students to understand better and solve mathematical problems. Hence, instructors of mathematics may implement collaborative learning activities in which students can be supplied with tutorials and students can study together and participate in group discussions that can be facilitated inside the classroom or outside the classroom through the use of internet and other online social networks such as Google and Facebook.

CHAPTER SIX: SUMMARY, DISCUSSION, AND CONCLUSION

6.1 Summary

6.1.1 Purpose of the Study

The purpose of the research study is to examine whether there is a significant relationship between students' motivation to succeed in introductory mathematics courses offered by universities in the UAE and students' cognitive mathematics self-concept, students' affective mathematics self-concept, students' extrinsic motivation as students' expectations of future career and income, students' age, and the number of mathematics courses taken by students. Furthermore, the research study aimed at investigating the correlations between students' cognitive mathematics self-concept, students' affective mathematics self-concept, students' expectations of future career and income, students' age, and the number of mathematics courses taken by students. Therefore, the study attempts to find out whether students' cognitive mathematics self-concept, students' affective mathematics self-concept, students' expectations of future career and income, students' age, and the number of mathematics courses taken by students are significant predictors of students' motivation to succeed in undergraduate introductory mathematics courses.

6.1.2 Rationale and Significance

The rationale behind the research study stems from its endeavor to identify a significant area in research on students' motivation to succeed in undergraduate introductory mathematics courses and then fill the gap. Thus, the rationale is based on the significance of mathematics achievements for students and academic institutions in particular, as well as for the society in general. The success of students in introductory mathematics courses has a significant impact on students' persistence to obtain degrees in mathematics, science, and engineering disciplines. Moreover, administrations of academic institutions may improve the quality of their offered education by promoting students' motivation to succeed in mathematics courses which ultimately improves students' retention rates, students' graduation rates, and students' engagement. The administrations of academic institutions may be able to improve students’ learning experience as well as performance, and instructors may be able to take the necessary actions to enhance the academic performance of all students and in particular weak students. In addition to that, the gained knowledge on the predictive factors of students' motivation to succeed in undergraduate introductory mathematics courses may improve students' ability to interpret and use mathematics in many various applications and situations of life which ultimately promotes students' participation in the development of the UAE society. Hence, this study is just but one of the attempts to enhance the understanding of students' motivation to succeed in introductory mathematics courses and the factors that predict students' motivation.

6.1.3 Research Approach and Methodology

The sample of this research study includes a total of 685 students which is made up of 319 male students and 366 female students and the age of students ranged from 18 to 42 years old. All the participants were registered in different introductory mathematics courses at four academic institutions of higher education in the UAE, namely the UAEU, the ADU, the AAU, and the KIC.

A 55-item survey instrument has been tailored in both English and Arabic languages by compiling items from the MSLQ, IMI, SDQ, ATMI, and supplementary items designed by the researcher. The designed instrument for this research study embodies 35 items which measure intrinsic and extrinsic motivation of students and 20 items that are intended to measure students' mathematics self-concept. The choices of all the 55 items are prepared based on a 5-point Likert scale with response options of strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The survey questionnaires were administered to the participants at their academic institutions. The number of participants in the survey questionnaires is 685 students out of 800 distributed survey questionnaires, resulting in a response rate of 85.6%. A total of 17 students out of 25 students had been selected to participate in the semi-structured interviews which lasted from one hour to two hours; this represents a response rate of 68% in the qualitative data collection process.

6.1.4 Analysis of Quantitative Information

The demographic information of students include age and number of mathematics courses taken. The mean age is almost the same for male and female students reflecting no major gender difference in terms of students' age. Moreover, the mean of the number of mathematics courses taken by students is the same for male and female students which indicates that no gender differences exist in the number of mathematics courses taken by male students and female students.

The quantitative data have been analysed using exploratory factor analysis on SPSS 20.0 which indicates that the items of motivational subscales and mathematics self-concept subscales loaded onto their own factors with loading of 0.3 or more similar to the results obtained in previously held research studies. The Cronbach alpha reliability coefficients of the four motivational subscales are above 0.75 proofing acceptable internal consistencies and reliabilities for the items' scores and the Cronbach alpha reliability coefficients of the two mathematics self-concept subscales are above 0.80 indicating also acceptable internal consistencies and reliabilities for the items' scores. Furthermore, the hypothesis tests of significance have been performed to determine whether differences between male and female means scores exist and the results indicate that male and female students are similar in most of the students' motivation and mathematics self-concept items. This implies that no statistically significant gender differences exist in the mean scores of students' motivation and mathematics self-concept items.

Moreover, several multiple regression and correlation models have been proposed in this research study to analyse the relationship between students' motivation to succeed in mathematics, cognitive mathematics self-concept, affective mathematics self-concept, expectations of future career and income, students' age, and the number of mathematics courses taken by students. The proposed model fits the data very well and explains more than 71% of the variance in the dependent variable of students' motivation to succeed in introductory mathematics courses. In addition to that, the estimated results indicate a very strong correlation between students' motivation to succeed in introductory mathematics courses and the set of independent variables included in the research study.

It has been clearly indicated in the results of the quantitative analysis that mathematics self-concept is a very significant predictor of students' motivation to succeed in introductory mathematics courses. The regression and correlation analysis shows that mathematics self-concept alone explains 65% of the variance in students' motivation to succeed in introductory mathematics courses. Furthermore, the analysis shows that the other independent variables are statistically significant contributors to the explanation of the variance in students' motivation to succeed in introductory mathematics courses which include students' extrinsic motivation represented by expectations of future career and income, students' age, and the number of mathematics courses taken by students. The two subscales of mathematics self-concept including the cognitive mathematics self-concept and the affective mathematics self-concept are both statistically significant predictors of students' motivation to succeed in introductory mathematics courses. The joint contribution of the cognitive mathematics self-concept subscale and the affective mathematics self-concept subscale to the explanation of variance in students' motivation (66.3%) is slightly higher compared to the explanation of the overall mathematics self-concept (65.0%).

The regression analysis examining gender differences among the impacts of the variables indicates that the cognitive mathematics self-concept is the strongest predictor of male students, whereas the affective mathematics self-concept is the strongest predictor of female students. Moreover, the findings indicate that students' age as a measure of students' maturity is significantly correlated with the perception of success in mathematics subscale of the motivation among female students, whereas the number of mathematics courses taken by students is significantly correlated with students' motivation to succeed in introductory mathematics courses. The analysis which examines the gender differences in the inter-correlation among variables discloses only minor variations related to gender. However, these variations are not sufficient enough to propose that male and female students have different patterns of relationships with the variables included in this research study.

6.1.5 Analysis of Qualitative Information

The insights into the relationship between students' motivation to succeed in introductory mathematics courses, mathematics self-concept, and the demographic information have been enlightened, enhanced, and complemented by the findings from the analysis of the qualitative data gathered through the semi-structured interviews. This explanatory approach of using the qualitative data to refine and expand on the quantitative findings is very significant in social research. Therefore, the qualitative analysis does not only support the quantitative findings, but also provides more insightful understanding of the social phenomenon of students' motivation to succeed in mathematics courses and students' mathematics self-concept.

It has been shown by the qualitative findings of the thesis that students enter colleges with several motivations which include engagement in the educational process and development of themselves at the personal level. The self-concept of students and their perceptions about themselves in terms of their motivation to pursue and succeed in all the courses of their majors are crystallised by their motivation to develop and grow through experiences with the environment and interactions with significant other persons. The motivation of students to succeed in introductory mathematics courses is only one of the several motivations of students to engage in the educational process, and the mathematics self-concept of students is only one of numerous self-perceptions of students in relation to all courses they expect to take in order to earn their desired degrees. The qualitative analysis of the themes defining students’ mathematics self-concept shows that the qualitative information enhances the definition and measurement of mathematics self-concept in the quantitative analysis. The qualitative analysis also indicates that students’ motivational themes obtained from the qualitative information are relevant to the motivational subscales measured in the quantitative analysis. The analysis of the qualitative information indicates that students' motivation to succeed in introductory mathematics courses is only but one of the motivations to engage with the educational process, and their mathematical self-concept is only but one of the frequent self-perceptions students form about themselves in relation to all the courses students take or are expected to take in order to complete their desired degree programmes.

6.2 Discussion

Based on the qualitative analysis of the themes which define mathematics self-concept, it is indicated that the definition and measurement of mathematics self-concept has been enhanced by the qualitative data. Moreover, the analysis indicates that the motivational subscales in the quantitative data have been supported by the motivational themes in the qualitative data.

The current research study aimed at examining whether or not there is a relationship between students’ mathematics self-concept and students’ motivation to succeed in undergraduate introductory mathematics courses. In other words, the thesis attempts to decide whether the motivations of students to succeed in introductory mathematics courses are related to the self-perceptions of students about themselves in relation to learning and succeeding in introductory mathematics courses. The quantitative findings confirm the hypothesis that students' mathematics self-concept is a significant predictor of students' motivation to succeed in undergraduate introductory mathematics courses.

The relationship between students' mathematics self-concept and students' motivation to succeed in mathematics courses has been affirmed in the qualitative analysis which provided additional insights into various aspects. These aspects include social or college environment context such as relationships with classmates or peers; pre-existing relationships with family members such as the influence of parents and siblings; the support of instructors; and other facilitating factors such as textbooks, online resources, calculators, and additional tutorials. The quantitative and qualitative findings also indicate that some of the differences in students' motivation to succeed in introductory mathematics courses can be attributed to students' maturity measured by students' age, mathematics experience of students measured by the number of mathematics courses taken by students, and students' identification with their mathematics instructors and the perceived encouragement and support students receive from their instructors. Therefore, it might be suggested to tailor certain academic activities inside the classroom of mathematics in order to accommodate students' individual variations so that students' motivation to succeed in introductory mathematics courses can be promoted by integrating social factors with stimulation, control, and interest factors (Middleton & Spanias 1999).

Furthermore, there have been little attempts made by researchers in the personal construct paradigm in order to explain the relationship between extrinsic motivators and the learning process of mathematics. However, the quantitative and qualitative findings of this current study have shown a significant correlation between extrinsic motivators such as mathematics grades, expectations of future career and income, instructors' encouragements and praises from one side, and students' motivation to succeed in mathematics courses from another side. Moreover, the qualitative findings show the value of tutorials and other resources in helping students to understand better and solve mathematical problems. Indeed, the value of tutorials in helping students to understand better and solve mathematics problem was mentioned by students during the semi-structured interviews. Hence, instructors of mathematics may implement collaborative learning activities in which students can be supplied with tutorials and students can study together and participate in group discussions that can be facilitated inside the classroom or outside the classroom through the use of internet and other online social networks such as Google and Facebook.

This study identifies concepts and ideas which are relevant to the understanding of the complex concepts of students' motivation to succeed in mathematics courses and mathematics self-concept. Another important aspect of students' motivation is the instrumental value of mathematics as a significant prerequisite for various majors and professions such as sciences, civil engineering, mechanical engineering, electrical engineering, computer engineering, architecture, information technology, medicine, accounting, banking, finance, and business administration. There is a positive correlation between the perceived value of a mathematical task and students' motivation. Therefore, students should be enlightened about the purpose and value of mathematical theories and how these theories might be applied in solving real-life problems in order to promote their value to students. It has been expressed by the students in the interviews that understanding the practical and applied aspect of the mathematical theories makes more sense to students and develops their understanding. This approach will further enhance students' motivation, since it has been shown in research that students' motivation to succeed in mathematics is facilitated or inhibited by enhancing students' understanding of the value of mathematics and its instrumental worth (Dowson & McInerney 2004).

The findings of this study reveal that the perceptions of some students about mathematics are based on using numbers to solve problems and the motivation of these students to learn and succeed in mathematics may boost and preserve as long as more numbers are used or different methods are created to connect numbers with the area of mathematics taught to them. This group of students believes that mathematics is about numbers or numerical facts which supply them with the excitement and motivation to succeed in mathematics courses. Moreover, students who perceive success in mathematics as understanding how to use mathematical formulas instead of memorising them will create their own techniques to excel in mathematics. Applying and learning mathematical formulas does not only instil the formulas in students' memories, but also the intensive practice supports in developing students' memory capabilities.

Furthermore, some students perceive mathematics as a magic which provides them with the necessary quantitative methods to understand and solve the secrets and puzzles of the world. This group of students will be motivated whenever new concepts, formulas, and theories are introduced to them because of their confidence that this approach will pave the way for them to explore and understand the hidden secrets of the world. Being mesmerised with the magic of mathematics is easy; however, such mesmerisation may crystallise into ideas and knowledge which can be applied in various courses, if it is appropriately comprehended and appreciated. Mathematics plays a distinguished role in other courses and subjects at the college level, since it is an entry requirement to many majors.

The students who possess the perception about mathematics as an application of theory will be expecting to get exposed to more methods of applying every theory taught to them. The comprehension and appreciation of these students is subject to the number of application problems delivered and solved during the mathematics lesson. Some respondents articulated that understanding mathematical theories can be facilitated by solving real life application problems which definitely fosters students' motivation to understand and succeed in other future mathematics topics. The students who possess the perception about mathematics as a sport that stimulates their brain will be expecting to be challenged in order to accomplish something important during their learning process. The students who possess the perception about mathematics as a right or wrong experience will have good feelings whenever they solve the mathematical problems correctly. Some respondents expressed that they become confused and frustrated when they get wrong solutions. This implies finding out how the instructors can accommodate all these diverse perceptions into one consistent motivation for the delivery of the lesson, and whether the instructors will be able to motivate different students in the same way and at the same level while they teach mathematics. Therefore, it is worthy to shed the light on the role of the instructor as a facilitating or inhibiting factor inside or outside the classroom.

The findings of this study also indicate that motivated students to learn mathematics have enjoyment and interest in doing mathematics as well as strong belief in the usefulness of mathematics in their education and their future careers and endeavors. It has been clarified through the self-determination theory of Deci and Ryan (1985) that intrinsically motivated students experience enjoyment and interest, and they are more likely to spend persistence and effort on their desired activities. Schiefele et al. (1992) emphasise that students' attributions of high value to a specific subject area usually allow the motivational variable of enjoyment and interest to be instiled in students' minds. For instance, some of the students expressed during the interviews that they enjoy learning mathematics, because of several reasons such as they love to calculate and solve problems, they are good at mathematics, mathematics courses are fun courses, mathematics courses rely on understanding instead of memorising, and mathematics courses provide them with a challenging environment to squeeze their minds mentally and physically. Other students enjoy mathematics for other reasons such as being taught by good and enthusiastic instructors and getting the opportunity to get exposed to the real-life applications of mathematics. The success of students in mathematics is strongly predicted by the quality of their experience in mathematics classes, which is mainly and strongly predicted by the enjoyment and interest of students in mathematics (Schiefele et al. 1992).

It has been found in this research study that mathematics self-concept and students' experiences with the environment have shaped their self-perceptions of academic ability, confidence, effort, competence, like, dislike, fear, societal stereotypical notion, goal, and achievement which all are related to students' motivation to succeed in introductory mathematics courses. The qualitative findings also reveal that students, who are confident about their mathematical abilities, are more comfortable when they are confronted by mathematical problems. This implies that assisting students to develop self-confidence in mathematics is not only significant for its own moral virtues, but will also support in promoting students' motivation to succeed in mathematics. Therefore, students who possess high level of self-confidence are highly motivated to succeed in mathematics when compared with students who possess low level of self-confidence.

Another important finding is the effort made by students to learn mathematics which is another variable of mathematics self-concept that is related to self-confidence. It has been indicated by some of the responses in the qualitative findings that students have a feeling of their ability to control their success in mathematics. The students feel that their success in mathematics is conditional to their actions such as the effort exerted by them to learn mathematics. Weiner (1985) proposes that the persistence of successful students in their efforts to learn mathematics is due to students' feeling that efforts end up with success. Thus, effort is very significant for its own value and its positive influence on learning mathematics.

It has been also found in the study that mathematics ability and mathematics talent are also another two features of mathematics self-concept which were mentioned by students during the semi-structured interviews. It has been expressed by some students that mathematics ability and talent provide them with an opportunity to achieve quick learning of mathematics and confrontation of complicated mathematics problems with ease. The students feel that mathematics ability and mathematics talent are divinely granted for only some people. This feeling advocates without any doubt the close relationship between innate ability and quick learning which is found by the research study of Dweck (2002). On the other hand, some students believe that not every student has the talent; however, every student has the ability to study and succeed in mathematics. These students adopt in general an incremental instead of entity view of mathematics ability and the incremental theory of mathematics ability explained by Dwech (2002) as the theory in which the mathematical skills of students can be improved overtime and with hard work and persistence.

Another finding of this study is that the existence of good instructors, clear and simplified teaching style, and instructors’ support and engagement in the college environment does not only assist in developing a positive mathematics self-concept of students, but also enhances students' motivation to learn and succeed in introductory mathematics courses. The responses of students from the semi-structured interviews reflect that the instructor is viewed as a significant factor in the process of learning mathematics regardless of instructors' experiences. It has been shown by Harter et al. (1992) that there is a strong relationship between the perceived support and encouragement of instructors and the responsible behaviours, intrinsic values, academic aspirations, and enhanced self-concept of students. Furthermore, Op't Eynde et al. (2006) propose that the positive beliefs of students about their instructors are associated with more positive beliefs about mathematics such as students' confidence in their mathematical abilities. Unfortunately, the survey questionnaire of this research study does not include items about the mathematics instructors which would have provided information about how instructors perceive their roles in students' learning of mathematics and whether instructors view themselves as information providers instead of providing students with the opportunity to actively engage in analysing and processing information (Anthony 2000). Probably, this is another potential area for future research in order to examine the educational implications of the role of instructors in the learning and teaching process of mathematics.

The qualitative findings include also other theoretical orientations which do not fit in a neat way into any of the aforementioned categories in the qualitative analysis. One of the qualitative findings is mathematics anxiety which was experienced in the past by some participants who tried their best to overcome mathematics anxiety through persistence and experience, as well as sufficient explanation, encouragement, and sympathetic feedback from their instructors. The research study of Middleton and Spanias (1999) has shown that students who perceive mathematics as a difficult subject and poorly believe in their ability to do mathematics tend to avoid mathematics whenever it is possible. These students who have such feelings are referred to as mathematics anxious. Some of the participants in the semi-structured interviews indicated that they had certain incidents in their mathematics education memories which have been reflected significantly on their learning process. However, the fact that these students still persist on pursing college mathematics reflects their determination to overcome mathematics anxiety.

6.3 Conclusion

The study has shown that mathematics self-concept and its two components of cognitive and affective mathematics self-concept are significant predictors of students' motivation to succeed in introductory mathematics courses. It has been also shown in this study that students' motivation to achieve in mathematics is neither only a product of mathematics self-concept variables such as mathematics ability, skill, effort, competence, and self-confidence, nor it is so stable so that intervention programmes cannot be designed to enhance students' motivation. Therefore, the motivation of students to succeed in mathematics is highly influenced by demographic factors such as age and number of mathematics courses taken as well as social or college environment context such as relationships with classmates or peers; pre-existing relationships with family members such as the influence of parents and siblings; the support of instructors; and other facilitating factors such as textbooks, online resources, calculators, and additional tutorials.

The findings reflect the influence of parents and other family members on students' mathematics self-concept and their motivation to succeed in mathematics courses. The study indicates that students' behaviours and motivations to succeed in mathematics can be facilitated or inhibited by parental and sibling influence. It has been shown that the learning and success of students is significantly predicted by the general parental involvement of parents in the education of their children. Hence, it is believed that the involvement of parents and siblings in their children's education promotes children's social behaviours and their interactions with peers and develops the formation of self-concept.

This study was held in the UAE only and one of the limitations is the restricted coverage of the study to the UAE. It is recommended to expand on the current study by including in the sample academic institutions from the Gulf Cooperation Council (GCC) countries or other Arab countries in order to generalise the findings. It is obvious that the findings of the study support the conceptual relationship between mathematics self-concept and students' motivation to succeed in mathematics. However, additional studies could attempt to replicate the results of this study by including students from academic institutions at the GCC or Arab countries. Further research may assist in the future to examine the impact of students' grades on students' motivation to succeed in mathematics and students' mathematics self-concept. Moreover, the impact of significant others on students' motivation and achievement might be investigated in future research studies. Based on the findings of this study, it is reasonable to hypothesise that significant others including parents, instructors, and peers may significantly impact students' motivation to succeed in mathematics through certain facilitating conditions identified in the qualitative findings. For instance, the Facilitating Conditions Questionnaire (FCQ) developed by McInerney et al. (2005) may be employed in future research in order to identify which sources of influence from significant others such as parents, instructors, and peers may have the most impact on students' motivation and mathematics self-concept.

It has been shown in this study that the perceptions of students about their ability have influence on students' motivation to succeed in mathematics courses through its mediating impact on mathematics self-concept. Meece et al. (1988) have demonstrated that the value perceptions of students such as interest are strongly influenced by the ability perceptions of students. Thus, it is recommended to include in future research not only test-based indicators of ability, but also measures of perceived competence or ability.

In summary, the research study provides a valid empirical evidence for the importance of considering both the cognitive and the affective components of mathematics self-concept in models of students' motivation to succeed in mathematics courses. The self-perceptions of students about their ability and competence to succeed in mathematics are closely related to students' motivation to succeed in mathematics. Moreover, the demographic factors, the extrinsic motivation factors as well as the home and college environment factors have implications on students' motivation to engage in the educational process and succeed in introductory mathematics courses. In spite of the fact that extensive research effort has been spent to address the nature of the relationship between students' motivation and students' achievement in mathematics, the impact of self-concept on students' motivation to learn and succeed has been neglected. Hence, the humble contribution of this study to the literature of motivation and mathematics self-concept lies behind its significance, and the research on students' motivation is expected to make use of the findings of this research study.

References

Abdul Majeed, A., Darmawan, I. G. N. & Lynch, P. (2013). A confirmatory factor analysis of attitudes toward mathematics inventory (ATMI). *The Mathematics Educator*, vol. 15 (1), pp. 121-135.

Abouserie, R. (1995). Self-esteem and achievement motivation as determinants of students' approaches to studying. *Studies in Higher Education*, vol. 20 (1), pp. 19-26.

Abuhamdeh, S., Csikszentmihalyi, M. & Jalal, B. (2015). Enjoying the possibility of defeat: Outcome uncertainty, suspense, and intrinsic motivation. *Motivation and Emotion*, vol. 39(1), pp. 1-10.

Afari, E. (2013). Examining the factorial validity of the attitudes towards mathematics inventory (ATMI) in the United Arab Emirates: Confirmatory factor analysis. *International Review of Contemporary Learning Research*, vol. 2 (1), pp. 15-29.

Ames, C. & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology*, vol. 80, pp. 206-267.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology*, vol. 84 (3), pp. 261-271.

Anthony, G. (2000). Factors influencing first year students' success in mathematics. *International Journal of Mathematics Education in Science & Technology*, vol. 31 (1), pp. 3-14.

Armstrong, W. B. (2000). The association among students success in courses, placement test scores, student background data and instructor grading practices. *Community College Journal Research and Practice*, vol. 24 (8), pp. 681-695.

Artelt, C. (2005). Cross-cultural approaches to measuring motivation. *Educational Assessment*, vol. 10 (3), pp. 231-255.

Ashcraft, M. H. & Moore, A. M. (2009). Mathematics anxiety and the affective drop in performance. *Journal of Psychoeducational Assessment*, vol. 27 (3), pp. 197-205.

Asmus, E. P. (1986). Achievement motivation characteristics of music education and music therapy students as identified by attribution theory. *Bulletin of the Council for Research in Music Education,* vol. 86, pp. 71-85.

Aunola, K., Nurmi, J. E., Lerkkanen, M. K. & Rasku-Puttonen, H. (2003). The roles of achievement-related behaviours and parental beliefs in children's mathematical performance. *Educational Psychology*, vol. 23 (4), pp. 403-421.

Awan, R., Noureen, G. & Naz, A. (2011). A study of relationship between achievement motivation, self concept and achievement in English and mathematics at secondary level. *International Education Studies*, vol. 4 (3), pp. 72-79.

Awofala, A. O. (2016). Effect of personalisation of instruction on students' motivation to learn mathematics word problems in Nigeria. *Turkish Journal of Computer and Mathematics Education*, vol. 7(3), pp. 486-509.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, vol. 84, pp. 191-215.

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NY: Prentice Hall.

Barber, L. A. (1995). U.S. women in science and engineering, 1960-1990: Progress toward equality. *Journal of Higher Education*, vol. 66, pp. 213-234.

Barker, G. P. & Graham, S. (1987). Developmental study of praise and blame as attributional cues. *Journal of Educational Psychology,* vol. 79 (1), pp. 62-66.

Baroody, A. E., Rimm-Kaufman, S. E., Larsen, R. A. & Curby, T. W. (2016). A multi-method approach for describing the contributions of student engagement on fifth grade students' social competence and achievement in mathematics. *Learning and Individual Differences*, vol. 48, pp. 54-60.

Berdeaux, J. & Borden, J. (1984). The adult learner: A handbook for volunteer and new adult education teachers. *Arizona State Department of Education, Phoenix, Arizona*. ERIC Document Reproduction Service No. ED 253735.

Berry, L. (2003). Bridging the gap: A community college and area high schools collaborate to improve student success in college. *Community College Journal of Research & Practice*, vol. 27 (5), pp. 393-407.

Bong, M. (1996). Problems in academic motivation research and advantages and disadvantages of their solutions. *Contemporary Educational Psychology*, vol. 21 (2), pp. 149-165.

Bong, M. & Clark, R. E. (1999). Comparison between self-concept and self-efficacy in academic motivation research. *Educational Psychologist*, vol. 34 (3), pp. 139-154.

Bong, M. & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review*, vol. 15 (1), pp. 1-30.

Bressoud, D. (2009). Is the sky still falling? *Notices of the AMS*, vol. 56, pp. 20-25.

Brewer, E. W. & Burgess, D. N. (2005). Professor's role in motivating students to attend class. *Journal of Industrial Teacher Education*, vol. 42 (23), pp. 23-47.

Bridgeman, B., & Wendler, C. (1991). Gender differences in predictors of college mathematics performance and in college mathematics course grades. *Journal of Educational Psychology*, vol. 83(2), pp. 275-284.

Brophy, J. E., Rohrkemper, M., Rashid, H. & Goldberger, M. (1983). Relationships between teachers' presentations of classroom tasks and students' engagement in those tasks. *Journal of Educational Psychology*, vol. 75 (4), pp. 544-552.

Brophy, J. E. (1999). Toward a model of the value aspects of motivation in education: Developing appreciation for particular learning domains and activities. *Educational Psychologist*, vol. 34 (2), pp. 75-85.

Brophy, J. E. (2013). *Motivating students to learn*. 3rd edn. UK: Routledge.

Byrne, B. M. (1996). 'Academic self-concept: Its structure, measurement, and relation to academic achievement', in B. A. Bracken (eds). *Handbook of self-concept*. NY: Wiley.

Byrne, B. M. & Gavin, D. A. (1996). The Shavelson model revisited: Testing for the structure of academic self-concept across pre-, early, and late adolescents. *Journal of Educational Psychology*, vol. 88 (2), pp. 215-228.

Chao, T., Chen, J., Star, J. R. & Dede, C. (2016). Using digital resources for motivation and engagement in learning mathematics: Reflections from teachers and students. *Digital Experiences in Mathematics Education*, vol. 2(3), pp. 253-277.

Choi, N. (2006). Self-efficacy and self-concept as predictors of college students' academic performance. *Psychology in the Schools*, vol. 42 (2), pp. 197-205.

Cook, S. A. & Borkovitz, D. K. (2017). Student perceptions of a mathematics major for prospective elementary teachers with an inquiry based philosophy. *PRIMUS*, vol. 27 (1), pp. 125-147.

Corbiere, M., Fraccaroli, F., Mbekou, V. & Perron, J. (2006). Academic self-concept and academic interest measurement: A multi-sample European study. *European Journal of Psychology of Education*, vol. 21 (1), pp. 3-15.

Correll, S. J. (2001). Gender and the career choice process: The role of biased self-assessments 1. *American Journal of Sociology*, vol. 106(6), pp. 1691-1730.

Covington, M. V. (1984). The self-worth theory of achievement motivation: Findings and implications. *The Elementary School Journal*, vol. 85 (1), pp. 5-20.

Cramer, D. (1998). *Fundamental statistics for social research: Step-by-step calculations and computer techniques using SPSS for windows*. NY: Routledge.

Cramer, D. & Howitt, D. L. (2004). *The Sage dictionary of statistics: A practical resource for students in the social sciences*. London: Sage.

Crump, C. A. (1995). Motivating students: A teacher's challenge. Conference paper. *The Annual Sooner Communication Conference*. Norman, Oklahoma. 6 April.

Deci, E. L., Eghrari, H., Patrick, B. C. & Leone, D. R. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of Personality*, vol. 62 (1), pp. 119-142.

Deci, E. L., Olafsen, A. H. & Ryan, R. M. (2017). Self-determination theory in work organizations: the state of a science. *Annual Review of Organizational Psychology and Organizational Behavior*, vol. 4(1), pp. 19-43.

Deci, E. L. & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behaviour. *Psychological Inquiry*, vol. 11 (4), pp. 227-268.

Deci, E. L. & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. NY: Springer.

Doane, D. P. & Seward, L. E. (2011). Measuring skewness: A forgotten statistic. *Journal of Statistics Education*, vol. 19 (2), pp. 1-15.

Dowson, M. & McInerney, D. M. (2004). The development and validation of goal orientation and learning strategies survey (GOAL-S). *Educational and Psychological Measurement*, vol. 64 (2), pp. 290-310.

Dweck, C. S. (2002). 'The development of ability conceptions', in A. Wigfield and J. S. Eccles (eds). Development of achievement motivation, *Academic Press*. London.

Eccles, J. S., Midgley, C., Wigfield, A., Reuman, D., Mac Iver, D. & Feldlaufer, H. (1993). Negative effects of traditional middle schools on students' motivation. *The Elementary School Journal*, vol. 39 (5), pp. 553-574.

Eccles, J. S. (2005). 'Subjective task value and the Eccles et al. model of achievement-related choices', in A. J. Elliot and C. S. Dweck (eds). *Handbook of competence and motivation*. NY: Guilford Publications. Ch. 7.

Elliott, A. C. & Woodward, W. A. (2007). *Statistical analysis quick reference guidebook: With SPSS examples*. London: Sage.

Fennema, E. & Sherman, J. A. (1976). Fennema-Sherman mathematics attitudes scales: Instruments designed to measure attitudes toward the learning of mathematics by females and males. *Journal for Research in Mathematics Education*, pp. 324-326.

Fiore, G. (1999). Math-abused students: Are we prepared to teach them? *The Mathematics Teacher*, vol. 92 (5), pp. 403-406.

Foley-Peres, K. & Poirier, D. (2008). College math assessment: SAT vs. College math placement scores. *Educational Research Quarterly*, vol. 32 (2), pp. 41-48.

Foley, A. E., Herts, J. B., Borgonovi, F., Guerriero, S., Levine, S. C. & Beilock, S. L. (2017). The math anxiety-performance link: A global phenomenon. *Current Directions in Psychological Science*, vol. 26(1), pp. 52-58.

Follette, K., Buxner, S., Dokter, E., McCarthy, D., Vezino, B., Brock, L. & Prather, E. (2017). The quantitative reasoning for college science (QuaRCS) assessment 2: Demographic, academic and attitudinal variables as predictors of quantitative ability. *Numeracy*, vol. 10(1), pp. 1- 33.

Foote, N. N. (1951). Identification as the basis for a theory of motivation. *American Sociological Review*, vol. 16 (1), pp. 14-21.

Forawi, S. (2014). Youth career and educational aspirations: Perceptions and instrument validation. *The International Journal of Humanities Education*, vol. 11 (1), pp. 11-25.

Fraenkel, J. R., Wallen, N. E. & Hyun, H. H. (2014). *How to design and evaluate research in education*. 9th edn. NY: McGraw-Hill Education.

Fredricks, J. A., Blumenfeld, P. C. & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, vol. 74 (1), pp. 53-109.

Frymier, A. B. (1993). The impact of teacher immediacy on students' motivation: Is it the same for all students? *Communication Quarterly*, vol. 41 (4), pp. 454-464.

Gecas, V. (1982). The self-concept. *Annual Review of Sociology*, vol. 8, pp. 1-33.

Gragné, M. & Deci, E. L. (2005). Self-determination theory and work motivation. *Journal of Organizational Behavior*, vol. 26 (4), pp. 331-362.

Graham, S. & Golan, S. (1991). Motivational influence on cognition: Task involvement, ego involvement, and depth of information processing. *Journal of Educational Psychology*, vol. 83 (2), pp. 187-194.

Greenwood, J. (1984). Soundoff: My anxieties about math anxiety. *Mathematics Teacher*, vol. 77 (9), pp. 662-663.

Gresham, G. (2007). A study of mathematics anxiety in pre-service teachers. *Early Childhood Education Journal*, vol. 35 (2), pp. 181-188.

Grolnich, W. S., Ryan, R. M. & Deci, E. L. (1991). Inner resources for school achievement: Motivational mediators of children's perceptions of their parents. *Journal of Educational Psychology*, vol. 83 (4), pp. 508-571.

Guay, F., Marsh, H. W. & Boivin, M. (2003). Academic self-concept and academic achievement: Developmental perspectives of their causal ordering. *Journal of Educational Psychology*, vol. 95 (1), pp. 124-136.

Guay, F., Ratelle, C. F., Roy, A. & Litalien, D. (2010). Academic self-concept, autonomous academic motivation, and academic achievement: Mediating and additive effects. *Learning and Individual Differences*, vol. 20 (6), pp. 644-653.

Guest, G., Bunce, A. & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, vol. 18 (1), pp. 59-82.

Gupta, S., Harris, D. E., Caffier, N. M., & Caron, P. (2006). Predictors of student success in entry-level undergraduate mathematics courses. *College Student Journal*, vol. 40 (1), pp. 97-108.

Hannula, M. S. (2006). Motivation in mathematics: Goals reflected in emotions. *Educational Studies in Mathematics*, vol. 63 (2), pp. 165-178.

Harmon-Jones, E. & Harmon-Jones, C. (2010). On the relationship of trait PANAS positive activation and trait anger: Evidence of a suppressor relationship. *Journal of Research in Personality*, vol. 44 (1), pp. 120-123.

Harter, S. (1982). The perceived competence scale for children. *Child Development*, vol. 53, pp. 87-97.

Harter, S., Whitesell, N. R. & Kowalski, P. (1992). Individual differences in the effects of educational transitions on young adolescent's perceptions of competence and motivational orientation. *American Educational Research Journal*, vol. 29 (4), pp. 777-807.

Harvey, P. & Martinko, M. J. (2009). Attribution theory and motivation. *Organizational Behavior, Theory and Design in Health Care*, pp. 143-158.

Hodges, H. L. (1983). Learning styles: Rx for mathophobia. *The Arithmetic Teacher*, vol. 30 (7), pp. 17-20.

Hoffman, N., Vargas, J. & Santos, J. (2009). New directions for dual enrolment: Creating stronger pathways from high school through college. *New Directions for Community Colleges*, vol. 145, pp. 43-58.

Hootstein, E. W. (1994). Enhancing student motivation: Make learning interesting and relevant. *Education*, vol. 114 (3), pp. 475-479.

House, J. D. (1993). Non cognitive predictors of achievement in introductory college chemistry. AIR 1993 annual forum paper. *Annual Forum of the Association for Institutional Research.* Chicago. 16-17 May.

House, J. D. (2000). Academic background and self-beliefs as predictors of student grade performance is science, engineering and mathematics. *International Journal of Instructional Media*, vol. 27 (2), pp. 207-220.

House, J. D. & Telese, J. A. (2008). Relationships between students and instructional factors and algebra achievement of students in the United States and Japan: An analysis of TIMSS 2003 data. *Educational Research and Evaluation*, vol. 14, pp. 101-112.

Hunter, M. & Barker, G. (1987). If at first…: Attribution theory in the classroom. *Educational Leadership*, vol. 45 (2), pp. 50-53.

Jackson, C. D. & Leffingwell, R. J. (1999). The role of instructors in creating math anxiety in students from kindergarten through college. *The Mathematics Teacher,* vol. 92 (7), pp. 583-586.

Jacob, B., Frenzel, A. C. & Stephens, E. J. (2017). Good teaching feels good—but what is "good teaching"? Exploring teachers' definitions of teaching success in mathematics. *ZDM Mathematics Education*, pp. 1-13.

Johnson, D. W. & Johnson, R. T. (2003). Students motivation in co-operative groups. *Co-operative Learning: The Social and Intellectual Outcomes of Learning in Groups*, pp. 136-176.

Johnston, J. & DiNardo, J. (1972). Econometric methods. *New York*, vol. 19 (7), pp. 139-142.

Jones, B. D., Paretti, M. C., Hein, S. F. & Knott, T. W. (2010). An analysis of motivation constructs with first-year engineering students: Relationships among expectancies, values, achievement, and career plan. *Journal of Engineering Education*, vol. 99 (4), pp 319-336.

Jurik, V., Gröschner, A. & Seidel, T. (2014). Predicting students' cognitive learning activity and intrinsic learning motivation: How powerful are teacher statements, student profiles, and gender? *Learning and Individual Differences*, vol. 32, pp. 132-139.

Kasworm, C. E. & Pike, G. R. (1994). Adult undergraduate students: Evaluating the appropriateness of a traditional model of academic performance. *Research in Higher Education*, vol. 35 (6), pp. 689-710.

Kinch, J. W. (1963). A formalized theory of the self-concept. *American Journal of Sociology*, vol. 68 (4), pp. 481-486.

Kloosterman, P. (1988). Self-confidence and motivation in mathematics. *Journal of Educational Psychology*, vol. 80, pp. 345-351.

Lazarides, R. & Watt, H. M. (2015). Girls' and boys' perceived mathematics teacher beliefs, classroom learning environments and mathematical career intentions. *Contemporary Educational Psychology,* vol. 41, pp. 51-61.

Lazarus, M. (1974). Mathophobia: Some personal speculations. *National Elementary Principle*, vol. 53, pp. 16-22.

Leahey, E., Xie, Y. & Killewald, A. A. (2013). Is American Science in Decline? Contemporary Sociology, vol. 42 (6), pp. 790-792.

Lent, R. W., Brown, S. D. & Gore, P. A. (1997). Discriminant and predictive validity of academic self-concept, academic self-efficacy, and mathematics-specific self-efficacy. *Journal of Counseling Psychology*, vol. 44 (3), pp. 307-315.

Lewis, B. A., Williams, D. M., Frayeh, A. & Marcus, B. H. (2016). Self-efficacy versus perceived enjoyment as predictors of physical activity behaviour. *Psychology & Health*, vol. 31(4), pp. 456-469.

Lourmpas, S. & Dakopoulou, A. (2014). Educational leaders and teachers' motivation for engagement in innovative programmes. The case of Greece. *Procedia – Social and Behavioral Sciences*, vol. 116, pp. 3359-3364.

Lumsden, L. S. (1994). *Student motivation to learn*. ERIC Digest, Number 92.

MacNamara, D. & Penner, K. (2012). First-year math students: Using study skills and motivation to predict academic success. Kwantlen *University College* [online]. [Accessed 26 December 2015]. Available at: http://www.kpu.ca/__shared/assets/Math_Retention_Study2878.pdf.

Marilla, S. & McKeachie, W. J. (2013). *McKeachie's teaching tips: Strategies, research, and theory for college and university teachers.* 13th edn. CA: Cengage Learning.

Markus, H. & Nurius P. P. (1986). Possible selves. *American Psychologist*, vol. 41, pp. 954-969.

Marsh, H. W., Byrne, B. M. & Shavelson, R. J. (1988). A multifaceted academic self-concept: Its hierarchical structure and its relation to academic achievement. *Journal of Educational Psychology*, vol. 80 (3), pp. 366-380.

Marsh, H. W., Cairns, L., Relich, J., Barnes, J. & Debus, R. L. (1984). The relationship between dimensions of self-attribution and dimensions of self-concept. *Journal of Educational Psychology*, vol. 76 (1), pp. 3-32.

Marsh, H. W. & Craven, R. G. (2006). Reciprocal effects of self-concept and performance from a multidimensional perspective: Beyond seductive pleasure and unidimensional perspectives. *Perspectives on Psychological Science*, vol. 1 (2), pp. 133-163.

Marsh, H. W. & O' Neil, R. (1984) Self description questionnaire III: The construct validity of multidimensional self-concept ratings by late adolescents. *Journal of Educational Measurement*, vol. 21 (2), pp. 153-173.

Marsh, H. W. (1984). Relations among dimensions of self-attribution, dimensions of self-concept, and academic achievements. *Journal of Educational Psychology*, vol. 76 (6), pp. 1-32.

Marsh, H. W. (1986). Verbal and math self-concepts: An internal/external frame of reference model. *American Educational Research Journal*, vol. 23 (1), pp. 129-149.

Marsh, H. W. (1987). The big-fish-little-pond effect on academic self-concept. *Journal of Psychology*, vol. 79 (3), pp. 280-295.

Marsh, H. W. (1988). Causal effects of academic self-concept on academic achievement: A reanalysis of Newman. *The Journal of Experimental Education*, vol. 56 (2), pp. 100-103.

Marsh, H. W. (1990). Causal ordering of academic self-concept and academic achievement: A multiwave, longitudinal panel analysis. *Journal of Educational Psychology*, vol. 82 (4), pp. 646-656.

Marsh, H. W. (1990). The structure of academic self-concept: The Marsh/Shavelson model. *Journal of Educational Psychology*, vol. 82 (4), pp. 623-636.

Marsh, H. W. & Martin, A. J. (2011). Academic self-concept and academic achievement: Relations and causal ordering. *British Journal of Educational Psychology*, vol. 81(1), pp. 59-77.

Marsh, H. W. & Shavelson, R. (1985). Self-concept: Its multifaceted, hierarchical structure. *Educational Psychologist*, vol. 20 (3), pp. 107-123.

Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O. & Baumert, J. (2005). Academic self-concept, interest, grades, and standardized test scores: Reciprocal effects models of causal ordering. *Child Development*, vol. 76 (2), pp. 397-416.

Marshall, H. H. (1986). Games teachers and students play: An analysis of motivation in three fifth grade classrooms. *Paper Presented at the Annual Meeting of the American Educational Research Association*. ERIC Document Reproduction Service No. ED 270219.

Mason, M. (2010). Sample size and saturation in PhD studies using qualitative interviews. *Forum Qualitative Social Research*, vol. 11 (3) [online]. [Accessed 26 December 2015]. Available at: http://www.qualitative-research.net/index.php/fqs/article/view/1428/3027.

Mayer, R. E. (2011). Towards a science of motivated learning in technology-supported environments. *Educational Technology Research and Developm*ent, vol. 59 (2), pp. 301-308.

Mazer, J. P., Murphy, R. E. & Simonds, C. J. (2007). I'll see you on "Facebook": The effects of computer-mediated teacher self-disclosure on student motivation, affective learning, and classroom climate. *Communication Education*, vol. 56 (1), pp. 1-17.

McAuley, E., Duncan, T. & Tammen, V. V. (1989). Psychometric properties of the intrinsic motivation inventory in a competitive sport setting: A confirmatory factor analysis. *Research Quarterly for Exercise and Sport*, vol. 60 (1), pp. 48-58.

McInerney, D. M., Dowson, M. & Yeung, A. S. (2005). Facilitating conditions for school motivation: Construct validity and applicability. *Educational and Psychological Measurement*, vol. 65 (6), pp. 1046-1066.

Meece, J. L., Blumefeld, P. C. & Hoyle, R. H. (1988). Students' goal orientations and cognitive engagement in classroom activities. *Journal of Educational Psychology*, vol. 80, pp. 514-523.

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementations*. Hoboken, NJ: John Wiley & Sons.

Middleton, J. A. & Spanias, P. A. (1999). Motivation for achievement in mathematics: Findings, generalizations, and criticisms of the research. *Journal for Research in Mathematics Education*, vol. 30 (1), pp. 65-83.

Mido, C., Kusum, S. & Yun, M. (2007). Science engagement and science achievement: Longitudinal models using NELS data. *Educational Research and Evaluation*, vol. 13 (4), pp. 349-371.

Mwangi, J. G. & McCaslin, N. L. (1994). The motivation of Kenya's Rift Valley extension agents. *Journal of Agricultural Education*, vol. 35 (3), pp. 35-48.

Nagy, G., Watt, H. M. G., Eccles, J. S., Ulrich, T., Oliver, L. & Baumert, J. (2010). The development of students' mathematical self-concept in relation to gender: Different countries, different trajectories? *Journal of Research on Adolescence*, vol. 20 (2), pp. 482-506.

Niss, M. (1994). 'Mathematics in society', in R. Biehler, R. W. Scholz, R. Strasser and B. Winkelmann (eds). *Didactics of mathematics as a scientific discipline*. NY: Kluwer Academic Publishers. Ch. 7.

Norwood, K. S. (1994). The effect of instructional approach on mathematics anxiety and achievement. *School Science and Mathematics*, vol. 97 (5), pp. 248-254.

Nuttin, J. (2014). *Future time perspective and motivation: Theory and research method.* NY: Psychology Press.

Olafsen, A. H., Niemiec, C. P., Halvari, H., Deci, E. L. & Williams, G. C. (2017). On the dark side of work: a longitudinal analysis using self-determination theory. *European Journal of Work and Organizational Psychology*, vol. 26(2), pp. 275-285.

O'Mara, A. J., Marsh, H. W., Craven, R. G. & Debus, R. L. (2006). Do self-concept interventions make a difference? A synergistic blend of construct validation and meta-analysis. *Education Psychologist*, vol. 41 (3), pp. 181-206.

Op’t Eynde, P., De Corte, E. & Verschaffel, L. (2006). Epistemic dimensions of students’ mathematics-related belief systems. *International Journal of Educational Research*, vol. 45 (1), pp. 57-70.

Palacios, A., Arias, V. & Arias, B. (2013). Attitudes towards mathematics: Construction and validation of a measurement instrument. *Journal of Psychodidactics*, vol. 19 (1), pp. 67-91.

Parker, P. D., Marsh, H. W., Ciarrochi, J., Marshall, S. & Abduljabbar, A. S. (2014). Juxtaposing math self-efficacy and self-concept as predictors of long-term achievement outcomes. *Educational Psychology*, vol. 34(1), pp. 29-48.

Pintrich, P. R. & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, vol. 82 (1), pp. 33-40.

Pintrich, P. R., Smith, D. A. F., Garcia, T. & McKeachie, W. J. (1991). A manual for the use of the motivated strategies for learning questionnaire (MSLQ). Project on instructional processes and educational outcomes. *National Center for Research to Improve Postsecondary Teaching and Learning*, pp. 1-76.

Pinxten, M., De Fraine, B., Van Damme, J. & D'Haenens, E. (2013). Student achievement and academic self-concept among secondary students in Flanders: Gender and changes over time. *Irish Educational Studies*, vol. 32 (2), pp. 157-178.

Piotrowski, C. & Hemasinha, R. (2012). Career aspirations of undergraduate mathematics major: An exploratory study. *College Student Journal*, vol. 46 (1), pp. 46-50.

Plant, R. W. & Ryan, R. M. (1985). Intrinsic motivation and the effects of self-consciousness, self-awareness, and ego-involvement: An investigation of internally controlling styles. *Journal of Personality*, vol. 53 (3), pp. 435-449.

Poole, M. A. & O'Farrell, P. N. (1971). The assumptions of the linear regression model. *Transactions of the Institute of British Geographers*, pp. 145-158.

Raffini, J. P. (1993). *Winners without losers: Structures and strategies for increasing student motivation to learn*. Boston: Allyn & Bacon.

Rakes, G. C. & Dunn, K. E. (2010). The impact of online graduate students' motivation and self-regulation on academic procrastination. *Journal of Interactive Online Learning*, vol. 9 (1), pp. 78-93.

Raynor, J. O. (1981). Future orientation and achievement motivation: Toward a theory of personality functioning and change. *Cognition in Human Motivation and Learning*, pp. 199-231.

Razali, N. M. & Wah, Y. B. (2011). Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics*, vol. 2 (1), pp. 21-33.

Richardson, J. T. E. & King, E. (1998). Adult students in higher education: Burden or boon? *The Journal of Higher Education*, vol. 69 (1), pp. 65-88.

Richardson, M., Abraham, C. & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin*, vol. 138 (2), pp. 353-387.

Rosenberg, M. (1979*). Conceiving the self*. NY: Basic Books.

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology*, vol. 43 (3), pp. 450-461.

Rozek, C. S., Svoboda, R. C., Harackiewicz, J. M., Hulleman, C. S. & Hyde, J. S. (2017). Utility-value intervention with parents increases students' STEM preparation and career pursuit. *Proceedings of the National Academy of Sciences,* vol. 114(5), pp. 909-914.

Ryan, R. M., Connell, J. P., & Plant, R. W. (1990). Emotions in non-directed text learning. *Learning and Individual Differences*, vol. 2 (1), pp. 1-17.

Ryan, R. M. & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, vol. 55 (1), pp. 68-78.

Ryan, R. M. & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, vol. 25 (1), pp. 54-67.

Ryan, R. M., Koestner, R. & Deci, E. L. (1991). Ego-involved persistence: When free-choice behavior is not intrinsically motivated. *Motivation and Emotion*, vol. 15 (3), pp. 185-205.

Ryan, R. M., Mims, V. & Koestner, R. (1983). Relation of reward contingency and interpersonal context to intrinsic motivation: A review and test using cognitive evaluation theory. *Journal of Personality and Social Psychology*, vol. 45 (4), pp. 736-750.

Schmidt, H. G. (1993). Foundations of problem-based learning: Some explanatory notes. *Medical Education*, vol. 27 (5), pp. 422-432.

Schmidt, L., Palminteri, S., Lafarque, G. & Pessiglione, M. (2010). Splitting motivation: Unilateral effects of subliminal incentives, *Psychological Science*, vol. 21 (7), pp. 977-983.

Schiefele, U., Krapp, A. & Winteler, A. (1992). 'Interest as a predictor of academic achievement: A meta-analysis of research', in K. A. Renninger, S. Hidi & A. Krapp (eds). *The role of interest in learning and development*. Mahwah, NJ: Erlbaum.

Seidman, A. (2005). *College student retention: Formula for student success.* Westport, CT: Praeger Publisher.

Shapiro, S. S. & Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). *Biometrika*, vol. 52 (3/4), pp. 591-611.

Shapka, J. D., Domene, J. F. & Keating, D. P. (2006). Trajectories of career aspirations through adolescence and youth adulthood: Early math achievement as a critical filter. *Educational Research and Evaluation*, vol. 12, pp. 347-358.

Shavelson, R. L., Hubner, J. J. & Stanton, G. C. (1976). Self-concept: Validation of construct interpretations. *Review of Education Research*, vol. 46, pp. 407-441.

Shavelson, R. L. & Bolus, R. (1982). Self-concept: The interplay of theory and methods. *Journal of Educational Psychology*, vol. 74 (1), pp. 3-17.

Shernoff, J. D. & Hoogstra, L. (2001). Continuing motivation beyond the high school classroom. *New Direction for Child & Adolescent Development*, vol. 2001 (93), pp. 73-88.

Shilingford, S. & Karlin, N. J. (2013). The role of intrinsic motivation in the academic pursuits of nontraditional students. *New Horizons in Adult Education and Human Resource Development*, vol. 25 (3), pp. 91-102.

Shin, J. Y., Steger, M. F., & Henry, K. L. (2016). Self-concept clarity's role in meaning in life among American college students: A latent growth approach. Self and Identity, vol. 15(2), pp. 206-223.

Skaalvik, E. M. & Hagtvet, K. A. (1990). Academic achievement and self-concept: An analysis of causal predominance in a developmental perspective. *Journal of Personality and Social Psychology*, vol. 58 (2), pp. 292-307.

Skaalvik, E. M. & Rankin, R. J. (1990). Math, verbal, and general academic self-concept: The internal/external frame of reference model and gender differences in self-concept structure. *Journal of Educational Psychology*, vol. 82 (3), pp. 546-554.

Skaalvik, E. M. & Valås, H. (1999). Relations among achievement, self-concept, and motivation in mathematics and language arts: A longitudinal study. *The Journal of Experimental Education*, vol. 67 (2), pp. 135-149.

Skinner, E. A., Wellborn, J. G. & Connell, J. P. (1990). What it takes to do well in school and whether I've got it: The role of perceived control in children's engagement and school achievement. *Journal of Educational Psychology*, vol. 82 (1), pp. 22-32.

Slavin, R. E. (1990). Achievement effects of ability grouping in secondary schools: A best evidence synthesis. *Review of Educational Research*, vol. 60, pp. 471-499.

Smith, R. M. & Schumacher, P. A. (2005). Predicting success for actuarial students in undergraduate mathematics courses. *College Student Journal*, vol. 39 (1), pp. 165-177.

Soom, C. V., & Donche, V. (2014). Profiling first-year students in STEM programs based on autonomous motivation and academic self-concept and relationship with academic achievement. *PloS One*, vol. 9 (11), pp. 1-13.

Stewart, C., Root, M. M., Koriakin, T., Choi, D., Luria, S. R., Bray, M. A. & Courville, T. (2017). Biological gender differences in students' errors on mathematics achievement tests. *Journal of Psychoeducational Assessment*, vol. 35, pp. 47-56

Stipek, D. J. (1993). *Motivation to learn: From theory to practice*. Boston, MA: Allyn and Bacon.

Struthers, C. W., Perry, R. P. & Menec, V. H. (2000). An examination of the relationship among academic stress, coping, motivation, and performance in college. *Research in Higher Education*, vol. 41 (5), pp. 581-592.

Tanner, H. & Jones, S. (2000). Scaffolding for success: reflective discourse and the effective teaching of mathematical thinking skills. *Research in Mathematics Education*, vol. 2 (1), pp. 19-32.

Tapia, M. & Marsh, G. E. (2002). Confirmatory factor analysis for the attitudes toward mathematics inventory. *Annual Meeting of the Mid-South Research Association*, pp. 1-12.

Tapia, M. & Marsh, G. E. (2004). An instrument to measure mathematics attitudes. *Academic Exchange Quarterly* [online]. Vol. 8 (2). [Accessed 3 February 2015]. Available at: http://www.rapidintellect.com/AEQweb/cho25344l.htm.

Tella, A. (2007). The impact of motivation on student's academic achievement and learning outcomes in mathematics among secondary school students in Nigeria. *Eurasia Journal of Mathematics, Science & Technology Education*, vol. 3 (2), pp. 149-156.

Tennen, H. & Herzberger, S. (1987). Depression, self-esteem, and the absence of self-protective attributional biases. *Journal of Personality and Social Psychology*, vol. 52 (1), pp. 72-80.

Thijs, J. (2011). Ethnic difference in teacher-oriented achievement motivation: A student among early adolescent students in the Netherlands. *The Journal of Genetic Psychology*, vol. 172 (2), pp. 121-140.

Tolley, P. A., Blat, C., McDaniel, C., Blackmon, D. & Rovster, D. (2012). Enhancing the mathematics skills of students enrolled in introductory engineering courses: Eliminating the gap in incoming academic preparation. *Journal of STEM Education: Innovation and Research*, vol. 13 (3), pp. 74-86.

Tsao, Y. L. (2004). A comparison of American and Taiwanese students: Their math perception. *Journal of Instructional Psychology*, vol. 31, pp. 206-213.

Tsigilis, N. & Theodosiou, A. (2003). Temporal stability of the intrinsic motivation inventory. *Perceptual and Motor Skills*, vol. 97 (1), pp. 271-280.

Twigg, C. A. (2009). Using asynchronous learning in redesign: Reaching and retaining the at-risk student. *Journal of Asynchronous Learning Networks*, vol. 13 (3), pp. 147-155.

United Arab Emirates University (UAEU). (2015). *Graduation, attrition and time-to-degree institutional narrative-undergraduate programs* [online]. [Access 26 December 2015]. Available at: https://www.uaeu.ac.ae/en/vc/paidd/pdf/retention_report.pdf.

Valentine, J. C., DuBois, D. L. & Cooper, H. (2004). The relation between self-beliefs and academic achievement: A meta-analytic review. *Educational Psychologist*, vol. 39 (2), pp. 111-133.

Vallerand, R. J., Pelletier, L. G., Blais, M. R., Brière, N. M., Senecal, C. & Vallieres, E. F. (1993). On the assessment of intrinsic, extrinsic, and motivation in education: Evidence on the concurrent and construct validity of the academic motivation scale. *Educational and Psychological Measurement*, vol. 53 (1), pp. 159-172.

Vorderman, C., Porkess, R., Budd, C., Dunne, R. & Rahman-Hart, P. (2011). *A world-class mathematics education for all young people.* Report for the Conservative Party. London.

Voyer, D. & Voyer, S. D. (2014). Gender differences in scholastic achievement: A meta-analysis. *Psychological Bulletin*, vol. 140(4), pp. 1174-1204.

Watt, H. M., Carmichael, C. & Callingham, R. (2017). Students' engagement profiles in mathematics according to learning environment dimensions: Developing an evidence base for best practice in mathematics education. *School Psychology International*, vol. 38 (2), pp. 166-183.

Watt, H. M., Shapka, J. D., Morris, Z. A., Durik, A. M., Keating, D. P. & Eccles, J. S. (2012). Gendered motivational processes affecting high school mathematics participation, educational aspirations, and career plans: A comparison of samples from Australia, Canada, and the United States. *Developmental Psychology,* vol. 48 (6), pp 1-18.

Weiner, B. (1979). A theory of motivation for some classroom experiences. *Journal of Educational Psychology*, vol. 71 (1), pp. 3-25.

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review*, vol. 92, pp. 548-573.

Weiner, B. (1992). *Human motivation: Metaphors, theories, and research*. Newbury Park, CA: Sage Publications.

Weiner, B. (2004). 'Attribution theory revisited: Transforming cultural plurality into theoretical unity', in D. M. Mclnerney & S. Van Etten (eds). *Big theories revisited*. Greenwich, CT: Information Age Press. Ch.2.

Wigfield, A. & Eccles, J. (1992). The development of achievement task values: A theoretical analysis. *Developmental Review*, vol. 12, pp. 265-310.

Wigfield, A. & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology*, vol. 25 (1), pp. 68-81.

Wlodkowski, R. J. (1986). *Motivation and teaching*. Washington: National Education Association.

Wolff, K. L. (2004). The nonmusical outcomes of the music education: A review of the literature. *Bulletin of the Council for Research in Music Education*, vol. 159, pp. 74-91.

Wong, P. T. & Weiner, B. (1981). When people ask "why" questions, and the heuristics of attributional search. *Journal of Personality and Social Psychology*, vol. 40 (4), pp. 650-663.

Wright, D. (2009). *Mathematics and music*. Vol. 28. American Mathematical Soc.

Yeung, W. J., Linver, M. R. & Brooks-Gunn, J. (2002). How money matters for young children's development: Parental investment and family processes. *Child Development*, vol. 73 (6), pp. 1861-1879.

Yousef, D. A. (2011). Academic performance of business students in quantitative courses: A study in the faculty of business and economics at the UAE University. *Decision Sciences Journal of Innovative Education*, vol. 9 (2), pp. 255-267.

Yushau, B. & Omar, M. H. (2007). Preparatory year program courses as predictors of first calculus course grade. *Primus: Problems, Resources, and Issues in Mathematics Undergraduate Studies*, vol. 41 (2), pp. 92-108.

Zettle, R. D. (2003). Acceptance and commitment therapy (ACT) vs. systematic desensitization in treatment of mathematics anxiety. *The Psychological Records*, vol. 53 (2), pp. 197-215.

APPENDIX A: QUESTIONNAIRE IN ENLGISH AND ARABIC

Students' Perceptions of Mathematics Questionnaire

استبانة إدراكات الطلبة للرياضيات

Introduction	مقدمة
This survey questionnaire is conducted as part of a research study which aims at examining students' motivation, perceptions, and attitudes toward mathematics. Your cooperation in answering all the questions will be highly appreciated. Please note all your provided information will be kept strictly confidential and no identifying information will be included in any report. Only 18 years old or more can participate in this research study.	تُعد استبانة استطلاع الرأي هذه جزءاً من دراسة تهدف إلى تحليل حوافز وإدراكات ومواقف الطلبة تجاه الرياضيات. إنّ تعاونكم في الإجابة عن جميع الأسئلة سيكون في غاية الامتنان. يُرجى الملاحظة بأن جميع المعلومات المُقدمة سوف تُحفظ بسرية تامة حيث أنّه لن يتم الإفصاح بتاتاً عن أية معلومات تُحدد هوية أي مشارك في هذه الدراسة. تقتصر المشاركة في هذه الدراسة فقط على من لا تقل أعمارهم عن 18 سنة.

Section 1: Demographic Information	الجزء الأول: المعلومات الديموغرافية
1. **Gender:** a. Male b. Female	1. **الجنس:** أ. ذكر ب. أنثى
2. **Age:** a. 18 to 20 years b. 21 to 24 years c. 25 to 29 years d. 30 to 34 years e. 35 to 39 years f. 40 or older	2. **العمر:** أ. 18 سنة إلى 20 سنة ب. من 21 إلى 24 سنة ج. من 25 إلى 29 سنة د. من 30 إلى 34 سنة هـ. من 35 إلى 39 سنة و. 40 سنة أو أكثر

3. How many courses of mathematics have you taken since your graduation from high school and you earned the passing grade? a. None b. 1 course c. 2 courses d. 3 courses e. 4 or more courses	**3. كم مساقاً من الرياضيات درست منذ تخرجك من المرحلة الثانوية و نجحت بهم؟** أ. لم أدرس أي مساق ب. مساقاً واحداً ج. مساقين اثنين د. ثلاثة مساقات هـ. أربعة أو أكثر
4. How many courses of mathematics have you taken since your graduation from high school and you failed or withdrew them? a. None b. 1 course c. 2 courses d. 3 courses e. 4 or more courses	**4. كم مساقاً من الرياضيات درست منذ تخرجك من المرحلة الثانوية و رسبت بهم أو قمت بسحبهم؟** أ. لم أدرس أي مساق ب. مساقاً واحداً ج. مساقين اثنين د. ثلاثة مساقات هـ. أربعة أو أكثر
5. What is the highest level of mathematics courses which have been taken since your graduation from high school? a. NA. No mathematics courses have been taken since my graduation from high school b. 100 level courses c. 200 level courses d. 300 level courses e. 400 level courses f. Others, specify please………………………..	**5. ما أعلى مستوى من مساقات الرياضيات التي أخذتها منذ تخرجك من المرحلة الثانوية؟** أ. لم أدرس أي مساق رياضيات ب. مساقات مستوى 100 ج. مساقات مستوى 200 د. مساقات مستوى 300 هـ. مساقات مستوى 400 و. مساقات أخرى، يرجى التحديد…………………
6. What is your final grade in the last mathematics course taken since your graduation from high school? a. A (90-100) b. B+ (85-89) c. B (80-84) d. C+ (75-79) e. C (70-74) f. D+ (65-69) g. D (60-64) h. F (0-59)	**6. ما درجتك النهائية في آخر مساق رياضيات درسته منذ تخرجك من المرحلة الثانوية؟** أ. ممتاز (90–100) ب. جيد جداً مرتفع (85–89) ج. جيد جداً (80–84) د. جيد مرتفع (75–79) هـ. جيد (70–74) و. مقبول مرتفع (65–69) ز. مقبول (60–64) ح. راسب (0–59)

Section 2: Motivation and Perceptions of Mathematics الجزء الثاني: الحوافز والإدراكات تجاه الرياضيات						
Please check one box for each item:	Strongly Agree موافق بشدة	Agree موافق	Neutral محايد	Disagree غير موافق	Strongly Disagree غير موافق بشدة	يُرجى اختيار إجابة واحدة لكل عبارة
1- Mathematics is necessary for high school graduation.						1- الرياضيات مساق ضروري للتخرج من المرحلة الثانوية.
2- Mathematics is necessary for attaining a college degree.						2- الرياضيات مساق ضروري للحصول على شهادة جامعية.
3- Mathematics is necessary for securing a bright future career.						3- الرياضيات مساق ضروري لتأمين مهنة مُستقبلية مُشرقة.
4- Mathematics is important in our daily life.						4- الرياضيات مهمة في حياتنا اليومية.
5- Mathematics is a very needed and worthwhile course/subject.						5- الرياضيات مساق ضروري وجدير بالاهتمام.
6- I take mathematics courses because I want to develop my mathematical skills.						6- أقوم بأخذ مساقات الرياضيات لأني أريد أن أُطوّر مهاراتي الرياضية.
7- I take mathematics courses because they are mandatory requirements for college degree completion.						7- أقوم بأخذ مساقات الرياضيات لأنها متطلبات إجبارية لاستكمال الشهادة الجامعية.
8- Mathematics is one of the most significant courses to study.						8- الرياضيات واحدة من أهم المساقات التي يجب دراستها.
9- I usually use and apply mathematics outside the classroom.						9- أقوم باستخدام وتطبيق الرياضيات عادةً خارج الفصل.
10- I usually use what I learn in mathematics courses in other courses than mathematics.						10- أقوم باستخدام ما أتعلّمه بمساقات الرياضيات في المساقات الأخرى.
11- Mathematics is primarily about facts and operations.						11- الرياضيات تعتمد في المقام الأول على الحقائق والعمليات.
12- Mathematics is a method to think about problems and numbers.						12- الرياضيات وسيلة للتفكير بالمسائل والأرقام.
13- Mathematics is a very accurate and exact course/subject.						13- الرياضيات مساق دقيق جداً ومُتقن.
14- Things are either right or wrong in mathematics.						14- الأمور إما صحيحة وإما خاطئة في الرياضيات.
15- Mathematics is almost about making relationships and connections.						15- الرياضيات تعتمد تقريباً على إنشاء العلاقات والارتباطات.

Section 2: Motivation and Perceptions of Mathematics						**الجزء الثاني: الحوافز والإدراكات تجاه الرياضيات**
Please check one box for each item:	Strongly Agree موافق بشدة	Agree موافق	Neutral محايد	Disagree غير موافق	Strongly Disagree غير موافق بشدة	يُرجى اختيار إجابة واحدة لكل عبارة
16- Solving a lot of practice problems is the best approach to do well in mathematics.						16- حل الكثير من مسائل الممارسة يُعد أفضل نهج للوصول إلى أداء جيد في الرياضيات.
17- Memorising mathematical facts such as multiplication tables is the best approach to do well in mathematics.						17- حفظ الحقائق الرياضية مثل جداول الضرب يُعد أفضل نهج للوصول إلى أداء جيد في الرياضيات.
18- Memorising formulas is the best approach to do well in mathematics.						18- حفظ القوانين الرياضية يُعد أفضل نهج للوصول إلى أداء جيد في الرياضيات.
19- Mathematics is mainly about understanding rather than root memorising.						19- الرياضيات غالباً ما تعتمد على الفهم بدلاً من الحفظ عن ظهر قلب.
20- Mathematics courses require less hours of private study at home in comparison with other courses.						20- مساقات الرياضيات تتطلب عدداً أقل من ساعات الدراسة المنزلية مُقارنةً بالمساقات الأخرى.
21- I usually enjoy studying mathematics courses.						21- أنا عادةً أستمتع في أثناء دراسة مساقات الرياضيات
22- I take mathematics courses because they are fun.						22- أقوم بأخذ مساقات الرياضيات نظراً لأنها مُمتعة.
23- I take mathematics courses because they are easy.						23- أقوم بأخذ مساقات الرياضيات نظراً لأنها سهلة.
24- I take mathematics courses because of my general interest and the opportunity to learn new things.						24- أقوم بأخذ مساقات الرياضيات بسبب اهتمامي العام وإتاحة الفرصة لتعلم أمور جديدة.
25- Mathematics courses are very interesting.						25- مساقات الرياضيات مُشوقة جداً.
26- Mathematics courses are challenging.						26- مساقات الرياضيات تثير التحدي.
27- Mathematics courses are boring and dull.						27- مساقات الرياضيات مُمِلّة ومُضجِرة.
28- I feel happier in mathematics courses than any other courses.						28- أشعر بالسعادة أكثر في مساقات الرياضيات مقارنةً بالمساقات الأخرى.
29- I feel comfortable answering questions in mathematics courses.						29- أشعر بالارتياح عند إجابتي عن الأسئلة في مساقات الرياضيات.

30-	I prefer working on an assignment in mathematics than writing an essay.						30- أفضل عمل تكليفٍ في الرياضيات بدلاً من كتابة مقالة.
31-	I actually like mathematics courses.						31- أنا في الحقيقة أحب مساقات الرياضيات.
32-	Some career opportunities can only be occupied by individuals who successfully complete mathematics courses.						32- بعض فرص العمل يُمكن فقط أن تُشغل من قِبل أفراد أكملوا مساقات الرياضيات بنجاح.
33-	The earnings of individuals who successfully complete mathematics courses are quite good.						33- يُعد دخل الأفراد الذين أكملوا مساقات الرياضيات بنجاح جيد جداً.
34-	My success in mathematics courses will pave my way for a prestigious future career opportunity.						34- إنّ نجاحي في مساقات الرياضيات سوف يُعبد طريقي للحصول على وظيفة مرموقة في المستقبل.
35-	My success in mathematics courses will affect my future earnings/income.						35- إنّ نجاحي في مساقات الرياضيات سوف يُؤثر على دخلي/كسبي في المستقبل.

Section 3: Attitudes Toward Mathematics						الجزء الثالث: المواقف تجاه الرياضيات
Please check one box for each item:	Strongly Agree موافق بشدة	Agree موافق	Neutral محايد	Disagree غير موافق	Strongly Disagree غير موافق بشدة	يُرجى اختيار إجابة واحدة لكل عبارة
1- I believe I am good at solving problems in mathematics.						1- أنا أعتقد بأنني جيد في حل مسائل الرياضيات.
2- I learn mathematics easily.						2- أتعلم الرياضيات بسهولة.
3- I have always been good at mathematics.						3- لقد كنت دائماً جيداً في الرياضيات.
4- I usually get excellent grades in mathematics courses.						4- أحصل عادةً على تقديرات ممتازة في مساقات الرياضيات.
5- I was good in mathematics when I was young in comparison with now.						5- لقد كنت جيداً في الرياضيات عندما كنت صغيراً مقارنةً بمستواي فيها الآن.
6- Mathematics was easier in earlier grades in comparison with now.						6- كانت الرياضيات أسهل في الصفوف السابقة مقارنةً مع الآن.
7- I usually get average grades in mathematics courses.						7- أحصل عادةً على تقديرات متوسطة في مساقات الرياضيات.
8- I have the confidence in my ability to learn advanced mathematics courses.						8- لدي الثقة بقدرتي على تعلم مساقات الرياضيات المُتقدمة.
9- I have the willingness to take more than the required number of mathematics courses.						9- لدي الاستعداد لأخذ عدد أكبر من عدد مساقات الرياضيات المطلوبة مني.
10- I have the ability to solve very difficult problems in mathematics.						10- لدي القدرة على حل مسائل صعبة جداً في الرياضيات.
11- During my education, I plan to take as much mathematics courses as I can.						11- أخطط خلال دارستي لأخذ أكبر عدد ممكن من مساقات الرياضيات.
12- If I don't understand something immediately in mathematics, I prefer to figure it out by myself.						12- إذا لم أفهم شيئاً ما على الفور في الرياضيات، أفضل فهمه بنفسي.
13- If I don't understand something immediately in mathematics, I prefer to have someone explains it to me.						13- إذا لم أفهم شيئاً ما على الفور في الرياضيات، أفضل أن يشرحه أحد ما لي.
14- The ability of individuals to do well in mathematics is directly related to how much they solve problems.						14- إنّ قدرة الأفراد على تحقيق أداء جيد في الرياضيات متعلقة مباشرةً بعدد المسائل التي يقومون بحلها.

Section 3: Attitudes Toward Mathematics						الجزء الثالث: المواقف تجاه الرياضيات
Please check one box for each item:	Strongly Agree موافق بشدة	Agree موافق	Neutral محايد	Disagree غير موافق	Strongly Disagree غير موافق بشدة	يُرجى اختيار إجابة واحدة لكل عبارة
15- Individuals who are good at mathematics are also good problem solvers.						15- يُعد الأفراد الجيدون في الرياضيات جيدين في حل المشكلات أيضاً.
16- Some individuals are innately good at mathematics.						16- بعض الأفراد جيدون في الرياضيات بالفطرة.
17- I like to explore new concepts in mathematics.						17- أحب اكتشاف مفاهيم جديدة في الرياضيات.
18- I like to solve new problems in mathematics.						18- أحب حل مسائل جديدة في الرياضيات.
19- I like being given a formula by my mathematics instructor and being asked to compute problems.						19- أحب أن يتم إعطائي القوانين من قِبَلِ مدرس الرياضيات والطلب مني حل المسائل.
20- I like being given challenging work by my mathematics instructor.						20- أحب أن يتم إعطائي عملاً يثير التحدي من قِبَلِ مدرس الرياضيات.

Section 4: Interview Participation

الجزء الرابع: المشاركة بمقابلة

The researcher is planning to hold a 20 to 40 minute follow-up interview to discuss issues related to perceptions of mathematics courses. Please complete the following information, if you are interested in participation.	يُخطط الباحث للقيام بمقابلة تتراوح مدتها من 20 إلى 40 دقيقة لمناقشة قضايا ذات صلة بإدراكات الطلبة تجاه مساقات الرياضيات. يرجى استكمال البيانات التالية إذا كان لديك الرغبة بالمشاركة.
Name:	الاسم:
Email address:	البريد الإلكتروني:
Mobile Number:	رقم الهاتف:

APPENDIX B: INTERVIEW GUIDE

The purpose of this interview guide is to explore the predictive factors that influence students' motivation to succeed in undergraduate introductory mathematics courses. The interviewees should not be less than 18 years old in order to be eligible for participation in this interview.

Your participation in this study is highly appreciated. Please be assured that the provided information will remain strictly confidential at all times and the information will be utilised for research purpose only.

Students' Motivation Question

1- Do you think mathematics is important at either the college level or personal level or professional level? Why or why not?
2- Why do you take mathematics courses?
3- Describe your feelings when you are inside the classroom of mathematics?
4- Describe some useful approaches that motivate students to succeed in mathematics courses?
5- In your opinion, what is the best approach to do well in mathematics courses?
6- Describe what recently motivated or demotivated you to succeed in mathematics?
7- Do you think mathematics courses are interesting and enjoyable? Why or why not?
8- Do you think mathematics is important for your desired career in the future? Why or why not?

Mathematics Self-Concept

9- Do you think you are good at mathematics? Why or why not?
10- In your opinion, is mathematics more difficult at the college level compared to the school level? Why or why not?
11- Do you plan to take more mathematics courses than required at the college level? Why or why not?
12- If you don't understand something immediately in mathematics, how do you mange to understand it?
13- Do you feel that your prior performance in mathematics at the school level influence your perceptions about your performance in mathematics at the college level? Why or why not?
14- Do you think your perceptions about your mathematical abilities influence your motivation to succeed in mathematics course? Why or why not?

APPENDIX C: ETHICS FORM

<u>To be completed by the student and submitted to the Ethics Research Committee</u>

NAME OF RESEARCHER: Mohamad Mustafa Hammoudi

CONTACT TELEPHONE NUMBER: +971-050-573-6613

EMAIL ADDRESS: 2013121013@buid.ac.ae

DATE: March 8, 2015

PROJECT TITLE: An Examination of the Predictive Factors on Students' Motivation for Success in Undergraduate Introductory Mathematics Courses in the UAE.

BRIEF OUTLINE OF PROJECT (100-250 words; this may be attached separately. You may prefer to use the abstract from the original bid):

The purpose of the thesis is to examine the relationship between certain predictive factors and students' motivation to succeed in undergraduate introductory mathematics courses offered by universities in UAE. Therefore, the major research question is: how can students' motivation to succeed in undergraduate introductory mathematics courses at universities in UAE be predicted? The following three sub-questions have been articulated to address the major research question:

1. Is there any significant relationship between students' motivation to succeed in undergraduate introductory mathematics courses and students' mathematics self-concept including its two components, cognitive and affective self-concept?
2. Is there any significant relationship between students' motivation to succeed in undergraduate introductory mathematics courses and students' expectations of future career and income?
3. Is there any significant relationship between students' motivation to succeed in undergraduate introductory mathematics courses and students' demographic information such as age, gender, and number of mathematics courses taken?

MAIN ETHICAL CONSIDERATION(S) OF THE PROJECT (e.g. working with vulnerable adults; children with disabilities; photographs of participants; material that could give offence etc):

The three basic ethical principles, which are respect for person, beneficence, and justice will be explicitly implemented and shared with the potential interviewees.

DURATION OF PROPOSED PROJECT (please provide dates as month/year):

From April, 2015 to December, 2015.

DATE YOU WISH TO START DATA COLLECTION: May 1, 2015.

Please provide details on the following aspects of the research:

1. **What are your intended methods of recruitment, data collection and analysis?**

Please outline (100-250 words) the methods of data collection with each group of research participants.

The research methodology will be constructed through an explanatory design of a mixed research paradigm. Fraenkel et al. (2014) indicate that qualitative methods are used to refine and expand on the findings of quantitative methods when an explanatory design is used. Therefore, the data collection process will dominantly start with the quantitative information which will be followed up by the qualitative information. The quantitative information will be gathered through the use of survey questionnaire instrument. In addition to that, the qualitative information will be gathered through conducting a number of interviews. A comprehensive, in-depth, semi-structured interview will be held with a number of undergraduate students. The duration of each interview is about 20 to 40 minutes.

2. **How will you make sure that all participants understand the process in which they are to be engaged and that they provide their voluntary and informed consent? If the study involves working with children or other vulnerable groups, how have you considered their rights and protection?**

The potential interviewees will receive a brief description of the study. They will also receive a copy of the consent form that will describe the purpose of the study and their involvement as participants in the research process. This entails sending the information via email. Then, a follow-up call or introductory meeting will be conducted with the potential interviewees in order to ensure their clear understanding of the process in which they will be engaged.

3. **How will you make sure that participants clearly understand their right to withdraw from the study?**

A copy of the consent form will be sent to the potential interviewees. It describes their right to withdraw at anytime and maintains their anonymity and confidentiality. The potential interviewees will be assured that their responses will remain very confidential at all the times, and the information obtained from them will be utilised for research purpose only. The three basic ethical principles will be explicitly shared with the potential interviewees, and whenever they feel that any principle is not in an effective implementation, they have the full right to withdraw from the study.

4. **Please describe how will you ensure the confidentiality and anonymity of participants. Where this is not guaranteed, please justify your approach.**

The confidentiality and anonymity of the participants will be guaranteed. All the transcripts and other documents will not contain any information about the potential interviewees such as their names and locations. Codes will be used to ensure the anonymity of such information.

5. **Describe any possible detrimental effects of the study and your strategies for dealing with them.**

I don’t anticipate any detrimental effects on the potential interviewees.

6. **How will you ensure the safe and appropriate storage and handling of data?**

All materials including transcripts and drafts will be kept in a locked cabinet to which only the researcher has access.

7. **If during the course of the research you are made aware of harmful or illegal behaviour, how do you intend to handle disclosure or nondisclosure of such information (you may wish to refer to the BERA Revised Ethical Guidelines for Educational Research, 2004; paragraphs 27 & 28, p.8 for more information about this issue)?**

Not applicable.

8. **If the research design demands some degree of subterfuge or undisclosed research activity, how have you justified this?**

Not applicable.

9. **How do you intend to disseminate your research findings to participants?**

The participants will be asked if they will be interested to see the research findings. If they show an interest in looking at the research findings, a draft of the paper will be shown to them.

Declaration by the researcher

I have read the University's Code of Conduct for Research and the information contained herein is, to the best of my knowledge and belief, accurate.

I am satisfied that I have attempted to identify all risks related to the research that may arise in conducting this research and acknowledge my obligations as researcher and the rights of participants. I am satisfied that members of staff (including myself) working on the project have the appropriate qualifications, experience and facilities to conduct the research set out in the attached document and that I, as researcher take full responsibility for the ethical conduct of the research in accordance with the Faculty of Education Ethical Guidelines, and any other condition laid down by the BUiD Ethics Committee.

Print name: Mohamad Hammoudi

Signature: 

Date: March 8, 2015

Declaration by the Chair of the School of Education Ethics Committee (only to be completed if making a formal submission for approval)

The Committee confirms that this project fits within the University's Code of Conduct for Research and I approve the proposal on behalf of BUiD's Ethics Committee.

Print name:
(Chair of the Ethics Committee)

Signature:

Date:

APPENDIX D: UNIVERSITIES' RECRUITMENT LETTER

Dear Chief Academic Affairs Officer:

This letter is written to invite your students to participate in a research study aims at examining the relationship between certain predictive factors and students' motivation to succeed in undergraduate introductory mathematics courses offered by universities in the UAE. The benefits include recommended predictive factors to be shared with you which may enhance your students' academic success in undergraduate introductory mathematics courses. Therefore, this study is expected to provide significant information to administrations and math professors in order to improve math performance and knowledge of all students.

I am currently conducting this research as part of my thesis for the doctor of philosophy programme at the British University in Dubai (BUiD). Students in undergraduate introductory mathematics courses will be asked to participate in completing the enclosed survey questionnaire. The participation of students is completely voluntary and students' responses will be kept strictly confidential and anonymous. Students will be asked to optionally participate in an interview and interested students in participation will be asked to provide their contact information on the bottom of the survey questionnaire.

The survey questionnaire is enclosed and if you have any questions about the study, please contact me at +971-050-573-6613. Your participation in this important research study will be highly appreciated. Thank you very much in advance for your time and assistance. I wish my request will be approved and I look forward to hearing from you as soon as possible.

Best Regards,

Mohamad Hammoudi
Doctoral Candidate
The British University in Dubai (BUiD)
Mobile No. +971 (050) 573 6613
Email: 2013121013@buid.ac.ae

APPENDIX E: CONSENT FORM

The British University in Dubai and those conducting this project subscribe to the ethical conduct of research and to the protection at all times of the interests, comfort, and safety of subjects. This form and the information it contains are given to you for your own protection and full understanding of the procedures. Your signature on this form will signify that you have received a document which describes the procedures, possible risks, and benefits of this research project, that you have received an adequate opportunity to consider the information in the document, and that you voluntarily agree to participate in the project.

Any information that is obtained during this study will be kept confidential to the full extent permitted by law. Knowledge of your identity is not required. You will not be required to write your name or any other identifying information on the research materials. Materials will be held in a secure location and will be destroyed after the completion of the study.

Having been asked by *Mohamad Mustafa Hammoudi*, a Doctorate student at The British University in Dubai to participate in:

A research study on *An Examination of the Predictive Factors on Students' Motivation for Success in Undergraduate Introductory Mathematics Courses in the UAE* is held as a partial requirement in fulfilment of the *Ph.D. thesis*.

Purpose:

The purpose of the research study is to examine the relationship between certain predictive factors and students' motivation to succeed in undergraduate introductory mathematics courses offered by universities in UAE. Therefore, the major research question is: how can students' motivation to succeed in undergraduate introductory mathematics courses at universities in UAE be predicted?

The research methodology will be constructed through an explanatory design of a mixed research paradigm. Fraenkel et al. (2014) indicate that qualitative methods are used to refine and expand on the findings of quantitative methods when an explanatory design is used. Therefore, the data collection process will dominantly start with the quantitative information which will be followed up by the qualitative information. The quantitative information will be gathered through the use of survey questionnaire instrument. In addition to that, the qualitative information will be gathered through conducting a number of interviews.

Interview process:

The respondents to the survey questionnaire will be invited to optionally participate in an interview. Students who are interested in participation will be asked to provide their names and contact information on the bottom of the survey questionnaire. Subsequently, a number of students will be contacted to participate in a comprehensive, in-depth, semi-structured interview. The duration of each interview is expected to last for about 60 to 120 minutes. The interviews will be taped using voice recorder after securing each interviewee's approval. In case an interviewee disagrees to use voice recorder, interview notes will be taken instead by the researcher and only code identifies will be used to transcribe the interviews. All the tapes, notes, and transcription will be maintained in a locked cabinet which is accessed by the researcher only. After the completion of this research study, all the original tapes and notes will be destroyed.

I have read the procedures specified in the document.

I understand the procedures to be used in this study and any personal risks to me in taking part.

I agree to participate by taking part in about 60 to 120 minutes interview.

I understand that I may withdraw my participation in this study at any time.

I also understand that I may register any complaint I might have about the study with the researcher named above or with:

Dr. Clifton Chadwick, (Supervisor)
Faculty of Education at The British University in Dubai
Telephone number: 04-3914438
Clifton.chadwick@buid.ac.ae

I may obtain copies of the results of this study, upon its completion, by contacting:
Name: Mohamad Mustafa Hammoudi
Mobile: +971(050) 573 6613
Email: 2013121013@student.buid.ac.ae

I have been informed that the research material will be held confidential by the Researcher.

I understand that my supervisor or employer may require me to obtain his or her permission prior to my participation in a study such as this.

NAME (Please type or print legibly): ______________________________________

ADDRESS: ____

____

SIGNATURE: __________________________________

DATE: _____________________________________

ONCE SIGNED, A COPY OF THIS CONSENT FORM S

APPENDIX F: DATA COLLECTION REQUEST LETTER ISSUED BY THE BUID

الجامعة البريطانية في دبي

The British University in Dubai

www.buid.ac.ae

04 November 2015

To whom it may concern

This is to certify that **Mr Mohamad Mustafa Hammoudi – Student ID No. 2013121013** is a registered full-time student on the **Phd in Education** programme – Math Education in **The British University in Dubai**.

Mr Hammoudi has completed all the taught modules and has progressed to the 'Thesis' stage. His research study title is **"An Examination of the Predictive Factors on Students' Motivation for Success in Undergraduate Introductory Mathematics Courses in UAE."** We would like to kindly request you to provide Mr Hammoudi with the needed support to collect data to his research through interviews, observation, surveys or other tools.

This letter is issued on the request of Mr Hammoudi. Should you require further information, you may contact the undersigned.

Yours sincerely,

الجامعة البريطانية في دبي
الإدارة الطلابية
Student Administration
The British University in Dubai

Amer Alaya
Head of Student Administration

PO Box 345015 · Block 11 Dubai International Academic City Dubai U A E · T +971 4 279 1400 · F +971 4 279 1490

FB.com/BUiD.Team BUiD_Team youtube.com/BUiDadmin @BUiD_Team BUiD

APPENDIX G: DATA COLLECTION ETHICAL APPORVAL FORM ISSUED BY THE UAEU

Social Sciences Research Ethics Committee
-Approval-

Proposal number: *ERS_2015_4244*

Title of Project: An Examination of the Predictive Factors on Students' Motivation for Success in Undergraduate Introductory Mathematics Courses in UAE

PI: Mohamad Mustafa Hammoudi

Co-PI:

The above proposal has been reviewed by:

- ☒ one member of the Social Sciences REC
- ☐ two members of the *Social Sciences REC*

And the decision is:

- ☒ Favourable
- ☐ Favourable with Additional Conditions
- ☐ Provisional Opinion
- ☐ Unfavourable Opinion
- ☐ No Opinion (Proportionate Review* only)

Reason:

After evaluating this proposal, we see no major ethical concerns. Therefore, the proposal is approved.

Name (Chair or designee): Clara Morgan

Clara Morgan

Signature

January 10, 2016

Date

The decisions available to the Committee are defined as follows:

"**Favourable** with standard conditions" means that the study has ethical approval to proceed, as long as local management approval is in place prior to the study starting.

"**Favourable with Additional Conditions**" means that the study has ethical approval in principle but there are certain issues, which need to be addressed prior to the study starting such as a minor change to participant documentation. It is the responsibility of the Principal Investigator to ensure that additional conditions are met.

"**Provisional Opinion**" means that there are more substantial changes, which need to be made before the study starts. These changes would require further ethical review on the basis of which a favourable or unfavourable opinion would be given by the Ethics Committee.

Unfavourable Opinion means that the study does not have ethical approval to proceed and a further application would need to be submitted should the applicant choose to proceed with the study. Advice and guidance will be provided by the Committee setting out the reasons for their decision and suggesting changes which would mean that a favourable opinion on resubmission would be more likely. For applications processed through the Proportionate Review* Service an unfavourable opinion is only given where the application is of such poor quality that it is probable that an unfavourable opinion would be given if it were to be reviewed at a full meeting.

No Opinion (Proportionate Review* only), means that the Proportionate Review sub-committee (3 members) have deemed that the proposed study does have material ethical issues and will therefore need to be reviewed by a full committee.

**The aim of proportionate review is for studies which present minimal risk or burden for participants to be reviewed by a proportionate review sub-committee within 14 days of receipt of a valid application.*

APPENDIX H: DATA COLLECTION ETHICAL APPORVAL

EMAIL ISSUED BY THE ADU

From: **Mohamad Mustafa Hammoudi** <2013121013@student.buid.ac.ae>
Date: Wed, Jan 6, 2016 at 1:10 PM
Subject: Re: Your research application
To: Essam Dabbour <essam.dabbour@adu.ac.ae>
Cc: Ashraf Khalil <ashraf.khalil@adu.ac.ae>

Dear Dr. Essam:
Thank you very much for your valuable support and guidance.
Best Regards,
Mohamad Hammoudi
Doctoral Candidate
The British University in Dubai (BUiD)
Mobile No. +971 (050) 573-6613
Email:2013121013@buid.ac.ae

On Wed, Jan 6, 2016 at 12:47 PM, Essam Dabbour <essam.dabbour@adu.ac.ae> wrote:

Dear Mr. Mohamad

Based on the expedited reviews received from two of the IRB members, I am pleased to inform you that your research project titled "***An Examination of the Predictive Factors on Students' Motivation for Success in Undergraduate Introductory Mathematics Courses in UAE***" is now **APPROVED** by the IRB at Abu Dhabi University. You may now start collecting data. Please make sure to inform me once you have completed your data collection with filling the attached closeout form. I would like to wish you the best of luck in your research. All the best

Dr. Essam Dabbour, P. Eng., M. ASCE

Associate Professor
Department of Civil Engineering
College of Engineering, Abu Dhabi University
P. O. Box 59911, Abu Dhabi, United Arab Emirates
Member,*American Society of Civil Engineers* (ASCE)
Member,*Institute of Transportation Engineers* (ITE)

APPENDIX I: SEMI-STRUCTURED INTERVIEWS TRANSCRIPTS

Student ID: MH01
Student Name: Peter
Age: 19 years old
Major: Bachelor of Business Administration in Accounting
Last Grade in Mathematics: A

Motivation: Peter believes that mathematics is the base and centre of all sciences and mathematics is needed to solve and understand problems in many major courses. Peter thinks that mathematics teaches him logical and reasonable thinking skills and everything about numerical facts. Moreover, Peter believes that he must know how to deal with numbers, because there are many things in his daily life which are represented by numbers such as money and banking. Peter feels excited inside the classroom of mathematics, because he likes mathematics and loves solving problems that require thinking. He thinks that accurate reading and analysis of mathematical problems motivates him to succeed in mathematics courses, so the careful reading and understanding of the problem is almost half of the solution for Peter. In addition to that, Peter believes that thinking about solutions while he is solving questions and putting in his mind that he wants to find solutions motivates him and challenges him to succeed in mathematics courses. Peter enjoys understanding mathematics and its applications in real life, but he does not enjoy memorising mathematical formulas. Peter's passion for mathematics and his good understanding of the topics also motivates him to succeed in mathematics courses. Peter thinks that mathematics courses are interesting and enjoyable courses, because mathematics is a sport for his brain and he is already passionate about the subject. Peter believes that mathematics is important for his desired career in the future, since his major is accounting and it is all about numbers and dealing with numbers.

Mathematics Self-Concept: Peter is good at mathematics and enjoys dealing with numbers, because he likes solving problems related to mathematics. He thinks that the human brain is more developed at the college level and it requires harder questions to think about compared to his level at school. Peter plans to take more courses in mathematics, because he likes to have a greater knowledge about mathematics and he likes hard challenges. Peter directly asks his instructors to repeat for him or asks his instructors during their office hours for help, if he does not understand something immediately in mathematics. Peter believes that his prior performance in mathematics at the school level is the base for mathematics at the college level, and the good understanding of the basics at the school level supports him to perform well in mathematics at the college level. Peter thinks his perception that he is good at mathematics motivates him to focus more and work harder to succeed in mathematics courses at the college level.

Student ID: MH02
Student Name: Asfer
Age: 22 years old
Major: Bachelor of Science in Mechanical Engineering
Last Grade in Mathematics: B+

Motivation: Asfer believes that mathematics is the most reliable tool a professional can use to solve real world problems at the professional level. He thinks that mathematics helps him to generalise complex world problems into simple equations. For Asfer, mathematics is like a puzzle and whenever he discovers something new in mathematics, another puzzle soon follows it. Asfer likes to discover new concepts and formulas and mathematics provides him with a great environment to achieve that. Asfer feels that he is in the other world whenever he is inside the classroom of mathematics, because mathematics has its own dimension to be exact. Moreover, he feels that the mathematics class is like a soccer field where he can be creative and excel in all areas of mathematics. Asfer enjoys learning new ideas and tips from his enthusiastic instructors and he learns new things day by day. Asfer believes that understanding how mathematics plays a vital role in his daily life is a useful approach that motivates him to succeed in mathematics courses. For example, he uses mathematics equations to calculate speed, acceleration, and distance to travel from one city to another city inside the UAE. Asfer believes the best approach to do well in mathematics is to practice and solve many mathematical problems. Learning the concepts of trigonometry has immensely motivated Asfer to succeed in mathematics. He is fascinated by how simple trigonometric equations may change the beauty of the world, and he thinks that everything involves shapes, dimensions, and trigonometry has made it much easier for professionals to build beautiful buildings, architectures, etc. For Asfer, mathematics courses are interesting, because they provide him with a challenging environment to squeeze his mind both mentally and physically. Mathematics is like solving a puzzle for Asfer and once he succeeds in solving it, he will reach the best enjoyable feelings. Asfer has the passion in automotive engineering which implies the use of mathematics. Asfer uses mathematics in AutoCAD software to simulate the crash test of cars, which if it is done in reality, it might be dangerous and expensive. Asfer believes that calculations involving aerodynamics, weight distribution, gears, and fluid mechanisms are various aspects of auto engineering major which requires immense use of mathematics; therefore, mathematics is a vital choice for his future career.

Mathematics Self-Concept: Asfer believes he is an average student in mathematics and he has a long path to walk in order to be good at mathematics. For Asfer, mathematics at the college level is easier than mathematics at the school level, since at school he had to learn from the very basic to complex mathematics equations, unlike at university where he just has to practically apply the concepts learnt at school and research them. Asfer does not prefer to take mathematics courses more than the required mathematics courses for his major. He prefers to take algebra and calculus separately, because calculus requires him to spend many hours on practicing algebra in order to do well in calculus. If Asfer does not understand something immediately in mathematics, he tries to use online resources like Khan Academy and some online databases. Inside the classroom, he asks his colleagues for help sometimes and he always stays in touch with his instructors to discuss with them his questions and get reliable answers. Asfer has been always positive about mathematics and he thinks that having a strong foundation in mathematics at the school level will be a key to his success in mathematics at the college level. Asfer believes that his mathematical abilities influence his motivation to succeed in mathematics courses and mathematics has been always a subject that motivates him to be more creative.

Student ID: MH03
Student Name: Walaa
Age: 20 years old
Major: Bachelor of Arts in English
Last Grade in Mathematics: F

Motivation: Walaa believes that mathematics is important, since it plays a serious role at the college, personal, and professional levels. She uses mathematics to perform many different daily tasks such as telling time, counting change or making strategic decisions in her personal life or work life. She thinks that almost every profession uses some form of mathematics. Walaa takes mathematics courses, since they are college requirements and she has to take them. Walaa feels anxious when she is inside the classroom of mathematics and she cannot wait until the class is over. She sometimes feels sleepy and bored, because she hates mathematics. Walaa believes that presenting a challenge to students motivates them to succeed in mathematics courses, because when students are challenged intellectually, nearly most of them react with enthusiasm. Moreover, Walaa thinks recreational mathematics may motivate students to succeed in mathematics courses. Walaa believes that the best approach to do well in mathematics courses requires attending classes on a regular basis, being involved in the class, reviewing old material notes, and previewing new lesson materials. Walaa has not been motivated recently by anything to succeed in mathematics. She has to pass the class so that she can move on and never take a mathematics course again. Walaa thinks mathematics courses are boring and mathematics has nothing to do with her future desired career, because she plans to work as a translator.

Mathematics Self-Concept: Walaa is not good at mathematics, because she hates mathematics and she does not expect herself to be good at mathematics. Walaa believes that mathematics was harder for her when she was at school compared to the college, because the material taught at school was hard, more complicated, and takes more time to be understood. Walaa does not plan to take more mathematics courses than required at the college level, because she does not like mathematics. Walaa usually gets a tutor to teach her, if she does not understand something immediately in mathematics. Walaa thinks that if her performance in mathematics at school was terrible, she believes that her performance at college maybe the same, so her prior performance in mathematics at school influences her current performance in mathematics at college. Walaa believes that some past events may influence her ability to control what happens to her in the future. For example, having a bad experience with mathematics at school can affect her ability to understand mathematics and be good in it at college. Therefore, her perceptions about her mathematical abilities influence her motivation to succeed in mathematics courses.

Student ID: MH04
Student Name: Muayad
Age: 19 years old
Major: Bachelor of Science in Mechanical Engineering
Last Grade in Mathematics: A

Motivation: Muayad believes that mathematics is important at different levels, since it is a factual subject. For example, the sum of 1 + 1 will never change. It equals two today and it will remain two forever. Mathematics courses help Muayad to solve complex issues and problems in a very short time, because it helps in converting word problems into simple equations. Muayad feels that he is looking to the world from different angles or from another planet whenever he is inside the classroom of mathematics. Muayad thinks that one of the useful approaches to motivate students succeed in mathematics is to understand how mathematics is powerful in solving real life applications. Muayad believes that the best approach to do well in mathematics is to understand why the mathematical theories and equations have been developed and to apply them in his daily life in a decent way through intensive practice and one-to-one discussion with the instructors. Using the calculator facilitates Muayad's learning of mathematics. Muayad has been recently motivated to learn the concept of fundamental theory in calculus, because it provided him with the opportunity to see the function in its future with infinity and to know its behaviour in a very short time which is zero. Mathematics courses are very interesting for Muayad, because they are powerful and useful. Muayad believes that all types of sciences depend on mathematics. Muayad has the passion to work in the academia as a professor and researcher in science in the field of physics and he cannot achieve his dream without mathematics.

Mathematics Self-Concept: Muayad got 100 in mathematics at high school and when it comes to linear equation, multi variable calculus, and differential equations, he just can understand them perfectly. Muayad believes that mathematics at the college level is the same at the school level. However, at the college level he can apply what he learns in mathematics by working on research studies and projects and asking his instructors who have the ability to answer his questions properly. Muayad thinks that the teaching style of mathematics at high school depends on memorising; however, it depends more on understanding at the college level. Muayad does not plan to take more mathematics courses than the required at the college level, because he plans to take only the necessary courses for him to graduate. Muayad believes that students should not be asked to memorise mathematical formulas, but they should be taught how to apply and use mathematical formulas to solve real life applications, because if a student does not understand why and how to use a specific mathematical formula, the student will not be able to use the formula even if the formula is provided to the student. Muayad always asks his instructors, if he does not understand something in mathematics and he sometimes tries to use online resources. Muayad thinks that mathematics is a language and he relies on what he learnt at school as the foundation which influences his performance in mathematics at the college level. Muayad believes that his perceptions about his abilities in mathematics influence his motivation to succeed in mathematics courses and this was obvious for him when he passed the mathematics placement test and that impacted positively his motivation to succeed in the calculus course.

Student ID: MH05
Student Name: Rashid
Age: 20 years old
Major: Bachelor of Science in Information Technology
Last Grade in Mathematics: B

Motivation: Rashid believes that mathematics is involved in almost everything in the world; therefore, it is a very important subject. Rashid takes mathematics courses, because they are fun courses for him and he likes them so much. Rashid feels happy inside the classroom of mathematics, because he prefers mathematics courses more than other courses, especially if the instructors of mathematics have excellent teaching skills. Rashid thinks that the best approach that motivates him to succeed in mathematics courses includes reading his notes and trying to understand them well; watching YouTube videos that illustrate different ways of explanation which can be understood, if he does not understand from his instructors; and practicing more examples. Rashid believes that mathematics is very important for his major and he tries to work hard to do well and pass mathematics courses with high grades. Rashid thinks that mathematics courses are enjoyable, because he can understand them well and because they do not rely on memorising. Mathematics courses are interesting for Rashid, since they provide him with the opportunity to learn new things. Rashid's major is information technology and mathematics courses are important for his desired career in the future.

Mathematics Self-Concept: Rashid's latest results in mathematics courses were good so he believes he is good at mathematics. Rashid has finished one course of mathematics at the college level so far and he feels that mathematics at the college level is not difficult compared with mathematics at the school level. Rashid plans to take more mathematics courses than required, because he is good at mathematics and he finds mathematics to be enjoyable and fun subject which is very important even after graduation from the college. Rashid tries to watch videos on YouTube and practice more online examples, if he does not understand something immediately in mathematics. Rashid believes that his prior performance in mathematics at the school level influences his perception about his mathematics at the college level, since he learnt the basics of mathematics at school which help him to succeed in mathematics at the college level. Rashid thinks that his perceptions influence his motivation to succeed in mathematic courses, since if he tells himself that he is not good at mathematics, he will not be able to understand anything. But, if he believes in his abilities, he will work harder to understand what he finds it to be difficult.

Student ID: MH06
Student Name: Nadin
Age: 22 years old
Major: Bachelor of Arts in English
Last Grade in Mathematics: B

Motivation: Nadin thinks that mathematics is important for her, since life will be difficult without mathematics. For example, she uses mathematics in her daily life when she is going to pay for something in order to know the amount of change that she should receive. Nadin takes mathematics, because it is something important in her life to know about. Nadin feels very comfortable and relaxed inside the classroom of mathematics. The mathematics course was easy for her and she did not face difficulties during the course. Nadin believes that she is usually motivated to succeed in mathematics courses whenever the instructors are enthusiastic, make the class interesting to students, do not make students feel that mathematics is complicated and hard to understand, and try to make some interesting activities that students can enjoy and make them feel mathematics is easy. Nadin thinks that the best approach for her to do well in mathematics is to review the notes before the class and practice and solve more problems which make her more confident and feel the exam is easy. Nadin believes that the negative suggestions or word-of-mouth from negative people towards mathematics can lead her to become afraid from mathematics or demotivated to succeed in mathematics courses. Nadin thinks that mathematics courses are interesting and enjoyable, especially while she is answering questions and she is confident about her answers. Nadin is studying translation and she thinks her future career does not require knowledge about mathematics.

Mathematics Self-Concept: Nadin is good at mathematics, because sometimes she solves mathematical problems and puzzles and she feels excited while solving them. Nadin believes that mathematics at the college level is easy, simple, and not complicated in comparison to mathematics at the school level. She thinks that the taught materials at school are huge in quantity and were not taught properly which makes mathematics hard for students. Nadin has no plans to take more mathematics courses than the required, because she does not need them for her major and she already knows the important things about mathematics and no need for her to go in-depth at mathematics. When Nadin does not understand something immediately in mathematics, she prefers trying to understand it more than one time. If she still does not understand it, she asks for a help from her brother who is good at mathematics and she wants to be like him. Nadin believes that her prior performance in mathematics at the school level does not influence her perceptions about her performance in mathematics at the college level, because mathematics at the college level is taught in an easy way to understand. Nadin thinks that her perceptions about her mathematical abilities influence her motivation to succeed in mathematics courses.

Student ID: MH07
Student Name: Abdul Rahim
Age: 22 years old
Major: Bachelor of Business Administration in Accounting
Last Grade in Mathematics: A

Motivation: Abdul Rahim believes that mathematics is an important thing that has been always around him not just only in the college and professional environments, but also in his personal environment. Abdul Rahim takes mathematics courses to help him in both his personal life as well as his professional life, but mainly in his professional life as the world is continuously evolving mathematics and this fact will remain unchanged. So, Abdul Rahim believes that he should have the knowledge in mathematics. It is very hard for Abdul Rahim to describe his feelings when he is in a mathematics class, because his feelings are always on a roller coaster ride especially in mathematics classes. Abdul Rahim's feelings in mathematics classes depend on three main aspects which are the classroom environment, the taught lesson, and the way it is taught. According to the previous three aspects, Abdul Rahim's feelings always change. Abdul Rahim thinks that understanding the practicality of mathematics motivates him to succeed in mathematics courses. That is why before any mathematics lesson, he personally tends to look at the practical side which not only helps him understand the lesson, but also motivates him to succeed. Abdul Rahim believes that the best approach to do well in mathematics is to understand its practice in the real world and how it can be used in different circumstances. Abdul Rahim was recently introduced to learn probability and how to calculate the chances of different event outcomes. This was to him a very interesting subject, because he personally always likes challenges, puzzles and this lesson includes puzzles and games that motivate him to succeed. Abdul Rahim believes that most of the time mathematics courses are interesting and enjoyable.

Sometimes, there are some lessons that do not make sense to him and he does not see their practical value, so he finds them very less interesting. There are other times when questions come up in the form of puzzles and he always loves good challenges. Abdul Rahim's dream job is to become an accountant and he believes that it is very important for him to be knowledgeable in mathematics, if he wants to fulfil his dream.

Mathematics Self-Concept: Abdul Rahim believes that he is good at mathematics, because he always passes with good grades in mathematics courses and he also tends to use the gained knowledge from mathematics and apply it as much as he can in his daily life. Abdul Rahim thinks that mathematics at the college level is more difficult than mathematics at the school level not because he is taught something new, but mainly because the knowledge he gained at school was very basic. Abdul Rahim does not plan to take additional mathematics courses, if they are not required, because he wants to finish his college studies faster, but he may consider taking mathematics courses, if they are needed for his graduation. Abdul Rahim always uses online learning resources such as YouTube and Khan Academy when he does not understand something in mathematics, because this approach is very helpful and usually works out. Abdul Rahim believes that the mathematics basics he learnt at school give him the leading edge in college studies at mathematics over his college colleagues. Abdul Rahim thinks that his school did a great job in preparing him and teaching him the basics in the right way, since the basics in mathematics are the keys to success and will be used at all levels of mathematics courses. Abdul Rahim believes that his perceptions about his mathematical abilities matter and influence his motivation to succeed in mathematics courses. Abdul Rahim thinks that students have different perceptions and that is why if a problem is given to a group of students, the final solution to the problem might be found in different ways and styles by different students. For example, if he develops a perception about himself by looking at the question and saying this is an easy question, he will be very willing to attempt solving the question with great confidence. But, if he develops a perception that the question is very complicated and he does not have the ability to solve it, he will not even attempt to solve the question in order to save his time. So, basically perceptions influence confidence a lot for Abdul Rahim.

Student ID: MH08
Student Name: Sally
Age: 18 years old
Major: Bachelor of Arts in Mass Communication
Last Grade in Mathematics: D

Motivation: Sally thinks mathematics is important at the college level, because the material is more concentrated and explained briefly rather than being extended and expanded which takes a lot of time to be covered and studied, especially at schools. Sally believes that mathematics courses are important for everyday life in terms of regular calculations and evaluations made on a daily basis at businesses and other jobs besides its necessity when it comes to certain majors such as engineering, medicine, etc. It is the key to enter any other major course or major study. Sometimes, Sally gets a little bored as a student inside the classroom of mathematics, because she has to pay full attention at the professor while explaining a certain point. But overall, she personally thinks mathematics is more like games with numbers and clues but in form of a problem solving. The best approach for Sally to do well in mathematics is to pay attention and ask as many questions as she can about any problem solving in order to improve her abilities and become better at mathematics-related major courses. Sally never was an A student at mathematics, neither a B student. However, she has always had fun in doing mathematics and putting her efforts into it, since it does not only measure her intelligence, but also identifies her perspectives and points of view. Sally thinks mathematics courses are interesting and enjoyable, because they can be expressed in forms of games, face-to-face challenges, oral tests, and even daily brain exercises. Sally believes that mathematics is important for future careers depending on the desired careers of students.

Mathematics Self-Concept: Sally thinks she is an average student at mathematics, because she has been told by her parents and school teachers that she is more of a theoretical person not very much involved with calculations, logic, and problem solving. Sally believes that mathematics at the college level is more brief and applied compared to mathematics at the school level, since it carries this sort of ease that does not get her confused. Sally does not intend to take more courses of mathematics if they are not required; however, she never stops playing games related to mathematics and calculations, because she gets so much benefit from them. Sally usually studies at her friend's house after she takes the lecture of mathematics with the professor, since she understands and learns faster when she is alone with a person or two, not a group of people. Sally did not used to do well in mathematics at school and that did not affect her performance at college, since she tries to have positive perceptions about herself at college. Sally thinks that her perceptions about her mathematical abilities influence her motivation to succeed in mathematics, because she believes that all it takes from a student to like a subject and have the desire to succeed at it is to have positive perceptions. Otherwise, students will not be motivated to succeed or do any good, if what all they do is complaining about mathematics.

Student ID: MH09
Student Name: Omar
Age: 24 years old
Major: Bachelor of Business Administration in Finance
Last Grade in Mathematics: B

Motivation: Omar believes that mathematics is important at the college level, because it is needed to pass the courses. He also believes that it is important at the personal level, since he passes through situations that require from him to use some basic knowledge in mathematics. Omar thinks that mathematics is not important at the professional level as the calculations can be done by using computers. Omar takes mathematics courses, because of his belief that he should know the basics of mathematics and because taking mathematics courses is a requirement for him, not an option. Omar feels bored when he is inside the classroom of mathematics. Omar believes that reducing the number of classes, reducing the amount of lessons, and lowering the passing grade are useful approaches that motivate students to succeed in mathematics courses. Omar thinks that solving practice questions constantly and taking private lessons is the best approach to do well in mathematics courses. Omar was recently motivated to succeed in mathematics when he studied with a group of his colleagues. Omar believes that mathematics courses are neither interesting nor enjoyable, because the instructor's teaching style depends on talking and explaining only. Omar thinks that mathematics is important for his desired career in the future, in particular the basic course of mathematics is important for business majors.

Mathematics Self-Concept: Omar thinks that he is not really good at mathematics, because he usually forgets everything and how to solve when the semester is over. Omar believes that mathematics is more difficult at school, because students at school are taught everything in mathematics in contrary to mathematics taught at college which concentrates on the important things related to student's major. Omar does not want to take mathematics courses, if they are not required, because he does not like mathematics. When Omar does not understand something in mathematics, he usually asks his instructors for further explanation and he sometimes uses online resources such as YouTube. Omar believes that his prior performance in mathematics at the school level influences his perceptions about his performance in mathematics at the college level, because he is always at the same level and what he gets in the college is like what he used to get in school. Omar thinks that his perceptions about his mathematical abilities influence his motivation to succeed in mathematics courses as when he feels that something is difficult, it makes it difficult for him to study it.

Student ID: MH10
Student Name: Haifa
Age: 18 years old
Major: Bachelor of Architecture
Last Grade in Mathematics: B+

Motivation: Haifa believes that mathematics is important at the college, personal, and professional levels, because mathematics has been used in everything, specially technology. Haifa takes mathematics courses, because her major depends on mathematics which will help her later on. Haifa actually enjoys her time inside the classroom of mathematics, since she loves calculations and solving problems. Haifa believes that listening to music is a useful approach that motivates students to succeed in mathematics courses. She usually listens to music while solving mathematical problems and this approach increases her concentration, saves her energy, and helps her enjoy the learning process. Haifa thinks that the best approach to do well in mathematics courses depends on the instructor's teaching style. For Haifa, good instructors should force students to understand the mathematical concepts rather than memorising them.

Haifa believes that mathematics courses are interesting, because they rely on understanding and they do not have anything to do with memorising. Haifa thinks that mathematics is important for her desired career in the future, because architectural engineers have to perform certain calculations and all are related to the basics in mathematics.

Mathematics Self-Concept: Haifa believes she is good at mathematics, since she personally enjoys understanding this subject. Haifa thinks that mathematics is the same at the school level and at the college level and the difficulty will be something that helps students in their majors. Haifa does not plan to take any additional mathematics courses, if they are not required. She believes that her university will ask her to take only the courses that she absolutely needs in her major. Haifa always seeks the help of her father who is a teacher of mathematics and he always emphasises the importance of mathematics and motivates her to learn mathematics. Haifa believes her performance in mathematics at the school level influences her perceptions about her performance in mathematics at the college level, because she was good at mathematics in school and she is still good at mathematics in her college. Therefore, she thinks that her perceptions about her mathematical abilities influence her motivation to succeed in mathematics courses.

Student ID: MH11
Student Name: Dawood
Age: 22 years old
Major: Bachelor of Business Administration in Accounting
Last Grade in Mathematics: B+

Motivation: Dawood thinks that mathematics is very important at all the different levels of his daily life and without mathematics nothing is going to work in a good way. Dawood takes mathematics courses, because he is a business student majoring in accounting and he wants to learn the concepts related to calculating money and without having the knowledge about the basics of mathematics; it may be difficult for him to succeed in his major. Dawood takes mathematics courses in order to use the gained skills in his life. For Dawood, the class of mathematics is interesting, since he gets the chance to answer, participate, and engage in the discussion. Dawood believes that being active inside the classroom is a useful approach that motivates him to succeed in mathematics courses. Dawood thinks that the best approach to do well in mathematics courses is to study on a regular basis, never accumulate the materials, ask questions, and solve problems. Dawood believes that mathematics courses are interesting, since they give him a room to participate more in the classroom activities. Dawood thinks mathematics is very important for his desired career in the future as his dream is to become an accountant and the major of accounting implies having the knowledge about the basics of mathematics.

Mathematics Self-Concept: Dawood believes he is so good at mathematics, because he likes this subject. Dawood thinks that mathematics taught at the school level was basic and easy, but it is taught in-depth at the college level. Dawood does not plan to take additional mathematics courses, if they are not required as part of his major. Dawood usually seeks his instructor's help or study with his friends in groups, if he does not understand something immediately in mathematics. Dawood believes that if he didn't understand and succeed in the basics of mathematics at school, it was going to be hard for him to succeed in mathematics at the college level. Therefore, his prior performance in mathematics at school influences his perceptions about his performance in mathematics at college. Dawood thinks that as long as he has positive perceptions about his mathematical abilities and he learns mathematics, it becomes easier and he becomes more motivated and interested in it. So, he believes that his perceptions about his mathematical abilities influence his motivation to succeed in mathematics courses.

Student ID: MH12
Student Name: Moen
Age: 19 years old
Major: Bachelor of Science in Chemical Engineering
Last Grade in Mathematics: A

Motivation: Moen believes that mathematics is needed in his daily life and academic life and without mathematics; he will not be able to do simple life tasks. Moen takes mathematics courses, because they are part of his major requirements. Moen does not have any specific feelings toward mathematics classes. Sometimes, he feels bored and sometimes the topic may interest him. Moen thinks knowing that he has to finish mathematics courses in order to graduate and work motivates him to pass these courses. Moen believes that teaching students about the importance of mathematics and its significance in real life applications is the best approach to do well in mathematics courses. Moreover, showing students how to enjoy solving mathematical problems motivates Moen to succeed in mathematics courses. Moen loves mathematics and enjoys solving mathematical problems and he thinks mathematics courses are interesting and enjoyable. Moen's desired career in the future is to work the field of engineering and engineers need mathematics in order to be able to do their job.

Mathematics Self-Concept: Moen always gets good grades in mathematics courses and he thinks he is good at mathematics. Moen believes that mathematics is more difficult at the college level compared to the school level, because it is inclusive of more specific information. Moen does not want to take any mathematics courses which are not required from him at the college level, because he wants to graduate quickly. If Moen does not understand something in mathematics, he usually starts by looking it up in the notebook and tries to understand it alone. If still he does not understand it, he asks his instructor. Moen still uses the mathematical skills leant at school in other mathematics courses at the college level; therefore, he thinks that his prior performance in mathematics at the school level influences his perceptions about his performance in mathematics at the college level. Moen believes that his perceptions about his mathematical abilities influence his motivation to succeed in mathematics courses, because if a person believes in his or her abilities, he or she will pass.

Student ID: MH13
Student Name: Tuleen
Age: 19 years old
Major: Bachelor of Science in Civil Engineering
Last Grade in Mathematics: C+

Motivation: Tuleen thinks that mathematics is not important, because she does not use it in her daily life. Tuleen takes mathematics courses, because she is forced to take mathematics at school and college. Tuleen feels confused inside the classroom of mathematics due to the difficulty of the subject. Tuleen believes that solving more practice problems is a useful approach that motivates students to succeed in mathematics courses. Tuleen thinks that the best approach to do well in mathematics is to study on a daily basis. Getting good marks motivates Tuleen to succeed in mathematics. Tuleen does not think that mathematics courses are interesting and enjoyable all the time; it depends on the lesson. Tuleen does not believe that mathematics is important for her desired career in the future.

Mathematics Self-Concept: Tuleen believes that she is an average student at mathematics and she needs more practice. Tuleen believes that mathematics is difficult at both the school level and the college level, because the material of mathematics is the same at all levels. Tuleen has no plans to take additional mathematics courses, if they are not required. Tuleen usually seeks the help from her friends or instructors whenever she does not understand something immediately in mathematics. Tuleen believes that her performance in mathematics at the school level influences her perceptions about her performance in mathematics at the college level, since if a student has good grades in mathematics at school, the student will continue with the good performance at college. Tuleen thinks that her perceptions about her mathematical abilities influence her motivation to succeed in mathematics courses.

Student ID: MH14
Student Name: Mustafa
Age: 20 years old
Major: Bachelor of Science in Electrical Engineering
Last Grade in Mathematics: A

Motivation: Mustafa believes that mathematics is important at the college, personal, and professional levels. First of all, at the college level, mathematics improves his mental abilities. Secondly, he needs mathematics in his daily life, when it comes to the personal level. For example, Mustafa uses mathematics in order to know how much he needs for his priorities per day. Finally, Mustafa is not sure if all professions need mathematics, but he thinks most professions need mathematics. For instance, physicians need to have knowledge in mathematics in order to do calculations for several things such as Body Mass Index (BMI) or how much dose a certain patient needs to recover. Mustafa is an electrical engineering student and he needs mathematics and this is the reason for him to take mathematics courses. Mustafa's feelings inside the classroom of mathematics depend on the topic explained by the instructor and whether he understands it or not. When Mustafa faces no trouble understanding the concept of a topic, he enjoys the class of mathematics. Mustafa thinks that challenging students in understanding a concept or in solving a question is a useful approach that motivates students to succeed in mathematics courses. Mustafa believes that the challenge approach is the best approach for him to do well in mathematics, because this approach always encourages him to figure out how something is done or how it happens. Mustafa enjoys his time when he is given a mathematical formula and when he uses the formula to solve the real life application problem and interpret the solution. He thinks that students should be taught how to understand the use of mathematical formulas instead of memorising them, because formulas will not be useful for students even when they are given to students, if students do not understand how to use the formulas. Mustafa was recently demotivated by neglecting a specific subject which resulted in him not understanding the concept. Mustafa believes that mathematics courses are interesting and enjoyable, because he finds that solving a question is as interesting as cracking a code. Mustafa thinks that mathematics is important for his desired career in the future, because his career is all about measurements such as the length and the current flowing through a wire with a certain dimension.

Mathematics Self-Concept: Mustafa believes he is good at mathematics as he enjoys it. Mustafa thinks that mathematics is more difficult at the college level compared to the school level, because the amount of materials taught at school is similar to the amount of materials taught at college, but the material is taught at school over a longer period of time. Moreover, the material taught at the college level is an advanced level of mathematics. Mustafa has no plan to take mathematics courses, if they are not required, because he would like to graduate as soon as possible. He may take more mathematics courses after he graduates. If Mustafa does not understand something immediately in mathematics, he seeks help from a friend or the instructor himself; he might also look in the internet for a better explanation. Mustafa believes that succeeding in mathematics depends on how he feels about the subject. If he ever keeps in mind that the subject is hard, he will actually suffer in succeeding in it. Therefore, Mustafa's prior performance in mathematics at school influences his perceptions about his performance in mathematics at college. Mustafa thinks that his mathematical abilities are good enough to motivate him to succeed in mathematics courses and he believes that his perceptions about his mathematical abilities influence his motivation to succeed in mathematics courses.

Student ID: MH15
Student Name: Nisreen
Age: 18 years old
Major: Bachelor of Science in Civil Engineering
Last Grade in Mathematics: A

Motivation: Nisreen believes that mathematics is important specially at the school level, since it provides students with the basics needed for them to succeed in the future. Nisreen takes mathematics courses, because they help her to become smarter. Nisreen feels so good inside the classroom of mathematics and she is all the time focused and concentrated. Nisreen thinks that studying hard and getting tutors are useful approaches that motivate students to succeed in mathematics courses, if students face difficulties in mathematics. The best approach for Nisreen to do well in mathematics courses is to study on a daily basis. Nisreen likes mathematics as it is a fun subject for her and she thinks mathematics courses are interesting and enjoyable, because they are more like mind games. Nisreen's major is engineering and she believes that mathematics is important for her desired career in the future.

Mathematics Self-Concept: Nisreen believes that she is good at mathematics, because it is her favourite subject. Nisreen thinks that mathematics is a little bit difficult at the college level in comparison with the school level, since it contains more details at the college level. Nisreen plans to take additional courses of mathematics, if they are not required, because they are always helpful. If Nisreen does not understand something immediately in mathematics, she directly asks her instructor. Nisreen believes that the information taught at school is different from the information taught at college; therefore, students' performance in mathematics at school may not influence students' performance in mathematics at college. Nisreen thinks that her perception about her mathematical abilities influences her motivation to succeed in mathematics courses, because if she likes mathematics, she can always do well at mathematics courses.

Student ID: MH16
Student Name: Charls
Age: 20 years old
Major: Bachelor of Science in Civil Engineering
Last Grade in Mathematics: D

Motivation: Charls believes that mathematics is very important in his life, because he uses it in a daily basis such as in the grocery store or even if he is buying a new shirt. Therefore, mathematics is very important and helpful for Charls in his simple everyday life. Charls takes mathematics courses, because he is doing his undergraduate degree in civil engineering and mathematics courses are compulsory courses for him. Charls feels comfortable inside the classroom of mathematics and he understands well depending on who is teaching and how the subject is taught. Charls believes that some useful approaches that motivate students to succeed in mathematics courses include taking down notes, revising what is learnt inside the classroom immediately in the same day, and using technology such as the internet and other online resources to understand and clarify doubts. The best approach in Charls's opinion to do well in mathematics is to concentrate inside the classroom and take down notes as much as possible, because mathematics is not like any other subject; it requires understanding the concepts in order to solve problems. Charls was recently motivated to succeed in mathematics by his instructor and friends who helped him to prepare for exams. Sometimes, Charls thinks that mathematics courses are interesting, but they were never enjoyable for him. Charls believes that mathematics is important for his desired career in the future, because as a civil engineering student, he needs mathematics for his future career.

Mathematics Self-Concept: Charls cannot say he is good at mathematics, but he can just say that he is not bad at it. Charls thinks that mathematics is more difficult at the college level compared to the school level, because at the college level, mathematics is way detailed and it prepares students to the real life jobs such as civil engineers and this is why it has to be more difficult. Charls does not plan to take mathematics courses, if they are not required, because he personally does not enjoy doing mathematics. Charls hates memorising mathematical formulas, because he usually forgets all the formulas after he finishes the course. If Charls does not understand something immediately in mathematics, he tries to search the internet and solves as much examples as he can until he gets the idea. In case none of this works out, he visits the Learning Support Centre at his university and asks the mentors. Charls believes that his prior performance in mathematics at the school level influences his perceptions about his performance in mathematics at the college level, because if his background about mathematics was not built in the right way at school, he would find difficulties in understanding what is given in the lecture at university. Charls thinks that his perceptions about his mathematical abilities influence his motivation to succeed in mathematics courses, since whenever he does something he does not like, he never gives everything to it. But, once he does the things he likes and prefers, he would give his full potential and be the best at it in the field.

Student ID: MH17
Student Name: Zaher
Age: 19 years old
Major: Bachelor of Science in Computer Engineering
Last Grade in Mathematics: B

Motivation: Zaher believes that mathematics is important at the college, personal, and professional levels, since it is required at every field and everywhere and it is called the mother of science. Zaher takes mathematics courses, because he is an engineering student and he is interested in mathematics. He thinks that mathematics is the base in the field of engineering and everything is strictly connected with mathematics. Zaher feels happy and good whenever he is inside the classroom of mathematics, if the instructor is good and can explain the concepts easily. But, if the instructor does not have full control on the subject and the class, the course of mathematics becomes very boring for him. Zaher believes that studying at home on a regular basis and reviewing the materials immediately after the lecture are useful approaches that motivate students to succeed in mathematics courses. Zaher thinks that the best approach to do well in mathematics courses is to have an appropriate and quite classroom environment and skilled instructors in teaching mathematics. Zaher was recently demotivated to succeed in a mathematics course because of two issues. The first issue is the class size which was too large and the instructor could not help everyone sufficiently. The second issue is the class time which was from 7 pm to 9 pm, and during this time, he usually becomes tired and sleepy. Zaher believes that mathematics courses are interesting and enjoyable, because he likes mathematics. Zaher is a computer engineering student and he thinks mathematics is important for his desired career in the future, since in every computer programme, there is a need for mathematics and it is not possible to run any programme without mathematics.

Mathematics Self-Concept: Zaher believes he is good at mathematics, because he is interested in mathematics and he got good scores in mathematics courses. Zaher thinks that everything includes mathematics is easy for him, if he works hard and has interest in the subject. Zaher plans to take more courses of mathematics, because they are more needed at the college level and will be helpful for him. If Zaher does not understand something immediately in mathematics, he asks his friend or visits the instructor during office hours who is always approachable. He sometimes searches for online help by using Google and YouTube. Zaher believes that his prior performance in mathematics at school influences his perceptions about his performance in mathematics at college and he also believes his perceptions about his mathematical abilities influence his motivation to succeed in mathematics courses.