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The Influence Of A Career Planning Stem Explorations Course On Vocational Maturity, Career Decidedness And Career Thoughts For Undergraduate Students

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THE INFLUENCE OF A CAREER PLANNING STEM EXPLORATIONS COURSE ON VOCATIONAL MATURITY, CAREER DECIDEDNESS AND CAREER THOUGHTS

by

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ABSTRACT

According to the National Academy of Sciences (NAS), innovation that accompanies careers in science, technology engineering, and math (STEM) create a driving force in the economy and the creation of jobs, yet many positions remain open due to the lack of qualified individuals to fill them (NAS, 2011). Continuing research and innovation proves to be important, yet not enough students graduate with STEM degrees and enter into STEM careers. Career planning courses for undergraduate students increase student confidence about their abilities to make career decisions (Grier-Reed & Skaar, 2010: Scott & Ciani 2008). Vocational maturity and career decision making skills also improve as a result of these courses (Reese & Miller, 2006; Scott & Ciani, 2008). Although research provides evidence of the impact of career planning courses that are specific to certain disciplines (Heffner, Macera & Cohen, 2006), the need for research exists on examining the role career planning courses have in STEM recruitment and retention.

This study aimed to investigate the influence of career development intervention in STEM recruitment and retention efforts by examining career decidedness, career thoughts and vocational maturity. Furthermore, the influence of the class was examined by using demographics such as gender, ethnicity, SAT scores, and algebra math placements scores. The Career Development Inventory (CDI) and Career Thoughts Inventory (CTI) provided measures of career thoughts, career decidedness and vocational maturity for this study. The results provided clarity as to the influence of the career planning course. Vocational maturity and career decidedness increase by the end of the career planning course and negative career thoughts decreased. Implications of the findings include counselor education, career development, practice and future research. In a time when billions of dollars are spent on STEM initiative, the

current study provided an economically viable career development STEM initiative. The research reveals millions are dollars invested into updating lab equipment, purchasing new materials for students, and training teachers. The current study utilized a career planning course allowing students to explore their likes, dislikes, and abilities and how the aforementioned are connected to career interests. This study also provides insight into how the STEM effort can more specifically recruit students who will excel in STEM disciplines.

This dissertation is dedicated to my beloved grandmother, Wilhel Johnson. I love you and I am a better person for having known you.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER I - INTRODUCTION

Problem Statement

According to the National Academy of Sciences (NAS), innovation that accompanies careers in science, technology engineering, and math (STEM) create a driving force in the economy and creation of jobs, yet many positions remain open due to the lack of qualified individuals to fill them (NAS, 2011). Continuing research and innovation proves to be important, yet not enough students graduate with STEM degrees and enter into STEM careers. The National Math + Science Initiative (NMSI) reports that in 2009, science and engineering bachelor's degrees comprised only 20 million of the 56 million degrees awarded to individuals approximately 25 years old. In addition, 40% of men with a STEM degree practice in their field with only 26% of women doing the same (NMSI, 2011). Individuals in STEM careers comprise the driving force behind innovation and research in the United States. Locally, this STEM crisis shows more relevance, with only 20% of degrees awarded in Central Florida being in STEM fields (NAS, 2011). This percentage lags behind national average of 30%. This STEM crisis calls for much attention because it reflects various education issues present in the United States. Solutions to this problem prompt many organizations to encourage more students to major in STEM (Lenaburg et al., 2012; Soldner et al., 2012; Zhe, 2010). STEM retention for undergraduates remains low despite the effort put into the development of these programs.

Specific to undergraduate retention, the STEM crisis in the United States shows that undergraduate attrition rates for students in STEM areas remain high (Tinto, 1993; Wilson, 2012) and less than half of the undergraduate students who enter as STEM majors actually graduate with a STEM degree (Hayes, Whalen & Cannon, 2009; Wilson et al., 2012). Seymour and Hewitt (1997) conducted a study involving seven universities and found that 44% of STEM undergraduates changed their major before graduation (Seymour & Hewitt, 1997). Presently, challenges still arise in regards to retention rates in STEM (Watkins, 2013). Another study at a Midwestern university found that 42% of students who enrolled in the College of Science and Mathematics left the college after freshman year. Approximately 30% of the original students actually received a degree in math or science in 4-6 years (Koenig, Schen, Edwards, & Bao, 2012). One study compared students' majors from 1995-1996 when they first enrolled with their majors to when they were last enrolled through 2001. This study showed that 36% of the students no longer had an interest in STEM majors when last enrolled (National Center for Education Statistics, 2009). The government also categorizes the STEM crisis as national one. In 2008 colleges and universities awarded only 4% of U.S bachelor's degrees in engineering compared to 31% in China (NMSI, 2011). In that same year colleges and universities awarded 31% of U.S bachelor's degrees in science and engineering compared to 61% in Japan and 51% in China (NMSI, 2011).

Social Significance

In their late teens and early twenties, young adults make various transitions that include examining their educational or vocational preferences. This marks a time of decision making and confusion for many young adults and is known as emerging adulthood (Arnett, 2007); the time when these individuals make the transition from adolescence to adulthood and begin making decisions about family and career. Emerging adulthood holds five distinctions from young adulthood. These distinctions include; (a) the age of identity explorations, (b) the age of instability, (c) the self-focused age, (d) the age of falling in between and (e) the age of possibilities (Weiss, Freund & Wiese, 2012). Young people try to figure out who they are and explore their options in these stages. This is both an exciting time and a stressful time for emerging adults. Those transitioning to college and beginning their undergraduate studies become overwhelmed because of the many options to choose from (Arnett, 2007). The many options available to them give reason for emerging adults to become confused about making career decisions. If confusion surrounding decision making persists, students experience mental health issues (Walker & Peterson, 2012).

In many cases, decision making confusion indicates the presence of mental health issues (Walker & Peterson, 2012). Career indecision contributes to depression and career-related distress for many students (Rottinghaus, Jenkins, & Jantzer, 2009; Walker & Peterson, 2012). The uncertainty of one's future or career path causes distress for students, hence the importance of career guidance. If the individual experiences depression or another mental health issue, this may then impede their ability to make career decisions (Lenz, Peterson, Reardon, & Saunders, 2010). Two factors that might influence dysfunctional career thoughts include maximizing and rumination (Paivandy, Bullock, Reardon & Kelly, 2008). Students place pressure on themselves when thinking about career decisions and worry about making the best decision or constantly think about their careers (Paivandy et al., 2008). However, students with strong career decision making abilities experience less depression (Rottinghaus, Jenkins, & Jantzer, 2009). Additionally, strong career decision making positively relates to subjective well-being (Uthayakumar, Schimmack, Hartung & Rogers, 2010). Career decidedness also relates to increased life satisfaction (Hirschi, 2009; Lounsbury et al., 1999) and a sense of power.

In an effort to increase the number of STEM degrees granted and to increase knowledge of STEM fields in 2010, 13 federal agencies invested over $3 billion in 209 programs (Scott, 2012). Approximately one third of the programs had obligations of 1 million dollars or less with others having over 100 million dollars (Scott). In Florida, school districts spend hundreds of thousands each year on STEM programs. In 2011 the Hillsborough County district spent approximately $836,000 on K-12 STEM education. One high school in the district spent $220,000 for various equipment such as SMART boards and iPads (Catalanello, Solochek & Ackerman, 2012). Many of these STEM education programs use their funds for teacher training, laboratory equipment and other supplies, but fail to incorporate career development approaches or interventions (Scott, 2012).

The cost of career indecisiveness amounts to billions of dollars lost each year (Jarvis, 1991). It costs approximately $25,000 to completely train an employee and with the number of emerging adults switching jobs this number can total to $7.5 billion lost each year. The frequency of job changes, causes more wasted money. The cost of unemployment insurance between 1987 and 1988 was $2.4 billion or $10 million every business day of the year (Jarvis, 1991). Jarvis (1991) also explains that the cost of voluntary dropouts participating in training programs sponsored by the government amount to millions of dollars. The total amount of money lost due to participants dropping out of these programs was $300 million. These numbers clearly display why career decidedness and career planning are of such importance. If students made more informed career decisions and engaged in career planning, the amount of agency and government money lost would significantly decrease (Jarvis, 1991).

In the United States, emerging adults need support and interventions to keep them engaged in their educational pursuits. Annually, the government spends $17 billion in Medicaid and health care expenditures for the uninsured, $3.7 billion in college remediation costs, and billions of dollars in incarceration costs due to students dropping out of high school (Amos, 2008). If this population of students were more engaged or enrolled in a career planning course, many of these numbers would decrease significantly (Amos, 2008; Perry et al., 2010). Given the amount of money spent on STEM education and other educational interventions, career planning and exploration courses pose as an alternative to those efforts.

A potential solution exists with career planning and exploration courses that not only help students with career decision, career thoughts and vocational maturity, but they also affect academic performance. Students who take career courses experience higher graduation rates, graduate with less credit hours and graduate in less time than students who do not participate in these courses (Folsom, Peterson, Reardon & Mann, 2002). Graduating in less time and with less credit hours means less money spent on tuition, books and other expenses (Arnett, 2007). College proves to be financially burdening to many college students and graduating earlier with less credits could save students a significant amount of money (Folsom et al., 2002; Malcom & Dowd, 2012). Undergraduate students spend a significant amount of time taking classes to explore their interests and a career class can lessen the amount of general education classes students take. In a career planning course, students learn about various disciplines without having to spend money on taking a class to learn about each discipline of interest. Study results show that career courses make more sense economically than having students take a variety of courses (Folsom et al., 2002).

Professional Significance

The federal government supports various research and demonstration projects to examine and develop strategies to increase STEM engagement and retention. Interventions, thus far include bridge programs that allow students transitioning from high school to college or from community college to universities to get information on STEM majors. These programs allow students to conduct various research projects with faculty and gain more knowledge in STEM disciplines (Lenaburg, Aguirre, Goodchile & Kuhn, 2012; Verma, Dickerson & McKinney, 2011; Zhe, Doverspike, Zhao, Lam, & Menzemer, 2010). Some programs focus on increasing interest through STEM summer camps for outstanding or gifted students (Dieker, Grillo, & Ramlakhan, 2012). The goals of these programs include increasing confidence and interest in STEM majors. Students completing their high school education or in community colleges benefit from these STEM interventions. However, these students might not know what direction to take in STEM. Incorporating career counseling interventions aids in career exploration within a particular discipline, clarity to career choice, and less commitment anxiety to that choice (Scott & Ciani, 2008).

Investigating a STEM-focused career planning course taught by a mental health professionals has implications for STEM selection and retention. Students not only participate in activities to enhance knowledge of STEM majors and careers, but also learn about themselves and their interests through the use of various career assessments. It is crucial for STEM initiatives to include career development concepts and interventions.

Theoretical Foundation

Many career theories exist that address career choice and development. Gottfredson's Theory of Circumscription and Compromise and Cognitive Information Processing Theory (CIP) provides theoretical guidance and foundation for this study. Linda Gottfredson's Theory of Circumscription and Compromise provides a theoretical background that illustrates how and why adolescents and emerging adults choose certain careers. This theory specifically speaks to how and why women and individuals of color choose certain occupations and disregard others based on environments, masculine and feminine careers, and influence from parental figures. This theory provides insight into why underrepresented populations choose certain careers and is easy for STEM professionals, counselor educators to understand. Secondly, this theory will draw attention to innovative ways to work with women and students of color in the STEM effort. This theory establishes the procedures to address (a) career choice, (b) influences from the environment and (c) narrowing career choice.

Linda Gottfredson Theory of Circumscription, Compromise and Self-Creation describes how career choice develops at a young age (Cochran et al., 2011; Gottfredson, 1981; Zunker, 2008). Influenced by the environment and people around them, young girls and boys create a list of acceptable and unacceptable careers. Mother's and father's occupations have a great influence on career thoughts of young people. A central concept in Gottfredson's theory is sex-type; masculine versus feminine occupations. Young people, especially young women, categorize occupations in this manner and doing this has a large effect on how they view occupations. These views remain embedded in the minds of young people for a long time.

Cognitive Information Processing Theory provides a comprehensive theoretical background that illustrates the importance of examining the relationships between career and life stress, negative career thoughts and an individual's career decision state. Each of these factors relate to the readiness to engage in the career decision making process. This theory provides a theoretical for the use of the Career Thoughts Inventory used in the current study. Secondly, it will provide insight into how negative thoughts affect decision making and confidence in the ability to make decisions. This theory establishes the procedures to address (a) career decidedness, (b) career thoughts, and (c) vocational maturity of undergraduate students.

Cognitive Information Processing Theory emerged more than 20 years ago. The use of computer-based guidance and information systems helping people to make educational and career decisions inspired the development of CIP. One focus of CIP explains how individuals receive and process information to solve career or vocational problems and make career decisions (Reardon, Lenz, Sampson & Peterson, 2011). The origins of the CIP approach to career development trace back to the differentiated service delivery model explained by Reardon and Minor (1975).

Purpose of Study

Negative career thoughts create challenges for students in regards to career decision making (Paivandy et al., 2008). When students do not feel good about themselves and are unaware of their career options, negative thoughts transpire and affect how well they make decisions (Sampson, Reardon, Peterson & Lenz, 2004). Students who experience dysfunctional thoughts in regards to career decision making display avoidance behaviors and become anxious about making decisions (Sampson et al., 2004). This leads to avoiding career exploration behavior and delays choosing a major and moving forward with one's career or schooling

(Sampson et al., 2004). Undergraduate students might choose to enroll in a career class when they begin their studies.

Career courses for undergraduate students prove to be successful. Many career courses succeed in aiding students to feel more confident about their abilities to make career decisions (Grier-Reed & Skaar, 2010: Scott & Ciani 2008). Vocational maturity and career decision making skills also improve as a result of these courses (Reese & Miller, 2006; Scott & Ciani, 2008). The research also provides evidence of career courses that are specific to certain disciplines (Heffner, Macera & Cohen, 2006). Unfortunately, the research fails to show the role career courses can have in the STEM crisis. A lack of research exists on STEM-focused career courses that aid students in choosing and committing to STEM majors.

The STEM effort implements various programs to increase student interest in STEM majors and career and this adds to the innovative programs being implemented across the country. A gap exists in the research in regards to STEM-focused career courses and these ideas inform STEM professionals of ways to construct a career planning course. Allowing students the opportunity to intensely explore their STEM options names one important aspect in retaining students in STEM. A career planning and explorations course like the one in the current study allows students to get their questions answered and make more informed decisions about their career paths. This research is also the next step after bridge programs which focus on engaging high school students and community college students transitioning to universities. Because career courses yield successful results (Scott & Ciani, 2008), engaging students in a STEM-focused career planning course could potentially increase STEM retention.

The study aims to investigate, through quantitative research methods, the role career development interventions play in the STEM recruitment and retention efforts by examining career decidedness, career thoughts and vocational maturity. This research will identify how a STEM-focused career planning course influences three constructs of the study (career thoughts, career decidedness and vocational maturity) and provide additional insight into career development interventions as a successful strategy for STEM undergraduate retention.

On a more broad scale, this research will inform counselor educators and other researchers on how career planning and development aids in undergraduate career planning, particularly in STEM, through educating students about their STEM career choices and maintaining engagement in the process. By using career assessments, guest lectures and experiential learning components, this type of career intervention can have a strong influence on the way future career courses are implemented in universities. Whether the course is specific to a certain disciplines, or more broad in nature, this outline will be useful.

Hypotheses

This study aims to examine how an undergraduate STEM-focused career planning course influences the career thoughts and career decidedness of emerging adults considering a STEM major. In addition, this study aims to examine how an undergraduate STEM-focused career planning course effects STEM major selection and the differences that exist in SAT scores, Algebra Math Placement scores, Career Thoughts Inventory scores and Career Development Inventory scores between those that select a STEM major and those that do not. To achieve this aim, I will use quantitative research methods to examine the following hypotheses:

Null Hypothesis 1: An undergraduate STEM career planning course has no influence on career thoughts, as measured by the Career Thoughts Inventory (a) for Fall 2012, and (b) for Summer/Fall 2013 participant cohorts.

Null Hypothesis 2: An undergraduate STEM career planning course has no influence on career decidedness and vocational maturity, as measured by the Career Development Inventory (a) for Fall 2012, and (b) for Summer/Fall 2013 participant cohorts.

Null Hypothesis 3: An undergraduate STEM career planning course has no influence on career thoughts, career decidedness and vocational maturity as measured by the Career Development Inventory and Career Thoughts Inventory when controlling for gender (a) for Fall 2012, and (b) for Summer/Fall 2013 participant cohorts.

Null Hypothesis 4: An undergraduate STEM career planning course has no influence on career thoughts, career decidedness and vocational maturity as measured by the Career Development Inventory and Career Thoughts Inventory when controlling for ethnicity (a) for Fall 2012, and (b) for Summer/Fall 2013 participant cohorts.

Null Hypothesis 5: An undergraduate STEM career planning course has no influence on STEM major selection.

Null Hypothesis 6: No differences exist in SAT scores between those that select a STEM major and those that do not.

Null Hypothesis 7: No differences exist in Math Placement Scores between those that select a STEM major and those that do not.

Null Hypothesis 8: No differences exist in Career Thoughts Inventory scores and Career Development Inventory scores between those that select a STEM major and those that do not.

Null Hypothesis 9: No differences exist in Career Thoughts Inventory scores between those in COMPASS and those in EXCEL.

This research makes an important and needed contribution to STEM recruitment and retention efforts along with the role career development can play in these efforts. This research provides knowledge about successful effort to engage undergraduate students in STEM majors and increase career decidedness. It will also provide important implications for career development and counselor education which are essential aspects of the STEM effort.

Methodology

Prior to beginning the evaluation for the current study, I will receive approval from the University's Institutional Review Board (IRB). Data will be collected in accordance with the IRB proposal. The current study will utilize data collected from the UCF COMPASS (Convincing Outstanding-Math-Potential Admits to Succeed in STEM) program, an NSF-funded project with the goal to increase the number of students pursuing a STEM discipline. The project includes participating in the career planning course, receiving math tutoring, and being assigned to a mentor for additional support through the program. This course is a STEM-focused career course that utilizes assessments, guest lecturers and experiential learning labs to aid students in solidifying a major in STEM. This program has four main goals; (a) recruit, (b) capture, (c) retain, and (d) research. The course is a general undergraduate career planning course that was modified for an National Science Foundation (NSF) funded STEM recruitment and retention project. The course is divided into three sections, (1) Who am I? Personal

Assessment, (2) Where am I going? The World of Work in STEM, and (3) How do I get there? Experiential Learning and STEM Major Identification. In the "Who am I?" portion of the class, the students complete the Career Thoughts Inventory (CTI), Career Development Inventory (CDI) along with career assessments that allow them to explore personality, interests, values and skills. In the second portion of the class, "Where am I going?" guest lecturers come into the classroom and speak to the students about their STEM careers. The last portion of the class, "How do I get there?" allows the students to visit experiential learning labs where they can see what STEM professionals accomplish from day to day. Students also narrow their focus and discuss major options. As a member of the research team, I will assist in the collection of the data for the study. I will analyze the sample to address the aforementioned hypotheses.

The participants enrolled in the undergraduate career planning course focused on STEM explorations will complete the *Career Thoughts Inventory* and *Career Development Inventory* twice in the semester; in the beginning and at the end of the 15 week semesters. Participant responses to the assessments will be recorded and prepared to be analyzed. Demographic information such as SAT score, algebra math placement score, gender and ethnicity will also be obtained from Institutional Knowledge Management office in order to examine the research hypotheses.

Undergraduate college students will complete assessments to provide information on career decidedness, career thoughts and vocational maturity. Differences in ethnicity and gender will be examined along with examining the differences in SAT scores, algebra math placement scores, Career Thoughts Inventory scores and Career Development Inventory scores in regard to major selection.

The students enrolled in the eight sections of MHS 2330 Career Planning: STEM Explorations during Fall 2012, Summer 2013 and Fall 2013 will be the respondents for this research. The instructor and teaching assistants will provide students with research IRB approval and an explanation of the COMPASS program as their consent to participate in this study.

Research Design

The current study will employ a correlational research design that will examine relationships occurring following the treatment intervention for students who will participate in the MHS 2330 Career Planning: STEM Explorations course. The current study lacks a control group which categorizes it as a correlational design. Additionally, the repeated measurements of the same group qualify it as a time series design (Rovai, Baker & Ponton, 2013). Participants selected for research will be involved in this research through purposive sampling.

Participants

The participants in the current study will consist of undergraduate students attending a major metropolitan university in the Southeastern United States. Through the use of purposive sampling, the research team will seek out students with SAT math scores of 550 and over with the use of brochures and advisors who aid in encouraging students to take the course. Students register for MHS 2330 as their first requirement of enrolling in COMPASS and as an elective course to encourage undecided students to identify a STEM major through career exploration. I will utilize participant data from the undergraduate career course to conduct the analysis for the current study. I included those participants who volunteered to complete the assessments, completed intervention, and complete post and follow-up assessments in the current study.

Instruments

This study utilized two assessments that were collected as part of the project requirements: (a) Career Thoughts Inventory (CTI: Sampson et al., 1996a; Sampson et al., 1996b), and (b) Career Development Inventory (CDI: Glavin & Rehfuss, 2005; Super et al., 1988). The students in the current study took the assessments at the beginning and end of the semester as part of the course's requirements. The Career Thoughts Inventory (CTI) and Career Development Inventory (CDI) provide pre-test and post-test results about career thoughts and career decidedness respectively.

The CTI seeks to measure negative career thoughts and uses subscales of Decision Making Confusion (DMC), Commitment Anxiety (CA) and External Conflict (EC) to help students understand where their negative career thoughts might originate (Sampson et al., 1996a; Sampson et al., 1996b). The CTI is a 48 question assessment that measures negative career thoughts. The assessment follows a 4-point Likert scale and asks students to circle Strongly Disagree, Disagree, Agree or Strongly Agree. Assessment scoring yields a total score and three subscales: Decision Making Confusion (DMC), Commitment Anxiety (CA) and External Conflict (EC). The CTI's interpretation is based on three different norming groups; adults, college students and high school students. This assessment provides a CTI total score and T score along with scores for each subscale. In all, there are five scores provided in this assessment (Sampson et al., 1996a; Sampson et al., 1996b; Wright et. al, 2000). The analyses in the current study will use total scores, T scores and scores for each subscale. A T score above 50 indicates dysfunctional thinking. Scores above 11, 13 and 3 for DMC, CA and EC, respectively, indicates difficulties in those areas. According to Sampson et al, 1996, the internal consistency (alpha) coefficients of the CTI total score range from .97 to .93 and the three construct scales' alpha coefficients range from .94 to .74.

The CDI assess vocation maturity for students and uses subscales of Career Planning (CP), Career Exploration (CE) and Decision Making (DM) (Super et al., 1988). The Career Development Inventory is a 120 item inventory that assesses vocational maturity for students. The CDI uses a 5-point Likert scale ranging from Not Much to A Great Deal. Career Planning (CP), Career Exploration (CE), and Decision Making (DM) are the three main subscales of the inventory. World of Work (WW) and Knowledge of Preferred Occupation (PO) are two additional subscales that provide sources related to resources to support career decision making and information on preferred occupation. Higher scores indicate the individual has the requisite attitudes and competencies required to make sound educational and vocational decisions (Glavin & Rehfuss, 2005). Creed and Patton (2004) reported satisfactory internal reliability coefficients for all subscales (ranging from .70 to .87).

Participant demographic (age and ethnicity) and academic data (SAT scores) will be obtained from the Associate Director of Institutional Research who works within the Institutional Knowledge Management office at the university. I sought out this information for the purposes of this study. The students taking the course do not fill out a demographic form because their information is stored in the Institutional Knowledge Management office.

Data Analyses

I intend to examine 9 hypotheses in this study. First, the preliminary analysis of the data will be done first to identify any outliers that might have an effect on the findings. Management of missing data, and checking for violations of assumptions specific to a repeated measures MANOVA and Chi Square Goodness of Fit will be checked. Two statistical analyses will be used to investigate the 9 hypotheses in this study. A repeated measures MANOVA will be used to evaluate hypotheses 1-4, 8 and 9 which examine the influence the career course has on career thoughts, career decidedness and vocational maturity and whether the course influences STEM major selection. Assumptions for a repeated measures MANOVA are: (1) sphericity, (2) complete data for all subjects, (3) normal distribution, and (4) equally spaced intervals. I will use a MANOVA to examine hypothesis 6 that will examine the difference in SAT scores between those that select a STEM major and those that do not. An analysis of variance will be used to evaluate hypothesis 7 that examines whether differences exist in Algebra Math Placement scores between those that choose a STEM major and those that do not. I will use the Statistical Package for Social Sciences (SPSS) to conduct the statistical procedures.

Definition of Terms

Following, I operationally define terms or phrases for the purposed of the current study:

Career Decidedness: defined as the state of being decided about occupational, educational training and employment choices, whereas career indecision is the state of being undecided about a choice relating to the vocation one wished to pursue (Osipow, 1987; Williamson, 1937).

Career Intervention: defined as any treatment or effort intended to enhance an individual's career development or to enable the person to make better career-related decisions (Spokane & Oliver, 1983).

Career Planning Course: defined as a course taken for regular academic credit with learning objectives, mastery performances, and grades connoting levels of attainment (Folsom et al., 2004).

Career Thoughts: defined as outcomes of one's thinking about assumptions, attitudes, behaviors, beliefs, feelings, plans, and/or strategies related to career problem solving and decision making (Peterson, 1991).

Emerging Adulthood: defined as a phase of life span between adolescence and adulthood. It refers to young adults who do not have children or began a lifelong career in their early twenties. The five standard milestones used to define “adult”—completing university, leaving home, getting married, having a child, and establishing financial independence—are being achieved later, or not at all (Arnett, 2007).

STEM Effort: refers to the attempt to increase students' abilities in STEM (science, technology, engineering and mathematics) subjects and encourage students to declare STEM majors. Efforts are also made to retain students in these majors and encourage them to enter into STEM careers (Gonzalez & Kuenzi, 2012).

Vocational Maturity: defined as the way an individual successfully completes certain career development tasks that are required according to his or her current developmental phase. It is seen as the collection of behaviors necessary to identify, choose, plan and execute career goals. (Super, 1977).

Limitations

A number of limitations exist for the current study. To begin with, this study lacks a comparison group. All of the students in this study received the intervention; therefore it is difficult to analyze the growth in the students participating in this study. Secondly, threats to internal validity such as maturation or history could affect study outcomes. Each student has various experiences that may affect their career thoughts or decidedness; therefore, the results of the study might not reflect the effectiveness of the intervention. In terms of history, students learning could be affected by interruptions caused by the construction going on nearby. Testing could also be a threat to internal validity as the results from the posttest might be due to the pretest. The intervention is comprised of many components and it will be difficult to examine which part of the intervention had the most affect on the students, therefore, multiple treatment interference could cause a threat to external validity. In regards to data input, a number of individuals input the data over the course of the study. Although data input is reviewed for accuracy, human error could cause some scores to be inputted incorrectly in the database. Lastly, in terms of the John Henry Effect, I might behave in an unnatural way due to my knowledge of the research being done. I am the instructor of the course, the graduate assistant on the NSF grant and I am researching the data for my dissertation.

Although there are potential limitations in the current study, it has many implications for career development and counselor educators and is a unique and important study. Incorporating career and STEM interventions provides a unique way of increasing STEM major selection and retention by examining career thoughts and career decidedness. By using various interventions such as career assessments, guest lecturers and experiential learning components, this type of career planning course could strongly influence the way other universities implement their courses.

Summary

The STEM crisis in the United States, specific to undergraduate retention, shows that undergraduate attrition rates for students in STEM areas is high and less than half of the undergraduate students who enter as STEM majors graduate with a STEM degree. Negative career thoughts create challenges for students in regards to vocational maturity and career decision making. Students who have dysfunctional thoughts in regards to career decision making become anxious about making decisions. That anxiety leads to avoiding career exploration behavior and delays choosing a major and moving forward with one's career. Allowing students to explore these thoughts and feelings would result in students becoming more insightful and confident in making career decisions.

Career courses for undergraduate students prove to be successful for many undergraduate students. Many career courses allow students to gain more information on various careers, explore themselves, and have success in aiding students to feel more confident about their abilities to make career decisions. Whether these course are specific to a certain discipline or broad, they are successful and positively affect student's vocational maturity. Unfortunately, the research does not show the role career courses can have in the STEM crisis. There is a lack of research on STEM-focused career courses that aid students in choosing and committing to a STEM major.

A STEM-focused course allows students to immerse themselves in the world of STEM and get their questions answered in order for them to make more informed career decisions. This research will also be the next step after bridge programs which focus on engaging high school students and community college students transitioning to universities. Engaging those students in a STEM-focused career planning course would increase interest and STEM retention. Career development and counselor education should play a large role in the STEM effort and the current study shows the importance of that.

CHAPTER II - REVIEW OF THE LITERATURE

Introduction

According to the National Academy of Sciences (NAS), innovation that accompanies careers in science, technology engineering, and math (STEM) are a driving force in the economy and creation of jobs, yet there are not enough individuals to fill these open positions from year to year (NAS, 2011). Continuing research and innovation proves to be important, yet not enough students are graduating with STEM degrees and entering into STEM careers. The National Math + Science Initiative (NMSI) reports that in 2009, only 20 million of the 56 million bachelors degrees held by adults, age 25, were in science or engineering. In addition, 40% of men with a STEM degree practice in their field with only 26% of women doing the same (NMSI, 2011). Research shows that 60% of U.S employers are having difficulty finding individuals who are qualified to fill positions. Additionally, the employment market shows that unemployed individuals outnumber job postings 3.6 to one, compared to 1.9 to one in STEM occupations (NAS, 2011).

An increase of career planning courses is important to increase student's career decidedness, career thoughts and vocational maturity. These courses provide students more direction in their undergraduate careers and allow students to explore their various career options. In regard to the STEM crisis and retaining undergraduate students in STEM, career planning courses specific to STEM influence students in staying in their major and feeling more confident about their decisions. STEM-focused career courses provide students information on majors and careers specific to STEM and allow students to explore their various interests. The purpose of this study is to use quantitative research methods to investigate of the role career development interventions plays in the STEM recruitment and retention efforts by examining career decidedness, career thoughts and vocational maturity. This research will identify how a STEM-focused career planning course affects the three constructs of the study (career thoughts, career decidedness and career vocational maturity) and gives insight into innovative interventions for STEM undergraduate retention.

STEM Overview

The current STEM crisis appears as a new issue but history shows that STEM crises existed in the past. The Morrill Act of 1862, the launch of the Soviet satellite Sputnik in 1957 and the National Defense Education Act all have importance to the discussions of STEM crises (Jolly, 2009). The Morrill Act of 1862 intended to establish colleges and universities to study agriculture and mechanical arts but also supported science and engineering programs. This indirectly led to the establishment of the university research system. More recently, similarities can be drawn between STEM initiatives involving the launch of the Soviet satellite Sputnik in 1957, its legislative history, and the current “quiet crisis” over America’s ability to compete globally (Jolly, 2009).

Morrill Act

President Abraham Lincoln signed the Morrill Act on July 2, 1862 (Billings, 2012). Morrill Act of 1862 is important to note because the federal government was involved in higher education, in particular, for "common people." People such as farmers needed to have access to higher education specific to their interests. At that time a shift occurred from classical to more of a focus on STEM areas. Instead of having a focus on art and literature, the focus was on the sciences (Key, 1996).

At first, the mission of the Morrill Act was to teach agriculture and mechanics arts along with classical studies. The government intended for the working class to gave both practical and liberal education. They saw it as a training ground for people; if they had the necessary training then they could expand their knowledge and create more well-rounded citizens (Alperovitz, Dubb & Howard, 2008). The next movement towards STEM occurred years later as the result of Sputnik.

Sputnik

Soviet Russia launched a rocket on October 4, 1957, known as Sputnik (Rigden, 2007). At the time, the world viewed the United States as a world leader but this launch caused them to question their high position in the world. The U.S had a reputation as being innovators in medical research, electronics and automobile design, but Sputnik caused them to be viewed as falling behind and not being able to keep up with other countries. Because of these new views, the United States focused their efforts on improving programs in schools that would increase abilities in science. The National Defense Education Act of 1958 was the answer (Wissehr, 2009).

Before Sputnik, World War II significantly impacted education (Wissehr, 2009). The need for industrial and agricultural equipment and supplies created an employment gap and the need for individuals to fill those positions. Unfortunately, there were not enough qualified people to fill these positions. The U.S interpreted this as a lack of training in school to be knowledgeable in science and math. This turned into a commitment to strengthening educational training for young people. During the war, the government recruited science teachers to train individuals and work on technology projects. This, in turn, caused less available faculty to teach returning soldiers taking advantage of the Servicemen's Readjustment Act of 1944, which allowed soldiers a college education. Despite those occurrences, the U.S remained prideful of its position as a world power (Wissehr, 2009).

Although the U.S government held mixed views on the launch of Sputnik, one thing became evident; this was a threat to the U.S and its image as a global power. Dwight D. Eisenhower, the President of the U.S at the time, knew something had to be done and two months later a 2-kg object with a Vanguard rocket was launched. However, it exploded on the launch pad (Rigden, 2007). Some immediate effects were the first form of distance learning provided by the National Broadcasting Company's (NBC) Continental Classroom. This program was aimed at improving high school science teachers. The American Association for the Advancement of Science (AAAS) created a document calling for better training for science teachers. At the time, not all teachers were required to have an undergraduate degree and this organization questioned that. Other programs included summer camps that taught science to students while school was not in session. This time was called the "golden age of science education" (Rudolph, 2012; Wissehr, 2009). What was important about this time was that science was becoming significant. The government began to think about ways in which the U.S could compete with other countries and keep their reputation as a global leader. Because sciences became more significant during this time, the President's Science Advisory Committee (PSAC) was formed on December 1, 1957 and hired a scientific adviser for the President

(Rigden, 2007). Congress also passed the National Defense Education Act (NDEA) of 1958 as a result of Sputnik.

National Defense Education Act

The general aim of NDEA was to strengthen the educational systems in the U.S, specifically in the sciences. One specific aim was to modernize school laboratories across the country with $300 million over four years (Rudolph, 2012). Not only were laboratories modernized, but schools that did not have labs were provided with lab spaces. Laboratories also received new and more updated materials.

Jolly (2009) examined the National Defense Education Act (NDEA) and present STEM initiatives. The NDEA aimed to help students with financially difficulties to succeed in STEM areas. The act distributed $1 billion over 4 years and was to be distributed into 40,000 loans, 40,000 scholarships and 1,500 graduate fellowships. The NDEA intended for these monies to aid undergraduate and graduate students and many institutions were also able to match any funded amount (Jolly, 2009). Teachers and researchers worked together in the effort to encourage students to succeed in these areas. One of the coauthors of NDEA, Carl Elliott, found importance in identifying particularly gifted students for the program and encouraged school counselors to identify these individuals.

STEM Crisis

In 2009 approximately 20% of female freshman intended on declaring a STEM (Science, Technology, Engineering and Mathematics) major (NSF, 2012). Hayes et al. (2009) reported that less than half of the students who declared a STEM major graduated with a STEM degree. In 2009, there were a total of 927,600 bachelor degrees awarded to female undergraduate students. Approximately 255,000 of those awarded were in Science and Engineering fields. According to the National Science Foundation (2012), 60,000 undergraduate females graduated with a degree in biological and agricultural sciences. Additionally, 1,768 females graduated with a degree in earth, atmospheric and oceanic sciences, 13,865 with a degree in mathematics and computer sciences, 7,451 in the physical sciences and 12,750 in engineering. Interestingly, 73,164 female undergraduate students graduated with a degree in psychology and 84,780 with a degree in social science (NSF, 2012). These statistics show that many female students choose social science major much more than STEM majors. Degrees awarded in social science was more than 45 times more than degrees awarded in earth and oceanic sciences. In regards to career, only 26% of women with a STEM degree are practicing in their field (NMSI, 2011).

The National Math + Science Initiative (NMSI) reports that in 2009, only 20 million of the 56 million bachelor's degrees held by adults, age 25, were in science or engineering. In addition, 40% of men with a STEM degree practice in their field with only 26% of women doing the same (NMSI, 2011). Individuals in STEM careers constitute the driving force behind innovation and research in the United States. Specific to undergraduate retention, the STEM crisis in the United States shows that undergraduate attrition rates for students in STEM areas remain high (Tinto, 1993; Wilson, 2012) and less than half of the undergraduate students who enter as STEM majors actually graduate with a STEM degree (Hayes, Whalen & Cannon, 2009; Wilson et al., 2012). Another study at a Midwestern university found that 42% of students who enrolled in the College of Science and Mathematics left the college after freshman year. Approximately 30% of the original students actually received a degree in math or science in 4-6 years (Koenig, Schen, Edwards, & Bao, 2012). One study compared students' majors from 1995-1996 when they first enrolled with their majors to when they were last enrolled through 2001. This study showed that 36% were no longer in STEM majors when last enrolled (National Center for Education Statistics, 2009). The government also categorizes the STEM crisis as national one. In 2008 colleges and universities awarded only 4% of U.S bachelor's degrees in engineering compared to 31% in China (NMSI, 2011). In that same year colleges and universities awarded 31% of U.S bachelor's degrees in science and engineering compared to 61% in Japan and 51% in China (NMSI, 2011).

In reaction to the current STEM crisis, the federal government developed many grant opportunities to increase STEM interest. According to the Northwest Association for Biomedical Research (NWABR; 2013) more than 65 projects exist funded by the National Institutes of Health (NIH) across 40 states in the U.S. NIH serves more than 82,000 K-12 students and more than 5,000 K-12 teachers each year with in person programs. Online programs serve more than 20 million K-12 students and educators each year. Additionally, NIH funds many exhibitions at museums and science centers across the nation. Overall, NIH has a goal of supporting science exhibits, teacher professional development programs, out of school learning opportunities and student research experiences (NWABR, 2013).

The National Science Foundation (NSF) funds many STEM education programs across the United States. It has the distinction of being the only federal agency with a goal of improving education in science and engineering fields. Approximately 66% of NSF's STEM education budget provides support for postsecondary students and teaching or learning in STEM fields (Gonzalez, 2012). A significant amount of NSF's funding goes to the Discovery Research K-12 programs along with Mathematics and Science Partnership programs; both aim to improve STEM education (Gonzalez, 2012). The National Science and Technology Council (NSTC) estimated that in the 2012 fiscal year, $1.2 billion of the $3.4 billion in STEM education investments came from NSF.

NSF and NIH, two primary federal agencies in the STEM education effort, fund various programs across the U.S (Gonzalez, 2012). These programs allow school to update science laboratories, provide teacher and educator trainings, run summer programs for students interested in STEM and update learning material in classrooms (Gonzalez, 2012; NWABR, 2013). Although commendable efforts, none of these programs include career development programs for students. They aim to improve STEM education by preparing teachers and providing up-to-date learning materials, but lack career development components. Including career development components into the STEM effort allows a more comprehensive understanding of student development and choices.

Career Development

Preparing for the world of work and obtaining meaningful work defines career development. Career development encompasses the exploration of interests, values and skills to find an appropriate occupation (Zunker, 2002). Career development also explores career choice and career maturity. Many career counselors and educators utilize career theories and models in the career development process. These models provide structure, with theoretical guidance, that aid professionals in using them with individuals.

Career Theory and Models

Many career theories exist that address career choice and development. Gottfredson's Theory of Circumscription and Compromise and Cognitive Information Processing Theory (CIP) provides theoretical guidance and foundation for this study. Linda Gottfredson's Theory of Circumscription and Compromise provides a theoretical background that illustrates how and why adolescents and emerging adults choose certain careers. This theory establishes the procedures to address (a) career choice, (b) influences from the environment and (c) narrowing career choice.

Cognitive Information Processing Theory provides a comprehensive theoretical background that illustrates the importance of examining the relationships between career and life stress, negative career thoughts and an individual's career decision state. Each of these factors relate to the readiness to engage in the career decision making process. This theory establishes the procedures to address (a) career decidedness, (b) career thoughts, and (c) vocational maturity of undergraduate students.

Career development and counseling in the United States, developed a widespread system of theories and intervention approaches over the past 100 years. This process began with the work of Frank Parsons and his trait-factor approach in the early twentieth century (Betz, Fitzgerald, & Hill, 1989; Zunker, 2002). The trait-factor approach eventually evolved to become an influential approach that remains relevant, across cultures, in the twenty-first century with a strong theoretical and empirical base. No matter one's geographical location or culture, vocational and career related issues remain significant (Hesketh & Rounds, 1995; Leung, 2004). In an age of economic globalization, many individuals continue to be affected by a multitude of career and vocational related concerns. Although some of these concerns describe culture specific ones, others apply to many cultural groups. Searching for one's life purpose and meaning, the road to self-actualize, and the efforts to deal with problems of employment and unemployment, all express examples of issues that affect many individuals from various backgrounds and cultures (Richardson, 1993; Lips-Wiersma & McMorland, 2006).

Trait-Factor Theory

Frank Parson's is known as the founder of the vocational guidance movement. Originally entitled the talent-matching approach, Parson's ideas centered around the concept of matching. Parson's believed that occupational decision making occurred when people had accurate understanding of themselves (Harrington & Long, 2013). This understanding included an individual's interests and personal abilities. In addition, occupational decision making also occurred through knowledge of jobs and the labor market and objective judgment about the relationship between individual traits and the labor market (Leung, 2008).

This theory assumes the possibility to measure individual talents and traits required in certain occupations. Parson's theory also assumes that people should be matched with an occupation that is a good fit for them. When individuals are matched with an occupation that is a good fit, they tend perform better and produce more (Parsons, 1909). In Parson's, *Choosing a Vocation*, there are seven stages outlined for career counselors to work through with clients.

The first step involves noting key facts about the person, especially ones related to the vocational problem (Parsons, 1909). In the second step, self-analysis, the counselor takes note of anything that might impact career or career development. Choice and decision is the third stage where the counselor guides the client in choosing a vocation. After the client chooses a vocation, it is the counselor's job to analyze the decision and make sure they are a match. The fifth stage, outlook on the vocational field, requires that the counselor be aware of training, apprenticeships and other career knowledge (Harrington & Long, 2013; Parsons, 1909). Induction and advice mark the sixth stage in which logical and reasoning are at the center. Lastly, in the general helpfulness stage, the counselor guides the client in reflecting on the decision they have made. Working through these stages helps individual's match their interests and characteristics with those of career and vocational options (Leung, 2008). The Trait-Factor Theory's goal is to help individuals match their interests with an occupation while allowing the individual to arrive at their own conclusion.

Social Cognitive Career Theory

Social Cognitive Career Theory (SCCT) examines the way in which individuals develop career and academic interests, select choices based on interests and persist in their choices (Lent, Brown and Hackett, 1994, 2000a, 2000b). SCCT proposes three process models of career development that explain (a) academic and vocational interest development, (b) how people make career and educational choices, and (c) career and educational performance and stability (Leung, 2008). These three process models discuss, and center around three core factors important to vocation development; self-efficacy, outcome expectations and personal goals.

Self efficacy, as defined by Lent and colleagues (1994) is the beliefs about one's personal capabilities. The beliefs that individuals have about themselves can affect their judgment when thinking about their ability to overcome challenges or obstacles. Outcome expectations are defined as anticipated results of various behaviors in regard to vocational maturity. This factor is important to note because when an individual sees positive expectations, they will be more motivated to continue working towards their goals. Lastly, personal goals are the decisions one makes to engage in certain behaviors like choosing a major (Soldner et al., 2012).

The three core factors, self efficacy, outcome expectations and goals, are the core variables in each of the three process models. The interest model explains that individuals are attracted to activities they feel efficacious in and think positive outcomes will come from. These three, in turn, lead to creating goals that aid in sustainable behavior (Leung, 2008). The choice model explains that self efficacy, outcome expectations and interest interact and aid in the development of career choices and goals. The process of developing of career choices and goals is influenced by both the environment and the person's nature or personal characteristics. When thinking about career choices and goals, individuals might compromise personal interests depending on their career needs (Leung, 2008).

Holland's Theory of Vocational Personalities in Work Environment

Holland's RIASEC Model describes six occupational themes used to categorized individuals (Holland, 1985, 1997). Those themes are accompanied by careers that are related to those themes. Those themes are explained below:

Realistic-R: This group is comprised of DOERS. They prefer to deal with things rather than people. They are described as honest, persistent, shy, modest and practical. Careers: Automotive Engineer, Construction Worker, Police Officer

Investigative-I: This group is comprised of THINKERS. They enjoy solving abstract problems and understanding the physical world. They are described as curious, introverted, rational, critical and intellectual. Careers: Anesthesiologist, Biologist, Computer Analyst, Electrical Engineer

Artistic-A: This group is comprised of CREATORS. They like to work in settings that offer opportunities for self-expression. They are described as complicated, emotional, impulsive, intuitive and nonconforming. Career: Actor, Dancer, English Teacher, Graphic Designer

Social-S: This group is comprised of HELPERS. They are sociable and responsible and have little interest in machinery or physical skills. They are described as friendly, generous, understanding and insightful. Careers: Counselor, Homemaker, Occupational Therapist, Schoolteacher

Enterprising-E: This group is comprised of PERSUADERS. They enjoy leading, speaking and selling. They are described as ambitious, domineering, popular, optimistic and risk-taking. Careers: Banker, Industrial Engineer, Lawyer, Stockbroker

Conventional-C: They are comprised of ORGANIZERS. They prefer highly ordered activities that characterize office work. They are described as careful, obedient, orderly and self-controlled. Careers: Accountant, Librarian, Legal Secretary, Computer Operator

When thinking about their career options, individuals look for certain environments that allow them to exercise their skills and abilities. Those who do not consider an appropriate work environment might feel unfulfilled in their career because they are unable to exercise their most dominant abilities and skills. This person and environment interaction should have a certain level of congruence, as described by Holland (1985, 1997). A low match between work environment and abilities or skills yields low congruence while high match yields high congruence. Low congruence tends to result in low job satisfaction while high congruence results in high job satisfaction. Organized in a hexagon, the six interest typologies are arranged in terms of similarities and differences. Types that are adjacent to each other in the hexagon are the most similar while types that are opposite from one another, on the hexagon, are the least similar (Leung, 2008).

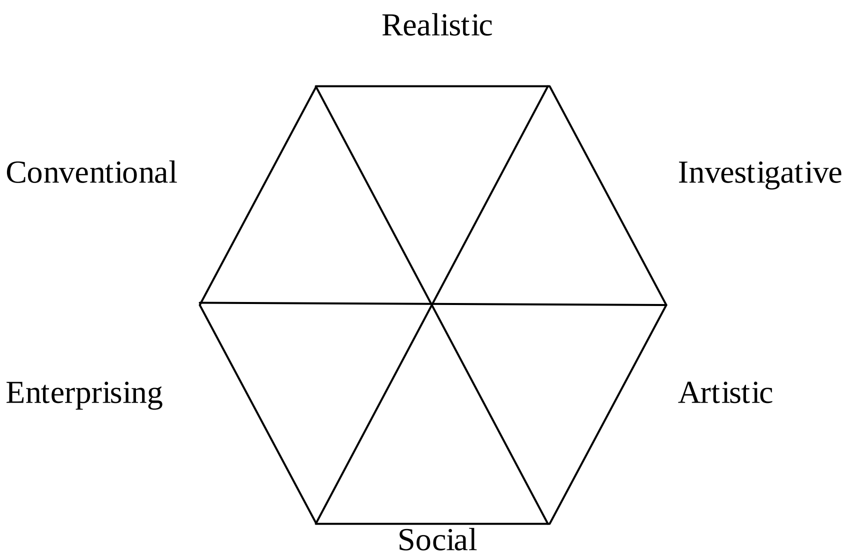

Figure 1: Holland's Hexagon

Differentiation is another concept in Holland's theory. Differentiation is the degree to which high and low interest types are distinguishable. When there is low differentiation, high and low types are not distinct, but in high differentiation, there are distinctions between high and low types. In sum, Holland's typologies provide a starting point for individuals exploring their career options (Holland 1985, 1997).

Self Concept Theory of Career Development

Donald Super (1969, 1980 1990) proposed that self concept was essential to career development. Super identifies five stages of growth individuals go through when developing self concept; growth, exploration, establishment, maintenance and disengagement. Each stage is vital to developing a self concept.

The growth stage, occurring from birth to mid teens, is when self concept begins to develop and children transition from play to work orientation (Leung, 2008). The three sub stages of the growth stage are fantasy, interest and capacity. The fantasy stage occurs from 4-10 years of age and during this time children want their needs met. From 11-12 years of age, children explore their likes and dislikes during the interest stage (Gonzalez, 2008). These likes and dislikes serve as the basis for career choices later on. During the capacity stage, from ages 13-14, young people are able to see how their skills are connected to certain job they might be interested in. This ability to connect skills to jobs is called vocationalizing self-concept (Gonzalez, 2008).

During the exploration stage, which is from mid teens to early 20s, young people begin to develop a realistic self concept and try various jobs they are interested in (Gonzalez, 2008; Super

1990). During this process of trying new things, young people develop preferences that become choices once they act on the preferences. The sub stages in the exploration stage are tentative, crystallization and specifying vocational preference. In the tentative stage (15-17 years old) young people take on part time jobs to identify what they gravitate to and incorporate their interests and abilities in the process. Individuals in the crystallization stage begin to lean towards a specific choice. This choice usually comes in the form of choosing a major or area of training. Individuals in this stage are 18-21 years of age and are entering college or finishing their vocational training. Specifying a vocational preference occurs in the early twenties. During this stage, the individual has an idea of what they want to pursue but see this as a trial period for most of them. Individuals might change their interests during this stage depending on how much they enjoy their work or vocational experience (Leung, 2008).

The third stage, establishment, occurs from the mid twenties to mid forties. Trial and stabilization (25-30 years old) and advancement (30-40 years old) are the two sub stages in establishment (Gonzalez, 2008). During trial and stabilization, individuals accept positions in their fields of interest and might changes jobs once or twice before finding the right placement. In the advancement phase, the person tries to stabilize themselves, performing in such a way that would allow them to gain seniority in the organization they work for. In the fifth stage, maintenance, the professional is in their mid forties through sixties and might face competition from younger workers during this time (Gonzalez, 2008). They continue to do well in their positions and enjoy exploring their hobbies and other interests. Late sixties through retirement marks the disengagement or decline stage. During this stage professionals experience disengagement from the world of work and begin thinking about retirement (Gonzalez 2008; Leung, 2008).

Theory of Work Adjustment

The Theory of Work Adjustment (TWA) is based off of the person-environment correspondence theory which views career development as a balance of adjustment and accommodation (Dawis, 2002, 2005; Dawis & Lofquist, 1984). The person simply referred to as P, looks for an environment, referred to as E, that meet their needs. The environment, in terms of career development, is an organization, company, or other type of work environment the P is seeking. E looks for individuals who meet the needs or requirements of the organization. Satisfaction between P and E are dependent upon needs, values and requirements being met (Leung, 2008). Various adjustment styles help explain how P and E find balance and remain satisfied with each other.

Flexibility, activeness, reactiveness and perseverance are four adjustment styles explained in TWA (Dawis, 2005). Flexibility refers to how well P adjusts to or tolerates E, and how easily P becomes dissatisfied with E. The second adjustment style, activeness, refers to whether P's willingness to change E in order to decrease dissatisfaction. Reactiveness refers whether or not P would consider changing when dissatisfied, with no change in E. Lastly, perseverance refers to how long P will tolerate or try to adjust to E before choosing to move on and leave E (Leung, 2008). Although these adjustment styles focus on how P tolerates E, the same styles apply to how E tries to maintain balance with P.

Gottfredson's Theory of Circumscription and Compromise

The current study will focus on Gottfredson's Theory of Circumscription and Compromise and Cognitive Information Processing Theory. Linda Gottfredson's Theory of Circumscription and Compromise provides a theoretical background that illustrates how and why adolescents and emerging adults choose certain careers. This theory specifically speaks to how and why women and individuals of color choose certain occupations and disregard others based on environments, masculine and feminine careers, and influence from parental figures. This theory provides insight into why underrepresented populations choose certain careers and is easy for STEM professionals, career counselors and school counselors to understand. Secondly, this theory will draw attention to innovative ways to work with women and students of color in the STEM effort. This theory establishes the procedures to address (a) career choice, (b) influences from the environment and (c) narrowing career choice.

Linda Gottfredson Theory of Circumscription, Compromise and Self-Creation describes how career choice develops at a young age (Cochran et al., 2011; Gottfredson, 1981; Zunker, 2008). Influenced by the environment and people around them, young girls and boys create a list of acceptable and unacceptable careers. Mother's and father's occupations have a great influence on career thoughts of young people. A central concept in Gottfredson's theory is sex-type; masculine versus feminine occupations. Young people, especially young women, categorize occupations in this manner and doing this can have a large effect on how they view occupations. These views remain embedded in the minds of young people for a long time.

According to Gottfredson, development occurs through four stages; orientation to size and power (ages 3-5), orientation to sex roles (ages 6-8), orientation to social valuation (ages 9-

13) and orientation to internal unique self (14+) (Zunker, 2008). The first stage is a concrete one and sex roles aid in creating a sense of self. In the second stage gender development is significant to growth. Social class and “self-in-situation” effect work preferences in the third stage. In the fourth stage, sex roles, social class and self awareness have the greatest influence on career/vocational aspirations. Gottfredson’s theory progress from concrete to complex as a child matures and self concept is a central theme to this theory. Self concept, as explained by Gottfredson, is influenced by socioeconomic background, values, place in society and gender. This theory recognizes external barriers that limit a person’s access to certain goal and career/vocational aspirations (Zunker, 2008). This aspect of the theory speaks to students of color in particular because of the environments in which they might be exposed.

Three other aspects that influence career choice according to Gottfredson’s theory are social space, circumscription and compromise (Gottfredson, 1981). Social space involves creating a list of acceptable careers paths and circumscription is the narrowing of these choices. Compromise is adjusting goals and aspirations to fit external circumstances such as access to education and family responsibilities (Zunker, 2008). Women and students of color face external realities at young ages that strongly influence their career/vocational goals. They might look at their influences and people around them in certain occupations and disregard other that might not fit in their world view. This can quickly narrow their choices of career and vocational paths. Self concept, as described by Gottfredson, is essential to career and vocational aspirations and might affect the way women and students of color choose a career (Gottfredson, 1981). Gottfredson's theory is important to the current study because it explains how and why women and students of color might make career and vocational decisions. The faculty and research assistants on the COMPASS project realize the importance of gender and diversity representation in the program. The team remains cognizant of the influence of gender and ethnicity on career choice, therefore they try to ensure that the students are exposed to both male and female professionals along with professionals from various ethnic backgrounds. The first time students interact with STEM professionals is during the second portion of the class the teams believes in the importance of various representation.

Cognitive Information Processing Theory

Cognitive Information Processing Theory provides a comprehensive theoretical background that illustrates the importance of examining the relationships between career and life stress, negative career thoughts and an individual's career decision state. Each of these factors relate to the readiness to engage in the career decision making process. This theory provides a theoretical for the use of the Career Thoughts Inventory used in the current study. Secondly, it will provide insight into how negative thoughts affect decision making and confidence in the ability to make decisions. This theory establishes the procedures to address (a) career decidedness, (b) career thoughts, and (c) vocational maturity of undergraduate students.

Cognitive Information Processing Theory emerged more than 20 years ago. When CIP was created, it was inspired from the use of computer-based guidance and information systems helping people to make educational and career decisions. One focus of CIP is how individuals receive and process information to solve career or vocational problems and make career decisions (Reardon, Lenz, Sampson & Peterson, 2011). The origins of the CIP approach to career development are traced to the differentiated service delivery model explained by Reardon and Minor (1975). CIP was formally introduced in an article (Sampson, Peterson, & Reardon, 1989) and later followed by a book (Peterson, Sampson, & Reardon, 1991).

CIP aims to help individuals make informed and knowledgeable career and life decisions, while learning about more healthy problem-solving and decision-making skills that can be used for future choices (Reardon et al., 2011). CIP offers a practical theoretical perspective that is appropriate for individuals who are presented with numerous career problem-solving and decision-making challenges over their lives. CIP is unique among other career theories because it emphasizes cognition, emotion, learning, and decision making (Reed et al., 2001).

One key assumption of CIP is that career decision making is affected by both emotional and cognitive processes. When using a CIP approach in career counseling, it is important to assess and address distressing emotions and negative career thoughts at the beginning of the career decision making process (Bullock-Yowell, Peterson, Reardon, Leierer & Reed, 2011). The importance of examining the relationships amongst career and life stress, negative career thoughts and an individual's career decision state relates to the readiness to engage in career decision making and problem solving. Sometimes an individual's inhibiting emotions and negative career thoughts can affect their perceptions of self-knowledge, occupational knowledge and readiness (Reed et al., 2001). The current study focuses on career decidedness, career thoughts and vocational maturity of undergraduate students who are at an age where emotions can affect their judgment. Students in the current study will take the Career Thoughts Inventory which originated from CIP and shows why it is of importance to use this as theoretical background.

Career Interventions

Presently, various forms of career interventions exist, however these interventions are fairly new (Holland, Magoon & Spokane, 1981). Prior to 1970 career interventions consisted of individual counseling, but in 1980 there were various form of interventions including individual counseling, tests/inventories and computer-assisted programs. Career counseling, group treatments, instructional materials, occupational information and interest inventories are all forms of career interventions used to aid individuals in their career and vocational pursuits (Holland et al., 1981).

Career counseling involves one on one interaction with a professional who aids an individual choose a career or highlight and explore one's career options (Holland et al., 1981). Group treatments include seminars, workshops or courses that either target certain populations (i.e, veterans, women, individuals of color) or provide general career information. Instructional materials consist of the many textbooks, workbooks and other printed materials created by professionals to aid individuals in finding employment, creating a resume or cover letter and cope with vocational difficulties. Occupational information systems such as the Dictionary of Occupational Titles or Occupational Information Network (Holland et al., 1981; Research Triangle Institute, 2012). Finally, the most popular form of career or vocational assistance are interest inventories which assess an individual's occupational likes and dislikes in regard to occupations (Holland et al., 1981).

Whiston (2002) outlines five principles to all types of career interventions using the Principles of Empirically Supported Interventions (PESI) (Wampold, Lichtenberg & Waehler, 2002). Principle one discusses considering the level of specificity when evaluating outcomes.

This article briefly discusses four levels of specificity that offer frameworks for examining the effectiveness of career interventions. The first level has to do with the effectiveness of all career interventions in general. Empirical trends concerning various types of career interventions describe the second level of specificity. Although this level is more specific, it is still somewhat general. The third level examines major approaches specific to certain populations. Approaches used with undergraduate college students is one population that might be examined in this stage. Level four, the most specific stage, examines specific approaches in specific areas for specific populations (Whiston, 2002). This level would examine the population in the current study; undergraduate students with certain SAT scores, interested in STEM. According to the first principle, it is important to consider levels of specificity when evaluating intervention outcomes.

The second principle states the importance of examining client factors when interpreting outcomes (Whiston, 2002). Age and underrepresented groups are two examples to consider when examining the effectiveness of career interventions. Most career interventions are done with college students (Whiston, 2002), yet are generalized to various populations. Oliver and Spokane (1988) found different effect sizes for using certain career interventions with elementary school children in comparison with other populations. Additionally, underrepresented groups (e.g., women and students of color) are important to consider when examining the effectiveness of a career intervention. Similarly to examining age, what is effective for women, might not be as effective with men (Whiston, 2002). Not only is it important to consider client factors when interpreting outcomes, but it is also important to examine methodology used.

Principle three states the importance of examining scientific evidence in its entirety (Whiston, 2002). Using appropriate methodology and paying attention to design, sample and measures are all important to interpreting the effectiveness of a study (Wampold et al., 2002). For example, a study might have a large effect size but use a poor outcome measure, therefore paying attention to methodology can change the way in which one views outcomes of a study. In addition to scientific evidence, examining evidence for absolute and relative effectiveness is useful. Absolute effectiveness looks at whether a career intervention is more effective than no treatment, while relative effectiveness compares various career interventions. Recognizing these differences can help with gaining a different perspective on the effectiveness of an intervention (Whiston, 2002). Whiston (2002) emphasizes the importance of more research being done on that examines relative effectiveness. This type of research would allow for more insight into various interventions.

The fifth principle states that causal attributions for specific ingredients be made only if the evidence is persuasive (Whiston, 2002). This principle describes that there should be persuasive evidence examining "which specific ingredients have a causal relationship with outcome" (Whiston, 2002, p. 229). Whether it is experiential learning, written exercises, or hearing guest lecturers, researchers should examine which approach had the most effect on the participants. Outcomes being assessed appropriately and broadly notes the sixth principle. For example, when examining career maturity, career thoughts or career decidedness, the correct and most appropriate measurement tool should be used. The last principle states that outcomes be assessed locally and there should be freedom of choice (Whiston, 2002). Assessing outcomes locally refers to the idea of taking into account various situations that might effect outcomes. These situations might be related to the budget or setting in which the intervention takes place. Freedom of choice refers to allowing researchers to choose whichever interventions they wish for their research. Recognizing and understanding these principles can aid career intervention research in moving forward an identifying which populations benefit from which interventions under certain circumstances.

STEM Interventions

The National Research Council (NRC) releases reports on successful k-12 STEM education programs and examines criteria to identify successful STEM schools and what schools should do to improve STEM learning (NRC, 2011). There are three goals outlined for improving STEM education. The first goal is to increase the number of students who pursue advanced degrees and careers in STEM and increase the number of women and minority participants. Because there is a connection between k-12 STEM education and the United States' competitiveness as a nation, it is important to support this group of students (NAS, 2007). This goal specifies students of color because only 10 percent of STEM doctorates are awarded to nonwhite and non-Asian students. Therefore there is a push to encourage students of color to enter into STEM majors in their undergraduate programs (Plunker, Burrough & Song, 2010). The second goal is to increase the number of STEM-capable individuals and increase women and individuals of color in the STEM workforce (NRC, 2011). STEM capable careers include medical assistants, nurses and k-12 teacher in STEM subject matter. The demand for STEM-capable workers far exceeds to supply, therefore, encouraging students to enter these fields is important as well (Lacey & Wright, 2009). The third goal is to increase STEM literacy for students whether or not they are interested in STEM careers or majors. Some knowledge in these areas is necessary for all students in regards to health and technology. Whether or not a student decided to pursue a career in STEM, the world around them is advancing and STEM knowledge at a certain level is necessary for everyone (NRC, 1996).

NRC uses three criteria to identify successful STEM schools and programs. These three criteria are related to STEM outcomes, STEM-focused schools and STEM instruction and school level practices (NRC, 2011). The first criterion, STEM outcomes is not only related to student test scores, but it also related to the culture of the school and its goals. Examining creativity, motivation and commitment, for example, are important in determining how well a school prepares its students. STEM-focused schools, the second criteria, are those schools with programs that have a focus of engaging certain groups (i.e, gifted students, students of color or women) in STEM. These programs have a more rigorous curriculum, more time learning STEM concepts, more accessible resources to teach STEM and better prepared teachers in STEM disciplines. STEM-focused schools with potential to meet the goals of STEM education are selective STEM schools, inclusive STEM schools and schools with STEM-focused career and technical education (CTE).

Selective STEM schools organize themselves around the STEM disciplines and are either state residential schools, stand alone schools, schools within a school or regional centers with half day courses (NRC, 2011). These schools support a healthy and engaging learning environment by having expert teachers, state of the art laboratory equipment and internship opportunities (NRC, 2011). Inclusive STEM schools emphasize STEM disciplines but do not have particular admissions requirements. These programs aim to give students a well rounded education, giving students knowledge on STEM disciplines, without singling out certain populations (NRC, 2011). Studies found that students in these programs scored higher on math and science achievement tests. Schools and programs with STEM-focused career and technical education (CTE) are present in high schools and aim to engage students and increase student retention. These programs allow students to explore STEM careers and learn the practicality of STEM subject matter. Although this type of programs sounds like it would be effective, not much research exits on these programs which is important to note because the current study examines how a career development aspect is implemented in a STEM intervention.

STEM programs are also present in mainstream high schools and these programs are vital because various kinds of students are able to benefit from them (NRC, 2011). The goals of these programs vary, with some wanting to give students general knowledge of STEM while others want to increase science literacy or increase the number of STEM capable students in STEM (NRC, 2011). In these "regular" high school programs, Advances Placement (AP) and International Baccalaureate (IB) programs allow students to gain a deeper meaning of certain content areas. In 2009, 35 percent of U.S public high schools offered AP and IB courses in English, Mathematics, Science and Social Studies (Lee & Rawls, 2010). Although these programs are well thought out, STEM instruction could affect the way students learn content in these areas (NRC, 2011).

Effective STEM instruction, as defined by the NRC, "capitalizes on students' early interest and experiences, identifies and builds on what they know, and provides them with experiences to engage them in the practices of science and sustain their interest", (NAP, 2011, p. 24). When teachers and instructors know how to use students' understanding in helping them learn concepts, the students gain a deeper meaning of the information presented. Teaching students in this manner allows students to ask analytical questions about the core ideas of the content. These questions lead to thought provoking discussions that allow students to absorb the information (NAP, 2011). Schools hope that by engaging students in this type of learning from k-12 it prepares them for their undergraduate programs.

NRC (2011) outlines a number of key elements to guide educators on how to properly develop STEM programs. The first key element is having a curriculum and a set of standards. These standards give teachers guidelines they must enforce to aid their students in gaining knowledge at the appropriate level of learning (Schmidt, 2011) The second element is teachers who are experts in their discipline. Unfortunately, many students who teach in STEM areas are not qualified in those areas, do not have certificates in those areas, or did not major in those subjects during their schooling (NRC, 2010). A system of assessment and accountability is the fourth element to developing effective programs. These systems should focus on student outcomes and teacher practices. With some schools not allotting enough time for instruction in STEM areas, NRCs suggests adequate instructional time as the fifth element. The last element is equal access to high quality STEM learning opportunities. Students from different ethnic and socioeconomic groups vary academic performance and some of these different are connected to educational programs implemented at various schools (Hill, Bloom, Black & Lipsey, 2008). By implementing these elements in various schools, k-12 programs, NRC hopes to increase the number of STEM capable students and increase the number of students who move on to STEM majors and careers. Existing programs have similar goals and focus on increasing interest in STEM for high school and undergraduate students (Verma, Dickerson & McKinney, 2011: Zhe et al., 2010).

Dieker, Grillo and Ramlakhan (2012) examined the influence of a STEM summer camp using virtual environments at the University of Central Florida (UCF). For the purposes of this study UCF's Media Convergence Lab (MCL) provided virtual and stimulated environments allowing students to engage in STEM activities. This study focused on engaging students transitioning from middle to high school in STEM experiences. Participants (*N* = 108) included students from local school districts in central Florida who were of low socioeconomic status and considered gifted students. The camp was a two day visit where students were first introduced to the STEM concept. They learned about various STEM careers and the importance of going to college in order to gain a career in STEM. Students were also exposed to mentors from diverse backgrounds who were STEM student athletes, faculty advisors or from the Student Diversity Office. These students also engaged in the virtual environment provided by the MCL and completed problem solving activities in STEM. The camp left students with more knowledge of STEM careers. A pre test taken by the students showed that 58% of the students knew the STEM acronym and 39% could identify a career representative of STEM fields. The post test showed that 100% knew the STEM acronym and 95% could explain the education needed to attain a career in various STEM fields (Dieker, Grillo & Ramlakhan, 2012).

One program's goal was to increase interest in STEM areas for high school students (Zhe, 2010). The students became involved in a 10 week program where they became involved in various research activities lead by faculty and graduate student mentors. The researchers thought that by becoming involved in this program and engaging in hand on activities, students' self confidence and career motivation would increase. Using visual demonstration and including the high school students in the research they would have more of an understanding of STEM disciplines. The program included eight principles: delivering materials in various ways in a clear manner, motivating students, accommodating various learning styles, using tactile aides, allowing students to use cognition and memory, engaging students in hand on activities, group work, and engaging in student interaction and feedback. Participants (*N* = 33) included students who were sophomores (*N* = 2), juniors (*N* = 16) and seniors (*N* = 15). There were more males (*N* = 18) than females (*N* = 15) and most of the participants were White (*N* = 25). Out of the 33 participants in the study, 21 were at a point where they had to make decisions about college and all 21 decided to attend college. In addition, 18 of the 21 students decided they wanted to go into a STEM major (Zhe et al., 2010).

Lenaburg and colleagues (2012) examined the influence of a 2 week summer bridge program designed to increase STEM interest in community college students in southern California. The program, named EPSEM (Expanding Pathways in Science, Engineering and Mathematics) Summer Institute (ESI) aimed to recruit mostly underrepresented students who were first generation college students. Many of these students were nontraditional students, meaning they worked full time, were part time students, had delayed enrollment, financial independence or having children. Participants (*N* = 161) were 40% female, 60% underrepresented and 60% first generation college students. All participants lived on a college campus during the two week period and attended sessions on transfer requirements and choosing courses in science and engineering amongst other types. Students were also introduced to various campus resources such as the tutoring center, library and counseling center. In addition, students worked on research projects in small groups with STEM faculty and graduate researchers. Students also took field trips to local industry professionals and presented on everything they learned at the end of the two week period. Results indicated that students had increased confidence and motivation to pursue STEM undergraduate degrees.

Freeman (2012) examined a career orientation course taught at St. John Fisher College for undergraduate students interested in Biology. The aim of the career orientation class is to increase awareness of various potential careers. The outline for the course is also used for

Psychology, Chemistry, English, Pharmacy, Education and Sport Management programs. There are five goals for the Biology career orientation course. The first goal, basic knowledge of biology and exposure to the fundamentals of biology, allows the students to be introduced to that specific field of study. The second goal of students being competent in a laboratory setting, gives students hands on experience and allows them to ask questions about being in that particular setting. The third goal states that students will be prepared for careers in natural and applied sciences as well as other professional programs. Thinking critically and being intellectually flexible is the fourth goal. This goal allows students to go beyond the surface level and gain a deeper understanding of biology. The last goal, creating students who are effective communicators, allows the students to share their knowledge in a proper manner and helps them work better in a group setting. After taking the course, students took pre and post surveys and results showed that the students had a better idea of what the biology major required and they were more aware of specific careers in biology.

Living Learning (L/L) Programs

Living learning (L/L) programs are also popular within STEM interventions. Designed from traditional undergraduate programs with residential communities of students, John Dewey's philosophy and Alexander Meiklejohn's ideas of residential learning communities, these programs encourage learning through community (Soldner et al., 2012). Students involved in these programs live together on campus, enroll in the same classes and are exposed to certain resources unavailable to students not involved in the program. The purpose of these programs is to foster a sense of community with students and allow them a type of cohort experience.

Through this experience, students are around other students going through the same experience; they can support each other and develop a sense of belongingness with each other. STEM-focused L/L programs allow students to complete research projects together, take field trips and enroll in classes together amongst other activities.

Soldner and colleagues (2012) conducted a study of L/L programs and asked students to fill out surveys online to gain more insight into their experiences in these programs. This study was part of a national study that surveyed 110,682 students across the nation. Participants (N = 5,240) were in their second semester of their first year and either had intentions on majoring in a STEM field or were enrolled in a STEM field. Most of the participants were women (N = 3,142) and all participants took the Residence Environment Survey. The researchers used structural equation modeling to analyze the data in this study. Results showed that interest in STEM pursuits ($\beta = 0.08$, $SE = 0.01$, $p \leq 0.05$), positive outcome expectations ($\beta = 0.21$, $SE = 0.02$, $p \leq 0.05$), and collegiate self-efficacy, operationalized here as confidence in one's STEM preparation ($\beta = 0.11$, $SE = 0.03$, $p \leq 0.05$) and college grades ($\beta = 0.10$, $SE = 0.02$, $p \leq 0.05$), were significantly related to students' likelihood to stay in STEM disciplines. In addition, participation in a STEM-focused L/L program was not directly related to the likelihood of completing a STEM undergraduate degree ($\beta = 0.02$, $SE = 0.01$, $p \leq 0.05$). Describing this study is important to note for the present study because students are part of the COMPASS program which allows students to be a part of an L/L experience.

Mentoring STEM Interventions

Borum and Walker (2012) conducted a qualitative study that aimed to understand the experience of Black women in higher education. The researchers wanted to get answers to the following questions:

1. How do Black women who have earned their PhDs in mathematics describe their undergraduate experiences in mathematics?
2. How do Black women who have earned their PhDs in mathematics describe their graduate experiences in mathematics?
3. What factors of the undergraduate and graduate experience do Black women perceive to have been most and least helpful to their success in earning their doctoral degree in mathematics?

The participants in this study (N = 12) were Black women with doctoral degrees in mathematics. They were either working for a college or university (n = 8), retired (n = 2) or working in another capacity (n = 2). The researchers conducted semi-structured interviews with each of the participants, using mostly open-ended questions. Results revealed that mentoring played a large role in retaining these women in graduate programs. Some of the women in this study discussed that having a mentor of the same ethnicity was helpful because they could see someone who was similar to them. However overall, not having a mentor of the same sex or ethnicity did not change their view of the importance of a mentor to lean on for support.

Kendricks, Nedunuri and Arment (2013) examined the influence of a program aiming to increase academic performance and retention of students in STEM. Central State University, a historically Black university (HBCU), created the Benjamin Scholars Program (BBSP) in 2009 with the goals of increasing retention and graduation rates. STEM faculty ran the program and assigned the students a mentor based on the student's interests and the faculty members' area of expertise. The students in the program, referred to as scholars, were required to take two STEM classes together per semester. In addition, there was a living learning component to the program and scholars live together in a dormitory. Other requirements included attending two professional workshops per year, completing research projects throughout the academic year and completing one internship. At the end of each year, the students completed satisfaction surveys evaluating the program. Results of the surveys showed that mentor support was positively correlated to the students' GPA ($r = 0.539$, $p = 0.03$). Although other factors contributed to academic success, however mentoring had the most impact on their success.

Holland, Major and Orvis (2012) investigated the role of peer mentoring and self-development activities, referred to as capitalization, in helping students remain in a STEM major. Participants in this study ($N = 214$) were undergraduate students recruited from one historically Black university and one university that was predominately White. The majority of the participants, averaging 20 years of age, were African American (52%) and male (59.3%). All participants in the study were STEM majors mostly in engineering and computer science. An original scale was used to measure peer mentoring and capitalization was measured by a workplace-oriented measure created by Maurer and colleagues (2003). Satisfaction with major, affective commitment to major, involvement with major and willingness to mentor others were three other factors measured. The researchers in this study used multiple regression analyses to test their hypotheses. Results showed that peer mentoring predicted satisfaction with major ($\beta = .33$, $p < .0005$) and capitalization also predicted satisfaction with major ($\beta = 0.15$, $p = 0.28$). Peer mentoring predicted commitment to one's major ($\beta = 0.32$, $p < 0.0005$) along with capitalization ($\beta = 0.15$, $p = 0.045$). Both peer mentoring ($\beta = 0.27$, $p < 0.0005$) and capitalization ($\beta = 0.17$, $p = 0.012$) significantly predicted involvement with major. Both peer mentoring ($\beta = 0.29$, $p < 0.0005$) and capitalization ($\beta = 0.15$, $p = 0.028$) significantly predicted willingness to mentor others.

Wilson and colleagues (2012) investigated hierarchical mentoring as a way to retain undergraduate students in STEM. The Howard Hughes Medical Institute Professors Program at Louisiana State University created a mentor model for their STEM undergraduates. They created the model using factors that influence STEM retention. These factors were academic performance, self image, pre college background, academic advising, financial support and social integration in STEM culture. The belief behind this model is that if students are motivated, they will want to change their maladaptive behaviors for more positive behaviors. Additionally, when students are supported, they are more likely to be successful. This mentorship program, illustrated in the form of a ladder, and take students through various levels including learning effective study strategies and learning styles, research opportunities, mentor and mentee activities, and helping the students create a positive mindset in which they are empowered. The retention data showed that students in the program were more successful in completing their STEM bachelor degree than those who did not take part in the program. Over 70% of the students who entered the program graduated, which is higher than the national average (Wilson et al., 2012).

Career Assessments

History of the evolution of assessment from 1914-1974 and considerations for the future of assessment are highlighted to provide historical perspective to inform practitioners as they serve the diverse needs of complex client populations (Harrington & Long, 2013). Interest inventories began in 1914 with the work of Jesse Davis who published the Student Vocational Self Analysis for 10th graders in public schools. This was a guide to assessing self awareness and occupational process. In 1917, James Miner, a psychologist, examined whether student's career choices were their own or influenced by teachers and created an assessment to help his research (Harrington & Long, 2013). Clarence Yoakum ran a seminar on how to measure interests and had students create 1,000 questions related to this topic. A year later in 1920, The Carnegie Interest Inventory was the first standardized interest inventory published by the Carnegie Institute of Technology's Bureau of Personnel Research in Pittsburgh, Pennsylvania. In 1923, Max Freyd developed two instruments examining gender differences; the instrument for males had 80 occupations while the instruments for females had 67 occupations. Karl Crowdery was the first to separate various occupations by interests in 1924 (Harrington & Long 2013).

The Strong Vocational Interest Blank (SVIB) was developed in 1927 by E.K Strong and The Vocational Interest Blank for Women followed in 1933 (Harrington & Long, 2013). Strong developed questions for these inventories using eight topics; occupational titles, school subjects, hobbies, occupational activities, kinds of people, forced choice of preferences and activities and personal characteristics (Strong et al., 2004). Bruce Le Suer developed the Occupations Interest Blank in 1937 which was published by the Psychological Corporation. In 1947 L.L. Thurstone created An Interest Schedule published by the University of Chicago's Psychometric Laboratory.

This marked the first time an assessment was theory based. There were 9 new instruments created from 1956-1974, many of which used a Likert type scale (Harrington & Long, 2013). Moving away from gender specific inventories, the Strong-Campbell Interest Inventory (SCII), created in 1974, hoped to promote more equal gender treatment. John Holland's theory was used in creating this instrument.

In 1982, the first edition of A Counselor's Guide to Career Assessment Instruments was published (Whitfield, 2009). This guide remains relevant and is a comprehensive handbook designed to assist counselors in the process of selecting appropriate career assessments for use with clients. With the many assessments on the market that professionals have to choose from, many of which aim to measure the same construct, it can be a complicated and time consuming process to find one that is both appropriate for the counselor's target population and one that is both valid and reliable (Harrington & Long, 2013). This guide offers a variety of career assessment-related topics, such as current trends in assessment, selecting an assessment instrument, essential assessment competencies, as well as standardized reviews of 71 career assessment instruments, the purpose of this guide is to simplify what can often be a very confusing task. With the many assessments developed in years prior, guidebooks such as these were appropriate to help professionals choose with assessments to use with clients or students (Miller & Erford, 2010).

Frank Parsons, known as the father of vocational guidance, was named director of the Breadwinners Institute in Boston in 1905 which ultimately led to the creation of the Vocation Bureau in 1908. The purposes of the Vocation Bureau were "to aid young people in choosing an occupation, preparing themselves for it, finding an opening in it, and building up a career of efficiency and success" (Parsons, 1908, in The Arena; quoted by Davis, 1969, p. 113).

On May 1, 1908, Parsons presented a report on the progress of the Vocation Bureau where he used the term "vocational guidance" for the first time in conjunction with the work of the Bureau. Parsons' (1909) text, *Choosing a Vocation*, was published on May 1, 1909 by a personal friend at Parsons' request, approximately six months after his death. In this book, Parsons detailed his ideas for developing a vocational guidance process based on scientific methods (Davis, 1969).

One of Parsons' most important contributions to vocational guidance was his conceptual model which is frequently cited in vocational development theory texts (e.g., Herr & Cramer, 1996; Zunker, 1994). Parsons model included three parts with the first being a clear understanding of yourself, aptitudes, abilities, interests, resources, limitations, and other qualities. Second, a knowledge of the requirements and conditions of success, advantages and disadvantages, compensations, opportunities, and prospects, in different lines of work, and third, true reasoning on the relations of these two groups of facts. (Parsons, 1909, p. 5).

The history of career assessments prefaced the creation and organization of career interventions presently used. Explaining the history of career assessments allows for an understanding of how and why certain interventions fell into place. These assessments lend themselves to the creation of interventions that in turn give the assessments strength in regards to reliability and validity.

Overview of Career Assessments

Assessments provide counselors with the tools they need to aid individuals through the career development process. Whether assessing interests, skills, abilities or career choice, career assessments give an individual a starting point for counseling and exploring career options (Zunker, 2002). Assessments also inform counselors on appropriate interventions to use with individuals given their results (Whitfield et al., 2009).

Ability tests are one type of career assessment. This category of tests measure a specific ability or skill (Zunker, 2002). Aptitude tests fall into one of two categories; multiaptitude test barriers and single tests meant to measure specific aptitudes. Multiaptitude test barriers test many aptitudes and provide information important to the career decision making process (Zunker, 2002). Single aptitude tests allow the individual to gain more information on a specific aptitude such as artistic or musical aptitudes. These tests provide individuals with an idea of their abilities or aptitude in certain areas. Through this information, an individual can begin their career development process. In many situations, people benefit from knowing and understanding their abilities and begin the career process with an idea of what they are good at (Whitfield et al., 2009).

Holland's RIASEC Model describes six occupational themes used to categorized individuals (Holland, 1985, 1997). Those themes are accompanied by careers that are related to those themes. The Holland types are broken down into five groups; Realistic, Investigative, Artistic, Social, Enterprising and Conventional. These five environments describe appropriate careers and work environments for the individual. Individuals in the Realistic category, for example, prefer to work with things rather than people and are described as frank, honest, humble, natural and persistent. Appropriate occupations for the Realistic group include Electrical Engineer, Chef, Floral Designer and Construction Worker (Sukiennik, Raufman & Bendat, 2013). Individuals are usually given three primary types that are appropriate for them. For example, someone's results of "SAC" would mean they are social, artistic and conventional.

This means that the individual has traits of social, artistic and conventional that are accurate to them. The results of this assessment allow the individual to gain insight into what work environments may or may not be appropriate for them (Zunker, 2002)

The Differential Aptitude Test (DAT) is an aptitude test appropriate for teenagers and adults (Zunker, 2002). This aptitude test includes verbal reasoning, numerical reasoning, abstract reasoning, perceptual speed and accuracy, mechanical reasoning, space relations, and spelling and language usage. The DAT takes about three hours to complete, making it longer than many other career tests (Zunker, 2002). The DAT predicts grades in high school and college but does not predict vocational success, therefore the assessment is sometimes paired with the Career Interest Inventory (CII). The CII gives measure of Social Service, Clerical Services, Health Services, Agriculture, and Customer Services amongst others. Although one of the more popular tests, the DAT is amongst many other ability tests (Whitfield et al., 2009).

Other aptitude tests include the Career Ability Placement Survey, the Flanagan Aptitude Classification Test, the Inventory of Work-Relevant Abilities (IWRA), the MicroSkills III, the Occupational Aptitude Survey and Interest Schedule-2 (OASIS-2) and the Wiesen Test of Mechanical Aptitude. High school, college students and adults benefit from many of these assessments that discuss characteristics relevant for career decision making (Zunker, 2002).

Career counselors also use achievement tests in the career development process. Achievement tests measure competence in the areas of mathematics, language usage and reading. Achievement tests differ from aptitude tests in that they only measure specific content areas (Whitfield et al., 2009; Zunker, 2002). Aptitude tests measure specific skills and abilities learned from various experiences. Although they only measure certain knowledge, these tests give individuals ideas on the careers they should pursue (Zunker, 2002). Vocational schools, colleges and universities take achievement test scores into account when deciding on admission into programs. Research suggests that genetics and environment influence achievement test scores (Wainwright et al., 2005). In addition, one's self perceptions also effect their self estimates of their abilities (Zunker, 2002). Attitudes towards these tests also effect test outcomes. One study examined the way in which beliefs effect test scores and found that when women scored lower on math tests they thought indicated whether or not they were weak in math (Brown & Joseph, 1999). The same outcome occurred when men took a test that they thought would indicate whether or not women were strong in math. Achievement tests fall into two categories; general survey batteries or surveys specific to a certain topic or area.

The Stanford Achievement Test (STAT), used for high school students, is a survey published in 1965 (Zunker, 2002). The STAT measures language, mathematics, reading, spelling, science and social science among adolescents in high school (Qi & Mitchell, 2012). Scores for the STAT fall in a normal bell curve and are labeled as poor, below average, average, above average and superior. Students are able to view their score report and see which areas they excelled in and which areas they scored the lowest in (Zunker, 2002). The Wide Range Achievement Test - Revision 3 (WRAT3), published in 1936, measures mathematics, reading and spelling. The WRAT3 applies for a wide age group; 5-64 years old. This assessment does not take a long time to complete and aids administrators in helping individuals with career planning. Scores range from 55-145 with a score of 100 being average. Other achievement tests include the Basic Achievement Skills Individual Screener (BASIS), Comprehensive Test of Basic Skills and the Peabody Individual Achievement Test (PIAT) (Zunker, 2002).

Achievement tests allow career counselors, educators and future employers to see a measurement of an individual's competence level in various areas (Whitfield et al., 2009). This provides these individual's information directly related to their academic achievements (Zunker, 2002). Although not directly related to academic achievement, interest inventories are another kind of career assessment. Interest inventories play a large role in career development because they allow the individual explore their activities they enjoy (Zunker, 2002).

Strong (1943) started the discussion of interests and how an individual's likes or dislikes are related to career choices and preferences. Strong (1943) found that individuals in various careers have similar interests that differentiate them from other groups of workers in other occupations. Artistic individuals and investigative individuals require different work environments and choose occupations that fit their interests (Holland, 1997). Swanson (1999) studied the stability of vocational interests and found that these interests are stable over time even when using different measures. Swanson (1999) also found that stability increases with age and become more clarified as time goes by.

When a professional works with an individual in exploring interests, they have the individual take an assessment to examine these interests. The results of interest profiles yield flat or elevated results (Zunker, 2002). Flat profiles, also known as depressed profiles have little differences in scores and the scores center around the average range. A number of reasons exists for a flat profile. The individual might be indecisive about their career or experiencing a mood swing when taking the assessment (Hansen, 1985). Other reasons include little knowledge about the world of work, meaning that the person does not have a broad fund of information to reference when answering the questions on the assessment. Additionally, a narrow interest range and an unwillingness to work might contribute to a flat profile (Zunker, 2002).

On the other hand, elevated profiles have many high scores indicating high interest levels (Hansen, 1985). Reasons for an elevated profile include reluctance to respond with the answer of "dislike" because they do not want to be perceived as negative. Therefore, they "agree" or "like" statements and this results in many high scores (Zunker, 2002). Secondly, the individual taking the assessment could have various interests. Flat or elevated results help the professional aid the individual in exploring their interests and creating necessary and appropriate interventions. The Strong Interest Inventory (SII) and the Kuder Occupational Interest Survey (KOIS) remain two of the more popular interest inventories (Zunker, 2002).

The SII (Harm et al., 1994) is based on ideas of Strong (1943) saying that a person who has similar interests to other individuals in the workplace are more satisfied in that occupation than those who do not have similar interests. The SII includes 317 items measuring interests on areas of occupations, school subjects, activities, leisure activities, types of people, preference between activities, personal characteristics and the world of work (Zunker, 2002). The SII also includes the Skills Confidence Inventory (SCI; Betz, Borgen & Harmon, 1996) which measures an individual's level of confidence in performing various activities all related to Holland's themes of realistic, investigative, artistic, social, enterprising, and conventional. Results of the SII provide General Occupational Themes (GOTs), the Basic Interest Scales (BISs) and the Occupational Scales (OSs). This scale provides information about interests and confidence in one's skills that give professionals a starting point for starting the career process (Whitfield et al., 2009).

Kuder (1963) developed four inventories, including the Kuder Occupational Interest Survey (KOIS) that measures Vocational Interest Estimates, Occupational Scales and College Major Scales. The results show high, average and low scores for each subscale and the results are relatively easy to understand (Whitfield et al., 2009). The score being divided into three categories allow the individual to see where they score specifically on each item (Zunker, 2002).

Other interest inventories include the Campbell Interest and Skill Survey (CISS), Career Assessment Inventory Career Exploration Inventory and the Occupational Aptitude Survey and Interest Schedule-2 (OASIS-2).

Personality inventories "measure individual differences in social traits, motivational drives and needs, attitudes, and adjustment - vital information in the career exploration process" (Zunker, 2002, p. 113). These inventories provide support and insight when considering a certain career or vocation. Certain personality traits correspond with or are more prominent in certain careers, therefore exploring personality in regard to career proves vital in the career development process (Zunker, 2002). C.G Jung's ideas about personality inspired the Myers Briggs Type Indicator (MBTI), an assessment that measures normal personality traits.

Individuals respond to items measuring the following traits; extroversion vs. introversion, sensing vs. intuition, thinking vs. feeling and judging vs. perceiving (Culp & Smith, 2009; Whitfield et al., 2009). These four pairs identify how a person gains energy, perceives information, makes decisions and demonstrates his or her lifestyle respectively (Zunker, 2002). Each type has strengths along with potential vulnerabilities. Listed below is a table explaining each personality type.

Table 1: Personality Types

Personality Type	Description
Extroversion (E)	• Focus on the outer world of people and things • Often act quickly, sometimes without thinking • Like to have people around
Introversion (I)	• Focus on inner world of ideas/impressions • Like quiet for concentration • Tend to be careful with details
Sensing (S)	• Focus on concrete and present information gained from their senses • Tend to be good at precise work • Like an established way of doing things
Intuition (N)	• Focus on future • Dislike doing the same thing repeatedly • Follow their inspirations, good or bad
Thinking (T)	• Tend to base decisions on logic and on objective analysis of cause and effect • Do not show emotion readily • Tend to be firm-minded
Feeling (F)	• Base their decisions primarily on values • Tend to be aware of their own and other people's feelings • Are more people oriented
Judging (J)	• Like an organized approach to life • Work best when they can plan their work and follow the plan • Want only the essentials needed to begin their job
Perceiving (P)	• Like a flexible approach to life • Adapt well to changing situations • Do not mind leaving things open for alterations

Depending on how an individual responds to the questions, they get results stating their personality type (Whitfield et al., 2009). Sixteen personality types exist for the MBTI and each type has unique characteristics that set it apart from other types. Jung believed that certain personality types thrive in certain work environments (Chauvin et al., 2010) therefore the results of the MBTI provide counselors with an appropriate self assessment before continuing with counseling.

Other personality inventories include the Sixteen Personality Factor Questionnaire (16PF; Cattell, 1970), and the NEO Personality Inventory-Revised (NEO PI-R; Costa & McCrae, 1985). Each of these instruments allow counselors to have a discussion with individuals about how their personalities influence their career decisions. The counselors can help the individual visualize how their personality would fit into certain careers of interest (Zunker, 2002). Not only do personality traits influence career decisions, but values influence career choice as well.

Value assessments aid individuals in assessing themselves and examining their beliefs. Those beliefs, in turn, effect people's career choices and decisions (Whitfield et al., 2009). Personal development occurs when individuals explore their values and have a good understanding of what they are looking for in a career (Zunker, 2002). Having discussions centered around values such as family, leadership, teamwork and security allow people to learn what they want in a career and why they want those things.

The Minnesota Importance Questionnaire (MIQ) consists of various statements related to psychological needs and measures vocational needs of importance to an individual (Thompson & Blain, 1992). Each statement relates to one of six values emphasized in this assessment; achievement, comfort, status, altruism, safety and autonomy. The achievement value describes a work environment that allows a person to fully use their abilities. The comfort values describes a work environment that allows the person to receive satisfactory compensation and makes the person feel secure (Zunker, 2002). Opportunities for advancement and being recognized as influential describes the status value. Valuing altruism in a work environment allows the individual to feel that they do work that is morally correct and the safety value describes a work environment that is orderly, predictable and structured. Lastly, the autonomous work environment allows an individual to express themselves creatively (Zunker, 2002). Results of the MIQ provide individuals with which values are most important to them and provides a list of occupations that would be appropriate for that individual (Zunker, 2002).

The Survey of Interpersonal Values (SIV), similar to the MIQ, measures six values related to how individuals relate to other people (Shapurian, Hojat & Merenda, 1981). The SIV measures support, conformity, recognition, independence, benevolence and leadership. The SIV lists three statements at a time and asks the individual to choose the most important one. The results them show the individual which values are most important to them. Other interest inventories such as the Values Scale and Values Arrangement List provide individuals with values that are important to them in order to help with self discovery and understanding (Zunker, 2002). Along the path of self discovery and understanding is examining one's career development. Career development inventories exist that measure various aspect of career development that influence progress towards career maturity (Zunker, 2002).

Various career development inventories measure concepts such as career thoughts, vocational maturity, career self efficacy and anxiety (Zunker, 2002). Career development inventories aid career counselors in identifying where an individual is on their career path. Whereas interest inventories and value inventories examine likes/dislikes and beliefs, career development inventories examine the process of career choice (Zunker, 2002).

The Career Decision Scale (CDS) provides an estimate of career indecision as well as an outcome measure for determining the effects of interventions relevant to career choice or career development (Osipow, 1987; Zunker, 2002). The CDS is a short scale made up of 19 items. The

Certainty scale measures the degree of certainty a student feels about decision about a college major or a career. The Indecision scale provides a measure of career indecision. The last item is an open-ended one and allows the student to clarify or offer further information about his or her career decision making. High Certainty Scale Score indicates certainty of choice of career and school major (Zunker, 2002). Certainty scores at the 15^{th} percentile or less are significant, suggesting uncertainty about the selection of either career and/or major. High Indecision Scale indicates indecision with regard to career choice. Scores which equal or exceed the 85th percentile should be considered significant, indicating indecision (Osipow, 1987). Karimi (2007) reported an internal reliability (.80) for an Iranian sample.

The Career Decision Self-Efficacy Scale (CDSE) measures confidence in one's ability to complete tasks related to one's career (Grier-Reed & Skaar, 2010; Taylor & Bentz, 1983). Individuals who take the CDSE rate their perceived efficacy on a 5 point Likert Scale. This assessment consists of five subscales; self-appraisal, occupational information, goal selection, planning and problem solving (Grier-Reed & Skaar, 2010). Self appraisal measures the ability to appraise one's abilities as they relate to career. Occupational Information measures how much one locates information about college majors and various occupations. Matching one's personality with career to help identify a major or career explains goal selection and planning is knowing how to implement a career choice. Lastly, problem solving measures the ability to cope or make alternate plans (Taylor & Bentz, 1983). The CDSE aid professionals in creating interventions to help individuals increase their self-efficacy (Zunker, 2002). Although popular career development inventories, the CDS and CDSE will not be utilized for the current study. The current study will utilize the Career Development Inventory (CDI) and Career Thoughts Inventory (CTI).

The CTI is a 48 question assessment that measures negative career thoughts. The readability of the CTI was calculated to be at a 6.4 grade level so it is fairly easy to read through and understand (Harris & Jacobson, 1982). The assessment follows the Likert scale and asks students to circle Strongly Disagree, Disagree, Agree or Strongly Agree. This assessment is broken down into three subscales: Decision Making Confusion (DMC), Commitment Anxiety (CA) and External Conflict (EC). The CTI has separate scoring for adults, college students and high school students. The DMC scale measured negative feelings confusion about decision making. The CA scale measured difficulty to commit to a specific choice and the experience of anxiety about making a decision. The EC scale measured the amount of outside influences effecting career thoughts. A higher CTI scale score may indicate a specific problem area for career decision making. This assessment provides a CTI total score and T score along with scores for each subscale. In all, there are five scores provided in this assessment. For example a student can have a CTI Total score of 47 and T score of 46 with DMC=15, CA=21 and EC=5. CTI Total scores ranges from 0-144, DMC scores range from 0-42, CA scores range from 0-30 and EC scores range from 0-15. A higher CTI scale score indicates a specific problem are for career decision making, so a person with a 42 on the DMC has an extremely difficult time making decision compared to someone who scored a 9 (Sampson et al., 1996). According to Sampson et al, 1996, the internal consistency (alpha) coefficients of the CTI total score range from .97 to .93 and the three construct scales' alpha coefficients range from .94 to .74. The CTI is considered to be a reliable instrument, meaning that various populations who take the test would get the same results.

The Career Development Inventory assesses vocational maturity for students and is comprised of various subscales. Career planning (CP) high scores indicates appropriate career planning activities and behavior; as well as curiosity with regard to their place in the world of work. Low scores mean that an individual may have given little thought to career decisions, and therefore may not be serious about choosing an occupation or learning about their options. Career exploration (CE) high scores mean that one is fully aware of the resources available to them, and gathered information relevant to future occupational choices. Low scores indicate one has not explored sources of quality information regarding career opportunities available to them. Decision making (DM) high scores mean that the student is capable of making healthy and appropriate career and vocational decisions. Low scores mean that the student needs to work on making better career and vocational decisions. This student might benefit from studying effective decision making skills. World of work (WW) high scores mean that students may have a lot of information to support their career decision making. Low scores reveal that the student may need more information about occupational fields and career development before making important career decisions and occupational choices. Knowledge of preferred occupation (PO) high scores reveal that the student has obtained detailed information about their preferred occupation. Low scores mean that the student may need to gather more detailed information regarding their occupation of choice. When all scales on the instrument are high, this means that the individual is capable of making sound educational and vocational decisions (Glavin & Rehfuss, 2005). Creed and Patton (2004) reported satisfactory internal reliability coefficients for all subscales (ranging from .70 to .87).

For the purposes of the current study I will utilize the CDI and the CTI to examine vocational maturity, career thoughts and career decidedness. The population in the current study are undergraduate students interested in STEM (science, technology, engineering and mathematics) careers who have, on average, high math SAT scores. Because the students already have an interest in a certain area, STEM, I want to examine their career choice, therefore I am using career development inventories. Career development research examines a number of constructs including vocational maturity, career thoughts and career decidedness amongst many others. Depending on the type of research and the questions one has, it is important to decide on the appropriate construct to examine.

Key Constructs

Career development research examines various aspects of career. Career research and assessments explore values, interests, dysfunctional thoughts, career maturity, anxiety and self efficacy amongst other constructs. Researching these various constructs aids in helping individual narrow and focus their career options. Expanding one's options also occurs as a result of researching these constructs. Despite the abundance of constructs that exist, I will discuss career decidedness, career thoughts and vocational maturity.

Career Decidedness

The concept of career decidedness is defined as the state of being decided about occupational, educational training and employment choices, whereas career indecision is the state of being undecided about a choice relating to the vocation one wished to pursue (Osipow, 1987; Williamson, 1937). Career decidedness can be enhanced, in emerging adults, by providing information on various careers and majors and by having students study their own interests (Grier-Reed and Skaar, 2010; Scott & Ciani, 2008).

Researchers have examined career decidedness within undergraduate or emerging adult populations. Although the research is lacking in career decidedness studies for STEM students there are many studies focused on career decidedness for undergraduate students. Hayes, Huey, Hull and Saxon (2012) studied career decision self efficacy using a sample of Jamaican youth described as "unattached" (*N* = 921) and found that assets such as parent communication and peer role models influence career decision self-efficacy. Grier-Reed and Skaar (2010) examined the outcomes of a constructivist career course using the Career Decision Self-Efficacy Scale-Short Form (CDSE-SF) and the Career Decision Scale (CDS) for undergraduate students (*N* = 82) and showed significant increases in career decision self-efficacy but no significant changes in career decision making. Heffner Macera and Cohen (2006) examined the influence of an undergraduate psychology course focused on career planning and academic advising (*N* = 154). At the end of the course students made more concrete plans for themselves and felt more confident about their careers. Scott and Ciani (2008) examined the effectiveness of an undergraduate career explorations course (*N* = 88). Career decision self-efficacy significantly increased and vocational identity amongst males significantly increased. Reese and Miller (2006) studied the effects of a career development course on career decision-making for undergraduate students (*N* = 96) and found that students had significantly less career decision difficulty and increased career decision self-efficacy.

Hayes, Huey, Hull and Saxon (2012) studied career decision self efficacy using a sample of Jamaican youth described as "unattached" to determine whether youth assets could predict career decision. The researchers described unattached youth as those without a job and who were not enrolled in any type of vocational training. The sample (*N* = 921) was comprised of 557 females and 364 males. They range from 16 to 25 years of age. The participants completed the Career Decision Self-Efficacy Scale (CDSE) and the Youth Asset Survey (YAS). The YAS asked questions regarding parent communication, peer role models and responsible choices.

Results from multiple regression analyses found that female youth reported higher CDSE scores than males. Results also indicated that youth who reported making more responsible choices, having higher future aspirations, and having more peer and non-parental adult role models had higher CDSE scores.

One limitation of this study was the lack of an intervention of any kind. It was a very good baseline for future research examining career decision self-efficacy. This study had a large sample size and its population is one that is lacking research in the literature. It gives ideas about expanding this research to young people in the Caribbean instead of only using children in the United States. The researchers thought to use the YAS which is helpful in seeing what factors could potentially influence CDSE scores.

Grier-Reed and Skaar (2010) examined the outcomes of a constructivist career course using the Career Decision Self-Efficacy Scale-Short Form (CDSE-SF) and the Career Decision Scale (CDS) which measure ability to make decisions and career indecision. There were 82 students enrolled in a large urban research university who took part in the study. About 47% of the students were European American, 19% were African American, 18% Asian American, 5% Latino American, 5% African, 4% multiracial and 1% other. The sample was comprised mostly of women (62%) and most of the participants were freshman (64%). The students were all enrolled in a constructivist career course that met once a week for two hours. The class was separated into three different modules.

The first module focused on self assessment. Students engaged in self reflection and explored their strengths using action, construction and narrative. They discussed career fantasies, completed a genogram and discussed their values and character qualities. The first module allowed the students to get a sense of themselves and engage in self exploration. The second module focused on constructing the future and uncovering strengths and the third module focused on planning, action and integration. They set goals and mapped out their plans including a career journey a career portfolio and final paper. Not only did they map out their plans, they examined their sense of identity across the past, present and future. The students completed the CDSE-SF and CDS as a pre and post test taken at the beginning and end of the semester.

To look at differences in scores across pretest and posttest of CDSE-SF and CDS a 2 x 2 crossed MANOVA with gender and race as the independent variables and CDSE and CDS as the dependent variables. The results showed no statistically significant differences in pre and posttest scores ($p = .702$). The CDSE-SF difference score had a significant intercept, but the CDS had no significant intercept, main effects or interaction. Post-hoc tests showed mean differences were significant in European American ($p < .01$), and African American ($p = .008$) CDSE-SF scores. Asian American showed a 10 point increase ($p = .054$). These results indicate that students in the constructivist career course were more empowered to make decisions in regards to career but had no change in career indecision and the effect was similar across gender and race. The results show a significant negative correlation between career decision self-efficacy and indecision on posttests, yet students in the constructivist career course showed significant increases in career decision self-efficacy with no decreases in career indecision.

Although this study is similar to the present one, it is not without its limitations. This study had no control group, making it difficult to measure exactly how much growth there was. A control group would allow for a measurement of the career intervention. The sample size (N = 82) was also small and results could have been different if there had been a larger sample size.

This study is important because it is similar to the study being done for this dissertation. The goal of the study was to examine career indecision and ability to make decisions, similar to this study which is examining career decidedness and career thoughts. The study was completed at a large university with 82 students. This study will have a similar sample size. In addition, most of the students were European American which is true for this study. This career course was separated into three parts, similar to the STEM-focused career course.

Heffner Macera and Cohen (2006) examined the influence of an undergraduate psychology course focused on career planning and academic advising. Throughout the course, lectures focused on choosing a major, job opportunities, applying to grad school and guest lecturers from professionals in psychology related careers. Class assignments included a resume, plan of study and a career explorations paper. Students were asked to complete a pre and posttest survey which asked questions regarding interests and career plans.

The participants (N = 154) were undergraduate students enrolled in the Psychology as a Profession course. Most of the students were female (62%) and the majority of students were freshman (36%) and sophomores (40%). The results showed that students evaluated the course as moderately high in value thought it would be appropriate for psychology majors to be mandate to take the course. Out of all the students, 93% changed their career plans and 20% felt more confident about their plans after taking the course.

Although this study is similar to the present one, it has many differences and has many limitations. The researchers in this study did not use a valid instrument to obtain information from the students. Using a career instrument could have strengthened the study much more. This study also had no control group to measure the results against. Even with these limitations, the study is worth mentioning because the framework is similar to that of the present study and showed some significant results. This study shows the importance of using valid instruments in a study as important as this one. The influence of a career planning course on choosing a specific major is the focus of this study and similar to the present study in that way.

Scott and Ciani (2008) examined the effectiveness of an undergraduate career explorations course. The researchers hypothesized that undergraduates enrolled in the course would report significant increases in career decision-making self-efficacy and vocational identity during the semester. Students (N = 88) at a large Midwestern university completed the Career Decision-Making Self Efficacy scale (CDMSE) as a pre and posttest and completed the My Vocational Situation diagnostic form. There were 54 freshman, 21 sophomores, 7 juniors and 5 seniors in the class. Most of the students were women, 58, and 91% of the participants were Caucasian, 5% African American and 5% Mexican American, Asian American, biracial and other.

The course was a one-credit course intended for undergraduate students interested in career exploration, occupational interests and decision making. The course was completely voluntary and was separated into three areas. First, the students looked at their own values and explored various careers and majors that might be of interest to them. Second, the students interact with professionals from various fields and are required to complete an informational interview. Lastly, the students learn skills that will help them in the process of finding a job. They complete a resume and learn about the interview process.

A repeated measures MANOVA was used to assess the student's self-efficacy for five tasks related to career decision making; self appraisal, occupational information, goal selection, planning and problem solving. The results showed that students reported significantly more adaptive self-efficacy beliefs after taking the career course. All subscales were significant (p <

.001). Women scores significantly increased on all scales ($p < .05$) and men showed significant improvement on all subscales except for Problem Solving. The results also showed that men had a higher vocational identity than women ($p < .05$).

This study, like others explained did not have a control which is a limitation. With the amount of assignments given in the class, it is hard to tell which assignment had the most influence on the students. Though it has its limitations, this study has similarities to that of the present study. Vocational maturity and ability to make career decisions were analyzed although they did not use the CDI or CTI.

Reese and Miller (2006) studied the effects of a career development course on career decision-making. The class was designed to help students who were undecided in their majors with career decision making. The course met for 50 minutes, once per week for the duration of a semester. Advisors recommended the class for students who were undeclared majors and other students took the class because they were in academic probation. The course followed Cognitive Information Processing Theory and the students took the CDMSE-SF and the Career Decision Difficulties Questionnaire (CDDQ) as pre and post tests. The CDDQ has subscales of lack of readiness, lack of information and inconsistent information. The researchers used an experimental design that compared students who completed the course ($N = 30$) with a quasi-control group of students who were enrolled in an introductory psychology course ($N = 66$).

Students were either enrolled in the career course or enrolled in one of two sections of an introductory psychology course (control group). The students enrolled in the career course were mostly females (18) and the median age for the students was 19.5. Approximately 87% of the students were White and the mean grade point average was 3.22. Students enrolled in the psychology course (control group) were 39 females and 27 males. Approximately 76% of the students were White and the overall grade point average was 3.22.

The researchers used a 3 × 2 repeated measures analysis of variance (ANOVA) and it revealed no statistically significant differences for the interaction hypothesis, ($p = .587$), meaning that there were no outcome differences between the three classes based on the pre-post total scores for CDMSE-SF. Although not significant, the results showed that students who completed the career course showed increased career decision-making self-efficacy overall, especially in the areas of obtaining occupational information, setting career goals, and career planning. The career course also appeared to lower perceived career decision difficulties.

Although one limitation of this study is the low sample size, it has many strengths. This study used a comparison group which was helpful to the strength of the study although the results were not significant. This study shows the effectiveness of having a control group in a study and gives ideas for the present study.

Career Thoughts

Career thoughts are defined as outcomes of one's thinking about assumptions, attitudes, behaviors, beliefs, feelings, plans, and/or strategies related to career problem solving and decision making (Peterson, 1991). Career thoughts is an important concept to discuss for the current study because negative career thoughts create challenges for students in regards to career decision making (Paivandy, Bullock, Reardon, & Kelly, 2008). When students do not feel good about themselves and are unaware of their career options, negative thoughts transpire and affect how well they make decisions (Sampson, Reardon, Peterson & Lenz, 2004). Students who have dysfunctional thoughts in regards to career decision making display avoidance behaviors and become anxious about making decisions. This leads to avoiding career exploration behavior and delays choosing a major and moving forward with one's career or schooling (Sampson, et al., 2004).

Wright and colleagues (2000) examined the relationship between Holland's RIASEC (Realistic, Investigative, Artistic, Social, Enterprising, Conventional) typology and dysfunctional thoughts. Participants (N = 81) in this study were majority female (N = 48) and from a large southeastern university. Participants ranged from 18-40 years old with 86.5% Caucasian, 5% Hispanic, 5% African American, 2.5% Asian American and 1% did not respond. 51% of the students were either freshman or sophomores. The researchers identified RIASEC type by having each participant use the Self Directed Search: Computer Version and career thoughts were measured by the Career Thoughts Inventory. Wright and her colleagues proved, through a canonical correlation, that dysfunctional thoughts effected certain RIASEC types more or in different ways than others. Social and Enterprising types were related significantly ($p < .05$) to dysfunctional career thoughts and zero order correlations between Social and Decision Making Confusion (DMC) were $r = -.25$. Zero order correlations between Enterprising and DMC were $r = -.26$. This study examined two variables used in the current study, showing the importance of noting it.

Walker and Peterson (2012) evaluated the relationship among dysfunctional career thoughts, career indecision and symptoms of depression. The participants (N = 158) in the study were from a large southeastern university and enrolled in a career development course. The sample was made up of 91 males and 67 females with 61.6% being Caucasian. Participants completed the Career Thoughts Inventory (CTI), the Occupational Alternatives Question (OAQ) and the Beck Depression Inventory-II (BDI-II) to measure career thoughts, career indecision and symptoms of depression respectively. Zero-order correlations between dysfunctional career thoughts and depression symptoms showed a moderately positive relationship between CTI and BDI-II scores ($r = .42$, $p < .001$). The relationship between Decision Making Confusion (DMC), Commitment Anxiety (CA) and External Conflict (CA), subscales of the CTI, and the BDI-II were ($r = .51$, $p < .001$), ($r = .40$, $p < .001$) and ($r = .39$, $p < .001$). These results showed that dysfunctional career thoughts were positively related to depressive symptoms.

Meyer-Griffith, Reardon and Hartley (2009) examined dysfunctional career thoughts and communication apprehension of undergraduate students enrolled in a career course. The participants ($N = 175$) were enrolled in a large research university. The sample was created of 88 women and 87 men and was mostly Caucasian (64%); the mean age of the students was 20 years old. Career thoughts were measured by the *Career Thoughts Inventory* and the *Personal Report of Communication Apprehension* was used to measure communication apprehension. Students completed the CTI on the first day of class and the PRCA in the seventh week of the class. Pearson product-moment correlations and a three way MANOVA was used to assess the data. Results showed significant relationships between CTI and PRCA scores. The total communication apprehension score was significantly correlated ($\alpha = .01$) with CTI scores. ANOVAs were conducted for all three subscales of the CTI and proved significant ($p < .05$). This study shows the importance of exploring these two areas and how they affect the career development of emerging adults in their undergraduate programs.

Davidson and colleagues (2012) examined the effectiveness of a 5 week group career counseling intervention, Advancing Career Counseling and Employment Support for Survivors

(ACCESS). The researchers recruited the participants (*N* = 73) by distributing flyers in a midsize midwestern city. Inclusion criteria for participation in the study included the ability to read and speak English, being in an abusive intimate relationship in the past 5 years and being at the age of majority. The participants ranges from 22-62 years old and their ethnicities were; 45 European American, 11 American Indian, 6 African American, 3 Latina, 1 Asian, 1 Pacific Islander and 6 multiracial.

Five female advanced psychology doctoral students ran the ACCESS program. The purpose of the ACCESS curriculum was to "assist in the empowerment of women IPV survivors by increasing (a) awareness of abusive and supportive power dynamics in their lives, (b) awareness and development of life and occupational skills, (c) ability to use their skills in decision making, and (d) ability to give back by working toward empowerment of others" (Davidson et al., p. 323, 2012). The researchers used five measurement tools in this study; Vocational Skills Self-Efficacy Measure-Revised (VSSE-R; McWhirter & Chronister, 2003), My Educational and Career Barriers Measure (MECB; Chronister, 2005), My Educational and Career Supports Measure (MECS; Chronsiter, 2005), Beck Anxiety Inventory (BAI; Beck, Epstein, Brown & Steer, 1988), and Center for Epidemiologic Studies-Depression Scale (CES-D; Radoff, 1977). Results showed decreases in perceived barriers and increases in career search self-efficacy.

Thrift and colleagues (2012) examine career thoughts of undergraduate college students enrolled in a college success course. This study used two interventions; the workbook intervention and research intervention. The workbook intervention allowed the students to use the CTI workbook to teach them how to reframe negative statements. The workbook also allowed the students to complete their Holland RIASEC code. The students completed the CTI, a research paper on an occupation of their choice and did an oral presentation on their career goals, for the research intervention. The participants in this study (N = 128) were enrolled in ten sections of a college success course at a university in the Western Pacific. The students were 39% men and 61% women, with 50% of them being Asian, 47% Pacific Islander and 3% other. The three treatment groups in this study were the workbook intervention, research intervention and control group. The control group completed the pre and post tests of the CTI over a 4 week period, but did not complete their Holland code. The researchers used an ANCOVA and MANCOVA to assess the CTI scores.

The results of the ANCOVA for the CTI total score pretest yielded a significant main effect (F = 8.80, df = 2, p < .001). The results of the MANCOVA for the CTI subscales showed a significant multivariate effect (Wilks's lambda = .807; F = 4.54, df = 6, p < .001) (Thrift et al., 2012. This study differs from other studies in that it used three treatment groups. The current study does not have a comparison group, therefore examining the results of a study with comparison allows for implications for future research. In addition, the participants in this study were mostly Asian and Pacific Islander. The majority of studies in the literature are comprised of mostly White students. Significant results with a different set of students shows generalizability of the instruments used.

The results of the explained studies show the importance of investigating career thoughts. The many studies investigating career thoughts shows how these thoughts influence decision making or choosing a major. Negative career thoughts strongly impact career development and vocational maturity in emerging adults.

Vocational Maturity

Vocational maturity is defined as an approach individuals take in responding to demands, issues, challenges, and expectations regarding work (Fletcher, 2012). Vocational maturity is also defined as the way an individual successfully completes certain career development tasks that are required according to his or her current developmental phase. It is seen as the collection of behaviors necessary to identify, choose, plan and execute career goals (Super, 1977). Different definitions of vocational maturity exist amongst various professionals (Gonzalez, 2008). Super (1951) and Crites (1968), in particular, defined vocational maturity differently. Super (1951) defined vocational maturity as maturity shown at a certain developmental stage, while Crites (1968) define it by comparing maturity with others of a different age (Gonzalez, 2008).

Super's model (1951, 1974) involves five dimensions and nineteen variables. The five dimensions are; career planfulness, career exploration, information, decision making and reality orientation. Career planning involves preparing in the present, intermediate future and distant future. Career exploration involves the extent to which one has used their resources as a way of researching various careers. The information dimension of Super's model includes education and instruction, income requirements, duties, supply and demand, conditions and career advancement. This dimension involves gaining more specific information on a field of interest. The decision making dimension involves principles along with practice and discusses how well one makes a decision when faced with various career choices (Glavin & Savickas, 2010). Reality orientation involves self-knowledge, realism, consistency, crystallization and work experience. These variables form and are strengthened through hands on experience that allows the individual to go beyond planning and exploration. All five dimensions of Super's theory describe how individuals increase their career maturity. Crite's (1971) differs slight in regard to dimensions and variables.

Crite's model (1971) is comprised of four dimensions; consistency, realism, competencies and attitudes. Consistency involves field, time, level, family and independence. This dimension refers to how consistent a person's preferences have been over time. Realism refers to the congruency between the individual's characteristics and work environment. Competency examines how well an individual is at the following; problem solving, planning, goal selection, self-appraisal and occupational information. The fourth dimension, attitudes, involves orientation, preferences, commitment and involvement. Orientation attitude refers to whether a person is task or pleasure oriented and attitude in regard to involvement is refers t to how active the person is in decision making. Commitment and preference attitudes refer to the individual's attitude towards narrowing down one's choices and choosing a career that is the best fit.

Table 2: Models of Career Maturity

Super (1951, 1974)	Crites (1971)
1. Career Planfulness • Distant future • Intermediate future • Present 2. Career Exploration • Consultation • Resources • Participation 3. Information • Education and instruction • Income requirements • Supply and demand • Conditions • Career advancement 4. Decision Making • Principles • Practice 5. Reality Orientation • Self-knowledge • Realism • Consistency • Crystallization • Work experience	Degree of career development 1. Consistency • Field • Time • Level • Family • Independence 2. Realism • Interests • Skills • Personality • Social class 3. Competencies • Problem solving • Planning • Goal selection • Self-appraisal • Occupational information 4. Attitudes • Orientation • Preferences • Commitment • Involvement

The construct of vocational, or career maturity as it is sometimes called, is frequently discussed in the career education and vocational guidance literature (Fletcher, 2012; Jordaan &

Heyde, 1979), and resulted in the formulation of several instruments to measure it. Factors that might influence an individual's career development include socioeconomic status, ability, achievement, aspirations, work experience, and academic performance (Fletcher, 2012). Presently, various researchers implement models of vocational maturity for emerging adults. Examining vocational maturity proves useful in understanding young adults who are making career decisions.

Dykeman (1982) examined correlations between vocational maturity and work effectiveness in adolescents. The participants in this study ($N = 90$) were enrolled in a career education program, averaged 14 or 15 years of age, and were labeled dropout prone by administrators in their school. Administration also labeled them as having behavioral problems and helped them gain employment at fast food restaurants where they work for no more than three hours per day. While working, all students were required to attend their academic classes each day. The career education program, entitled Work Experience and Career Exploration Program (WECEP), allowed the students to gain this work experience and required the students to take part in the class for one hour each day.

Vocational maturity was measured by the *Career Development Inventory* (CDI) and work effectives was measured by a progress report completed by the students employer (Dykeman, 1982). The progress report assessed quality and quantity of work, punctuality, attendance, enthusiasm, interest, courtesy, cooperation, appearance and following instructions. Students completed the CDI at the end of the school year and employers completed the progress report at the end of the school semester as well. Results found significant correlation (.23) between the progress report and CDI ($p < .05$). A correlation of .28 between decision making abilities and career information on the CDI and the progress report was significant ($p < .01$), while planning orientation on the CDI and the progress report were not significant. This study shows the importance the role vocational maturity takes on work effectiveness. This study is also relevant to the current study because it used the CDI to measure vocational maturity as it will in the current study. One limitation of the study is that the scales were only completed at the end of the intervention. The study could have had more strength if the CDI and progress reports were completed at the beginning and end.

Coursol, Lewis & Garrity (2001) compared the expectations of career counseling and the level of career maturity among trauma survivors. The participants in this study (N = 96) were from a midwestern social service agency and were comprised of trauma survivors (N = 48) and nonsurvivors (N = 48). The researchers define survivors as those who experienced trauma and nonsurvivors as those who had no trauma experience. The participants in both groups ranged in from 18-46 years old. The ethnicities of the survivors included 43 Caucasian, 1 Pacific Islander and 2 Hispanic participants. The nonsurvivors included 43 Caucasian, 1 Native American and 4 Hispanic participants.

The Expectation About Counseling-Brief Form (EAC-B; Tinsley, 1991) measured counseling expectations and the Career Maturity Inventory (CMI; Crites, 1978) measured career maturity. Before participating in the agency's group career counseling program, the participants completed both assessments. In regard to the EAC-B, univariate analyses found significant differences between both groups. Survivors indicated higher means on the Motivation and Openness Subscales and a lower mean on the Counselor Empathy subscale. The survivors expected to be more motivated, $F(1, 94) = 5.28$, $p < .05$, expected to be more open to counseling $F(1, 94) = 7.57$, $p < .05$, and expected to have less counselor empathy, $F(1, 94) = 4.88$, $p < .05$.

Results from the MANOVA showed no significant differences in survivor and nonsurvivor responses to the CMI; $F(1, 75) = 1.008$, $p > .05$.

Although this study focused on trauma survivors, it is important to note because it shows that these individuals were open to the group career counseling process and were motivated to stay in counseling. The researchers also introduced an instrument assessing expectations of the process. Using an assessment like the EAC-B provides useful information that is not being assessed in the current study. This article was not without limitations; this article needed a more detailed explanation of the results and the group counseling process.

Linnemeyer and Brown (2010) investigated career maturity and foreclosure in student athletes, and other students. Career foreclosure refers to a lack of career exploration and lack of involvement in the career process. The participants in this study ($N = 326$) were undergraduate students; 104 general, 121 fine arts and 101 student athletes. The majority of the students in this study were women (60%), with 40% male participation. Although the participants ranged from 17 to 60 years of age, the mean age was 20.9. The sample in this study was comprised of 33% freshmen, 16% sophomores, 25% juniors and 26% seniors with the majority (70%) identifying as Euro-American.

Career maturity was measured using the Career Maturity Inventory-Revised (Crites & Savickas, 1996) which is comprised of two sections. The first section is 25 items measuring occupational knowledge and decision making. The second section, also 25 items, is the attitude scale that identifies one's attitude towards career choice (Linnemeyer & Brown, 2010). Career foreclosure was measured by the *Commitment to Career Choices Scale* (Blustein, Ellis, & Devenis 1989). This scale consists of 28 items measuring foreclosure attitudes towards committing to a career and uses a 7 point Likert scale. The researchers ran an ANOVA to investigate group differences and found significant differences in career maturity across the three groups ($F(2,93) = 5.50$, $p < .01$, $\eta^2 = .16$). Through conducting post hoc comparisons, the researchers found that the mean score for career maturity of student athletes ($M = 17.33$) was significantly lower than the mean for general students ($M = 18.70$), but the score for fine arts students ($M = 17.70$) was not significantly lower than general students.

Counselor Education in STEM

Counselor education has not identified its role in the STEM crisis. A lack of research exists in regards to counselor education and the STEM crisis. Schmidt, Hardinge and Rokutani (2012) discussed the importance of involving school counselors in the STEM effort in order to create more of a focus on career development. Schmidt and colleagues (2012) also noted that school counselors need to increase their ability to focus on specific academic areas, therefore, better aiding STEM students in schools. School counselors also have the responsibility of increasing their knowledge in STEM disciplines and learning STEM specific interventions. Feller (2009) discussed the importance of training programs in counselor education that would allow counselors to take part in STEM education programs.

When discussing recruitment strategies for women in STEM, Milgram (2011) stated that many schools use counselors, in the STEM effort, to help with recruitment. Counselors are given information on the various STEM programs offered at schools and encourage students to enter into these fields. Milgram (2011) also noted that "reaching out to the counselors is critical because they can provide a pipeline for female students to STEM programs so that instructors and administrators do not have to do all the recruiting directly" (p. 7). This statement reveals the current perception of counseling and counselor education's role in the STEM effort. While counselor educators are qualified professionals who could be very helpful in the STEM effort, they are seen as helping hands who can aid in recruiting. In the previous section explaining effective STEM interventions, the researchers do not mention career development or counselor education. Clearly, the usefulness and essentiality of career development and counselor education in the STEM effort has not yet been acknowledged. A thorough search on the EBSCOhost Online Research Database yielded very few results for articles relating to counselor education and STEM. Little research exists for STEM career intervention as well.

STEM Career Interventions

Blustein et al., (2013) conducted a qualitative study to gain an understanding of urban high school student's reactions to a STEM career development program. This study was comprised of nine students who were interviewed after participating in the summer program and then again 12-18 months later. There were five females and four males who took part in the study. Six of the students attended a science specific high school and three attended a regular public high school. The participants in the study were all students of color and identified as such; three students primarily identified as African American, two identified as Haitian, one primarily identified as Puerto Rican, one identified as Mexican, one identified as El Salvadorian and one identified primarily as Jamaican (Blustein et al., 2013). 62 students took part in the summer program and 57 participated in the interviews. Of the 57 who participated in the interviews, only nine continued to the second interview.

The STEM/Career Development summer program was two weeks in length and had a goal of helping high school students transition to college and then to STEM careers (Blustein et al., 2013). The program emphasized the importance of the student's academic work to future careers. The STEM aspect of the program emphasized urban ecosystems and allowed students field experience and work with computer modeling software. The career development part of the program used a transferable skills (TS) curriculum. The curriculum allowed students to engage in self exploration, the world of work and helped them identify STEM skills that could translate to other careers as well. The results were then divided into various themes to summarize the participant's responses.

Educational and career planning was the first theme identified (Blustein et al., 2013). Many of the participants had reactions ranging from positive to neutral about their STEM coursework. Many students also thought the coursework they were doing was beneficial to them in future endeavors. Additionally, students who felt skilled in STEM were actively engaged in their classes and willfully assisted other students in need to help. STEM experiences was the second theme identified and many students stated that as they progressed through school, more of their conversations with their family members involved future career plans in STEM. Some students stated that they did not feel positively influenced by their peers during this time and began associating with new sets of peers. In regards to the summer program experience, the students thought the field work made science meaningful and they thought the experience was fun. Knowledge specific to urban ecology increased and student's reported that they discovered a wider range of career opportunities in STEM.

Lastly, when discussing educational barriers, the students suggested feeling that there was a lack of structured support for career exploration from guidance counselors. They felt they only encountered few "meaningful interactions" with counselors in regards to career development (Blustein, et al., 2013, p. 56). The responses from these students shows lack of involvement counselor educators have in the STEM effort. The students generally reported positive experiences with the STEM aspect of the program but felt that the career development aspect could have been much more helpful.

The lack of STEM career intervention studies and negative results from the existing ones shows the importance of incorporating counselor education and career development into the STEM effort. The aforementioned studies show the improper use of counselors in the STEM effort, although career development has proven to be useful to students. This literature review not only shows the importance of investigating career decidedness, career thoughts and vocational maturity, but shows the importance of connecting STEM interventions with career development interventions.

CHAPTER III - METHODOLOGY

Introduction

The STEM crisis in the United States, specific to undergraduate retention, shows that less than half of the undergraduate students who enter as STEM majors actually graduate with a STEM degree (Hayes, Whalen & Cannon, 2009; Wilson et al., 2012). Many STEM undergraduates tend to change their major before graduation (Seymour & Hewitt, 1997). Another study at a Midwestern university found that 42% of students who enrolled in the College of Science and Mathematics left the college after freshman year. Approximately 30% of the original students actually received a degree in math or science in 4-6 years (Koenig, Schen, Edwards, & Bao, 2012). In regard to STEM selection, research shows that math and science achievement, math self-efficacy beliefs, and post secondary experiences influence student's decisions to declare STEM majors (Wang, 2013). When students succeed in their high school math and science coursework, they believe they will likely succeed in college. Additionally, initial experiences in college provide insight into whether or not students believe they will succeed (Wang).

Career planning courses for undergraduate students prove to be successful. Career planning courses succeed in aiding students to feel more confident about their abilities to make career decisions (Grier-Reed & Skaar, 2010: Scott & Ciani 2008). Vocational maturity and career decision making skills also improve as a result of these courses (Reese & Miller, 2006; Scott & Ciani, 2008). The research also provides evidence of career planning courses that are specific to certain disciplines (Heffner, Macera & Cohen, 2006). Unfortunately, the research fails to show the role career planning courses can have in the STEM crisis. A lack of research exists on STEM-focused career planning courses that aid students in choosing and committing to STEM majors.

The STEM effort implements various programs to increase student interest in STEM majors and career and this adds to the innovative programs being implemented across the country. There is a gap in the research in regards to STEM-focused career planning courses and these ideas inform STEM professionals of ways to construct a career planning course. Allowing students the opportunity to intensely explore their STEM options is important in retaining students in STEM. A career planning course like the one in the current study allows students to get their questions answered and make more informed decisions about their career paths. This research is also the next step after bridge programs which focus on engaging high school students and community college students transitioning to universities. Engaging those students in a career planning course increases interest and STEM retention.

The purpose of this study is to use quantitative research methods to investigate of the role career development interventions plays in the STEM recruitment and retention efforts by examining career decidedness, career thoughts and vocational maturity. This research will identify how a STEM-focused career planning course influenced the three constructs of the study and will give insight into innovative interventions for STEM undergraduate retention. This research will also spark a dialogue about how to more effectively aid underrepresented populations in STEM.

Hypothesis

This study aims to examine how an undergraduate STEM-focused career planning course influences the career thoughts, career decidedness and vocational maturity of emerging adults considering a STEM major. In addition, this study aims to examine how an undergraduate STEM-focused career planning course affects STEM major selection and whether differences exist in SAT scores, Algebra Math Placement scores, Career Thoughts Inventory scores and Career Development Inventory scores between those that select a STEM major and those that do not. To achieve this aim, I will use quantitative research methods to examine the following hypotheses:

Null Hypothesis 1: An undergraduate STEM career planning course has no influence on career thoughts, as measured by the Career Thoughts Inventory (a) for Fall 2012, and (b) for Summer/Fall 2013 participant cohorts.

Null Hypothesis 2: An undergraduate STEM career planning course has no influence on career decidedness and vocational maturity, as measured by the Career Development Inventory (a) for Fall 2012, and (b) for Summer/Fall 2013 participant cohorts.

Null Hypothesis 3: An undergraduate STEM career planning course has no influence on career thoughts, career decidedness and vocational maturity as measured by the Career Development Inventory and Career Thoughts Inventory when controlling for gender.

Null Hypothesis 4: An undergraduate STEM career planning course has no influence on career thoughts, career decidedness and vocational maturity as measured by the Career Development Inventory and Career Thoughts Inventory when controlling for ethnicity.

Null Hypothesis 5: An undergraduate STEM career planning course has no influence on STEM major selection.

Null Hypothesis 6: No differences exist in SAT scores between those that select a STEM major and those that do not.

Null Hypothesis 7: No differences exist in Algebra Math Placement scores between those that select a STEM major and those that do not.

Null Hypothesis 8: No differences exist in Career Thoughts Inventory scores and Career Development Inventory scores between those that select a STEM major and those that do not.

Null Hypothesis 9: No differences exist in Career Thoughts Inventory scores between those in COMPASS and those in EXCEL.

This research makes an important and needed contribution to STEM recruitment and retention efforts along with the role career development can play in these efforts. This research provides knowledge about successful effort to engage undergraduate students in STEM majors and increase career decidedness. It will also provide important implications for career development and counselor education which are essential aspects of the STEM effort.

Research Design

Prior to beginning the evaluation for the current study, I will seek approval from the University's Institutional Review Board (IRB). The current study will utilize data collected from the UCF COMPASS (Convincing Outstanding-Math-Potential Admits to Succeed in STEM) program, an NSF-funded project with the goal to increase the number of students pursuing a STEM discipline. The project includes participating in the career planning course, receiving math tutoring, and being assigned to a mentor for additional support through the program. This course is a STEM-focused career course that utilizes assessments, guest lecturers and experiential learning labs to aid students in solidifying a major in STEM. This program has four main goals: (a) recruit, (b) capture, (c) retain, and (d) research. The course is a general undergraduate career planning course that was modified for a STEM recruitment and retention project funded by the National Science Foundation (NSF). The course is divided into three sections, (1) Who am I? Personal Assessment, (2) Where am I going? The World of Work in STEM, and (3) How do I get there? Experiential Learning and STEM Major Identification. In the "Who am I?" portion of the class, the students complete the Career Thoughts Inventory (CTI), Career Development Inventory (CDI) along with career assessments that allow them to explore personality, interests, values and skills. In the second portion of the class, "Where am I going?", guest lecturers come into the classroom and speak to the students about their STEM careers. The last portion of the class, "How do I get there?", allows the students to visit experiential learning labs where they can see what STEM professionals do on a day to day basis. Students also narrow their focus and discuss major options. As a member of the research team, I will assist in the collection of the data for the study. I will analyze the sample to address the aforementioned hypotheses.

The participants enrolled in the undergraduate career planning course focused on STEM explorations will complete the *Career Thoughts Inventory* and *Career Development Inventory* twice in the semester, both at the beginning and at the end of the 15 week semesters. Participant responses to the assessments will be recorded and prepared to be analyzed. Information regarding SAT scores will also be obtained from Institutional Knowledge Management in order to answer the research questions. Undergraduate college students will complete assessments to provide information on career decidedness, career thoughts and vocational maturity. Differences in ethnicity and gender will be examined along with examining the influence of SAT scores.

Career planning courses for undergraduate students prove to be an effective intervention for improving career development. Several career planning courses succeed in aiding students to feel more confident about their abilities to make career decisions (Grier-Reed & Skaar, 2010: Scott & Ciani 2008). Through learning about themselves and their interests, student's vocational maturity and career decision making skills also improve as a result of these career planning courses (Reese & Miller, 2006; Scott & Ciani, 2008). Additionally, the research provides evidence of career planning courses that are specific to certain disciplines (Heffner, Macera & Cohen, 2006). Unfortunately, the research fails to show the role that career planning courses can have in the STEM crisis. A lack of research exists on STEM-focused career planning courses that aid students in choosing and committing to STEM majors. Examining career decidedness, vocational maturity and career thoughts amongst undergraduate students enrolled in a career planning course will help inform career educators and those involved in the STEM effort about how to improve career development with this population.

Participants

Participants for the current study are recruited for the COMPASS program based on an undeclared major status, interest in STEM disciplines and math SAT scores of 550-800. Participants will be involved in this research through purposive sampling. Because of the challenge to recruit undergraduates in educational programs, schools employ active recruitment and outreach strategies. Active recruitment strategies include individual tours for students, demonstrations or mentorship activities (Davis et al., 2012). The aim is to gain student's attention and create excitement and interest to increase the chance of them becoming a part of these programs. Although students in the current study were not recruited using those types of strategies, they were carefully recruited based on academic achievement and interest.

The students enrolled in the eight sections of MHS 2330 Career Planning: STEM Explorations during Fall 2012, Summer 2013 and Fall 2013 will be the participants for this research. The instructor and teaching assistants will provide students with research IRB approval and an explanation of the COMPASS program as their consent to participate in this study. I will utilize participant data from the undergraduate career planning course to conduct the analysis for the current study. I will include participants who volunteered to complete the assessments, completed the intervention, and complete post and follow-up assessments in the current study.

It is important to note the differences between the Fall 2012 group and the Summer/Fall 2013 group of students. During the first semester of the COMPASS program, the number of students enrolled in the class was less than anticipated. Therefore, the research team enrolled some students who did not have an interest in STEM and might not have had SAT math scores of 550-800. Additionally, in regards to the class format, the class guest lecturers differed from the other two semesters. In Fall 2012, none of the guest lecturers were STEM professionals in the industry; all were professors at the university. In the Summer and Fall 2013 semesters, the research team incorporated STEM industry professionals during the guest lecturer weeks of the class.

I conducted an *a priori* power analysis for the hypotheses using G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007) to determine if the undergraduate career planning course sample size would ensure adequate power with each of the analyses. Conducting *a priori* power analyses allow researchers to determine the sample size necessary for adequate power (Balkin & Sheperis, 2011; Cohen, 1992).

The *a priori* power analyses conducted for the current study utilized an alpha level of .05, moderate effect size of .67 (Cohen, 1988), and a recommended power of .80 (Cohen, 1992). The power analysis conducted for hypotheses one through four indicated a sample of 11 participants for adequate power. The anticipated sample for the current study is 110 individuals. Thus, sample size will not likely be a limitation for hypotheses one through four. G*Power identified a sample of nine in order to achieve adequate power for hypothesis five.

Attrition existed for participants who completed both the Career Thought Inventory (CTI) and Career Development Inventory (CDI). A total of 113 participants took the CTI and one of those individuals did not complete the post test (N = 112). I found a 12% (n = 13) attrition from pre to post for the CTI with 100 completing the post. For the CDI, I encountered a 12% (n = 14) attrition with 99 completing the post test. Those participants who did not complete the CTI and

CDI were not included in the analyses. Students take the CTI during class and take the CDI online. In order not to weaken the correlation estimates in the data, I decided to delete those cases of individuals who did not complete the assessments. If there had been fewer incomplete cases, I would have considered data imputation. See Table 1 for attrition of the CTI and CDI administration and participants who did not complete CDI and CTI post tests.

Table 3: Attrition for CTI and CDI Administration

	CTI			**CDI**		
	Complete	*Missing*	***Tot***	*Complete*	*Missing*	***Tot***
Pre-Assessment	112	1	**113**	113	0	**113**
Post-Assessment	100	13	**113**	99	14	**113**
Missing CDI Post	27, 32, 51, 55, 106, 108, 187, 219, 261, 267, 273, 275, 277, 301					
Missing CTI Post	51, 67, 109, 133, 184, 218, 233, 235, 239, 241, 267, 275, 319					

<u>Measurement Instruments</u>

The COMPASS program utilizes several instruments. However, the current study will include only those instruments that measure the constructs of career decidedness, vocational maturity and career thoughts. Therefore, I will analyze the results from the Career Thoughts Inventory and the Career Development Inventory. During the career planning course, the students take the assessments during the first week of the course and during the last week of the course. Following is a brief overview of each instrument. Additionally, demographic data for each student will be utilized for the current study.

Demographic Data

Participant demographic (age, ethnicity and gender) and academic data (SAT scores and Algebra Math Placement scores) will come from the Associate Director of Institutional Research who works within the Institutional Knowledge Management office at the university. The Institutional Knowledge Management office holds records of all student information and because this data is part of a larger NSF funded grant a demographic form was not necessary. Students in the study will not fill out a specific demographic form for the study, although the Career Thoughts Inventory (CTI) requires certain demographic data (age and ethnicity).

The Career Thoughts Inventory

The CTI is a 48 question assessment that measures negative career thoughts (Sampson et al., 1996a; Sampson et al., 1996b). The assessment follows a four-point Likert scale and asks students to circle Strongly Disagree, Disagree, Agree or Strongly Agree. This assessment is broken down into three subscales: Decision Making Confusion (DMC), Commitment Anxiety (CA) and External Conflict (EC). The first subscale, DMC, examines whether or not one is confused about making decisions and career choices. The second subscale, CA, examines whether one finds it difficult to commit to a specific choice or feels anxiety about making choices, which makes the choice harder to make. EC, the last subscale, looks at how well one balances the importance of his or her ideas with the importance of ideas of family members and friends. The CTI has separate scoring for adults, college students and high school students. A higher CTI scale score may indicate a specific problem area for career decision making. This assessment provides a CTI total score and T score along with scores for each subscale.

In all, there are five scores provided in this assessment. In all, there are five scores provided in this assessment. For example a student can have a CTI Total score of 47 and T score of 46 with DMC=15, CA=21 and EC=5. CTI Total scores ranges from 0-144, DMC scores range from 0-42, CA scores range from 0-30 and EC scores range from 0-15. A higher CTI scale score indicates a specific problem for career decision making, so a person with a 42 on the DMC has an extremely difficult time making decision compared to someone who scored a 9 (Sampson et al., 1996). According to Sampson et al, (1996a), the internal consistency (alpha) coefficients of the CTI total score range from .97 to .93 and the three construct scales' alpha coefficients range from .94 to .74. The CTI is considered to be a reliable instrument, meaning that various populations who take the test would get the same results.

The Career Development Inventory

The Career Development Inventory is a 120 item inventory that assesses vocational maturity for students (Glavin & Rehfuss, 2005; Super et al., 1988). The CDI uses a five-point Likert scale ranging from Not Much to A Great Deal. Career Planning (CP), Career Exploration

(CE), and Decision Making (DM) are the three main subscales of the inventory. World of Work (WW) and Knowledge of Preferred Occupation (PO) are two additional subscales that provide information on resources to support career decision making and information on preferred occupation. Higher scores for a student on Career Planning (CP) indicates appropriate career planning activities and behavior; as well as curiosity with regard to his or her place in the world of work. Low scores mean that an individual may have given little thought to career decisions, and therefore may not be serious about choosing an occupation or learning about his or her options. Career Exploration (CE) high scores mean that one is fully aware of the resources available to them, and gathered information relevant to future occupational choices. Low scores indicate that one has not explored sources of quality information regarding career opportunities available. Decision Making (DM) high scores mean that the student is capable of making healthy and appropriate career and vocational decisions. Low scores mean that the student needs to work on making better career and vocational decisions. This student might benefit from studying effective decision making skills. World of Work (WW) high scores mean that students may have a lot of information to support their career decision making. Low scores reveal that the student may need more information about occupational fields and career development before making important career decisions and occupational choices. Knowledge of Preferred Occupation (PO) high scores reveal that the student has obtained detailed information about his or her preferred occupation. Low scores mean that the student may need to gather more detailed information regarding his or her occupation of choice. When all scales are high, this indicates the individual has the requisite attitudes and competencies required to make sound educational and vocational decisions (Glavin & Rehfuss, 2005). Creed and Patton (2004) reported satisfactory internal reliability coefficients for all subscales (ranging from .70 to .87).

Procedure

The COMPASS (Convincing Outstanding-Math-Potential Admits to Succeed in STEM) Program recruits first time in college students referred to as FTICs with math SAT scores greater than 550. After recruiting the students into the program, the students are enrolled in an undergraduate career planning course specific to COMPASS students. The COMPASS career planning course is the first requirement of the program and students must take this course to be a part of the program.

The class is designed to introduce students to career and life planning theories and concepts and to help students apply these to their own lives with emphasis on STEM careers. The objectives for the course are as follows:

1. Students will participate in learning-centered activities and experiences to become familiar with career development theories and apply them to their own career and life planning.
2. Students will participate in learning centered activities and experiences to become more familiar with the career-decision making process, including the role of self-concept, and apply them to their own career and life planning.
3. Students will assess their own interests, values, and career readiness levels along with strengths and weaknesses pertaining to life and STEM-related career planning.
4. Students will explore STEM majors and careers related to their personal characteristics.
5. Students will engage in autonomous experiential learning (shadowing) activities in STEM fields.

6. Students will integrate and apply their knowledge from their self-assessments on personality, interests, values, social and cultural influences to identify appropriate STEM career and majors.
7. Students will narrow their career focus to a specific STEM field and develop a related action plan.

The STEM-focused career class utilizes an outline similar to a general career planning course. General career planning courses also allow for students to engage in self exploration activities or assessments and career or major exploration. The STEM-focused career planning course focuses each activity on STEM. The second portion of the class, "Where am I going? The World of Work in STEM" allows students to hear the experiences and journeys of professionals in STEM careers. In a regular career planning course, guest lectures are from various fields and not focused on STEM careers. In addition, the students in the STEM career planning course engage in experiential learning laboratory activities with professionals in STEM. In a non STEM-focused career course, students visit professionals in fields of their choice and might conduct an information interview to gain more knowledge about a certain career. Both classes utilize similar assignments such as the Career Action Plan, Major Research Paper, Information Interview and Resume/Cover Letter Critique, but the focused career planning course has an underlining emphasis on STEM. The STEM course highlights careers in STEM and encourages students to pursue degrees in STEM areas.

In the Fall and Spring semesters, the class meets for one hour and twenty minutes, two days per week. The first day of class consists of the main lecture where all the students in the class meet with the instructor and the teaching assistants. On the second meeting day, the class is divided into various sections (discussion groups) allowing for more of an intimate conversation amongst the students. During the discussion groups, the instructor went into more depth on various topics discussed in the course. The course is divided into three sections, (1) Who am I? Personal Assessment, (2) Where am I going? The World of Work in STEM, and (3) How do I get there? Experiential Learning and STEM Major Identification.

In the "Who am I?" portion of the class, the students complete a hard copy of the Career Thoughts Inventory (CTI), and the online version of the Career Development Inventory (CDI) along with career assessments that allow them to explore personality, interests, values and skills. During this portion of the class, the students also take the Myers Briggs Type Inventory and an interest profiler, work values sorter and basic skills survey all of which are part of their semester grade. The students explore the values associated with STEM careers and complete a STEM-related Card Sort activity. This activity allows them to see how their skills and interests can translate into STEM careers. In the second portion of the class, "Where am I going?" guest lecturers come into the classroom and speak to the students about their STEM careers. The guest lecturers come from STEM fields in Life Sciences (Biology, Chemistry and Forensic Sciences), Engineering (Civil, Environmental, Industrial, Electrical, Computer, Mechanical and Aerospace) and Physical and Natural Sciences (Mathematics, Physics, Statistics and Computer Science). The last portion of the class, "How do I get there?" allows the students to visit experiential learning labs where they can see what STEM professionals do on a day to day basis. During this portion of the course, the students begin synthesizing and integrating their experiential learning lab experiences. Students also narrow their focus and discuss major options. They also complete major action planning by writing a Career Action Plan outlining their career goals for the next few years. During the last week of class, the students complete the CDI and CTI posttests and discuss the changes in their results.

My last hypothesis will examine differences in Career Thoughts Inventory scores between those in the COMPASS and EXCEL groups. The EXCEL *in Science, Technology, Engineering & Mathematics* program aims to increase student success in STEM disciplines in the first two years of college. The program recruits approximately 200 students each year and is structured to build strong math skills amongst the students. The program offers support and mentoring for all required courses common to engineering, science and mathematics majors. Students also have access to the EXCEL Center which offers free tutoring by graduate students, a computer lab and a study area. Students also have a mentor and EXCEL advisors who can help them plan their class schedules. All students in the program enroll in EXCEL Seminar I and II, courses that introduce the concept of undergraduate research experiences in STEM disciplines and focus on exposing the students to STEM faculty and researchers. As part of the course, the students take the Career Thoughts Inventory twice during the semester; once at the beginning of the course and again at the end of the course.

Variables

The current study will evaluate certain socioeconomic demographics (i.e., gender and ethnicity), SAT scores career thoughts, career decidedness, and vocational maturity. Although the students complete a number of assessments (Myers Briggs Type Inventory, interest profiler, work values sorter and basic skills survey) I will only use a portion of the data for my analysis. In order to investigate the current study's hypotheses, I will analyze the following independent and dependent variables.

Independent Variables

Independent variables are the ones in which we have control over (Kusurkar et al., 2011). Therefore, socioeconomic demographic factors are independent variables. The current study will examine the following demographic variables: (a) gender and (b) ethnicity. I identified the socioeconomic demographic variables based upon previous research that linked these variables to vocational maturity (Fletcher, 2012). When examining hypotheses three and four, which discuss the career planning course's influence on career thoughts, career decidedness and vocational maturity, I will examine differences based on gender and ethnicity.

Additionally, the current study will examine SAT scores and Algebra Math Placement scores as an independent variable. I will obtain SAT scores through student services and focus on overall scores and math SAT scores. Research shows that students with higher SAT scores, math scores in particular, tend to perform better in STEM areas (Park et al., 2008). I will examine differences that may exist in SAT scores, Career Thoughts Inventory scores and Career Development scores between those that select a STEM major and those that do not.

Dependent Variables

Dependent variables are those being measured for changes that may have occurred (Kusurkar et al., 2011). Therefore, the constructs comprising the current study's dependent variables include vocational maturity, career thoughts and career decidedness. I will utilize the CTI to measure career thoughts. Researched identified the CTI as a widely used self-report measure for students career thoughts (Sampson et al., 1996a). Hypotheses one and four will utilize CTI scores when analyzing the data. In addition, I will utilize the CDI to measure career decidedness and vocational maturity. Research also identified the CDI as a sound instrument to measure vocational maturity and career decidedness (Creed & Patton, 2004). Hypotheses two and four will utilize CDI scores.

Data Analysis

Statistical Package for Social Sciences (SPSS) will serve as the software to utilize the current study's statistical procedures. I intend to examine 9 hypotheses in this study. First, the preliminary analysis of the data will be done first to identify any outliers that might have an effect on the findings. Management of missing data, and checking for violations of assumptions specific to a repeated measures MANOVA will be checked. Assumptions for a repeated measures MANOVA include the following: (1) sphericity, (2) complete data for all subjects, (3) normal distribution, and (4) equally spaced intervals. A repeated measures MANOVA will be used to evaluate hypotheses 1-4, 8 and 9 which examine the influence the career course has on career thoughts, career decidedness and vocational maturity and whether the course influences STEM major selection. Assumptions for a repeated measures MANOVA are: (1) sphericity, (2) complete data for all subjects, (3) normal distribution, and (4) equally spaced intervals. I will use a MANOVA to examine hypothesis 6 that will examine the difference in SAT scores between those that select a STEM major and those that do not. An analysis of variance will be used to evaluate hypothesis 7 that examines whether differences exist in Algebra Math Placement scores between those that choose a STEM major and those that do not. I will use the Statistical Package for Social Sciences (SPSS) to conduct the statistical procedures.

Summary

The purpose of this study is to use quantitative research methods to investigate of the role career development interventions plays in the STEM recruitment and retention efforts by examining career decidedness, career thoughts and vocational maturity.

The COMPASS project aims to increase retention in STEM for undergraduate students in their first years of school. All students who are part of the program take a three credit career planning course that meets twice a week for one hour and twenty minutes over a 16 week semester. The course is divided into three sections, (1) Who am I? Personal Assessment, (2) Where am I going? The World of Work in STEM, and (3) How do I get there? Experiential Learning and STEM Major Identification. During the course, students take pre and post assessments to measure career decidedness, vocational maturity and career thoughts. The Career Development Inventory (CDI) measures vocational maturity while the Career Thoughts Inventory (CTI) measures negative career thoughts.

After seeking approval from the University's Institutional Review Board (IRB) and consent from all involved participants, I will begin analysis on the four aforementioned hypotheses. A repeated measures MANOVA will be used to evaluate the influence the career planning course on career thoughts and career decidedness; gender, ethnicity and STEM major selection will also be examined. An analysis of variance will be used to evaluate whether differences exist among SAT scores, Career Development Inventory scores, and Career Thoughts Inventory scores. The independent variables include demographic information such as gender, ethnicity and SAT scores. Career decidedness, career thoughts and vocational maturity will serve as the dependent variables for the current study.

CHAPTER IV - RESULTS

Introduction

Career planning courses for undergraduate students increases student confidence about their abilities to make career decisions (Grier-Reed & Skaar, 2010: Scott & Ciani 2008). Vocational maturity and career decision making skills also improve as a result of these courses (Reese & Miller, 2006; Scott & Ciani, 2008). Although research provides evidence of career planning courses that are specific to certain disciplines (Heffner, Macera & Cohen, 2006), the need for research exists examining the role career planning courses have in STEM recruitment and retention. Thus the need exists for additional research examining how STEM-focused career planning courses assist students in making better career choices and having less negative career thoughts.

The study aims to investigate of the role career development interventions plays in the STEM recruitment and retention efforts by examining career decidedness, career thoughts and vocational maturity. Furthermore, the study examined the influence of the class by using demographics such as gender, ethnicity SAT scores, and algebra math placements scores. The following nine null hypotheses addressed the study's focus:

Null Hypothesis 1: An undergraduate STEM career planning course has no influence on career thoughts, as measured by the Career Thoughts Inventory (a) for Fall 2012, and (b) for Summer/Fall 2013 participant cohorts.

Null Hypothesis 2: An undergraduate STEM career planning course has no influence on career decidedness and vocational maturity, as measured by the Career Development Inventory (a) for Fall 2012, and (b) for Summer/Fall 2013 participant cohorts.

Null Hypothesis 3: An undergraduate STEM career planning course has no influence on career thoughts, career decidedness and vocational maturity as measured by the Career Development Inventory and Career Thoughts Inventory when controlling for gender (a) for Fall 2012, and (b) for Summer/Fall 2013 participant cohorts.

Null Hypothesis 4: An undergraduate STEM career planning course has no influence on career thoughts, career decidedness and vocational maturity as measured by the Career Development Inventory and Career Thoughts Inventory when controlling for ethnicity (a) for Fall 2012, and (b) for Summer/Fall 2013 participant cohorts.

Null Hypothesis 5: An undergraduate STEM career planning course has no influence on STEM major selection.

Null Hypothesis 6: No differences exist in SAT scores between those that select a STEM major and those that do not.

Null Hypothesis 7: No differences exist in Math Placement Scores between those that select a STEM major and those that do not.

Null Hypothesis 8: No differences exist in Career Thoughts Inventory scores and Career Development Inventory scores between those that select a STEM major and those that do not.

Null Hypothesis 9: No differences exist in Career Thoughts Inventory scores between those in COMPASS and those in EXCEL.

Preliminary Analysis

To investigate the nine hypotheses, the current study utilized multivariate analyses of variance (MANOVA), within-group and between-group repeated measures MANOVA, analysis of variance and Chi Square test goodness of fit with the Statistical Package for Social Sciences (SPSS). The current study also conducted preliminary analyses to test for assumptions, outliers and missing data. The study will address assumption violations during the analyses results section for each hypothesis. No missing data existed for the Career Thoughts Inventory or Career Development Inventory. However, not all participants completed the math placement exams so missing data existed for those participants. I removed those participants from the analysis that involved those scores (Hypothesis 7). I did the same for SAT scores (Hypothesis 6) and STEM major selection (Hypotheses 5-8). The research team obtained SAT scores, algebra math placement scores and major selection information from the Institutional Knowledge Management office.

Table 4: Missing Data for Algebra Math Placement, SAT Scores and Major Selection

	Complete	*Missing*	***Tot***
Algebra Math Placement	42	71	**113**
SAT Total	89	24	**113**
SAT Verbal	89	24	**113**
SAT Math	89	24	**113**
Major Selection	76	37	**113**

Additionally, the study tested for outliers in my data and for CDI and CTI scores. When I obtained Mahalanobis distances and determined critical values using a chi-square table, I found one outlier when examining CDI scores. Because that particular score (58.0) was much higher than the critical value (36.12), I removed that person from the analyses. I repeated the test for outliers with CTI scores and found two outliers. Because one value (26.2) was very close to the critical value (26.1), I decided to keep it in the data set and removed the second person who had a value of 33.6. Testing for these outliers satisfied the assumption of multivariate normality.

The Fall 2012 cohort differed from the Summer and Fall 2013 cohort in three ways; (a) SAT scores, (b) interest in STEM, and (c) guest lecturer format. The grant team experienced less enrolled than anticipated for the Fall 2012 cohort, therefore in order to increase enrollment, the team opened the class to some individuals who had not declared interest in STEM and did not have SAT math scores of 550-800. Additionally, after the Fall 2012 class, the team decided to incorporate industry personnel into the guest lecture weeks of the course. So as a part of the preliminary analysis, the study also examined for statistically significant differences between the Fall 2012 cohort and the Summer/Fall 2013 cohort. A t-test was run between Fall 2012 and Summer 2013 and another t-test for Fall 2012 and Fall 2013 to examine for statistically significant differences. Results of the test showed significant differences between the Fall 2012 cohort and the other two cohorts. For Fall 2012 and Summer 2013, statistically significant differences in CDI Decision Making Pre Test [t (58) = 2.18, p = .034]; CDI Career Decision Knowledge Pre Test [t (58) = 2.14, p = .036]; CDI Career Planning Post Test [t (47) = 3.85, p = .000]; CDI Decision Making Post Test [t (47) = 2.19, p = .034]; CDI Career Decision Attitude scores [t (47) = 2.84, p = .007] were found. In regards to CTI scores, the study found significant differences in Decision Making Confusion Pre Test [t (57) = 2.66, p = .011]; Decision Making

Confusion Post Test [*t* (47) = 3.05, *p* = .004]; Commitment Anxiety Post Test [*t* (47) = 3.06, *p* = .004]; and Total Post Test [*t* (47) = 3.13, *p* = .003]. See Table 3 for means and standard deviations.

Table 5: Fall 2012 and Summer 2013 T Test

	Semester	N	Mean	SD	t	P Value
CDI Decision Making Pre Test	Fall 2012	**36**	**50.44**	**24.269**	**2.18**	**.034**
	Summer 2013	**24**	**36.92**	**23.067**		
CDI Career Decision Knowledge Pre Test	Fall 2012	**36**	**44.69**	**26.476**	**2.14**	**.036**
	Summer 2013	**24**	**31.25**	**21.826**		
CDI Career Planning Post Test	Fall 2012	**27**	**49.26**	**28.726**	**3.85**	**.000**
	Summer 2013	**22**	**77.86**	**21.772**		
CDI Decision Making Post Test	Fall 2012	**27**	**53.81**	**27.058**	**2.19**	**.034**
	Summer 2013	**22**	**36.14**	**28.893**		
CDI Career Decision Attitude Post Test	Fall 2012	**27**	**62.56**	**31.183**	**2.84**	**.007**
	Summer 2013	**22**	**84.09**	**18.764**		
CTI Decision Making Confusion Pre Test	Fall 2012	**35**	**15.09**	**6.604**	**2.66**	**.011**
	Summer 2013	**24**	**10.33**	**6.850**		
CTI Decision Making Confusion Post Test	Fall 2012	**26**	**11.54**	**8.406**	**3.05**	**.004**
	Summer 2013	**23**	**5.52**	**4.926**		
CTI Commitment Anxiety Post Test	Fall 2012	**26**	**16.77**	**6.121**	**3.06**	**.004**
	Summer 2013	**23**	**11.91**	**4.981**		
CTI Total Post Test	Fall 2012	**26**	**48.65**	**20.104**	**3.13**	**.003**
	Summer 2013	**23**	**32.35**	**16.303**		

When the t-test was conducted to assess differences between Fall 2012 and Fall 2013, statistical differences were found in CDI Career Planning Post Test [t (72) = 3.66, p = .001]; and CDI Career Decision Attitude Post Test scores [t (72) = 2.26, p = .027]. Additionally, the study found significant differences in CTI Decision Making Confusion Pre Test [t (86) = 2.72, p = .008]; CTI Commitment Anxiety Pre Test [t (86) = 1.99, p = .049]; CTI Decision Making Confusion Post [t (75) = 2.87, p = .006]; CTI Commitment Anxiety Post Test [t (75) = 3.81, p = .000]; and CTI Total Post [t (75) = 3.20, p = .002] scores. Although no significance was found on each scale of each test, groups were separated during analysis because moderate to large effect sizes ranging from .04-.24 were found. The study also examined effect size because I wanted to further explore the magnitude of the relationship between semesters. So, due to the differences found, I examined the Fall 2012 cohort separately than the combined Summer and Fall 2013 cohort in hypothesis one and two (i.e, Hypothesis 1a, 1b, 2a and 2b). See Table 4 for means and standard deviations.

Table 6: Fall 2012 and Fall 2013 T Test

	Semester	N	Mean	SD	*t*	P Value
CDI Career Planning Post Test	Fall 2012	**27**	**49.26**	**28.726**	**3.66**	**.001**
	Fall 2013	**47**	**73.28**	**24.269**		
CDI Career Decision Attitude Post Test	Fall 2012	**27**	**62.56**	**31.183**	**2.26**	**.027**
	Fall 2013	**47**	**76.72**	**22.591**		
CTI Decision Making Confusion Pre Test	Fall 2012	**35**	**15.09**	**6.604**	**2.72**	**.008**
	Fall 2013	**53**	**11.09**	**6.912**		
CTI Commitment Anxiety Pre Test	Fall 2012	**35**	**18.29**	**5.154**	**1.99**	**.049**
	Fall 2013	**53**	**15.91**	**5.933**		
CTI Decision Making Confusion Post Test	Fall 2012	**26**	**11.54**	**8.406**	**2.87**	**.006**
	Fall 2013	**51**	**5.98**	**7.268**		
CTI Commitment Anxiety Post Test	Fall 2012	**26**	**16.77**	**6.121**	**3.81**	**.000**
	Fall 2013	**51**	**11.33**	**5.520**		
CTI Total Post Test	Fall 2012	**26**	**48.65**	**20.104**	**3.20**	**.002**
	Fall 2013	**51**	**32.06**	**22.179**		

Because the MANOVA works best when dependent variables are moderately correlated, (Pallant, 2007) correlations were conducted to assess for multicollinearity. Large correlations existed between SAT scores, all yielding significance ($p < .01$). The study examined correlations separately for the Fall 2012 and Summer/Fall 2013 cohorts due to significant differences found in the t test. The Fall 2012 cohort CTI and CDI scores did not all yield significance ($p < .05$), however moderate correlations existed, allowing the appropriate analyses. CDI and CTI correlations for the Summer/Fall 2013 cohort did not all yield significance ($p < .01$), but, similar to the Fall 2012 cohort, moderate correlations existed. Overall, the assumption of multicollinearity was met for the current study.

Table 7: SAT Score Correlation

	Pearson Corr.	N	Sig (2-tailed)
SAT Total/SAT Verbal	.85	**89**	****.000**
SAT Total/SAT Math	.84	**89**	****.000**
SAT Math/SAT Verbal	.45	**89**	****.000**

**$p < .01$

Table 8: Fall 2012 CDI Correlation

	Pearson Corr.	N	Sig (2-tailed)
CDI Career Planning Pre/Post	.29	**28**	**.141**
CDI Career Exploration Pre/Post	.21	**28**	**.280**
CDI Decision Making Pre/Post	.62	**28**	***.000**
CDI World of Work Pre/Post	.51	**28**	***.005**
CDI Career Decision Attitude Pre/Post	.41	**28**	***.029**
CTI Career Decision Knowledge Pre/Post	.73	**28**	***.000**
CDI Career Orientation Total	.28	**28**	**.150**

*$p < .05$

Table 9: Fall 2012 CTI Correlation

	Pearson Corr.	N	Sig (2-tailed)
CTI Decision Making Confusion Pre/Post	.59	**26**	***.002**
CTI Commitment Anxiety Pre/Post	.46	**26**	***.021**
CTI External Conflict Pre/Post	.31	**26**	**.140**
CTI Total Pre/Post	.57	**26**	***.005**

*$p < .05$

Table 10: Summer/Fall 2013 CDI Correlation

	Pearson Corr.	N	Sig (2-tailed)
CDI Career Planning Pre/Post	.35	**71**	****.003**
CDI Career Exploration Pre/Post	.45	**71**	****.000**
CDI Decision Making Pre/Post	.28	**71**	**.018**
CDI World of Work Pre/Post	.46	**71**	****.000**
CDI Career Decision Attitude Pre/Post	.31	**71**	****.008**
CTI Career Decision Knowledge Pre/Post	.51	**71**	****.000**
CDI Career Orientation Total	.45	**71**	****.000**

**$p < .01$

Table 11: Summer/Fall 2013 CTI Correlation

	Pearson Corr.	N	Sig (2-tailed)
CTI Decision Making Confusion Pre/Post	.35	**74**	****.003**
CTI Commitment Anxiety Pre/Post	.45	**74**	****.000**
CTI External Conflict Pre/Post	.28	**74**	**.018**
CTI Total Pre/Post	.46	**74**	****.000**

**p <.01

Results of Data Analysis

Hypothesis 1A - Fall 2012 Cohort

To investigate the first null hypothesis, which stated that an undergraduate STEM career planning course has no influence on career thoughts as measured by the Career Thoughts Inventory, the current study conducted a repeated measures MANOVA to answer this hypothesis. The four Career Thoughts Inventory scores (Decision Making Confusion, Commitment Anxiety, External Conflict, total score) served as the dependent variables for this analysis and the Fall 2012 (N = 25) group of students served as the factor variables. I conducted a G*Power analysis to determine power based on my sample size that resulted in a value of .9 indicating sufficient power to continue the analysis. Levene's test was not significant (.191-.928) and Box's Test of Equality of Covariance Matrices was .001 therefore assumptions for equal variances and homogeneity of variance-covariance matrices were met. The first aspect of the

MANOVA analysis is the overall multivariate test. For this sample, the overall test did not indicate a significant difference in test scores between pre and post test administration with, Wilks' Lambda = .716, F (4, 21) = 2.08, p = .120, partial eta squared = .285. Thus although a decrease in CTI scores existed, this difference did not rise to the level of significance. Therefore, negative career thoughts, did not significantly decrease by the end of the career planning course. See table 10 for means and standard deviations.

Table 12: Fall 2012 CTI Means and Standard Deviations

	Mean	SD	N
CTI Decision Making Confusion Pre Test	14.92	5.431	25
CTI Decision Making Confusion Post Test	11.12	8.298	25
CTI Commitment Anxiety Pre Test	18.56	5.034	25
CTI Commitment Anxiety Post Test	16.84	6.236	25
CTI External Conflict Pre Test	4.08	2.414	25
CTI External Conflict Post Test	3.72	2.731	25
CTI Total Pre Test	53.60	16.581	25
CTI Total Post Test	47.68	19.882	25

Hypothesis 1B - Summer/Fall 2013 Cohort

To investigate Hypothesis 1B, which stated that an undergraduate STEM career planning course has no influence on career thoughts as measured by the Career Thoughts Inventory (CTI), a repeated measures MANOVA was conducted to answer this hypothesis. CTI scores served as the dependent variables, while the students from the Summer/Fall 2013 group served as the factor variables. Levene's test was not significant on any variables (.183-.570) and Box's Test of Equality of Covariance Matrices was larger than .001 (.020) therefore no violation of homogeneity of variance occurred. Results for the combined dependent variables for the Summer/Fall 2013 group (N = 74) indicated a significant difference in test scores between pre and post test administration, Wilks' Lambda = .441, F (4, 70) = 22.18, p =.000, partial eta squared = .56. Univariate results found that all variables significantly decreased following treatment: decision making confusion [F (1, 73) = 51.13, p = .000, partial eta squared = .41]; commitment anxiety [F (1, 73) = 68.29, p = .000, partial eta squared = .48]; external conflict [F (1, 73) = 18.78, p = .000, partial eta squared = .21]; and total score [F (1, 73) = 72.82, p = .000, partial eta squared = .50]. Therefore, decision making confusion, commitment anxiety, external conflict, and overall negative career thoughts decreased for the Summer/Fall 2013 group at the end of the career planning course. See Table 11 for the univariate results, means and standard deviations.

Table 13: Summer/Fall 2013 CTI Univariate Results

	Mean	SD	*N*	*p*	*eta²*
Decision Making Confusion			74	*.000	.41
DMC Pre	11.04	6.86			
DMC Post	5.84	6.60			
Commitment Anxiety			74	*.000	.48
CA Pre	16.12	5.28			
CA Post	11.51	5.33			
External Conflict			74	*.000	.21
EC Pre	4.16	2.75			
EC Post	2.93	2.95			
Total Score			74	*.000	.50
Total Pre	49.47	20.27			
Total Post	32.15	20.42			

*$p < .05$

Hypothesis 2A - Fall 2012 Cohort

The second null hypothesis states that an undergraduate STEM career planning course has no influence on career decidedness and vocational maturity as measured by the Career Development Inventory. The Career Development Inventory scores (career planning, career exploration, decision making, world of work, career decision attitude, career decision knowledge, career orientation total) were the dependent variables in this analysis and participants in the Fall 2012 ($N = 28$) group served as independent variables. Although the sample size for this test was small, adequate power ($\beta = .9$) was achieved. Levene's test was not significant on any scales (.062-.527) and Box's Test of Equality of Covariance Matrices was larger than .001 (.002) hence I assumed equal variance and homogeneity of variance. A repeated measures MANOVA was conducted to examine this hypothesis. The overall results of the multivariate test indicated a significant difference in test scores between pre and post test administration, Wilks' Lambda = .393, F (7, 21) = 4.64, $p = .003$, partial eta squared = .61. Univariate analyses found that career planning [F (1,27) = 99.53, $p = .000$, partial eta squared = .79]; career exploration [F (1, 27) = 156.05, $p = .001$, partial eta squared = .85]; decision making [F (1, 27) = 144.10, $p = .001$, partial eta squared = .84]; world of work [F (1, 27) = 88.42, $p = .000$, partial eta squared = .77]; career decision attitude [F (1, 27) = 29.70, $p = .000$, partial eta squared = .52]; career decision knowledge [F (1, 27) = 96.03, $p = .000$, partial eta squared = .78]; and career orientation total [F (1, 27) = 22.59, $p = .000$, partial eta squared = .46] scores increased significantly following the treatment. Overall, career decidedness and vocational maturity increased by the end of the course. See Table 12 for univariate results.

Table 14: Fall 2012 CDI Univariate Results

	Mean	SD	N	*p*	*eta²*
Career Planning			28	*.000	.79
CP Pre	20.39	16.04			
CP Post	48.43	28.53			
Career Exploration			28	*.000	.85
CE Pre	41.93	31.24			
CE Post	69.64	29.47			
Decision Making			28	*.000	.84
DM Pre	50.75	24.60			
DM Post	54.93	27.20			
World of Work			28	*.000	.77
WW Pre	44.54	30.20			
WW Post	51.32	31.83			
Career Decision Attitude			28	*.000	.80
CDA Pre	30.43	26.06			
CDA Post	62.32	30.63			
Career Decision Knowledge			28	*.000	.78
CDK Pre	46.00	26.35			
CDK Post	51.82	30.45			
Career Orientation Total			125.61	*.000	.82
COT Pre	31.11	23.10			
COT Post	60.61	30.74			

* $p < .05$

Hypothesis 2B - Summer/Fall 2013 Cohort

To investigate Hypothesis 2B, which states that an undergraduate STEM career planning course has no influence on career decidedness and vocational maturity as measured by the Career Development Inventory, a MANOVA was utilized. The Career Development Inventory scores (career planning, career exploration, decision making, world of work, career decision attitude, career decision knowledge, career orientation total) were the dependent variables in this analysis and participants in the Summer/Fall 2013 group served as independent variables. Box's test was larger than .001 (.005) and Levene's (.060-.659) test did not yield significance therefore homogeneity of variance and equal variance was assumed.. Overall findings for the Summer/Fall 2013 group also indicated a significant difference in test scores between pre and post test administration, Wilks' Lambda = .225, F (7, 64) = 31.6, p = .000, partial eta squared = .78. The results suggest a greater awareness of planning, exploration and decision making in regard to career. See Table 13 for univariate results. Each subscale increased at the end of treatment, therefore, the career planning course had a significant influence on vocational maturity and career decidedness: career planning [F (1,70) = 498.75, p = .000, eta^2 = .88]; career exploration [F (1,70) = 475.04, p = .000, eta^2 = .87]; decision making [F (1,70) = 338.67, p = .000, eta^2 = .83]; world of work [F (1,70) = 237.69, p = .000, eta^2 = .77]; career decision attitude [F (1,70) = 548.02, p = .000, eta^2 = .89]; career decision knowledge [F (1,70) = 242.10, p = .000, eta^2 = .78]; and career orientation total [F (1,70) = 362.69, p = .000, eta^2 = .84].

Table 15: Summer/Fall 2013 CDI Univariate Results

	Mean	*SD*	*N*	*p*	*eta²*
Career Planning			71	*.000	.88
CP Pre	29.86	25.00			
CP Post	75.24	23.32			
Career Exploration			71	*.000	.87
CE Pre	47.63	31.86			
CE Post	75.63	23.82			
Decision Making			71	*.000	.83
DM Pre	40.32	23.28			
DM Post	47.62	26.80			
World of Work			71	*.000	.77
WW Pre	41.54	29.00			
WW Post	50.68	29.96			
Career Decision Attitude			71	*.000	.89
CDA Pre	37.52	29.61			
CDA Post	78.87	21.76			
Career Decision Knowledge			71	*.000	.78
CDK Pre	35.24	22.69			
CDK Post	48.06	29.14			
Career Orientation Total			71	*.000	.84
COT Pre	35.00	27.10			
COT Post	70.68	27.84			

* $p < .05$

Hypothesis 3A - Fall 2012 Cohort

The third null hypothesis states that an undergraduate career planning course has no influence on career thoughts, career decidedness and vocational maturity as measured by the Career Development Inventory and Career Thoughts Inventory when controlling for gender. I conducted repeated measures MANOVAs to answer this hypothesis. The CTI and CDI scores were the dependent variables in this analysis while female (N = 13) and male (N = 6) served as the fixed factor. The sample size of the Fall 2012 cohort did not allow for the analysis to continue. See Table 14 for means and standard deviations.

Table 16: Fall 2012 Summer/Fall 2013 CTI and CDI Gender Means and Standard Deviations

	Gender	Mean	Std. Deviation	N
CTI Decision Making Confusion Pre Test	Female	15.31	5.528	13
	Male	12.33	5.750	6
	Total	14.37	5.620	19
CTI Decision Making Confusion Post Test	Female	11.23	10.142	13
	Male	11.33	7.146	6
	Total	11.26	9.097	19
CTI Commitment Anxiety Pre Test	Female	18.62	5.009	13
	Male	15.00	3.464	6
	Total	17.47	4.800	19
CTI Commitment Anxiety Post Test	Female	18.00	6.646	13
	Male	12.83	5.776	6
	Total	16.37	6.693	19
CTI External Conflict Pre Test	Female	3.69	1.932	13
	Male	3.33	1.211	6
	Total	3.58	1.710	19
CTI External Conflict Post Test	Female	4.08	2.900	13
	Male	1.83	1.835	6
	Total	3.37	2.773	19
CTI Total Pre Test	Female	46.69	13.155	13
	Male	57.17	4.708	6
	Total	50.00	12.106	19
CTI Total Post Test	Female	48.62	19.556	13
	Male	41.17	18.766	6
	Total	46.26	19.116	19
CDI Career Planning Pre Test	Female	22.08	12.339	13
	Male	9.00	9.033	6
	Total	17.95	12.774	19
CDI Career Planning Post Test	Female	53.31	24.581	13
	Male	19.50	10.766	6
	Total	42.63	26.376	19
CDI Career Exploration Pre Test	Female	44.92	29.937	13
	Male	25.83	25.686	6
	Total	38.89	29.392	19

	Gender	Mean	Std. Deviation	N
CDI Career Exploration Post Test	Female	69.92	28.482	13
	Male	46.67	31.627	6
	Total	62.58	30.693	19
CDI Decision Making Pre Test	Female	56.62	22.911	13
	Male	42.17	31.077	6
	Total	52.05	25.804	19
CDI Decision Making Post Test	Female	60.23	26.291	13
	Male	52.00	33.959	6
	Total	57.63	28.224	19
CDI World of Work Pre Test	Female	51.46	32.855	13
	Male	45.00	34.141	6
	Total	49.42	32.449	19
CDI World of Work Post Test	Female	57.23	30.307	13
	Male	45.17	39.260	6
	Total	53.42	32.767	19
CDI Career Decision Attitude (CP and CE) Pre Test	Female	33.31	27.795	13
	Male	14.00	15.735	6
	Total	27.21	25.862	19
CDI Career Decision Attitude (CP and CE) Post Test	Female	67.38	27.909	13
	Male	31.33	19.159	6
	Total	56.00	30.293	19
CDI Career Decision Knowledge (DM and WW) Pre Test	Female	52.23	25.140	13
	Male	40.83	28.708	6
	Total	48.63	26.075	19
CDI Career Decision Knowledge (DM and WW) Post Test	Female	58.62	31.266	13
	Male	48.17	36.935	6
	Total	55.32	32.489	19
CDI Career Orientation Total (CDA and CDK) Pre Test	Female	37.69	18.865	13
	Male	14.00	6.928	6
	Total	30.21	19.458	19
CDI Career Orientation Total (CDA and CDK) Post Test	Female	64.69	26.850	13
	Male	36.83	27.607	6
	Total	55.89	29.484	19

Hypothesis 3B - Summer/Fall 2013 Cohort

The third null hypothesis states that an undergraduate career planning course has no influence on career thoughts, career decidedness and vocational maturity as measured by the Career Development Inventory and Career Thoughts Inventory when controlling for gender. A repeated measures MANOVA was conducted to answer this hypothesis. Levene's test showed no significance and Box's test was larger than .001 (.102). The CTI and CDI scores were the dependent variables in this analysis while female (N = 38) and male (N = 32) served as the fixed factor. Results of the multivariate test showed no significance between females and males Wilks' Lambda = .859, F (11, 58) = .867, p = .58, partial eta squared = .141. Therefore, the career planning course had no significant influence on career thoughts, career decidedness and vocational maturity between females and males. See Table 15 for means and standard deviations.

Table 17: Summer/Fall 2013 CTI and CDI Gender Means and Standard Deviations

	Gender	Mean	Std. Deviation	N
CTI Decision Making Confusion Pre Test	Female	12.18	7.244	38
	Male	9.59	6.385	32
	Total	11.00	6.939	70
CTI Decision Making Confusion Post Test	Female	6.29	6.682	38
	Male	4.84	6.396	32
	Total	5.63	6.546	70
CTI Commitment Anxiety Pre Test	Female	16.89	4.643	38
	Male	15.03	6.813	32
	Total	16.04	5.770	70
CTI Commitment Anxiety Post Test	Female	12.97	4.439	38
	Male	9.72	6.081	32
	Total	11.49	5.463	70
CTI External Conflict Pre Test	Female	4.63	2.813	38
	Male	3.63	2.721	32
	Total	4.17	2.797	70
CTI External Conflict Post Test	Female	3.61	3.045	38
	Male	2.00	2.736	32
	Total	2.87	2.997	70
CTI Total Pre Test	Female	53.18	18.301	38
	Male	44.81	22.286	32
	Total	49.36	20.503	70
CTI Total Post Test	Female	36.39	17.962	38
	Male	27.25	22.994	32
	Total	32.21	20.775	70
CDI Career Planning Pre Test	Female	28.24	23.539	38
	Male	31.66	27.245	32
	Total	29.80	25.170	70
CDI Career Planning Post Test	Female	73.71	25.034	38
	Male	78.34	20.300	32
	Total	75.83	22.948	70
CDI Career Exploration Pre Test	Female	51.55	30.947	38
	Male	43.12	33.301	32
	Total	47.70	32.088	70

	Gender	Mean	Std. Deviation	N
CDI Career Exploration Post Test	Female	75.92	25.938	38
	Male	76.31	21.044	32
	Total	76.10	23.660	70
CDI Decision Making Pre Test	Female	40.87	23.181	38
	Male	39.16	23.907	32
	Total	40.09	23.360	70
CDI Decision Making Post Test	Female	44.79	26.360	38
	Male	50.69	28.129	32
	Total	47.49	27.145	70
CDI World of Work Pre Test	Female	41.50	32.731	38
	Male	41.81	24.871	32
	Total	41.64	29.196	70
CDI World of Work Post Test	Female	46.55	29.011	38
	Male	56.09	31.028	32
	Total	50.91	30.113	70
CDI Career Decision Attitude (CP and CE) Pre Test	Female	38.63	29.251	38
	Male	35.94	30.864	32
	Total	37.40	29.810	70
CDI Career Decision Attitude (CP and CE) Post Test	Female	77.84	23.326	38
	Male	81.13	19.442	32
	Total	79.34	21.547	70
CDI Career Decision Knowledge (DM and WW) Pre Test	Female	36.03	26.991	38
	Male	34.19	17.040	32
	Total	35.19	22.846	70
CDI Career Decision Knowledge (DM and WW) Post Test	Female	44.55	28.675	38
	Male	52.50	29.956	32
	Total	48.19	29.325	70
CDI Career Orientation Total (CDA and CDK) Pre Test	Female	35.37	26.112	38
	Male	34.25	28.987	32
	Total	34.86	27.266	70
CDI Career Orientation Total (CDA and CDK) Post Test	Female	68.50	26.289	38
	Male	74.06	29.775	32
	Total	71.04	27.869	70

Hypothesis 4

To investigate the fourth null hypothesis (a & b) stating that an undergraduate career planning course has no influence on career thoughts, career decidedness and vocational maturity as measured by the Career Development Inventory and Career Thoughts Inventory when controlling for ethnicity, I anticipated conducting a repeated measures MANOVA. However, due to sample size, analysis to examine my fourth hypothesis was not possible. See Table 16 for sample sizes.

Table 18: Ethnicity

	Fall 2013 (N)	*Summer/Fall 2013 (N)*
Voc. Maturity & Career Decidedness		
Caucasian/White	20	39
African American/Black	3	9
Hispanic	3	12
Asian	1	9
Other	1	2
Career Thoughts		
Caucasian/White	17	41
African American/Black	2	9
Hispanic	5	13
Asian	0	9
Other	1	2

Hypothesis 5

A Chi Square was utilized for the fifth null hypothesis, stating that an undergraduate career planning course has no influence on STEM major selection. Major Selection (STEM Major, Non-STEM Major) was the test variable used in this analysis. Because the literature shows that approximately 43% of students change their STEM major before graduation (Seymour & Hewitt) or leave their STEM major within the first year of college (Watkins, 2013), I used this statistic for the expected proportion for the "Non-STEM" major group of students. Concurrently, I used 57% for the expected proportion of the "STEM" group. A chi-square goodness of fit indicates a significant difference in the proportion of STEM Majors identified in the current sample (72%) as compared with the value of 43% obtained in previous studies, χ^2 (1, n = 69) = 6.73, p = .009. See Table 17 for Major Selection Chi Square results.

Table 19: Major Selection Chi Square Results

	Observed N	Expected N	Residual
STEM	50	39.3	10.7
NON STEM	19	29.7	-10.7
Total	69		

	Major Selection
Chi-Square	6.732[a]
df	1
Asymp. Sig.	.009

Hypothesis 6

To investigate the sixth null hypothesis which states no differences exist in SAT scores between those that select a STEM major (*N* = 47) and those that do not select a STEM major (*N* = 16), I utilized a MANOVA. SAT scores (Total, Verbal and Math) were the dependent variables in this analysis and STEM selection served as the independent variable. Levene's test of equality of error variance was not significant (SAT Math = .112, SAT Verbal = .661, and SAT Total = .603) therefore equal variances are assumed. Although the majority of students declared a STEM Major, results did not indicate a significant difference in SAT scores between those that selected a STEM major and those that did not, Wilks' Lambda = .981, F (2, 60) = .591, p = .56, partial eta squared = .019. Therefore, there were no significant differences in SAT scores between those that selected a STEM major and those that did not. See Table 18 for means and standard deviations.

Table 20: SAT and STEM Major Selection Means and Standard Deviations

	Major Selection	Mean	Std. Deviation	N
SAT Total	STEM	1223.4043	111.67259	47
	NON STEM	1188.7500	107.32350	16
	Total	1214.6032	110.77186	63
SAT Verbal	STEM	593.4043	66.47250	47
	NON STEM	576.2500	72.00694	16
	Total	589.0476	67.74512	63
SAT Math	STEM	630.0000	62.69318	47
	NON STEM	612.5000	51.05553	16
	Total	625.5556	60.04777	63

Hypothesis 7

The seventh null hypothesis states no differences exist in Algebra Math Placement scores between those that select a STEM major and those that do not. See Table 19 for means and standard deviations. Algebra Math Placement score was the dependent variable in this analysis with major selection being the independent variable. Due to small sample size (STEM Major = 32, Non-STEM Major = 6, and No Major Selected = 4), continuing in running the analysis was not possible.

Table 21: Math Placement and STEM Major Selection

	N	Mean	SD
STEM	32	303.385	122.37422
NON STEM	6	222.778	101.50426
DID NOT SELECT	4	245.000	156.31165
Total	42	286.309	123.90279

Hypothesis 8

The eighth null hypothesis states no differences exist in Career Thoughts Inventory (Decision Making Confusion, Commitment Anxiety, External Conflict, total score) and Career Development Inventory (Career Planning, Career Exploration, Decision Making, World of Work, Career Decision Attitude, Career Decision Knowledge, Career Orientation Total) scores between those that select a STEM major (*n* = 48) and those who do not (*n* = 18). I conducted a repeated measures MANOVA to answer this hypothesis. Students who did not select a major (*N* = 7) were not included in the analysis because that group was only comprised of 7 students. CTI and CDI scores were the dependent variables in this analysis while STEM major selection was the independent variable. Results of the multivariate test did not indicate significant difference in test scores based on major selection, Wilks' Lambda = .799, F (11, 51) = 1.16, p = .34, partial eta squared = .557. Therefore, no differences existed in CTI and CDI scores between those that selected a STEM major and those who did not. See Table 20 for means and standard deviations.

Table 22: CTI/CDI Scores and Major Selection

	Major Selection	Mean	SD	N
CTI Decision Making Confusion Pre Test	STEM	9.87	5.934	45
	NON STEM	10.94	6.338	18
	Total	10.17	6.020	63
CTI Decision Making Confusion Post Test	STEM	4.31	4.976	45
	NON STEM	6.17	5.924	18
	Total	4.84	5.283	63
CTI Commitment Anxiety Pre Test	STEM	15.56	5.562	45
	NON STEM	16.78	6.112	18
	Total	15.90	5.701	63
CTI Commitment Anxiety Post Test	STEM	10.78	5.134	45
	NON STEM	12.22	5.537	18
	Total	11.19	5.248	63
CTI External Conflict Pre Test	STEM	3.91	2.704	45
	NON STEM	4.00	2.473	18
	Total	3.94	2.620	63
CTI External Conflict Post Test	STEM	2.58	2.624	45
	NON STEM	2.83	2.834	18
	Total	2.65	2.665	63
CTI Total Pre Test	STEM	48.11	18.627	45
	NON STEM	47.28	18.905	18
	Total	47.87	18.557	63
CTI Total Post Test	STEM	28.18	16.759	45
	NON STEM	33.78	18.184	18
	Total	29.78	17.219	63
CDI Career Planning Pre Test	STEM	31.71	25.502	45
	NON STEM	32.72	26.196	18
	Total	32.00	25.493	63
CDI Career Planning Post Test	STEM	76.47	22.967	45
	NON STEM	79.67	17.664	18
	Total	77.38	21.495	63
CDI Career Exploration Pre Test	STEM	50.11	31.783	45
	NON STEM	45.89	34.970	18
	Total	48.90	32.495	63

	Major Selection	Mean	SD	N
CDI Career Exploration Post Test	STEM	78.22	23.225	45
	NON STEM	73.39	22.385	18
	Total	76.84	22.914	63
CDI Decision Making Pre Test	STEM	37.84	23.424	45
	NON STEM	40.94	21.743	18
	Total	38.73	22.826	63
CDI Decision Making Post Test	STEM	44.91	25.647	45
	NON STEM	53.06	31.002	18
	Total	47.24	27.278	63
CDI World of Work Pre Test	STEM	40.67	29.182	45
	NON STEM	47.39	33.952	18
	Total	42.59	30.493	63
CDI World of Work Post Test	STEM	54.44	30.845	45
	NON STEM	45.89	29.882	18
	Total	52.00	30.581	63
CDI Career Decision Attitude (CP and CE) Pre Test	STEM	40.09	29.673	45
	NON STEM	38.44	31.844	18
	Total	39.62	30.058	63
CDI Career Decision Attitude (CP and CE) Post Test	STEM	81.49	21.349	45
	NON STEM	78.61	15.856	18
	Total	80.67	19.853	63
CDI Career Decision Knowledge (DM and WW) Pre Test	STEM	32.82	22.479	45
	NON STEM	40.11	26.986	18
	Total	34.90	23.860	63
CDI Career Decision Knowledge (DM and WW) Post Test	STEM	47.13	29.517	45
	NON STEM	52.44	32.324	18
	Total	48.65	30.177	63
CDI Career Orientation Total (CDA and CDK) Pre Test	STEM	36.64	27.790	45
	NON STEM	35.78	29.075	18
	Total	36.40	27.929	63
CDI Career Orientation Total (CDA and CDK) Post Test	STEM	73.91	26.127	45
	NON STEM	67.56	28.930	18
	Total	72.10	26.876	63

Hypothesis 9

The ninth null hypothesis states no differences exist in Career Thoughts Inventory scores between those in COMPASS and those in EXCEL. The Career Thoughts Inventory scores (Decision Making Confusion, Commitment Anxiety, External Conflict, total score) are the dependent variables in this analysis with the COMPASS and EXCEL groups as fixed factors. A MANOVA was conducted to answer this hypothesis. Box's Test of Equality of Covariance Matrices ($p = .001$) assumed homogeneity of variance and no results for Levene's Test yielded significance therefore equality of variances was not violated. Overall results indicated a significant difference in test scores between COMPASS and EXCEL for the pre and post test administration, Wilks' Lambda = .674, F (8, 272) = 16.43, $p = .000$, partial eta squared = .326. The EXCEL group had significantly lower scores on each subscale of the Career Thoughts Inventory, indicating less negative career thoughts; decision making confusion pre [F (1,279) = 71.71, $p = .000$, $eta^2 = .20$]; decision making confusion post [F (1,279) = 5.56, $p = .019$, $eta^2 = .02$]; commitment anxiety pre [F (1,279) = 70.30, $p = .000$, $eta^2 = .20$]; commitment anxiety post [F (1,279) = 23.61, $p = .000$, $eta^2 = .08$]; external conflict pre [F (1,279) = 35.27, $p = .000$, $eta^2 = .11$]; external conflict post [F (1,279) = 11.65, $p = .001$, $eta^2 = .04$]; total pre [F (1,279) = 56.26, $p = .000$, $eta^2 = .17$]; and total post [F (1,279) = 6.60, $p = .011$, $eta^2 = .02$]. See Table 21 for between subject results.

Table 23: COMPASS and EXCEL CTI Test of Between Subjects Results

	Mean	*SD*	*N*	*p*	*eta²*
DMC Pre					
COMPASS	12.02	6.72	99	.000	.20
EXCEL	5.24	6.24	182		
DMC Post					
COMPASS	7.17	7.39	99	.019	.02
EXCEL	5.18	6.40	182		
CA Pre					
COMPASS	16.74	5.64	99	.000	.20
EXCEL	10.38	6.30	182		
CA Post					
COMPASS	12.86	6.01	99	.000	.08
EXCEL	9.07	6.37	182		
EC Pre					
COMPASS	4.14	2.65	99	.000	.11
EXCEL	2.24	2.52	182		
EC Post					
COMPASS	3.13	2.90	99	.001	.04
EXCEL	2.01	2.49	182		
Total Score Pre					
COMPASS	50.52	19.41	99	.000	.17
EXCEL	31.64	20.55	182		
Total Score Post					
COMPASS	36.07	21.94	99	.011	.02
EXCEL	29.12	21.85	182		

Summary

The purpose of this study is to use quantitative research methods to investigate of the role career development interventions plays in the STEM recruitment and retention efforts by examining career decidedness, career thoughts and vocational maturity. Furthermore, I examined the influence of the class by using demographics such as gender, ethnicity, SAT scores, and algebra math placements scores. The hypotheses were examined by using repeated measures MANOVA, MANOVA, one way ANOVA and Chi Square Goodness of Fit. Unfortunately due to sample size, I was unable to run analyses for hypotheses 3a, 4 (a & b), and 7 which aimed to examine; (a) the influence of a career planning course on career thoughts, career decidedness and vocational maturity when controlling for gender, (b) the influence of a career planning course on career thoughts, career decidedness and vocational maturity when controlling for ethnicity, and (c) differences existing in algebra math placement scores between those that select a STEM major and those that do not.

The first hypothesis, for which a repeated measures MANOVA was run, stated that an undergraduate STEM planning career course has no influence on career thoughts as measured by the Career Thoughts Inventory. Results found no significant differences for the Fall 2012 cohort and significant differences in CTI scores for the Summer/Fall 2013 cohort. Therefore, negative career thoughts decreased for the Summer/Fall 2013 cohort, but not for the Fall 2012 cohort. By utilizing a repeated measures MANOVA, the study examined the second hypothesis which stated that the career planning course had no influence on career decidedness and vocational maturity as measured by the Career Development Inventory. The results found significant differences in

CDI scores for both the Fall 2012 cohort and Summer/Fall 2013 cohort. Thus, vocational maturity and career decidedness significantly increased for both cohorts. While controlling for gender in my third hypothesis, the study examined whether the STEM career planning course had an influence on CDI and CTI scores. A repeated measures MANOVA was conducted for this hypothesis and found no significance for the Summer/Fall 2013 cohort. No significant difference in career thoughts, vocational maturity or career decidedness existed for the Summer/Fall 2013 cohort.

The fifth hypothesis in the current study examined the influence of the STEM career planning course on STEM major selection and a Chi Square Goodness of Fit test was used to examine it. Results showed a statistically significant difference in the proportion of STEM majors identified in the current sample as compared to the value obtained in previous studies. No significance was found for the sixth hypothesis for which I used a MANOVA to examine. The hypothesis stated that no differences existed in SAT scores between those that select a STEM major and those that do not. Using a repeated measures MANOVA, the current study explored my eighth hypothesis which stated that no differences existed in CTI and CDI scores between those that select a STEM major and those that do not. The analyses also found no statistically significant differences in SAT scores based on major selection. No significant differences existed in CDI and CTI scores between STEM and Non-STEM majors, therefore no difference in career thoughts, career decidedness and vocational maturity existed. Lastly, my ninth hypothesis stated that no differences existed in CTI scores between those in COMPASS and those in EXCEL. I utilized a repeated measures MANOVA for this hypothesis and found significant differences between the two groups. Students in the EXCEL group had less negative career thoughts than the COMPASS cohort.

CHAPTER V - DISCUSSION

The purpose of this study was to use quantitative research methods to investigate of the role career development interventions play in the STEM recruitment and retention efforts by examining career decidedness, career thoughts and vocational maturity. One hundred thirteen students took part in the COMPASS (Convincing Outstanding Math-Potential Admits to Succeed in STEM) program enrolling in a STEM-focused career planning course. Participants in the class completed the Career Thoughts Inventory (CTI) and Career Development Inventory (CDI) as pre/post test during the Fall 2012 and Summer/Fall 2013 semesters. Assessing participants' vocational maturity, career thoughts and career decidedness occurred during the first week of the course and the last week of the course. The study aimed to (a) examine the influence of a STEM-focused career planning course on vocational maturity, career thoughts and career decidedness; (b) examine differences in SAT and Algebra Math Placements Scores between those that select a STEM major; (c) examine differences in vocational maturity, career thoughts and career decidedness between those that select a STEM major; (d) examine the influence of the class on STEM major selection; and (e) differences in Career Thoughts Inventory scores between those in COMPASS and EXCEL.

This research identified how a STEM-focused career planning course influenced the three constructs (career thoughts, career decidedness and vocational maturity) of the study and gave insight into innovative interventions for STEM undergraduate retention. This research also sparks dialogue surrounding how to more effectively aid underrepresented populations (e.g. women) in STEM. On a more broad scale, the current study can inform counselor educators and other researchers on how career planning and development aids in undergraduate career planning, particularly in STEM, through educating students about career choices. By using career assessments, guest lectures, and experiential learning components, this type of career intervention can have a strong influence on the way future STEM-focused career courses are implemented in universities. Whether the course is specific to a certain disciplines, or more broad in nature, this outline will be useful.

To organize the results and discussion of my hypotheses, three discussion questions were created; What influence does the career planning course have on career thoughts, decidedness or vocational maturity? What influence does the career planning course have on STEM major selection? and What differences exist in either SAT scores, algebra math placement scores, and CDI/CTI scores between those that select a STEM major and those that do not select a STEM major?. I will discuss hypotheses 1-4 and 9 under the first question, hypothesis 5 for the second question and hypotheses 6-8 for the last question.

Question 1

The first questions asks: "What influence does the career planning course have on career thoughts, decidedness or vocational maturity?" and I will discuss hypotheses 1-4 and 9. Understanding the subscales of the Career Thoughts Inventory (CTI) and Career Development Inventory (CDI) is of importance as these hypotheses discuss significance regarding them. The CTI subscales include Decision Making Confusion (DMC), Commitment Anxiety (CA), and External Conflict (EC). The first subscale, DMC, examines whether one is confused about making decisions and making career choices. The second subscale, CA, examines whether one finds it difficult to commit to a specific choice or feels anxiety about making choices, this making the choice harder to make. EC, the last subscale, looks at how well one balances the importance of their ideas with the importance of ideas of family members and friends. A higher CTI scale score may indicate a specific problem area for career decision making.

Subscales of the CDI indicating vocational maturity and career decidedness included Career Planning (CP), Career Exploration (CE), Decision Making (DM), World of Work (WW), Career Decision Attitude (CDA), Career Decision Knowledge (CDK) and Career Orientation Total (COT). Career Planning (CP) indicates appropriate career planning activities and behavior; as well as curiosity with regard to their place in the world of work. Career Exploration (CE) indicates the extent to which one is fully aware of the resources available to them, and gathers information relevant to future occupational choices. Decision Making (DM) examines whether the student is capable of making healthy and appropriate career and vocational decisions. World of Work (WW) high scores mean that students may have a lot of information to support their career decision making. The three composite scale, Career Decision Attitudes (CDA), Career Decision Knowledge (CDK), and Career Orientation Total (COT), are the combination of CP and CE, DM and WW, and CDA and CDK respectively.

The first hypothesis stated that an undergraduate STEM planning career course has no influence on career thoughts as measured by the Career Thoughts Inventory. Results found no significant differences for the Fall 2012 cohort and significant differences in CTI scores for the Summer/Fall 2013 cohort. All subscales for the Summer/Fall 2013 cohort, including DMC, CA and EC decreased after taking the career planning course. Therefore, negative career thoughts decreased for the Summer/Fall 2013 cohort, but not for the Fall 2012 cohort. On a whole, CTI scores for the Summer/Fall 213 group were lower than scores for the Fall 2012 group. Students in the Summer/Fall 2013 group were undeclared students interested in STEM, however many students in the Fall 2012 group were interested in various disciplines. Interest in STEM was one reason why the groups were split before analysis. This finding is in line with what Cognitive Information Processing Theory (CIP) negative career thoughts and the readiness to engage in the career decision making process (Reardon et al., 2011). Individuals with less negative career thoughts are more prepared to engage in career decision making and planning behaviors. Thrift and colleagues (2012) examined career thoughts of undergraduate college students enrolled in a college success course and, using the CTI to measure career thoughts, found that by the end of the course, negative career thoughts decreased. This study differs from the current in that it had three groups; the workbook intervention, the research intervention and the control group. Interestingly, Wright and colleagues (2000) found that relationships existed between negative career thoughts and RIASEC types. For example, Social and Enterprising types were related to dysfunctional career thoughts. Students in the COMPASS program complete a RIASEC assessment and future research could benefit from looking at differences in regards to RIASEC type.

The second null hypothesis examined the influence of the STEM career planning course on career decidedness and vocational maturity, as measured by the Career Development Inventory. Overall results for the second null hypothesis for the Fall 2012 group indicated a significant difference in test scores between pre and post administration. All subscales increased following the students' participation in the career planning course, therefore, vocational maturity and career decidedness increased. Career planning (CP) and career exploration (CE) scores showed the most increase which caused career decision attitude (CDA) scores to increase the most. The CDA scale is comprised of the scores from career planning and exploration.

Results for the Summer/Fall 2013 group also indicated a significant difference in test scores between pre and post test administration. Career planning pre scores and post scores showed a significant increase meaning that students were more aware of the choices they needed to make in regards to career. The students were better able to plan for their careers. Each subscale increased at the end of treatment, therefore, the career planning course had a significant influence on vocational maturity and career decidedness. Career planning, career exploration, career decision attitude and career orientation total scores were higher for the Summer/Fall group and decision making was higher for Fall 2012 group. Although scores between the two groups differed, an overall change existed in vocational maturity and career decidedness.

The results of the Fall 2012 and Summer/Fall 2013 are in line with a study done by Scott and Ciani (2008) who used a similar format for a career planning course. Although the class was not a STEM-focused career planning course, the progression of the class was in line with the MHS 2330 STEM exploration course discussed in the current study. Using the Career Decision-Making Self Efficacy scale (CDMSE) and the My Vocational Situation diagnostic form to measure self efficacy in regard to career decision making and vocational maturity. By the end of the career planning course, the students reported significantly more adaptive self-efficacy beliefs and vocational maturity increased (Scott & Ciani, 2008). Results from other similar studies show an increase in decision making after being enrolled in a career planning course (Grier-Reed & Skaar, 2010; Reese & Miller, 2006). Research shows that students with strong career decision making abilities experience less depression (Rottinghaus et al., 2009) and positively relates to subjective well being and increased life satisfaction (Hirschi, 2009; Lounsbury et al., 2009; Uthayakumar et al., 2010). Students in the current study had higher vocational maturity and career decidedness by the end of the course. This creates a nice foundation for them in regards to career confidence. Being able to make good career decisions will, hopefully, aid in them staying in their STEM majors and on their career paths.

While controlling for gender in the third hypothesis, the study examined whether the STEM career planning course had an influence on CDI and CTI scores. Due to sample size it was not possible to run hypothesis 3a, however, I examined hypothesis 3b which focused on the Summer/Fall 2013 cohort. Results of hypothesis 3b did not yield significance; the career planning course did not prove to have a significant influence on CDI and CTI scores when controlling for gender. It is important to note however that, although not significant, CTI scores for males were lower than scores for females. In addition, males had higher Career Orientation Total (COT) scores on the CDI. Hayes et al., (2012) studied career decision self efficacy with a sample of Jamaican youth and found that female youth reported higher self efficacy scores than males which is in line with the current study.

The fourth hypothesis was not able to be run, which stated that the career planning course had no influence on career thoughts when controlling for ethnicity for the (a) Fall 2012 cohort and the (b) Summer/Fall 2013 cohort. The study aimed to be able to discuss implications for students of color in STEM, however, due to sample size, I was not able to do so.

The results of hypotheses one through four show why the Fall 2012 cohort was separated from the Summer/Fall 2013 cohorts. Results showed that negative thoughts decreased for the Summer/Fall 2013 cohort but not for the Fall 2012 cohort. One of the most significant differences between the two cohorts was decidedness. The Fall 2012 cohort was still deciding on majors and their career plan, whereas the Summer/Fall 2013 cohort had an interest in STEM. They had narrowed their interests more than the Fall 2012 group. One might imply that decidedness positively influenced negative career thoughts which is why the Summer/Fall cohort had a decrease in negative career thoughts.

The ninth null hypothesis was: No differences exist in Career Thoughts Inventory scores between those in COMPASS and those in EXCEL. Results for the combined dependent variables indicated a significant difference in test scores between COMPASS and EXCEL for the pre and post test administration. The EXCEL group had significantly lower scores on each subscale of the Career Thoughts Inventory, indicating less negative career thoughts. The COMPASS and EXCEL programs are both comprised of students interested in STEM (science, technology, engineering and mathematics), however EXCEL students are more decided in their choice to pursue STEM majors and careers. EXCEL and COMPASS both complete the Career Thoughts Inventory but are in two separate programs. COMPASS students take the career planning course while EXCEL students do not take part in a career planning course. Because of the EXCEL cohort's decidedness in STEM, the CTI results are in line with the students being more decided about their career paths. Paivandy (2008) discussed that two factors influencing dysfunctional career thoughts include maximizing and rumination. Students place pressure on themselves when thinking about career decisions and worry about making the best decision. COMPASS students, in contrast with EXCEL students, are in the stage of indecision. Although they might have an interest in STEM, they are exploring their place in STEM and that process might cause these maximizing or ruminating thoughts. EXCEL students are comprised of students who are decided on their paths, thus lower CTI scores reflect that decisiveness. Lastly, mean scores from the CTI show that COMPASS students had similar scores to EXCEL students on their post scores. By the end of the career planning course, COMPASS students were on the same level as EXCEL students who came into their undergraduate career with significantly more information on STEM.

In summary, and to answer the first research question, the current study showed that the career planning course positively influenced vocational maturity, career decidedness and career thoughts. Career thoughts for COMPASS students increased to a similar level as the more decided and STEM knowledgeable EXCEL students which speaks volumes about the career planning course. The findings regarding vocational maturity and career decidedness also speak to the importance of career planning courses. Career planning courses aid students in exploring their abilities and how those abilities are connected to careers. By engaging these students in the exploration process and exposing them to STEM professionals, they were able to make better informed career decisions and that was reflected in their CDI scores.

Question 2

THe second question for discussion asks "What influence does the career planning course have on STEM major selection?". The fifth null hypothesis was: An undergraduate STEM career planning course has no influence on STEM major selection. Results showed a significant difference in the proportion of STEM majors identified in the current sample (72%) as compared to the value (43%) obtained in previous samples. The literature shows that approximately 43% of students change their STEM major before graduation (Seymour & Hewitt) or leave their STEM major within the first year of college (Watkins, 2013), I used this statistic for the expected proportion for the "Non-STEM" major group of students. Looking at these statistics, it is important to note the significance of what the current study found. The majority of the students in the current declared a STEM major after taking the career planning course. This finding also speaks to the importance of career development in the STEM crisis. The literature shows that career planning courses influence career thoughts, career decidedness and vocational maturity (Grier-Reed & Skaar, 2012; Heffner et al., 2006; Meyer-Griffith et al., 2009; Reese & Miller, 2006; Scott & Ciani, 2008; Thrift et al., 2012). The literature also shows that current STEM efforts lack career development components (Scott, 2012) and STEM retention proves difficult (Hayes et al., 2009; Wilson et al., 2012). STEM efforts could benefit from adding career development components in their interventions and this study supports that claim.

STEM interventions for emerging adults allow students to conduct various research with faculty and gain more knowledge in STEM disciplines (Lenaburg et al., 2012; Verma et al., 2011; Zhe et al., 2010). Some programs focus on increasing interest through STEM summer camps for outstanding or gifted students (Dieke et al., 2012). The goals of these programs include increasing confidence and interest in STEM majors. Despite these programs, percentages for students graduating with STEM degrees remains low (NAS, 2011). The current study was able to show the ability to engage students in a more foundational way and from a career development perspective.

Question 3

Lastly, the third discussion questions asks "What differences exist in either SAT scores, algebra math placement scores, and CDI/CTI scores between those that select a STEM major and those that do not select a STEM major?" and hypotheses 6-8 will be discussed in this section. The sixth null hypothesis of the current study stated that no differences exist in SAT scores between those that select a STEM major and those that do not. SAT scores included SAT Math, SAT Verbal and SAT Total scores and the analysis examined those in the Summer/Fall 2013 cohort. In regard to STEM major selection, students either chose a STEM major, did not choose a STEM major or chose no major at all. Although the majority of students declared a STEM Major, results did not indicate a significant difference in SAT scores between those that selected a STEM major and those that did not. No significant differences in SAT scores existed whether they chose STEM major, Non-STEM major or No Major Selection. It is also important to note that SAT Total score was highest, on average, for those did not select a major. No significant differences existed in SAT Verbal scores for those who declared a STEM major, Non-STEM Major or No Major Selection. The results show verbal score were highest for those who did not choose a major. Lastly, SAT Math scores were also highest for those who did not select a major, followed by those who chose a STEM Major. One requirement for students participating in COMPASS was an SAT Math score of 550-800. However, the results of this analysis shows no difference in SAT scores based on major selection and yields major implications for future STEM efforts.

The seventh null hypothesis was: No differences exist in Math Placement Scores between those that select a STEM major and those that do not. Unfortunately, sample size did not allow for this hypothesis to be analyzed. Hypothesis eight examined whether differences existed in Career Thoughts Inventory scores and Career Development Inventory scores between those that select a STEM major and those that do not. Results did not indicate a significant difference in CTI and CDI scores based on major selection. Therefore no significant different existed in career thoughts, career decidedness, and vocational maturity between those that chose a STEM major and those who did not choose a STEM major.

Summary

This study used quantitative research methods to investigate the role career development interventions plays in the STEM recruitment and retention efforts by examining career decidedness, career thoughts and vocational maturity. Furthermore, the study examined the influence of the career planning course by using demographics such as gender, ethnicity, SAT scores, and math placements scores. In addition, the study compared results from the EXCEL group to examine career thoughts. The hypotheses were examined by using repeated measures MANOVA, MANOVA, one way ANOVA and Chi Square Goodness of Fit test.

The analyses found that negative career thoughts decreased as a result of the career planning course for the Summer/Fall 2013 cohort. Vocational maturity and career decidedness, significantly increased for both the Fall 2012 and Summer/Fall 2013 cohorts. When controlling for gender, there was no significant difference in career thoughts for the Summer/Fall 2013 cohort, however Career Thoughts Inventory scores were lower, overall, for males in the class.

Results from the current study also found no statistically significant differences in SAT scores based on major selection. No significant differences existed in CDI and CTI scores based on major selection. Lastly, the class significantly influenced STEM major selection; the majority of the students who took the course declared a STEM major after taking the career planning course.

Many STEM efforts allow students to conduct various research projects with STEM faculty to gain more knowledge of STEM disciplines (Lenaburg et al., 2012; Verma, Dickerson & McKinney, 2011; Zhe et al., 2010). The STEM-focused career planning course in the current study allowed students to engage in similar activities and yielded an increase in vocational maturity and career decidedness. Career courses for undergraduate students prove to be successful. Many career courses succeed in aiding students to feel more confident about their abilities to make career decisions (Grier-Reed & Skaar, 2010: Scott & Ciani 2008). Vocational maturity and career decision making skills also improve as a result of these courses (Reese & Miller, 2006; Scott & Ciani, 2008). Although not STEM specific, the research also provides evidence of career courses that are specific to certain disciplines (Heffner, Macera & Cohen, 2006). The discipline specific career planning course in the current study proved influential on career thoughts, vocational maturity and career decidedness.

Limitations of the Study

A number of limitations exist for the current study. To begin with, this study lacks a comparison group. All of the students in this study received the intervention; therefore it is difficult to analyze the growth in the students participating in this study. Only one of my hypotheses allowed for a comparison group, examining career thoughts, between the COMPASS and EXCEL students. Ideally, a comparison group of students who had all the benefits of COMPASS without taking the career planning course would have been beneficial. Additionally, a larger sample size could have increased generalizability of the study. Some of the samples for the hypotheses were smaller than anticipated. My sixth hypothesis, examining differences in SAT scores between those that select STEM and those that do not, might have yielded significance if the sample size were larger. Means showed that SAT scores (total, math and verbal) were higher for those students who declared STEM. In addition, with a larger sample size, I would have been able to run the appropriate statistical analysis for my seventh hypothesis examining differences in Algebra Math Placement Scores. Means also showed higher scores for those in STEM. The eighth hypothesis that examined a difference in CTI and CDI scores between those that a select a STEM major and those that do not might have also yielded significance with a larger sample. Because the study was correlation, causality could not be account for. There may have been other variables that influenced the relationship.

Threats to internal validity such as maturation or history are important to keep in mind. Each student had various experiences that may have affected their vocational maturity, career thoughts or decidedness; therefore, the results of the study might not reflect the effectiveness of the intervention. In terms of history, students learning could have been affected by interruptions caused by the construction going on near the classroom where the class was being taught. Testing could also be a threat to internal validity as the results from the posttest might be due to the pretest. Students taking the assessments became familiar with the questions when taking the pre test and might have answered in a way they thought would increase their score when taking the post test.

The intervention was comprised of many components and it would be difficult to examine which part of the intervention had the most affect on the students, therefore, multiple treatment interference could cause a threat to external validity. In regards to data input, a number of individuals input the data over the course of the study. Although data input was reviewed for accuracy, human error could cause some scores to be inputted incorrectly in the database. Lastly, in terms of the John Henry Effect, I might have behaved in an unnatural way due to my knowledge of the research being done. I was the instructor of the course, the graduate assistant on the NSF grant and I analyzed the data for this dissertation.

Although limitations exist in the current study, it has many implications for career development and counselor educators and is a unique and important study. Incorporating career and STEM interventions provides a unique way of increasing STEM major selection and retention by examining career thoughts and career decidedness. By using various interventions such as career assessments, guest lecturers and experiential learning components, this type of career planning course could strongly influence the way other universities implement their courses and influent the STEM effort.

Implications for Practice

It is crucial for career counselors and school counselors to be involved in the STEM effort as this issue has a lot to do with career development. School counselors are leaders and advocates for their student and have a significant impact and influence on the academic achievement, decisions, and career or vocational goals of students (NOSCA, 2010). The American School Counselor Association (ASCA), (2005) explains that school counselors should use their leadership and advocacy positions to influence school systems to help in maximizing student potential. School counselor advocacy and leadership, in regard to STEM, begins with gaining knowledge of the STEM crisis and all populations involved including adolescents. Feller (2009) discusses that training in disciplines is particularly necessary for school counselors because they may not have experience in these subject areas or any interest in STEM-related careers.

Many school counselors may not have been exposed to areas in STEM in their graduate training and education, and it is important to train and educate these professionals in this area. If school counselors expanded their knowledge on STEM and working with students in STEM they could not only have a positive effect and influence on the STEM crisis, but they could also aid other professionals. In sharing their knowledge with other counselors and administrators, more professionals can be involved in this effort. School counselors can use their knowledge in STEM to aid students in STEM interests and influence schools to increase mathematics and science achievement of adolescents (Schmidt, Hardinge, & Rokutani, 2012).

School and career counselors should play a large role in the STEM effort. As trained professionals, school and career counselors can give insight into how career development influences the STEM effort. There are not many interventions that utilize school and career counselors, but it is important for them to be involved in these interventions and discussions. Whereas many interventions stress the importance of exposing students to STEM projects and research, counselors can provide a different perspective and bring their knowledge of career development to the table. This research clearly outlines the ways in which school and career counselors can play a role in the STEM effort by showing how students can explore their career interests.

Training educators to teach STEM students also proves necessary (Brown et al., 2011). Researchers asked administrators and teachers the following questions to assess whether they had basic knowledge of STEM education and their beliefs about STEM education:

1. What is STEM education?
2. How does your definition of STEM Education affect the curriculum and instruction in your class?
3. What do the "T" and "E" in STEM Education mean?
4. Is STEM Education broader than science, technology, engineering, and mathematics?
5. Is STEM Education important? If so, why? If not, why?
6. Is STEM Education for all students? If so, why? If not, why?
7. How much time do you talk with other teachers in the STEM disciplines about what you are doing in your class? Do you ever collaborate with other teachers by doing theme-based lessons/units or co-teaching?
8. Do you access information related to STEM Education to stay professionally developed? If so, where do you obtain this information? What is the typical information you access?

The results of the study showed that only half of the participants were able to answer the first question. The administrators were able to define STEM education less than half of the time with only ten out of the twenty two having a clear definition. The researchers noted that one administrator said they were "highly insulted to be expected to know this acronym," (p. 3). Additionally, 75% of the participants answered yes to the fifth question asking whether or not STEM education was important. Overall, results of the study showed the importance of educating teachers and administrators on STEM education.

Future research should also look at whether or not counselor educators are trained to work with STEM students. At a time where the STEM crisis is at the forefront of educational issues, it is appropriate for counselor educators to be involved in STEM efforts. If not, future efforts might find ways to educate counselor educators on the STEM crisis and train counselor educators to work with STEM students. Counselor education has not identified its role in the STEM crisis. A lack of research exists in regards to counselor education and the STEM crisis. Schmidt, Hardinge and Rokutani (2012) discussed the importance of involving school counselors in the STEM effort in order to create more of a focus on career development. When discussing recruitment strategies for women in STEM, Milgram (2011) stated that many schools use counselors, in the STEM effort, to help with recruitment. Counselors are given information on the various STEM programs offered at schools and encourage students to enter into these fields. Clearly, the usefulness and essentiality of career development and counselor education in the STEM effort has not yet been acknowledged. Because of the lack of involvement in STEM efforts, training could be beneficial for counselor educators (Feller, 2009). There is much to be said about a counselor educator teaching the STEM focused career planning course in the current study. Throughout the course much of the discussion is surrounded around career development concepts. Because of that emphasis, it is important to train counselor educators to teach these discipline focused career planning courses. The current study showed an increase in vocational maturity and career decidedness and a decrease in negative career thoughts. The majority of students also declared a STEM major after taking the course. Students were able to talk through issues of external conflict, decision making and career planning amongst other issues. Training counselor educators and counselor educator doctoral students to deliver content in career planning courses for STEM students is important for future initiatives.

Implications for Research

The STEM effort implements various programs to increase student interest in STEM majors and career and this adds to the innovative programs being implemented across the country. A gap exists in the research in regards to STEM-focused career courses and these ideas inform STEM professionals of ways to construct a career planning course. Allowing students the opportunity to intensely explore their STEM options names one important aspect in retaining students in STEM. A career planning and explorations course like the one in the current study allows students to get their questions answered and make more informed decisions about their career paths. This research is also the next step after bridge programs which focus on engaging high school students and community college students transitioning to universities. The research shows career courses yield successful results (Scott & Ciani, 2008), and engaging students in the STEM-focused career planning course in this study proved successful. Although each hypothesis did not yield significant results, the outcomes showed many implications for future research.

Discipline specific career planning courses exist, however, the literature doe not discuss STEM-focused career courses. General career courses provide students an overview of various careers they might be interested in. These courses expand student knowledge on various careers and provide insight into many options that might be available to them. These courses help students increase their belief in their ability to make career decisions and increases their vocational identity (Grier-Reed & Skaar, 2010; Reese & Miller, 2006; Scott & Ciani, 2008). Career decision making improves by taking these general career planning courses (Reese & Miller, 2006). Career planning courses focused on specific disciplines have also proven to be useful. These career specific courses allow students to get an in depth look into a specific area of study or discipline. Psychology focused career planning courses, in particular, yield significant results for students (Thomas & McDaniel, 2004). These courses influence students to make more concrete plans for themselves and feel more confident about their careers in psychology (Heffner, Macera, & Cohen, 2006). Their knowledge of career options for psychology increases along with their confidence to make career decisions (Thomas & McDaniel, 2004). Research shows that specific career planning courses are successful, but this study shows that STEM specific career planning courses are beneficial and important.

The current study showed the importance of including career development in STEM efforts. Many students who were not able to make career decisions or plan for their careers had more of a sense of direction in regard to their career paths by the end of the semester. Engaging students in STEM and exposing them to STEM professionals helps, but students also need to take the time to explore themselves. The career planning course in the current study allowed the students to explore their values, likes and dislikes, abilities, and see where they were on their career path. The course allowed students the space to discuss various obstacles that could impede their career journeys. By discussing topics such as decision making, career planning, and external conflict, the students were able to gain an understanding of career development and the steps it takes to make well informed career decisions. Taking the time to allow students to participate in these discussions helped them decide whether or not to major in STEM and allowed the students to access various resources to make the decision. The results of this study prove why this research should continue. This kind of STEM-focused career planning course could potentially be implemented at various universities to aid in helping students declare STEM majors and engaging them in STEM. Benbow's (2012) results from a longitudinal study showed that exposure to educational opportunities and educational interventions increased the chance of success in individuals engaged in STEM careers. Continuing to provide interventions for STEM students should continue far beyond COMPASS. Another idea for future research would be a longitudinal study examining retention for STEM students that took a career planning course versus those who did not take a career planning course. The current study focused on the "capture" aspect of the COMPASS program, however, examining retention would allow for more insight into effective STEM efforts.

Giving students a chance to expand their minds by letting them have an opportunity to converse with each other and present various ideas is important. By exchanging ideas it opens room for new learning to occur. New learning leads to meaningful learning. Jonassen (2004) describes five attributes of learning; (1) meaningful learning is active: manipulative/observant, (2) meaningful learning is constructive: articulate/reflective, (3) meaningful learning is intentional: reflective/regulatory, (4) meaningful learning is authentic: complex/contextualized, (5) meaningful learning is cooperative: collaborative/conversational. Combining these five attributes together can potentially yield meaningful learning from interactions. The STEM-focused career planning course in the current study utilizes all five of these attributes of learning. By completing various assessments, engaging in class discussions, reflecting on guest lectures, and participating in experiential learning labs, students have a chance to absorb the information discussed in class.

The current study's results showed that career planning courses have a positive influence on students. Examining STEM students in particular, the current study showed that the majority of the students had an increase in career decidedness and vocational maturity. By taking a STEM focused career planning course, students were able to explore themselves and the world of STEM. Research shows that billions of dollars are spent on STEM initiatives (Scott, 2012). The current study examined a much more economically viable STEM initiative that succeeded in capturing students. Creating a STEM career planning course, recruiting a doctoral student, and purchasing career assessments proves to be much less expensive than updating laboratory equipment and purchasing iPads for students.

Underrepresented Groups in STEM

Although not significant, results in this study showed that females had higher Career Thoughts Inventory (CTI) scores than males. The research shows that only 26% of women who graduate with a STEM degree hold employment in their field of study (NMSI, 2011). In 2009 approximately 20% of female freshman intended on declaring a STEM (Science, Technology, Engineering and Mathematics) major (NSF, 2012). Hayes et al. (2009) reported that less than half of the students who declared a STEM major graduated with a STEM degree. In 2009, there were a total of 927,600 bachelor degrees awarded to female undergraduate students.

Approximately 255,000 of those awarded were in Science and Engineering fields. According to the National Science Foundation (2012), 60,000 undergraduate females graduated with a degree in biological and agricultural sciences. Additionally, 1,768 females graduated with a degree in earth, atmospheric and oceanic sciences, 13,865 with a degree in mathematics and computer sciences, 7,451 in the physical sciences and 12,750 in engineering. Interestingly, 73,164 female undergraduate students graduated with a degree in psychology and 84,780 with a degree in social science (NSF, 2012). These statistics show that many female students choose social science major much more than STEM majors. Degrees awarded in social science was more than 45 times more than degrees awarded in earth and oceanic sciences. These statistics pose a questions worth investigating: Why are there so few females choosing STEM?

Linda Gottfredson's Theory of Circumscription, Compromise and Self-Creation describes how career choice develops at a young age and explains how sex-type effects career choice (Cochran et al., 2011; Gottfredson, 1981; Zunker, 2008). When thinking about what career to pursue, emerging adults think about whether they can see themselves in certain careers. If a female emerging adult sees women in the career she wants to pursue, she is more likely to commit to that career. On the contrary, if the female emerging adult does not see anyone who looks like her in the profession, she might reject that career. Future STEM efforts, specific to female emerging adults, could benefit from including discussions surrounding sex type. One reason for commitment anxiety in the current study might be connected to sex type; the female students might have had anxiety making career decisions because they were unsure whether they would fit into certain careers. Targeting sex type with female STEM students might cause more female students to commit to STEM majors, graduate with a STEM degree, and work in their field. According to Gottfredson's theory (Gottfredson, 1981), the same may hold true for students of color in STEM. Future STEM efforts could focus on recruiting more students of color into STEM programs keeping in mind sex type and role models who look like them. Xu (2008) examined the intentions of attrition between males and females in higher education and found that they did not differ in intention to leave academia. However, the study found that female faculty were more likely to change positions in academia due to lack of research support, opportunities for advancement and academic freedom. Future research could ensure support for women interested in STEM at a young age. Future research supporting students of color in STEM also proves to be important.

The Bayer Corporation (2012) examined issues, specific to women and students of color, in science education by surveying STEM Department Chairs at the top research universities. Findings showed a lack of STEM diversity programs across the top universities. Additionally, the researchers found that females students enrolled at higher rate than students of color and female students are more likely to graduate than students of color. Transferring from community college to university also poses as a challenge for women of color in STEM (Reyes, 2011). Women of color many times feel unwelcomed in their new environment at the university level and attribute this to their ethnicity and gender. In addition, they feel as though their professors and advisors do not believe they are prepared to continue a STEM major. Lastly, a key finding of this study was that the "weeding out" process in STEM introductory courses proved to do more harm than good for underrepresented students (Bayer Corporation, 2012). Although research shows underrepresentation of women and students of color in STEM, it is important to note that at the current study's institution, ethnic minorities are not underrepresented, however women are an underrepresented group.

SAT and Math Placement

Other results of the current study showed that SAT Math scores did not significantly influence STEM major selection. The COMPASS program recruits students with SAT Math scores of 550-800 with the hope that the students' math competency allow them to get through math courses easier. Because higher SAT Math scores did not significantly influence STEM major selection, future programs could try allowing students with lower scores to become a part of STEM efforts. Hall and colleagues (2011) surveyed both high school and college students and found interest in a specific field as the most important consideration for career choice. Students might have been proficient in math and science, but interest drove them to certain career fields. Instead of choosing students based on math scores, efforts could focus more on interest in STEM, support and math tutoring for STEM students. COMPASS students in the current study have access to math tutors and mentors who aid them in their math courses and provide support for them. Focusing on this aspect could increase the number of students in STEM and effect student retention.

Sampson and colleagues (2013) examined variable affecting readiness to benefit from career interventions. Personal characteristics (negative thoughts), personal circumstances (external barriers), limited knowledge of self, options and decision making, and prior experience with career interventions all contributed to low readiness to benefit from career interventions. The STEM-focused career planning course described in this study is unlike most other STEM efforts because it addresses these issues. The class discusses and addresses the above issues during the first part of the course, Who am I? Personal Assessment. Adding a career development component to STEM efforts could increase the chance of students being able to benefit from career interventions. In order to incorporate this component, counselor educators need to be included in the effort.

Additional Career Instruments

Taylor and Betz's (1981) Career Decision Making Self Efficacy (CDMSE) scale measures an individual's belief that he or she can make important career decisions (Grier, 2010; Scott & Ciani, 2008). This scale has both the standard version (50 items) and a short form (25 items). For the purposes of this study students will complete the standard version of the scale. Students rate their perceived effectiveness on a 5-point Likert scale (1=no confidence at all to 5 =complete confidence). It has subscales of self-appraisal, goal selection, problem solving, planning and occupational information that measure the five Career Choice Competencies of John O. Crites' Theory of Career Maturity.

Self-appraisal is having the ability for an individual to assess abilities and interests in regards to education and career. Occupational information assesses the ability to seek resources about college major and various careers. Goal selection is the ability to identify an appropriate career by matching one's personality to a career. Planning assesses an individual's ability to create a plan for a career. This involves searching for a job, interviewing and writing a resume. Problem solving is being able to think of alternatives and having a "plan b." One study found strong internal consistency amongst the subscales for pre and post test: self appraisal (pretest: α= .77; posttest: α=.71), occupational information (pretest: α=.75, posttest: α=.65), goal selection (pretest: α=.80, posttest: α=.80), planning (pretest: α=.77, posttest: α=.78) and problem solving (pretest: α=.80, posttest: α=.70) (Taylor & Betz, 1983). Previous studies using the short form reported reliability coefficients of .73, .78, .83, .81, and .75, respectively for the subscales (Betz et al., 1996) and a test–retest reliability of .83 (Betz & Taylor, 2001).

The Skills Confidence Inventory (SCI) is a 190-item inventory measuring self-efficacy or confidence in regards to the six Holland themes and 27 basic confidence dimensions. The entire inventory takes 20-25 minutes to administer. The SCI (Betz & Borgen, 2006) uses the six Holland themes: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C) to measure self-efficacy and confidence. The items on this assessment begin with phrases such as "Indicate your confidence in your ability to . . ." and those phrases are followed by activities like "Identify the chambers of the heart" (Investigative) or "Write a book report" (Artistic) (Turner, Betz, Edwards & Borgen, 2010). This assessment uses a 5-point Likert scale ranging from *no confidence at all* (1) to *complete confidence* (5). Values of coefficient alphas for the six scales in a sample of 160 college students ranged from .91 to .94 (Betz & Borgen, 2006).

The Career Decision Scale provides an estimate of career indecision as well as an outcome measure for determining the effects of interventions relevant to career choice or career development. The CDS is a short scale made up of 19 items. The Certainty scale measures the degree of certainty a student feels about decision about a college major or a career. The Indecision scale provides a measure of career indecision. The last item is an open-ended one and allows the student to clarify or offer further information about his or her career decision making. High Certainty Scale Score indicates certainty of choice of career and school major. Certainty scores at the 15^{th} percentile or less are significant, suggesting uncertainty about the selection of either career and/or major. High Indecision Scale indicates indecision with regard to career choice. Scores which equal or exceed the 85th percentile should be considered significant, indicating indecision (Osipow, 1987). Karimi (2007) reported an internal reliability (.80) for an Iranian sample.

Walker and Peterson (2012): The Occupational Alternatives Question (OAQ) as another instrument to use for career indecision. The OAQ consists of two questions; making a list of occupations one is considering and ranking the occupations by marking the first choice followed by the rest. The OAQ uses a scale of 1 to 4; 1 = first choice listed with no alternatives, 2 = first choice listed with alternatives, 3 = no first choice listed/only alternatives and 4 = neither a first choice nor alternatives are listed. Higher scores on this scale indicate more career indecision and test-retest reliability reported was .93 (Slaney, 1978).

The Career Decision Making Self Efficacy Scale, Skills Confidence Inventory, Career Decision Scale and Occupational Alternatives Questionnaire allow future research to utilize other effective assessments with students. Using these assessments would allow researchers to examine self efficacy, confidence, decision making and career alternatives. Exploring these constructs, in regards to STEM students, would allow more insight into the need of this population of students.

Conclusion

The analyses found that negative career thoughts decreased as a result of the career planning course (Summer/Fall 2013 cohort). Additionally, vocational maturity and career decidedness significantly increased for both cohorts. When controlling for gender, there was no significant difference in CTI and CDI scores for the Summer/Fall 2013 cohort. The analyses also found no statistically significant differences in SAT scores based on major selection. In addition, there was no statistically significant difference in CTI and CDI scores between STEM and Non-STEM majors. Lastly, the career planning course significantly influenced STEM major selection.

The results of the current study yielded many implication for future practice and research. Including counselor educators and school counselors in the STEM effort would help infuse career development into these initiatives. Continuing to research how career development and STEM initiatives work together allows the STEM effort to move forward and allows counselor educators to have a larger role in these efforts. Educating teachers about STEM education would also allow STEM students to be more effectively taught in their classes. The results of the study also showed important implications for researching underrepresented groups in STEM including women and students of color. STEM initiatives and efforts paired with career development have the potential to change student outcomes and increase recruitment and retention.

APPENDIX A: IRB APPROVAL

University of Central Florida

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Cynthia Y. Young** and Co-PIs: **Andrew P. Daire, Christopher Parkinson, Melissa D. Dagley, Michael Georgiopoulos**

Date: **April 13, 2012**

Dear Researcher:

On 4/13/2012, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review: Exempt Determination
Project Title: COMPASS (Convincing Outstanding-Math-Potential Admits to Succeed in STEM) Project Description
Investigator: Cynthia Y Young
IRB Number: SBE-12-08370
Funding Agency: National Science Foundation
Grant Title: COMPASS (Convincing Outstanding-Math-Potential Admits to Succeed in STEM) Project Description

Research ID: 1053127.

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 04/13/2012 05:00:51 PM EDT

Joanne Muratori

IRB Coordinator

APPENDIX B: CONSENT FORM

Consent Form

Print Name: ____

PID: ______________________________

I have read the "Informed Consent to Participate" and agree to allow Dr. Cynthia Young and Dr. Michael Georgiopoulos to use the information I provide to conduct their research titled '**COMPASS** (**C**onvincing **O**utstanding**-M**ath**-P**otential **A**dmits to **S**ucceed in **S**TEM)

I am 18 years or older □ ☐

Signature ____ Date _______________

If under 18, please have parent or guardian sign as well:

Signature ____ Date _______________

APPENDIX C: INFORMED CONSENT

INFORMED CONSENT TO PARTICIPATE

COMPASS (**C**onvincing **O**utstanding**-M**ath**-P**otential **A**dmits to **S**ucceed in **S**TEM)

A research project is being conducted at the University of Central Florida and funded by the National Science Foundation on student learning in Science, Technology, Engineering and Math (STEM) by **Dr. Cynthia Young (College of Sciences) and Dr. Michael Georgiopoulos (College of Engineering and Computer Science) and other investigators** at the University of Central Florida. The purpose of the study is to recruit students into STEM disciplines and then positively influence them to persist in STEM and eventually become successful scientists and engineers by emphasizing their math competitiveness and other important skills such as communication, teamwork, active involvement in research, and experiential learning.

You are being asked to take part in this study by completing surveys and questionnaires throughout the program. Some of the surveys will be sent to you as e-mails and will take approximately 15 minutes of your time. To determine changes in career readiness that occur, assessments will be tracked throughout the course. Other questionnaires will be completed during class by your instructor. These surveys will take approximately 15 minutes of class time. This will allow us to collect information for feedback within the program and relate it to content specific work. Please be aware that you are not required to participate in this research and you may discontinue your participation at any time without penalty. You may also omit any items on the questionnaires or surveys you prefer not to answer.

There are no risks associated with participation in this study. If you have further questions about your rights, information is available from the contact person listed at the end of this consent form. Your responses will be analyzed and reported by an external assessor to protect your privacy. If you agree to voluntarily participate in this research project as described, please indicate your agreement by completing and returning the attached consent form. Please retain this consent cover letter for you reference, and thank you for your participation in this research.

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