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Under Pressure: Analysis of An Undergraduate Intervention for STEM Students in Academic Decline

Dena Ford
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UNDER PRESSURE: ANALYSIS OF AN UNDERGRADUATE INTERVENTION FOR STEM STUDENTS IN ACADEMIC DECLINE

by

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Sociology in the College of Sciences at the University of Central Florida Orlando, Florida

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Major Professor: Fernando Rivera
ABSTRACT

Students who successfully persist in STEM majors often gain positive attention highlighting their preparation and ability, though far too often, students who struggle while persisting in the major go unnoticed. This research analyzed demographics and characteristics of select undergraduate STEM majors with a focus on biology and forensic science who were not reaching the major GPA benchmark requirements. These students were persisting while in academic decline. Characteristics of interest in this study include self-reported level of familial pressure to be in the major, anxiety level of current declared major, and course workload anxiety level as well as admit type (either first time in college student or transfer). Anxiety levels reported and admit types were analyzed separately. These data were collected through a Student Self-Assessment questionnaire, which incorporated Likert Scale questions. Students were asked to rate their current level of pressure and anxiety related to declared major. An intersectional approach was used to guide this research, along with student narrative responses. The analysis focused on self-reported academic characteristics by gender and race to explore the academic impact differences reported by the underrepresented population, which was defined as Hispanic, Black, and female. The results found that more females across the race variable were struggling to meet the minimum major GPA requirement, and female transfer students slightly outnumbered female first-time-in-college (FTIC) students across the race variable. Characteristics revealed that women in all races reported higher levels of anxiety than men, though male reports of anxiety fluctuated with White males reporting lower levels and Black males showing a much higher reporting rate on average.

Keywords: major switchers, pre-medicine, academic intervention
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CHAPTER ONE: INTRODUCTION

Career fields and college degrees related to STEM have been dominated by White males for decades (National Center for Educational Statistics [NCES], 2012). Current research shows, however, that medicine fields in STEM (e.g. biological sciences) are well represented by women, and that women tend to pursue STEM careers with a goal of helping people, or with a communal emphasis. For example, Diekman, Clark, Johnston, Brown, and Steinberg (2011) found that a positive social impact was influential in career decision-making among women. Their research specifically analyzed gender differences related to STEM-related career goals. However, similar research also shows that while there is a slight increase in the number of women pursuing STEM fields, Black and Hispanic women are continuing to fall behind (Thom, 2001; Morton & Parsons, 2018). Intersectional factors such as gender and race play a key role in research related to stratification in STEM education, and academic disparities (IES, 2019). Flores (2018) argues that research focusing on a gender-only perspective risks perpetuating a White perspective rather than acknowledging disparities that exists among people of color pursing STEM degrees. The literature in this subject is often ambiguous and tends to branch off on conclusions that may only cover one side or one aspect of the conventional problem.

An intersectional approach can offer a multi-dimensional perspective inclusive of holistic identities. For instance, African American male students are reported to have increased anxiety for conducting research when compared to their White counterparts (Byars-Winston et al, 2016). To address this issue institutional programming with a mission of increasing student success through high impact practices (e.g. research and experiential learning) has gained growing support by four-year institutions. Moreover, support programs that aid underrepresented students
in the pursuit of science and research are beginning to make a positive impact (National Research Council, 2005; Estrada-Hollenbeck et al., 2008). Previous literature highlights a leaky academic pipeline for minority students. This process is described as leaky because non-minority students have historically planned for an academic experience that provides a pipeline from the undergraduate experience to a graduate school experience, and then being launched into a career. Researchers argue that a minority-experienced leaky pipeline leads to much lower rates of degree completion when compared to non-minorities (DePass & Chubin, 2009). Programming that introduces and advocates for social influences such as research mentors within the academic science community has been proposed to aid underrepresented students excel in STEM (Kuh, 2013; Stanford et al., 2017). For instance, Drexel University implemented the STAR Scholars Program in the summer of 2003 that was initially only available to honors students, though as the higher education landscape began to evolve and an increase in student support services were needed, this restricted access program lifted the restriction to honors-only students and was made available to all students who met their GPA and SAT criterion. The STAR Program provided students with a faculty research mentor. This match was made through the Office of Undergraduate Research. Students in this program were required to commit 40 hours (full-time) per week of research-intensive projects for 10 weeks over the summer, which were monitored by their appointment faculty mentor. Over 900 students participated in the STAR Scholars Program, and a 96% retention rate was cited in comparison to the national retention rate average of 60% for undergraduate students pursuing a bachelor’s degree (Stanford et al., 2017). Federal agencies such as the National Institutes of Health (NIH) have begun to recognize the importance of such evidence-based programming and practices that specifically offer support for historically underrepresented populations to encourage training and persistence in research-related fields.
Another example of successful programming is the EXCEL program, which is a STEM mentoring program that is offered through the University of Central Florida and recruits underrepresented students that have been admitted to the University. EXCEL is a calculus-based mentoring program that utilizes faculty and staff from student support resources to connect students with meaningful social and academic influences within the STEM learning community to increase retention in STEM (retrieved from https://excel.ucf.edu/explore/ on 1/31/2020). The analysis of this dissertation will highlight discrepancies in STEM education preparation and will offer empirical conclusions that focus on struggles experienced by underrepresented students.

The importance of increasing the number of underrepresented groups in STEM has gained national attention. For instance, President Obama stressed the importance of a STEM emphasis in our economy and made this a national priority during his administration. The President also emphasized the need to increase the amount of STEM participants from underrepresented populations (Committee on STEM Education, National Science and Technology Council, 2013; President’s Council of Advisors on Science and Technology, 2012), particularly among Black, Hispanics, and American Indians (Pee et al, 2017). As such, this dissertation examined institutional reports with an emphasis on Black and Hispanic populations as well as females. Although there continues to be an interest in increasing underrepresented populations in STEM fields it is important to also pay attention to factors that interfere with STEM degree-completion. Students who declare STEM majors in college without previous access to math and science preparation (such as advanced courses in high school or college preparation programs) generally struggle with math and science grades at the college level. Previous studies show that students who earn low grades in major-related courses in college tend
to lose confidence in their ability to persist in the major, which can negatively influence students’
decision-making in the major. These studies found that women have a lower persistence rate in
the major when lower grades are earned (Rask & Tiefenthaler, 2008; Griffith, 2010). Women,
however, are less likely to acknowledge ability related to their success and more likely to blame
low ability to failure than men (Cabrerea et al, 2001). Utilizing an intersectional approach, that
considers both gender and race, would offer a different perspective. For instance, there is
increasing evidence that Asian, Black, and Hispanic females are more likely than White females
to experience external factors such as familial pressure to persist in a major. Previous research
highlights barriers that impact underrepresented students and prevent degree-completion, which
include working full-time, caring for children or extended family, and lack of access to financial
means (Espinosa, 2011; Lloyd & Eckhard, 2010; Reyes, 2011; Scott et al, 2009; Whalen &
Shelley, 2010). Research also suggests that lack of access or a gap in access to resources in fact
decreases the likelihood for success (Chen, 2009). For instance, high schools that predominately
serve underrepresented racial and ethnic students lack access to courses such as calculus and
physic, which are common STEM courses that prepare students for STEM disciplines in higher
education. A 2012 report showed that less than one-third of high schools in the U.S. that serve
predominately underrepresented racial and ethnic groups offered calculus and less than half
offered physics (Snyder & Dillow, 2013). This is evidence that underrepresented students have
very limited access to STEM preparation, which leads to incongruencies related to the national
priority earlier referenced. Underrepresented groups are encouraged to pursue STEM though
fundamental courses necessary to prepare these students for STEM-related majors are not
generally available in their high schools. In response, post-secondary institutions have begun to
establish career-development programming that aim to increase STEM efficacy and confidence
in efforts to retain underrepresented populations in STEM majors (Bouwma-Gearhart et al, 2014; Dagley et al, 2016; Schneider et al, 2015). However, little attention is paid to students who declare a STEM major and continue to decline in their math and science GPA. Institutions have a responsibility to support the academic development process of all students who enroll across all disciplines with the goal of degree attainment. Historically black colleges and universities (HBCU’s) provide an example of a supportive structure created to holistically help all students navigate through academic barriers such as a decline in GPA. HBCU’s account for 3% of all U.S. colleges and universities, which produce 27% of the Black student population with STEM degrees (U.S. Department of Education, 2016). Providing institutional support and navigational guidance is essential for underrepresented students in college, and students who enter STEM majors with no previous math or science coursework are at a greater risk of academic decline or may completely leave the major. The purpose of this study was to better understand the factors that contribute to academic decline through the analysis of demographics and characteristics of students who underwent an academic intervention program that was implemented to target students in select STEM majors. Narrative career counseling techniques were used to explore anxiety and pressure related to their STEM degree as well as alternative majors outside of STEM. Personal experiences and perspectives are restructured through the narrative counseling approach that allow students to reshape their stories instead of repeating their story, which is derived from social constructionism (Monk, 1997; Semmler & Williams, 2000; Winslade & Monk, 2007). The data analysis of this study contributes to previous research illustrating that 1. females are struggling at a higher rate on average than males (64% of this cohort are female and 36% are male), 2. Academic decline has a different impact by admit type in males (results show that 45% of the transfer male population in this cohort are Hispanic and 65% of the male FTIC
population are White males) and females (results show that 59% of the transfer female population in this cohort are Hispanic and 52% of the FTIC female population are White) 3. Anxiety and pressure related to their choice of major impacts underrepresented students different than White males. Results show that Black males in this population report the highest mean rating of family pressure at 4.4 compared to White males rating of 3.1, anxiety of major at 5.3 compared to White males at 4.7, and anxiety of course workload anxiety at 6.7 compared to White males at 5.5 on a scale of 1-10.

The following chapters will discuss demographic and characteristic variables related to previous research in STEM degree interests and explore how these important factors are associated with the current study. Results that contribute to current research associated with STEM academic achievement will also be explored. Finally, outcomes related to this study will be discussed and areas of concern related to future research will be addressed.
CHAPTER TWO: LITERATURE REVIEW

Access to STEM preparation

An unequal distribution of resources offers evidence of disparities in STEM field education when analyzing the availability of preparation courses in U.S. high schools. Past literature shows that less than one-third of the U.S. high schools who serve underrepresented populations offer calculus, and less than half offer physics (U.S. Department of Education, 2016). Other studies show that advanced math and science courses, such as calculus and physics, are critical in STEM field preparation (Kokkelenberg & Sinha, 2010). In fact, STEM retention programs in higher education have begun to place an emphasis on students in need of math support (Dagley et al, 2016). Admission type of those pursuing STEM degrees at the four-year institution is essential to consider due to historical claims that have shifted in focus over the past few decades. For instance, reports from the 1980’s began to emphasize a decline in freshmen pursuing STEM majors. Researchers found a significant decline in freshmen at both two-year and four-year institutions who chose majors in the mathematics and science disciplines (Astin, 1985; Astin & Astin, 1993; Astin et al, 1987; Astin et al, 1985; Dey et al, 1991). Whereas a decline in freshmen pursuing STEM was highlighted, Astin and Astin (1993) argued that interest from the smaller portion of STEM underrepresented students declined at high rates. More specifically, 37% of underrepresented students in engineering completed degrees in the field compared to 68% of White students, and 65% of underrepresented students in their freshman and junior years left the science and math disciplines compared to 37% of White students (Culotta, 1992; Morrison & Williams, 1993). Furthermore, with regards to underrepresented groups of students pursuing engineering degrees, switching out of STEM majors was noted for only a
small portion of this group’s decline in persistence, and that roughly half of these students dropped out of school all together (Campbell, 1993).

Gender stratification in STEM is another important dimension. For instance, a 2001 report showed that young women who were pursuing a degree from a four-year institution following high school were less likely to major in math and sciences (Huang & Brainard, 2001). According to a 2011 Department of Commerce report, the distribution of STEM majors between male and female differed significantly with males in STEM declared engineering degrees at more than 2 times the rate of females (Beede et al, 2011). Elaine Seymour (2001) found through an ethnographic study of students from seven different Colorado institutions that discontent feelings about high school experiences and lack of sufficient STEM preparation lead groups of women and other underrepresented groups of students to switch to non-STEM majors. Females were cited to demonstrate ability with 60% of those enrolled in math and physics had an overall higher high school GPA average then males, though female persistence rates in mathematics and engineering majors declined significantly (Seymour, 2001).
Demographic Variables

Admission Type and STEM:

In more recent years, community colleges have offered women in STEM the opportunity to connect with inspiring faculty and advising that offers professional mentors and peer support. Community colleges play a crucial role in preparing underrepresented students for STEM-focused majors, and the National Science Foundation acknowledged this role in 2012. Self-concept and self-efficacy of community college transfer students who plan to pursue STEM majors has gained more research attention in efforts to understand social capital related to their decision of major (Starobin & Laanan, 2005; Johnson et al, 2012). Recent research also credits the pathway and role that community colleges play through their open-access policies which offer pre-STEM preparation for underrepresented students who want to pursue a bachelor’s degree (Starobin & Laanan, 2005; Starobin & Laanan, 2008; National Science Foundation [NSF], 2012; Hagedorn & Purnamassari, 2012). This shift in STEM focus by admit type may be explained by increased access to community college. Huang and Brainard (2001) found that females who had been advised by high school teachers and guidance counselors on college majors were less likely to major in science if attending a four-year institution. Influences of community college transfer students, however, were examined by Myers, et al (2015), and they found that demographics such as race and characteristics (e.g., first generation in their family to go to college) were significant influences on their decision to pursue a STEM major. Students who transfer to a four-year institution have historically encountered criticism by others with perceptions of lacking adequate education to prepare for the university or faced a type of transfer student stigma that creates critical barriers (Alexander et al, 2009; Berger & Malaney, 2003; Jackson & Laanan, 2011; Reyes, 2011). The literature reviews suggest that students who transfer
to four-year institutions after successful completion of STEM preparation courses may feel more prepared than FTIC students who have only completed high school-level math and science coursework. Intersectionality can highlight gender and race shifts by admit type.

Gender and STEM:

Males are more likely to show interest in STEM fields that are more math-intensive than females, and females represent only 25% of the STEM workforce (Babco, 2000; Su et al, 2009). Chen and Thomas (2009) found that females are less likely to pick and persist in a STEM major than males. Although females experience more stress across all disciplines than males (Barbosa-Leiker et al, 2013; Hall et al, 2006) previous research suggests that women in STEM perceive more stress due to discriminatory behaviors and stereotypes toward their perceived abilities (Steele & Aronson, 1995; Rice et al, 2015). Positive associations were linked between gender-based rejection and concerns about declaring a STEM major (Ahlqvist et al, 2013). Researchers found that these concerns further predicted decline in performance in STEM classes.

Race and STEM:

Historical research shows that two-thirds of Hispanic students and half of Black student populations in declared STEM majors left their major altogether compared to 27% of White students who left their STEM majors (Astin & Astin, 1993). Black and Hispanic students have significantly lower rates of mathematics and sciences preparation than White students (Tyson et al, 2007). Additionally, Griffith (2010) found that the lower rates of STEM persistence by females and minorities reverses when controlling for institutional characteristics (e.g. research-focused versus undergraduate education-focuses). Researchers argue that retention efforts have been unsuccessful due to their targeting efforts toward stigmatized groups such as underrepresented students through institutional efforts rather than supporting and strengthening
the undergraduate learning experience of all students (Seymour & Hewitt, 1997; Seymour, 2001). Research suggests that the lower rates of Black and Hispanic students in STEM is indicative of a gap in resources, more specifically lack of access to preparation courses and mentors in the field during their high school experiences.

Pressure and Anxiety Variables

Understanding background characteristics such as familial influences and levels of anxiety related to the declared major is important when analyzing patterns associated with persistence in STEM (Astin, 1993; Weidman, 1989; Pascarella & Terenzini, 1991; Pascarella & Terenzini, 2005). These influences create the individual narrative and shape the college experience. The intersectional approach provides a magnified analysis of pressure and anxiety reported by underrepresented groups of students.

Familial Pressure:

Students who experience external pressure to complete their degree have trouble taking ownership in their academic assignments and tend to work in the state of mind that focuses simply on completing the assignment rather than how the assignment fits into the overall pathway to the desired career. Their focus becomes clouded by others’ expectations, and warning signs of their experienced pressure can begin to show through below average grades earned within the declared major. Intersectionality can help to explain the differences in experience. Women of color, for instance, experience familial and cultural pressure different than White women, and men of color experience the same pressure different from women and White males (Lease, 2004). Research shows that students who are underrepresented also struggle with decision-making and lack a general understanding of how to seek help outside of their immediate
social support (Lease, 2004). In fact, a previous study revealed that pride was the reason students reported for refusing to seek help through campus resources (Palmer et al, 2009).

Anxiety Related to Major and Course Workload:

Assessing anxiety levels related to course workload and current declared major is necessary in understanding the differences in narratives of students in academic decline. Anxiety is a common factor that impacts academic performance reported by students (American College Health Association, 2014). Student academic anxiety is defined as experiences, including thoughts and feelings, that lead to avoidance or apprehension while students are studying for assignments or exams, which influences academic behaviors (Khoshlessan & Das, 2019). Students in the current study have earned below average grades in their major-specific courses and seemingly are not prepared to earn a degree in the field, and more specifically they are not meeting the major GPA requirement. These students are faced with a financial dilemma to re-take courses in many cases or to take additional courses that may not have been required if preparation courses were completed in high school. Previous studies show that an increase in courses needed for graduation (that were not previously planned) leads to an increase in financial stress because those under financial aid may be close to, or may reach, the maximum amount in financial aid allowed (Palmer et al, 2009). Financial stress often leads to the need to work more hours outside of schoolwork to pay for living expenses as well as books and tuition. Students in this study commonly reported the need to increase their work hours to pay for school, which reduces the number of hours dedicated to studying or completing homework. Students commonly report failing exams due to not having time to study because of their long work hours.
CHAPTER THREE: THEORY

Intersectionality was created through critical race theory along with Black feminist social movements to expose inequality, violence against women, and institutional disparities against women (Crenshaw, 1991; Collins, 2000; Collins, 2000). The intersectional approach plays a key role in how experiences are framed in academic and professional development when considering race and gender as mutually important factors. This theoretical approach claims that gender, race, and ethnicity cannot be separate dimensions when analyzing social stratification, and that one alone does not define inferences to inequality. Differential power struggles and social inequalities can impact interpersonal relationships when the dimensions of race, class, and gender are examined. When intersecting identities are influenced by these mutual factors of gender and race, social identities and narratives will vary (Cho et al, 2013; Choo & Ferree, 2010; Collins, 2000; Crenshaw, 1989; Glenn, 1999; Hancock, 2007; King, 1988; Nash, 2010; Walby, 2007; Zinn & Dill, 1996).

Intersectionality provides a lens to view inequality through a prism, or as an issue that has been constructed as a normal social process though institutions of power to marginalize underprivileged groups, and these social processes continue to be overlooked (Crenshaw, 2011). These experiences are not tied to groups by gender only or by race (or ethnicity) only, and rather they are experienced by groups and communities that have been marginalized by the privileged. Crenshaw argues that our identities are overlapping with gender, sex, and race. This lens provides an avenue to uncover and examine such norms that continue to oppress underrepresented groups of people. Marginalized communities are able to incorporate their experiences through narratives that educate and empower youths and roots from neighboring
communities to deviate from the social norms that are oppressive in nature. New experiences and narratives can challenge social norms that accentuate inequality. The Black Lives Matter Movement, created following the death of Trayvon Martin, is an example of how marginalized communities have used their narratives individually and collectively to expose discriminatory social norms (e.g., a black male walking alone at night does not equate to criminal activity). Trayvon Martin was an unarmed male teenager who was killed by George Zimmerman, a neighborhood watch volunteer, due to a suspicion of criminal activity. This prism highlights areas of unequal access to resources and implicit as well as explicit discriminatory practices. Viewing social problems through this prism offers alternatives that can disrupt and breakdown such oppressive social norms. Narratives magnify experiences that align with identity factors and include many layers that are not exclusive to gender and race or ethnicity. Previous research discusses a multiple jeopardy effect (King, 1988), which challenges the idea that discriminatory actions are based on a single factor. For instance, Black/African American males represent the smallest population in science fields when compared to Black/African American females, and when compared to Hispanic and Latinx males and females (Bidwell, 2015). Research shows that African American males tend to feel out of place and question their reasons for pursuing science, which can lead to feelings of vulnerability and isolation within the field (Emdin, 2001; Harper, 2010). Further research shows that the strength of African American males’ academic identity decreased the longer they remain in a university (Estrada et al, 2011).

Researchers in higher education have begun to embrace an intersectionality approach to better understand how student identities are shaped through systems of power, or through institutions. In fact, instructors are incorporating this theory into curriculums in efforts to raise awareness in the classroom (Harris & Patton, 2019; Wijeyesinghe & Jones, 2014). The Black
Lives Matter movement has adopted the intersectional approach in their framework to support pedagogies that incorporate teaching students the historical aspects of marginalized groups. It is their hope and mission to support these endeavors that will lead to underrepresented students thriving in the classroom through acceptance of their identity and culture that include historical aspects of inequality (Castillo-Montoya et al, 2019).

Aspects of educational struggles cannot be holistically understood without incorporating student narratives. Anxiety and pressure associated with these experiences can impact students in a number of ways, though a lifetime of power struggles and social inequalities will influence academic decision-making and alter pathways to success. Whereas the STEM fields seriously lack an equal distribution by race, research shows that African-Americans and Hispanics are underrepresented in these fields. However, upon closer analysis of NSF data, women are underrepresented in technology and engineering, though overrepresented in medical fields (2017). Intersectionality explores how oppression can be created through a system of unequal power that works to create inequality (Cole, 2009; Collins, 1990; Crenshaw, 1991; Schulz & Mullings, 2006).

Analysis of the population in this study began by looking at the distribution of race and gender in STEM-related majors to explore stratification in reported academic experiences related to pressure and anxiety. Providing additional empirical research that contributes to raising awareness of equality while paying attention to characteristics in underrepresented populations pursuing STEM is important on a macro level as well as raising awareness with faculty and staff at the micro level. Ultimately, raising awareness will lead to greater access to resources and will increase successful degree completion and overall graduation rates at the institution. Underrepresented populations include African-Americans and Hispanics as well as women.
(NCSES, 2017). However, rather than analyzing results of responses by race alone, the current study argues the importance of an intersectional approach, or the analysis of gender disparities within race, when analyzing results. Considering gender only across all races and undergraduate degrees earned, the National Center for Education Statistics (NCES) shows that females earned more bachelor’s degrees than males (2014). While women are earning degrees at a higher percentage than men, the NCES statistic does not represent the underlying disparities in our underrepresented populations of color. Vocational theories have focused on gender differences related to career interests, though little emphasis is placed on underrepresented populations of color (Su et al, 2009). Influences that impact academic and career decisions can be better understood through an intersectional approach.

The current study also analyzed both characteristics and demographics of students in academic decline in efforts to determine population patterns in academic decisions paired with narrative influences that have been factors in their decline. Characteristics include rated levels of familial pressure, anxiety of current major choice, course workload anxiety, and self-reported admission type (either FTIC or transfer). Demographics specifically include participants’ race and gender for an intersectional approach to the analysis. Students who displayed signs of incongruencies in the academic intervention were encouraged to explore influences that lead to their current choice of major and related academic decisions in college. Signs of incongruencies occurred when academic interests and values did not align with academic choices and career goals (e.g., avoiding undergraduate math and chemistry courses and planning to go to medical school).
CHAPTER FOUR: METHODOLOGY

The lead researcher along with other colleagues that included faculty and advisors, recognized an increasing number of undergraduate students pursuing majors in the College of Sciences at the University of Central Florida who were not meeting the major GPA requirement for graduation. Recognition of these GPA deficiencies were occurring while students were filing their intent to graduate forms. The deficiencies were acknowledged in advising sessions and through emails. Students were encouraged to complete a final review of their degree audit which stated whether or not requirements were satisfied. It was generally at this point when students recognized that there would be a delay in graduation due to this deficiency. These students, however, were in good academic standing by University standards. Good academic standing by University standards is measured by an average of 2.0 or higher in all grades earned only at this institution. Due to their good academic standing status, these students did not receive outreach or intervention efforts through the University, thus these students were expected to navigate through university resources as needed. Roadblocks in their education, however, arose when applying for graduation, as these students were informed that although all credit requirements were met, the major GPA was not meeting minimum requirements for graduation in their major, and a degree would not be awarded. As a result of these roadblocks, academic intervention efforts were planned and facilitated by the lead researcher and supported through college leadership. Implementation began at the start of fall 2013. This study focused on biology and forensic science because these majors cannot be completed on-line and these two majors reported the highest number of STEM students in academic decline within the College of Sciences. For the purposes of this study, all students were actively enrolled in the major, and
academic decline means that the student is not recognized by the University in an academic probationary status, though the student’s major-related grades are contributing to a decline in their cumulative GPA. This study focused on characteristics related to the cohort in academic decline with an intersectional approach.

**Career Counseling with Narrative Techniques**

The academic intervention framework in this study had an emphasis in narrative career counseling techniques. The narrative technique offers students a platform to holistically incorporate previous and current influences of both culture and gender differences that will likely continue to impact future decision-making processes. A life design approach to narrative counseling techniques centers future planning around current social support and cultural norms and includes six essential steps. Clients first identify issues and then develop goals. Clients are then encouraged to explore meaningful life experiences that tell their story, and the third step involves guidance to help clients view their story from alternative perspectives. Reframing the problem or areas of concern by the client following their understanding of alternative perspectives (based on personal reflection of the previous step) is the fourth step. The fifth step includes identification of concrete steps that clients can take to continue in their new personal and professional development. The final step involves either short term or long term follow up sessions (depending on needs of the client) with the counselor to report back personal progress (Savickas, 2009). The academic intervention in this study incorporated components of each step with follow up sessions only available in the current term of the students’ initial session due to interns’ availability. Students were encouraged to follow up with their professional academic advisor should they need follow up sessions in the future. Previous research shows that this
narrative counseling approach is especially beneficial when working with underrepresented and at-risk populations (Clark et al, 2004; Young et al, 2007). These populations are able to explore personal narratives that align with their interests and values while acknowledging cultural differences and unproductive decision-making patterns. Additionally, pursuit of career counseling is generally the result of a career path that is either not going as planned, or that has changed when new information is added, such as new opportunities. Through career counseling individuals can make decisions based on measurable goals, proactive planning, and personal values (Cochran, 1994). However, through their narrative discussions, students are able to explore past decision-making patterns that may have impacted their current academic status. Previous literature shows a link between external locus of control (e.g. pressure from family to pursue a STEM major) and a decline in academic performance. A previous study also showed that students with an external locus of control focus were more likely to earn below average grades and ultimately leave college before earning a degree (Gifford et al, 2006). Literature also shows that underrepresented populations were more likely to have an external locus of control (Lease, 2004). Narrative techniques in the academic intervention setting offer a safe space to explore culturally sensitive experiences and incorporate individualistic stories created through family, culture, language, and social interactions, and emerged from social constructionism (Winslade & Monk, 2007). Intersectional factors such as race and gender play a key role when using narrative techniques. This technique was found to be especially useful with this cohort. Students in the population represented a wide variety of nationalities, and their narratives significantly reflected their cultural differences.

The narrative technique is strength-based, allowing students to acknowledge both strengths and limitations based on past experiences, and is used as brief treatment in career
counseling, which makes it ideal for a college career counseling intervention program. Narrative counseling techniques provide a supportive space for clients to explore their successes while addressing their mental health and wellness needs. Narrative techniques also offer students guidance to construct his or her pathway by self-identifying life themes, cultural experiences, influences, and decision-making cycles (including indecisions) (Brott, 2004; Savickas et al, 2009). These self-identified factors are subjective and are personal perspectives based on experiential learning (Cochran, 1994). Through this framework, students are able to visually and verbally construct the reality of their current life roles and responsibilities outside of academics that inevitably impact their academic schedule and livelihood. Intersectional influences play a key role in analyzing narrative reports. The intersectional approach provides an analysis of characteristics specific to reported familial pressure and anxiety associated with current major and course workload by race and gender to determine if race and gender have an impact on the levels of student reporting. Students may select courses in college based on career interests and availability (e.g. hours available outside of work schedule) though may also neglect to allot time for homework, studying, family, and social obligations, thus overextending their obligations, or commitments. Narrative counseling techniques provide students in academic decline the space and guidance to tell their story while re-considering future decision-making techniques.

The academic intervention sessions were individual sessions and scheduled for one hour each. Completion of the intervention program was defined by participation in and completion of two sessions with a mental health counselor intern who previously received career counseling training as part of the graduate program curriculum. Informed consent was provided at the start of the first session. Students had an opportunity to decline the two-session academic intervention if they agreed to schedule a comprehensive advising session with their college advisor. The
intervention took place over the course of an academic term, and conclusion of the two sessions were required prior to the end of the outreach term. Students in this cohort were contacted through their University email address informing them of the major GPA deficiency with instructions on how to schedule their first session, and then were encouraged to schedule their second session within two weeks following the initial session. Aggregate data included student responses from multiple fall and spring terms between fall 2013 and fall 2015. Continuous enrollment was not required to participate though an active student status was required, and eligibility was based on the declared major being below minimum major GPA requirement, and completion of 6 credit hours in the major (toward the major GPA). The major GPA minimum requirement for those in the biology major was a 2.0 and included only major related courses completed at this institution. For instance, transfer students who completed major related courses at the two-year college level in a smaller class size and earned A and B grades would not have those grades calculated into their major GPA because they were not earned at this institution. The forensic science major GPA minimum requirement was a 2.5 and did include qualifying major related transfer grades. The 6 credit hours criterion was selected as a minimum in the selection process because rather than basing the risk factor on one course, the interest in research was to see completion of at least two courses in the major prior to recruiting them into an academic intervention. Courses in these two majors are often more than 3 credit hours, and GPA’s can steadily and quickly decline as they reach courses that are between 4 and 5 credit hours, placing the student at a higher risk of academic probation at the institution.

Whereas some students completed the intervention programming more than once, only their responses from the initial student self-assessment were included as this study focused on gathering responses from students in academic decline. Following the intervention, student
academic standing in this cohort was tracked through spring 2018.

**Intervention Objectives**

Intervention objectives were planned with a group of advisors, faculty, and graduate interns prior to the academic intervention implementation. Student GPA reports specific to undergraduate majors that reside within the College of Sciences were requested through institutional records. The volume of students in academic decline determined that the intervention would only focus on those pursuing biology and forensic science. Resources such as advisors, interns, and office space were limited. Students who were active in these majors completed courses on the main campus, thus attending two on-campus sessions would not impede their on-campus schedule or academic obligations. The initial objective was to identify those students in these majors who were on academic probation and who had received University outreach. These students were eliminated from the initial outreach list. This study then identified those in the population who had completed at least 6 credits in the major (or two science-related courses). Intervention efforts were targeted toward this cohort. Tangible evidence such as major GPA reports identifying students not meeting the major GPA requirement and who were in academic decline was then available to present to leadership highlighting a significant roadblock to student success and degree attainment. Through the support of leadership, interns from mental health counseling graduate programs who were focused on working with college students, and who had career counseling training were interviewed and recruited. The interns were provided with private office space within the advising area of the college. Interns were under contract for fall and spring terms only. They were required by their graduate program to have a designated number of individual face-to-face sessions each term. The lead researcher’s licensed mental
health counselor (LMHC) credential and national counseling credential (NCC) in mental health counseling met the requirement to supervise these interns for credit toward earning their master’s degree.

Once the cohort was identified for the academic intervention their advising office sent outreach emails. The email explained their risk in the major, and informed students of the required two session meetings to help keep them on track toward graduation. The email also explained that a hold had been placed on their account blocking future enrollment, and that completion of the two sessions would remove the mandatory advising hold.

Two sessions with a mental health counselor intern were required. Students who received the email outreach were instructed to call their advising office and schedule their first session. Academic advisors who were consulted suggested adding the college’s web link, campus location, office telephone number, and email address to offer students multiple modalities to ask questions and help them better understand the reason for the email and two sessions. Staff and faculty at the institution were mandated to follow the Family Educational Rights and Privacy Act (a.k.a. FERPA), which prohibits the verbal or written release of identifiable information to anyone other than the student (U.S. Department of Education, 1974). When communicating with the student on the phone or electronically, staff and faculty can provide policy information or guide the student through their student portal on-line to find academic information, though specific information relating to the student’s academics (i.e. grades or GPA) cannot be provided since identity cannot be confirmed.

Although an enrollment hold had been placed on the student account, it was important that students did not further associate this intervention with the notion of punishment. It was for this reason that researchers in this study were sensitive to the verbiage used in the initial email.
Students were told that although these two sessions were mandated, exploration experts, or career counselor interns, would be available to connect them with additional resources to help keep them on track toward graduation. Ultimately, the purpose of the message was to remind students of their end goal, which was to graduate.

Positive intervention outcomes were not measured solely by retention within the college or the major, rather retention at the University was considered a positive outcome of the intervention. The purpose of the intervention was not to encourage students to switch majors, although those who were identified as having values and interests that were not congruent with their academic and personal goals were encouraged to research alternative options that would provide opportunities in the same career field of interest. A reduction in course load was also a positive outcome, which allowed the student to place more focus and structured study time toward a lighter class schedule. Course load reduction, however, was not tracked following the intervention, and students reported in session whether or not they planned to reduce their load the following term. They were able to have meaningful conversations in session about obligations and course load stressors that may attribute to over-committing patterns of decision-making. A theoretical approach such as intersectionality that explores how identities of underrepresented groups of students are shaped through systems or institution of power that provides a platform for individual narratives may offer a source of empowerment.

Graduate mental health counselor interns were selected based on their interest and experience in working with college student development. An initial student self-assessment was created to collect data from participants with the assistance of the graduate interns. Prior to their first session with the intern, students in this cohort were given the assessment to complete when they arrived for their scheduled appointment. These sessions were considered career counseling
sessions and thus the decision was made to not collect data provided within the session, which would violate the confidentiality agreement. The student self-assessment did include identifiable information, as the assessment was used internally to release the student account holds following completion of the second session. However, the student identifiable information was removed and replaced with a numbering system when the data was imported into SPSS to eliminate identifiable student information. Upon completion of the student self-assessment, the intern would then greet the student with a relaxed and supportive demeanor to provide a positive environment for the student. This initial greeting was important, as the lead researcher found through advisor feedback that students who are mandated to meet with their college advisors or administrators often feared a negative outcome. Mental health counselor interns have extensive training in initial greetings that offer a supportive atmosphere fostering personal growth. The interns began the initial session with written consent that outlined confidentiality. Students were given the opportunity to decline the sessions and instead connect with their advisor in this initial session. Responses from the student self-assessment were used to begin the initial conversation to set personal goals that align with their academic interests and values. Narratives explored patterns and gave students the platform to reshape decision-making that impacts personal and professional growth. Intersectional factors that would continue to impact these decisions are intertwined and students were encouraged to acknowledge influences that may continue to have adverse and marginalized outcomes while embracing new opportunities for interpersonal relationships that align with personal values. Although two sessions were required, interns offered additional optional sessions as needed. The first session allowed the student to explore academic barriers through a verbal narrative process with the intern while setting initial short-term measurable goals. This was taught as a practical skill that could be transferred into other
areas of life. Homework was often provided to connect students to campus resources or to explore other areas of interest if the student reported not wanting to pursue the major. The second session allowed students to report back on their findings, which provided them with a purpose of personal accountability. Both short-term and long-term goals were re-evaluated in the second session along with any new information that the student explored related to their interests and study habits in between sessions.

Based on the literature review and the scope of the academic intervention the following research questions were analyzed:

RQ1. Are women more likely to declare medicine degrees than men?

RQ2. Are there any differences between race and admission type?

RQ2a. Are there any differences between race and career goals, specifically STEM career goals?

RQ2b. Are women more likely to pursue a career in medicine than males?

RQ3. What differences exist between Workload Anxiety, Anxiety of Major, Familial Pressure, Admit Type, and Gender and Race? In detail:

3a. Is being a Black male the best predictor of reported family pressure with major choice when analyzing characteristics of STEM students in academic decline?

3b. Is being a Black male the best predictor of anxiety reported with major choice when analyzing characteristics of STEM students in academic decline?

3c. Is being a Black male the best predictor of anxiety reported with course workload when analyzing characteristics of STEM students in academic decline?

Data were collected from 289 students between fall 2013 and fall 2015 pursuing undergraduate degrees in select majors and highlighted the biology and forensic science STEM
majors at a large southeastern research university. These data were collected from students who were in academic decline and completed an academic intervention program. The interest in collecting these data was focused in the ability to analyze demographics and characteristics of STEM students in academic decline. Students who were declared in the biology and forensic science majors though below the major GPA minimum requirements, and who were not on academic probation were recruited for this intervention.

Variables and Intervention Demographics

Independent Variables: *Gender* was measured by creating a dummy variable in SPSS and since female was the reference group, females were coded as 1 and males were coded as 0. *Race* data were re-coded into a new variable with White coded as 1, Hispanic coded as 2, Black coded as 3, and Other which included Asian, Multi-Racial, Non-resident Alien, American Indian/Alaskan Native, and Not Specified was coded as 4. *Career Goal* responses were based on common professional school-related career fields. This variable was re-coded into a separate variable to include STEM Career Goals responses as well as the undetermined responses, which were labeled as follows: 1=medicine, 2=lab research, 3=field research, 4=government agencies, 5=environmental conservation, 6=zoology (not vet), 7=crime scene investigation, 8=responses indicating unsure, and 9=no response. A separate dummy variable was then created with medicine as 1 and all other career goals as 0 to determine if more females pursue a medicine careers than males. Finally, in order to determine if there is a difference between races and pursuit of a STEM career a dummy variable was created with 1 as STEM-related career goals and 0 as all other goals. A variable was created for Biology and Forensic Science majors with Biology coded as 1, Forensic Science coded as 2, and all other majors coded as 3.
Dependent Variables: The final stage included multi-variate analysis, which began with a Two-way ANOVA between groups analysis of variance models. These models were created in the next phase to analyze impacts of race and gender on self-reported levels of 1. course workload anxiety, 2. anxiety of major, 3. familial pressure, 4. Admit type. The Admission Type variable incorporated First Time In College, or FTIC (students who earned less than 12 semester credit hours of postsecondary credits following high school graduation) and transfer (students who earned 12 semester credit hours or more at a postsecondary institution post high school graduation) students. FTIC was used as the reference group due to a current focus that the University has placed on this cohort and their time-to-completion. Finally, Linear Regression analysis included Black male as a predictor, admit type and first-generation college student were also added as independent variable to all three models: 1. course workload anxiety, 2. anxiety of major, 3. familial pressure. A Black male variable was created using a product term produced by combining the two dummy variables of male and Black. Both interaction dummy variables were created as dummy variables in order to create the Black male product term.

The student self-assessment questionnaire, which was administered at the start of the first session, consisted of 29 questions. Students were asked to rate the following statements on a Likert scale of 1-10 with 1 meaning ‘not at all’ and 10 meaning ‘absolutely’: I am feeling overwhelmed or anxious with my course workload; I am feeling overwhelmed or anxious about my major, or the thought of changing your major; and I experience family pressure related to my choice of major or career. Their responses were collected with non-identifiable information and were added as three separate variables in SPSS.
Analytic Plan

The first step in this analytical plan was to analyze gender frequencies separated by female and male participants to determine if more females pursuing select STEM majors were in decline than males. This evaluation would help to determine if there was a need to further explore gender stratification in STEM-focused interventions for students in academic decline. The purpose of this step was to analyze frequencies of gender by race to further explore demographics associated with the underrepresented groups in this study, which were Black and Hispanic populations, as well as an analysis of the White population comparison group.

Declared major was also analyzed with biology (56%) and forensic science (34%) and other (10%) listed in the major variable. The first research question addressed was “Are women more likely to declare medicine-related degrees than men?”

Research Question 2

To answer this question analyses were done by admit type, race, and gender using cross tabulations to determine if academic decline varied between STEM-focused students who transferred into the University and students who were admitted as first time in college. Cross tabulations were also generated to analyze career goal characteristics to further explore if career decision-making patterns varied by race and gender. Analysis also explored medicine career goals by gender to determine if women in this cohort were more likely to pursue a career in medicine than men. The next research question addressed was “Are there any differences between race, gender, admission type, and career goals?” and was broken down further to target the following analyses: RQ2a: Are there any differences between race (underrepresented races are reference group compared to all other races) and admit type (first time in college compared
to transfer); RQ2b: Are there any differences between race (underrepresented compared to all other races) and career goals (STEM-related career goals compared to all other career goals), specifically STEM-related career goals reported? RQ2c: Are women more likely to pursue a career in medicine than men?

Two-way ANOVA between groups analysis of variance models were created in this phase to analyze impacts of race and gender on self-reported levels of 1. course workload anxiety, 2. anxiety of major, 3. familial pressure, and 4. Admit type. Four separate models were created to answer the above RQ2 questions.

Research Question 3

Finally, three linear models were generated after analyzing the average mean scores by gender and race. A series of independent samples t-tests were first generated by isolating gender with race through interaction terms. Whereas White males reported the lowest mean score on average in all three models when compared to the underrepresented groups, Black males in this cohort reported the highest mean scores in two out of three areas of anxiety and pressure measured (family pressure and anxiety related to course workload). Further analysis was then needed to determine if being a Black male was the best predictor in this cohort of STEM students in academic decline on levels of reported anxiety and pressure compared to all other students in this cohort.

The following three questions will be answered in the final results phase: RQ3a - Is being a Black male the best predictor of reported familial pressure with major choice compared to all others in the cohort when analyzing characteristics of STEM students in academic decline?; RQ3b - Is being a Black male the best predictor of anxiety reported with major choice
compared to all others in the group when analyzing characteristics of STEM students in academic decline?; and RQ3c - Is being a Black male the best predictor of anxiety reported with course workload compared to all others in the group when analyzing characteristics of STEM students in academic decline?
CHAPTER FIVE: RESULTS

Bi-variate Analysis

Table 1 addresses the first research question: *Are women more likely to declare medicine degrees than men?* An output summary on cross-tabulations is provided including Chi-square summaries by gender and race demographics in the current study. More females were represented in this cohort than males, which included 103 males compared to 186 females. The summary also shows that more women are likely to pursue medical-related majors such as Biology (97) and Chemistry, or Forensic Science (71) than men (63 Biology and 26 Forensic Science). A Chi-square test for independence indicates significance associated between gender and major selection, \( x^2 (2, n=289)=6.09, p=.048, \phi=.146 \). A dummy variable was created for gender with females as the reference group to illustrate gender differences in undergraduate STEM majors in academic decline. As of fall 2019 the average undergraduate female population in the College of Sciences at this institution was 6,600 compared to 3,000 males. Females pursing a Biology major totaled 1,400 compared to 640 males. Females pursuing a Forensic Science major totaled 256 compared to 72 males. These averages aligned with the cohort in this study. Transfer student enrollment totals as of the fall 2019 term included 16,500 females and 13,000 males compared to FTIC enrollment of 15,000 females and 13,000 males (retrieved from https://ikm.ucf.edu/facts/interactive-facts/enrollment/ on 1/28/2020). However, further analysis of data from the current study, also listed in Table 1, offers additional demographic information of race. Whereas 37% (69 participants) of all females in decline were White, 28% (52 participants) of all females in decline were Hispanic, and 19% (35 participants) were Black. When compared to males across the three groups (White, Hispanic, and Black), more females
were in academic decline in this cohort than males. These totals suggested that Black and Hispanic groups were underrepresented in this study. Whereas women were overrepresented in these data, women in Black and Hispanic races were underrepresented within the total female population.

Table 1 also highlights frequencies of gender and the admit type. A cross-tabulation along with a Chi-square of gender and admit type was generated, and frequencies of these variables are illustrated along with the Chi-square summary. The Chi-square summary shows that there was not an association between admission type and gender, with FTIC and female as reference groups for the gender variable. A Chi-square test for independence indicated no significant association between gender and admission type, \( \chi^2 (2, n=289) = 3.51, p= .06, \phi = .118 \). Students are admitted to this institution either as a First-Time-In-College (FTIC) student or a transfer student (Trf). The Florida Board of Governors (BOG) defines a transfer student, through the State University System of Florida, as a student who has earned 12 semester credit hours or more at a postsecondary institution post high school graduation. The Florida BOG, however, suggests that students who consider transferring to a public university within the State should strongly consider earning an associate of arts degree from any Florida College System (FCS) institution to ensure that credits transfer smoothly to meet the University’s general education program (GEP) requirements (https://www.flbog.edu/forstudents/ati/transfer.php, 2019). FTIC students are defined by the Florida BOG as those who either do not have postsecondary credits, or those who have earned less than 12 semester credit hours of postsecondary credits following high school graduation. The admit type in this study refers to either of these two types. FTIC was used as the reference group due to a current focus the University has placed on this cohort and their time-to-completion. The Florida BOG created a
performance-based funding model consisting of ten metrics common to all state public universities. A four-year graduation rate specific to full-time FTIC students is listed in the top 5 metrics (https://www.flbog.edu/board/office/budget/performance_funding.php, 2019).

Table 1 Cohort Demographics of Race and Gender with Major and Admit Type Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Total n=289</th>
<th>Females n=186</th>
<th>Males n=103</th>
<th>X²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology</td>
<td>160 56%</td>
<td>97 53%</td>
<td>63 62%</td>
<td>6.09*</td>
</tr>
<tr>
<td>Forensic</td>
<td>96 34%</td>
<td>71 39%</td>
<td>26 26%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>27 10%</td>
<td>14 8%</td>
<td>13 13%</td>
<td></td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td>4.90</td>
</tr>
<tr>
<td>White</td>
<td>115 40%</td>
<td>69 37%</td>
<td>46 45%</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>84 29%</td>
<td>52 28%</td>
<td>32 31%</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>52 18%</td>
<td>35 19%</td>
<td>17 17%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>38 13%</td>
<td>30 16%</td>
<td>8 8%</td>
<td></td>
</tr>
<tr>
<td><strong>Admit Type</strong></td>
<td></td>
<td></td>
<td></td>
<td>3.51</td>
</tr>
<tr>
<td>First Time in College</td>
<td>154 53%</td>
<td>91 49%</td>
<td>63 61%</td>
<td></td>
</tr>
<tr>
<td>Transfer</td>
<td>135 47%</td>
<td>95 51%</td>
<td>40 39%</td>
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</tr>
</tbody>
</table>

*p=<.05

Table 2 addresses the research question; *RQ2a- “Are there any differences between race and admission type?”* The data shows that there are more White transfer (Trf) and FTIC students in this cohort than any other race group, with 23% White FTIC students and 17% White transfer. When analyzing the Hispanic student group, however, there were slightly more transfer Hispanic students at 15% than FTIC Hispanic students at 14%. Finally, the cohort included more Black FTIC students at 10% than Black transfer students at 8%. A Chi-square test for independence indicated no significant associations between race and admission type (with FTIC as the reference groups), $X^2 (2, n=289)=2.156, p=.541, \phi=.086$. Further analysis explored the underrepresented race populations (using the Black and Hispanic races variable) to determine if
an association between underrepresented races and admission type (with FTIC as the reference group) existed. A Chi-square test showed no association, $x^2 (2, n=289) = .49, p=.48, \phi = -.048$.

Table 2 Race and Admit Type Frequencies and Chi-Square

<table>
<thead>
<tr>
<th>Race</th>
<th>Total n=289</th>
<th>FTIC n=154</th>
<th>Transfer n=135</th>
<th>$X^2$</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>White</td>
<td>115</td>
<td>40%</td>
<td>66</td>
<td>23%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>84</td>
<td>29%</td>
<td>40</td>
<td>14%</td>
</tr>
<tr>
<td>Black</td>
<td>52</td>
<td>18%</td>
<td>29</td>
<td>10%</td>
</tr>
<tr>
<td>Other</td>
<td>38</td>
<td>13%</td>
<td>19</td>
<td>6.5%</td>
</tr>
<tr>
<td>Race Bi-Variate</td>
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<td></td>
</tr>
<tr>
<td>Underrepresented</td>
<td>136</td>
<td>47%</td>
<td>67</td>
<td>23%</td>
</tr>
<tr>
<td>All other races</td>
<td>153</td>
<td>53%</td>
<td>68</td>
<td>24%</td>
</tr>
</tbody>
</table>

*p=<.05

Table 3 below answers research question: RQ2b- “Are there any differences between race and career goals, specifically STEM-related career goals?” Table 3 highlights interests associated with STEM-related and non-STEM related career fields by race. A dummy variable was created with STEM-related careers as the reference group (1=STEM careers and 0=Non-STEM careers). However, career responses were first coded into 18 careers, and then narrowed into 7 STEM-related careers (outlined in Chapter 4) based on responses to the open career goal question earlier discussed. Although a Chi-Square test for independence showed no relationship associated with race and pursuit of a STEM career, Table 3 shows that 24% who are in pursuit of a STEM career were Hispanic and 13% were Black compared to 34% of the White student population. A Chi-Square test for independence showed no significant relationship, $X^2(2, n=289) = 3.84, p=.279, \phi = .115$. 

35
Table 3 Race and STEM Field Career Goals

<table>
<thead>
<tr>
<th>Race</th>
<th>Total n=289</th>
<th>STEM n=238</th>
<th>Non-STEM n=51</th>
<th>(X^2)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>White</td>
<td>115</td>
<td>40%</td>
<td>98</td>
<td>34%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>84</td>
<td>29%</td>
<td>69</td>
<td>24%</td>
</tr>
<tr>
<td>Black</td>
<td>52</td>
<td>18%</td>
<td>38</td>
<td>13%</td>
</tr>
<tr>
<td>Other</td>
<td>38</td>
<td>13%</td>
<td>33</td>
<td>11%</td>
</tr>
</tbody>
</table>

*p=<.05

Table 4 answers research question: RQ2c- “Are women more likely to pursue a career in medicine than men?” Characteristics of career decision-making are highlighted in Table 4, and it is evident that the pursuit of a medicine track in this study was the top career goal, with more women (n=46) than men (n=24) responding that they were pursuing a medicine career. Women in this cohort were not more likely to pursue a career in medicine than men. A Chi-square test was generated for independence and showed no significant association between gender and pursuit of a medicine career field, \(x^2 (2, n=289) = .023, p=.88, \phi=.017\).

Table 4 Medicine-related Career Goals by Gender

<table>
<thead>
<tr>
<th>Career Goals</th>
<th>Total n=289</th>
<th>Females n=186</th>
<th>Males n=103</th>
<th>(X^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Medicine</td>
<td>70</td>
<td>24%</td>
<td>46</td>
<td>25%</td>
</tr>
<tr>
<td>Non-Medicine</td>
<td>218</td>
<td>76%</td>
<td>139</td>
<td>75%</td>
</tr>
</tbody>
</table>

*p=<.05

This study also assessed if there was an association between student race (underrepresented races of Black and Hispanic) and the pursuit of medicine careers compared to all other races in the cohort. Table 5 shows the summary outcome. No significant association between race and the pursuit of medicine careers were found after generating a Chi-square, \(x^2 (2, n=289) = .023, p= \ldots\).
n=288) = .55, p= .46, phi = .052.

Table 5 Underrepresented Races and Medicine Career Goals

<table>
<thead>
<tr>
<th>Race</th>
<th>Total n=289</th>
<th>Med Career Goals n=70</th>
<th>Non-Med Car Goals n=219</th>
<th>X²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Underrepresented students</td>
<td>135</td>
<td>%</td>
<td>36</td>
<td>13%</td>
</tr>
<tr>
<td>All other students</td>
<td>154</td>
<td>%</td>
<td>34</td>
<td>12%</td>
</tr>
</tbody>
</table>

*p=<.05

Exploring characteristics such as anxiety and levels of pressure related to academic decision-making was essential to this study. Whether or not reported levels of anxiety and pressure differed in impact between male and female and among each of the three (White, Hispanic, and Black) racial groups was explored. The purpose of this intervention was to better understand personal barriers that this cohort experienced while attempting to complete their bachelor’s degree in their declared STEM major, and to ultimately aid with guidance and resources that would keep them on track toward degree completion at the University.

Multi-variate Analysis

Table 6 provides a summary of the mean response ratings by gender and race to questions related to 1. *Family pressure related to current declared major*, 2. *Anxiety related to current declared major*, and 3. *Anxiety related to current course workload*. Ratings to all three Likert scale questions were defined as 1 (meaning ‘not at all’) through 10 (meaning ‘absolute’). Beginning with the family pressure data, the response rate of males was 96% and females was 97%. Among White, Black, and Hispanic populations, White females on average reported higher
levels of family pressure (mean of 4.2) than Black or Hispanic females. However, Hispanic female averages were very close to White females (mean of 3.9). White males on average reported the lowest levels of family pressure. Both Hispanic male and female averages were reported the same for family pressure (mean of 3.9). However, Black males are on average reported higher levels of family pressure across all three races (mean of 4.4). Table 6 also shows levels of anxiety reported by race and gender on the current declared major. The response rate to this question was 96.1% for males and 96.8% for females. Hispanic females rated much higher on average (mean of 5.8) across the three races. However, Black and White females reported similar ratings (mean of 4.7 for White and 4.9 for Black). On the other hand, Black males on average reported higher rates of anxiety toward their declared major (mean of 5.3) across the three races, and Hispanic males followed close behind (mean of 4.8). White males, however, on average reported the lowest rate between genders and all three races (mean of 4.3). A series of independent sample t-tests were generated to analyze significant results. The independent sample t-test comparing the self-reported levels of family pressure for White males (using an interaction term) and all other groups in the cohort was the only t-test that reported a significant difference. The mean score for White male was 3.09 (SD=2.37) and the mean score for all others in the group was 4.06 (SD=3.16; t(277) =-2.334, p=.022, two-tailed). The strength of the differences in mean was small, with an eta squared result of .02 [-2.334^2/-2.334^2 + (43+236-2)]. Table 6 identifies this statistical significance outcome. Whereas this result was unexpected, it can be explained through recognition of the lowest average score (and negative t score of -2.334) of White males related to family pressure when compared to all others in the group. Finally, Table 6 summarizes the levels of reported anxiety of course workload on average by gender and race. The response rate for males was 95.1% and 96.2% for females to this question. The female
averages across the three races were very close with Black females in the lead (mean of 6.3) followed by White females (mean of 6.2), and Hispanic females (mean of 6.1). However, Black males on average reported a higher rate between genders and among all three races (mean of 6.7). Black males reported a much higher rate on average than Hispanic males (mean of 5.7) and White males (mean of 5.5). White males again reported on average lower levels of anxiety related to their course workload anxiety.
Table 6 Pressure and Anxiety Mean Rating Summaries

<table>
<thead>
<tr>
<th>Rating summary (mean rating)</th>
<th>White</th>
<th>Hispanic</th>
<th>Black</th>
<th>Other</th>
<th>Total</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3.1</td>
<td>4.4</td>
<td>3.6</td>
<td>3.6</td>
<td>3.6</td>
<td>96.1%</td>
</tr>
<tr>
<td>Mean</td>
<td>3.09</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.D</td>
<td>2.37</td>
<td>2.37</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t</td>
<td>(277) = -2.33*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4.2</td>
<td>3.9</td>
<td>3.5</td>
<td>4.9</td>
<td>4.1</td>
<td>96.8%</td>
</tr>
<tr>
<td>Anxiety of major</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4.3</td>
<td>5.3</td>
<td>5.1</td>
<td>4.7</td>
<td>4.7</td>
<td>96.1%</td>
</tr>
<tr>
<td>Female</td>
<td>4.7</td>
<td>4.9</td>
<td>4.9</td>
<td>5.1</td>
<td>5.1</td>
<td>96.8%</td>
</tr>
<tr>
<td>Anxiety of course workload</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>5.5</td>
<td>6.7</td>
<td>5.5</td>
<td>5.7</td>
<td>5.7</td>
<td>95.1%</td>
</tr>
<tr>
<td>Female</td>
<td>6.2</td>
<td>6.3</td>
<td>6.1</td>
<td>6.2</td>
<td>6.2</td>
<td>96.2%</td>
</tr>
</tbody>
</table>

Two-Way ANOVA

Table 7 illustrates the results from four separate two-way ANOVA models that analyzed the impacts of gender and race on 1. levels of familial pressure, 2. anxiety related to major choice, 3. anxiety related to course workload anxiety, and 4. admit type. The participants’ race variable was divided into 4 groups. White participants were coded as 1, Hispanic participants were coded as 2, Black participants were coded as 3, and all other races were listed as Other and coded as 4. Starting with the impacts on reported levels of course workload anxiety

40
(WorkLdAnx), Model 1 showed that the gender and race variable interaction effect did not yield significant results, $F = .72$, $p = .54$. The WBHO_Race variable also did not yield statistically significant results, $F = .88$, $p = .5$. The eta square, or size effect and degree to which the two variables were related, was small at .008. The main effect for the gender reference group, female is $F (1,269) = 1.19$, and $p = .28$, and did not yield statistical significance. Model 2 illustrates the impacts on reported levels of anxiety related to the major selection (AnxOfMajor). The gender and race (Gender*WBHO_Race) variable interaction effect did not yield significant results, $F = .76$, $p = .52$. The WBHO_Race variable also was not significant, $F = 1.4$, $p = .23$. The eta square in this model was reported at .008, thus a small size effect. The gender reference group main effect did not yield statistical significance, and is $F (1, 271) = .81$, and $p = .67$. Model 3 illustrates the impacts on familial pressure (FamPres) reported on the current choice of declared major. The gender and race (Gender*WBHO_Race) variable was not significant, $F = 1.39$, $p = .25$. The WBHO_Race variable was not significant either, $F = .34$, $p = .80$. The eta square was slightly stronger in this model at .02, though still considered to be a small size effect. Significance was not found in the reference gender group’s (female) main effect either, which was $F (1, 271) = .61$, and $p = .44$. Finally, Model 4 highlights impacts on admit type reported by gender and race. The gender and race variable (Gender*WBHO_Race) again was not significant, $F = .137$, $p = .938$. The WBHO_Race variable was also not significant, $F = .687$, $p = .561$. The eta square in this model was very low, which was reported at .007. Again, there was no significant impact in the reference gender group (female) main effect, which was $F (1, 281) = 2.0$, and $p = .164$.

Whereas statistical significance was not yielded in any of the 4 models, familial pressure appeared to have a greater impact on this cohort. The mental health counselor interns were asked
to provide their own narrative through an executive summary at the conclusion of their internship to highlight reported commonalities of reasons for academic decline, how the program was either addressing or not addressing the student needs, and a professional outlook of the program’s objectives. The narratives from the mental health counselor interns who worked with this cohort offered some insight on the movement in Model 4. The interns were asked to debrief in their executive summary and discuss common issues reported within the group in their sessions. Family pressure was listed as a top concern among all interns who worked with this cohort. Whether or not students rated family pressure as a concerning factor, they were commonly discussing it in their sessions.
Table 7 Two-way between groups ANOVA Models

<table>
<thead>
<tr>
<th></th>
<th>Model 1 Workload Anxiety</th>
<th>Model 2 Anxiety of Major</th>
<th>Model 3 Family Pressure</th>
<th>Model 4 Admit Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction Effect</td>
<td>F = .72</td>
<td>F = .76</td>
<td>F = 1.39</td>
<td>F = .137</td>
</tr>
<tr>
<td></td>
<td>p = .54</td>
<td>p = .52</td>
<td>p = .25</td>
<td>p = .938</td>
</tr>
<tr>
<td>Race</td>
<td>F = .88</td>
<td>F = 1.4</td>
<td>F = .34</td>
<td>F = .687</td>
</tr>
<tr>
<td></td>
<td>p = .5</td>
<td>p = .23</td>
<td>p = .80</td>
<td>p = .561</td>
</tr>
<tr>
<td>Eta Square</td>
<td>.008</td>
<td>.008</td>
<td>.02</td>
<td>.007</td>
</tr>
<tr>
<td>Main Effect Gender</td>
<td>F = 1.19</td>
<td>F = .81</td>
<td>F = .61</td>
<td>F = 1.948</td>
</tr>
<tr>
<td></td>
<td>p = .28</td>
<td>p = .67</td>
<td>p = .44</td>
<td>p = .164</td>
</tr>
<tr>
<td><strong>Mean Scores</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>6.25</td>
<td>4.70</td>
<td>4.17</td>
<td>--</td>
</tr>
<tr>
<td>Hispanic</td>
<td>6.12</td>
<td>5.84</td>
<td>3.92</td>
<td>--</td>
</tr>
<tr>
<td>Black</td>
<td>6.26</td>
<td>4.85</td>
<td>3.47</td>
<td>--</td>
</tr>
<tr>
<td>Other</td>
<td>6.13</td>
<td>4.90</td>
<td>4.87</td>
<td>--</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>5.50</td>
<td>4.33</td>
<td>3.09</td>
<td>--</td>
</tr>
<tr>
<td>Hispanic</td>
<td>5.66</td>
<td>4.84</td>
<td>3.87</td>
<td>--</td>
</tr>
<tr>
<td>Black</td>
<td>6.69</td>
<td>5.31</td>
<td>4.44</td>
<td>--</td>
</tr>
<tr>
<td>Other</td>
<td>5.50</td>
<td>5.13</td>
<td>3.63</td>
<td>--</td>
</tr>
</tbody>
</table>

*p =< .05

Linear Regression

The following section will summarize three linear regression models to answer the following three questions: 1. *Is being a Black male the best predictor of reported family pressure with major choice when analyzing characteristics of STEM students in academic decline?* 2. *Is being a Black male the best predictor of anxiety reported with major choice when analyzing characteristics of STEM students in academic decline?* 3. *Is being a Black male the best predictor of anxiety reported with course workload when analyzing characteristics of STEM students in academic decline?*

Model 1 results are shown in Table 6, and addressed the question “*Is being a Black male the best predictor of reported family pressure with major choice when analyzing characteristics*
of STEM students in academic decline?” The dependent variable in this model was reported familial pressure, and the predictor variables were Black male, Admit type, and First Generation. Compared to the other two models, this was reported as the weakest model fit when regressed, with the R Square showing .000. The ANOVA analysis also showed no significance with the model and the F score is .02. Whereas the strongest predictor in this model was the admit type variable, with a beta coefficient of .084, the Black male variable was still reported as the weakest variable in the model, with a beta coefficient of -.02.

A look at the qualitative data from the interns to better understand results from family pressure model found that students commonly reported that they needed to care for immediate and extended family members, which negatively impacted their time management planning to prioritize academics. Whereas this could be considered family pressure, it was not necessarily familial pressure related to remaining in the chosen STEM major. Different results with this model might have shifted if students were asked to report their level of pressure related to family obligations. Biology and forensic science majors both frequently reported that declaring these majors gave them more marketable choices for a career. However, the number one common student narrative reported by interns was pressure from parents about grades and career choice. This pressure was reported by interns as both explicit and implicit. Students who reported family pressure would sometime indicate that they were just afraid to approach the conversation of academic decline in their major with parents or family members, with little to no reported basis to their fear. Others, however, reported very specific reasons for the fear, and these reasons generally related to losing their financial assistance. Including a space near the rating scale to add a narrative related to the rating would have offered more qualitative data to compliment this model.
Model 2 is summarized in Table 6 and answers the question “Is being a Black male the best predictor of anxiety reported with major choice when analyzing characteristics of STEM students in academic decline?” The dependent variable in this model was Anxiety of Major, and the same predictor variables apply, which were Black Male, Admit Type, and First Generation. The analysis of the overall model fit found that this model was much stronger than model 1 and slightly stronger than model 3, with an R Square of .035. Though with only 4% of the model explaining the variability in anxiety reported with major choice, this is still very weak. However, the ANOVA analysis reported an F score of 3.286 with statistical significance of .02. The Black male variable in this model was not significant and was the weakest in the model with an unstandardized beta coefficient of -.043. This provided evidence that being a Black male in this cohort was not the best predictor of anxiety reported with the major choice. The Y-intercept of 5.63 represented the average reported level of anxiety from all others in the population with their major choice. According to these results, the Black male population on average reported a decrease of less than half of one unit when compared to all others in the group. On the other hand, the strongest predictor in the model was the first-generation variable. The t value was -3.047 with a significant value reported at .003. The beta coefficient was -1.010, and this provided evidence that when compared to all others in the population, students who self-reported as first-generation college students on average reported a one unit decrease in anxiety reported toward major choice.

When analyzing qualitative reports from the counselor interns, it was clear that students in this cohort commonly identified with being a first-generation college student. This was frequently reported by all interns as an influence in the individual narrative sessions. Students also commonly reported that they were unaware of a major GPA requirement, and the
significance of meeting the requirement for graduation. Mandatory supervision sessions with the interns revealed common statements from students in this cohort that were not congruent with their reported actions. For instance, reporting an inflated major GPA and low levels of anxiety toward major choice on the student self-assessment Likert scale prior to the initial meeting with the counselor intern. In fact, on-going training sessions with the interns were necessary to discuss how to manage combative students who adamantly argued that the institutional reporting of the major GPA was wrong. These statements were reported as antidotal as these instances of incongruent statements were not measured. However, inclusion of an additional variable that asked a follow up question to rate their anxiety of major choice on the same Likert scale following their second session may have yielded a different result with higher levels of anxiety reported. Students in this cohort frequently reported fears of “looking stupid” among peers and faculty, which lead them to avoid asking for help. A common statement reported by students who struggled with asking for help was “other students are getting it, why can’t I?” The frequency of these statements reported suggested that their academic confidence may initially be over-inflated. Measuring a post second-session rating level and analyzing whether or not a first-generation moderating effect had an influence on the anxiety reported toward major choice outcome might have yielded a different result. Students generally had a more realistic understanding of their academic circumstance following their first session and began to come to terms with their declining GPA.

Model 3 is also summarized in Table 6, and answered the question “Is being a Black male the best predictor of anxiety reported with course workload when analyzing characteristics of STEM students in academic decline?” The dependent variable in this model was anxiety reported with choice of major, and the same predictor variables apply, which were Black Male,
Admit Type, and First Generation. The overall model did not report statistical significance, with the F statistic at .415 and significance reported at .743 in the ANOVA analysis. This outcome provided evidence that anxiety reported with course workload from STEM students in academic decline does not differ from Black males, thus being a Black male was not the best predictor. The analysis in the model summary also reported the R Square at .005, and the Adjusted R Square at -.006, which indicated that the model fit was very weak. Using the qualitative summaries provided from the four interns who worked with this cohort, this study further analyzed factors associated with anxiety of course workload that were commonly reported by students in the intervention sessions. Whereas these factors were reported commonly, they were not measured. Inclusion of variables that represent these reports may have produced an outcome in this model that favored significance. For instance, including an average study time per week prior to attending the University compared to an average study time in the present would be a relevant variable to this model. Students commonly reported doing well in high school sciences and did not feel the need to study in high school, and thus never learned how to study. Previous research showed that secondary schools that predominately served underrepresented groups generally did not offer advanced math and sciences courses that prepared high school students for STEM majors (Snyder & Dillow, 2013). Also, specifically asking students in this cohort to rate the level of rigor associated with their course workload as a follow up to the anxiety of course workload variable might offer some insight. Transfer students commonly reported the shock of rigor associated with coursework load and the amount of time needed to study. Transfer students also commonly reported experiencing transfer shock. Transfer shock refers to a drop in GPA after the first term at the student’s new institution (Hills, 1965). Whereas the concept of transfer shock was discussed in session, it was not measured on the student self-
assessment. Adding this as an additional question may have produced significance by gender and race. Related to transfer shock, students commonly reported frustration in not understanding how to navigate the University system, which lead to further decline in their academics. Providing space for students to report reasons for their reported anxiety would also be beneficial in this model. For instance, students in this cohort commonly reported that they felt pressure from family, peers, and faculty to remain in their courses and “stick it out” rather than withdrawing. Common student reports also explained their struggles to conceptualize how remaining in a course knowing that they are earning below C average grades would further impact their GPA. Sessions with these students focused on empowering statements that allowed them to take ownership of their academic circumstance while learning how to navigate help and gain access to resources and help in understanding policies, such as the minimum GPA requirements. Sadly, students in this cohort commonly reported that due to their grades, they lost their Florida Bright Futures Scholarship while attending this institution, which lead to their need to increase workhours. Asking students to report if they recently lost their financial aid due to their grades would be relevant to this model, as research shows that increasing hours worked was common among students who lose their financial aid, which can then lead to academic decline or dismissal (Espinosa, 2011; Lloyd & Eckhardt, 2010; Reyes, 2011; Scott et al, 2009; Whalen & Shelley, 2010). Most students in this cohort reported working outside of school between 30-50 hours per week, which lead to procrastination and difficulty in maintaining motivation throughout the term. Finally, following the first session, the interns reported that students were noticeably less resistant to lowering their course load in order to concentrate on raising their grades. Tracking their course load by credit hours in the term of the session compared to the following term would have added a measurable variable to provide evidence of whether they
followed through with a course load reduction.

Whereas previous research offered evidence that Black males on average experienced higher levels of stress when compared to other races (Byars-Winston et al, 2016), this study did not reveal these results when Black male as a predictor was regressed. After further analysis of the data to test for Black male as a predictor as well as assessment reports made by the interns on common themes and narratives from students, admit type and first generation as independent variables was also added, along with Black male to determine if other predictors added significance to this study. According to the intern reports, students frequently identified as being first-generation college students and as transfer students, and it was common to see both characteristics. The first-generation college student predictor was significant in the model with levels of anxiety reported on major choice as the dependent variable.

When compiling all results from this study, and comparing the means of anxiety and pressure reported in the cohort by race and gender on average, Black males in this cohort of STEM students in academic decline reported higher levels of anxiety toward their course workload as well as familial pressure (though not significant), and White males reported statistically significant lower mean scores on average for familial pressure. However, Hispanic females on average reported higher levels of anxiety related to their declared major, though not significant. These findings complimented previous research to show cultural pressures that Hispanic females experience to pursue a career in the medical field helping others (Lease, 2004). Without an intersectional approach, these results may have only highlighted differences between gender or differences between races. However, the two-way ANOVA models found that gender and race did not significantly impact levels of family pressure report, or anxiety levels reported on major choice, or anxiety related to course workload, or the admit type (with FTIC as the
Finally, regressing models to test for Black males being a predictor of anxiety and pressure showed that in fact this was not a good predictor. However, once the first-generation predictor variable was added to the model, significance was found in the level of anxiety reported on course workload anxiety from first generation college students.

Table 8 Linear Regression

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Family Pressure</td>
<td>Anxiety of Major</td>
<td>Course Workload</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Anxiety</td>
</tr>
<tr>
<td>Black Male</td>
<td>-.02</td>
<td>-.002</td>
<td>-.434</td>
</tr>
<tr>
<td>Admit Type</td>
<td>.084</td>
<td>-.367</td>
<td>.033</td>
</tr>
<tr>
<td>First Gen</td>
<td>-.025</td>
<td>-.004</td>
<td>-.097</td>
</tr>
</tbody>
</table>

*p < .05
CHAPTER SIX: DISCUSSION

This study began with a STEM-specific focus on students in academic decline, though the intervention analysis suggested that a gap in resources and student social and cultural experiences may contribute to their academic decline, regardless of major. Student experiences play a significant role in how they identify with pressure and anxiety related to their academics. The data analysis offered evidence that both race and gender are essential components when assessing impacts related to academic decline, which both aligns and contributes to previous literature earlier cited. Each of these research questions will be further explored.

Do women pursue a bachelor’s degree at higher rates than males?

Far more females than males in this study were in academic decline, and results of this question were significant. Since the intervention focused on biology and forensic science fields, it is clear that women were overrepresented, though the critical message here is that females were struggling in their STEM-related courses at a higher rate on average than males across all three races, yet Black males were reporting higher levels of anxiety on average when compared to all other races. Implementation of this brief intervention framework addressed gender disparities through guided narrative discussions that were strength-based. The interns offered a safe and supportive environment, and their intervention sessions provided students with the space to build on their decision-making skills that incorporated previous personal, cultural, and professional experiences.

Are there any differences between race, gender, admission type, and career goals?

There were no significant differences between race, gender, and admit type, and there were no significant differences when race, gender and career goals were regressed. Florida Statute 1007.23 is the Statewide Articulation Agreement and Legislation that was established with the
intent to offer students in the state of Florida a seamless transfer while preserving credits already earned “…and strengthening relationships among K-20 public organizations, between public and private organizations, and between the education systems as a whole and Florida’s communities.” (retrieved by http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&Search_String=&UR L =1000-1099/1007/Sections/1007.01.html on 10/10/19). The policy illustrates the importance of this relationship, which is to provide support toward the student’s transition between institutions, and to offer efficient progression toward the degree-completion. Furthermore, this statewide policy implies that K-20 advisory boards, appointed by the Commissioner of Education and Chancellor of the State University System (SUS), are to be included in the collaboration and planning of policies to enhance the articulation process. Supporting policies are reported to include credits that are transferable between other state institutions (retrieved by http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&Search_String=&UR L=1000-1099/1007/Sections/1007.01.html 10/10/19). However, Florida’s SUS provides access and opportunities to students who transfer within the state and complete an A.A. degree from any Florida public institution. Though what happens when students transfer from institutions outside of the state? More specifically in the state of Florida, how are students who transfer from Puerto Rico or Cuba impacted? Students who transfer into the institution with transcripts recorded in Spanish have historically been subjected to enormous fees associated with official institutional translation into English, and their earned credits are also subject to evaluation to determine whether or not they will apply toward the STEM major. Students who incorporate out-of-state credit, including credits from Puerto Rico and Cuba, into the A.A. degree are rarely aware that those out-of-state credits will need further evaluations as they transfer from institution to
The reverse transfer phenomenon is likely to occur when students are struggling at the four-year institution either financially or academically, or both. Hispanic and Latino students who perceive lack of cultural resources or complications after transferring to the four-year institution may feel discriminated against. Such perceptions of discrimination offer “legitimate uncertainty” in their choice of transfer (Trent et al, 2006). Reverse transfer can be an attractive option for those who prefer smaller class sizes and who rely on financial aid to continue their education, though degree-seeking status is still necessary to obtain federal financial aid.

Goldrick-Rab and Pfeffer (2009) found that between lateral and reserve transfer students (lateral meaning transferring to the same type of institution such as community college to community college) the reverse group were more likely to complete a degree rather than initially starting at a university. They indicate that the reverse transfer increase in degree-completion also produces increased opportunities of educational stratification, as those most likely to opt for the reverse transfer are students from low socioeconomic status families (Goldrick-Rab & Pfeffer, 2009).

The transfer student population in this study appeared to be better adjusted in their declared STEM major than the FTIC student population. Myers, Starobin, Chen, Baul, and Kollasch (2015) conducted a study that showed demographics and background characteristics of undergraduate students influenced their decisions to major in STEM when transferring from a community college to a university. This study did not track those students who were considered reverse transfer students or who transferred with credits from Spanish institutions. Interns reported, however, that transfer shock was a concern experienced by many students. Overall, more FTIC students (female=91 and male=63) were in academic decline than reported transfer students (female=95 and males=40). Whereas female admit types were close in numbers
(FTIC=91 and transfer=95) there appeared to be a much bigger gap between male admit types (FTIC=63 and transfer=40), with FTIC male students struggling more than male transfer students. When looking closer at the data, it is evident that a higher percentage of Hispanic transfer females (59%) were in academic decline compared to Hispanic transfer males (45%). Though more Hispanic FTIC males on average (55%) were in decline when compared to Hispanic FTIC females (41%). However, both White and Black FTIC male students on average (65%) were in academic decline at the highest rate compared to all three races and between the two genders. These data contributed to research associated with transfer STEM student adjustment though added an important intersectional analysis that highlighted differences of gender experiences between races. In addition, transfer student narratives often expressed having opportunities and greater access to pre-STEM preparation courses (e.g. flexible course schedules and lower tuition rates than the university). Transfer students have also been exposed to resources and policies that offer familiarity to college navigation.

RQ3. What differences exist between Workload Anxiety, Anxiety of Major, Familial Pressure, Admission Type, and Race and Gender? In detail:

3a. Is being a Black male the best predictor of reported family pressure with major choice when analyzing characteristics of STEM students in academic decline?

3b. Is being a Black male the best predictor of anxiety reported with major choice when analyzing characteristics of STEM students in academic decline?

3c. Is being a Black male the best predictor of anxiety reported with course workload when analyzing characteristics of STEM students in academic decline?

Significant results were not yielded for any of the three models above with the Black male variable as a predictor. Shifting over to reported levels of pressure and anxiety, it was
evident that Black males on average reported experiences of higher levels than White males and Hispanic males, though significance in regression was not yielded. This was especially evident with significance reported in the independent-sample $t$ test of White males when compared to all other groups, as the White male variable showed significance in family pressure levels (lower levels than any other group) of anxiety on average mean scores. Moreover, Black males reported on average a one unit increase in course workload anxiety than Hispanic males, and Hispanic males reported a one unit increase on average than White males. The intersectional approach offered a reframing message to suggest that this is a gender-specific issue, and rather exposed narratives from Black and Hispanic males as evidence that this is an issue specific to underrepresented students. Furthermore, graduation rates should also be considered when analyzing academic intervention results. The current study did include tracking graduation rates of the cohort by race and gender, though the data results were not included in the results section because additional factors such as switching majors and a break in enrollment will need to be analyzed further. However, preliminary results showed that more females from this cohort than males graduated with a bachelor’s degree following the intervention, and White females (46) graduated at a higher rate on average followed by Hispanic females (29), and Black females rates were much lower (14). Investigating this disparity among Black female graduation rates will be important for future analysis of these data.

Mental health counselor interns provided additional programming feedback at the end of their internship with an executive summary that included commonalities of students reporting academic decline factors. Overwhelmingly, interns reported that many students did not know they had a major GPA, and respectively, did not know that they were required to meet a minimum major GPA to be eligible for graduation. Whereas the interns maintained clear
boundaries and were prohibited from providing academic advising to the students, they were able to help these students formulate questions related to their academic concerns and encourage a follow up meeting with their college advisor to address these questions. Factors that were reported consistently as common narrative themes were familial pressure, financial strain (having to work fulltime while attending school) and contributing to family and household responsibilities. STEM courses at the university are generally offered during the week and during the day hours. Students who work full time often struggle to attend these classes regularly, which leads to a decline in grades. Common narratives that arose included losing scholarship awards due to decline in grades, and ultimately needed to increase work hours to pay for classes. Furthermore, interns reported that students who identified as a pre-med student commonly attributed their major choice to influences from family based on grades earned in high school sciences courses. Students generally had limited practical career knowledge and were encouraged to ‘be a doctor’ if they liked science in high school or to pursue forensic science if they enjoy CSI television shows. These discussions allowed counselor interns the opportunity to offer career exploration guidance and connections to resources that help students align their interest, strength, and skills with academic options, which often can help keep them on the same or similar career path. Counselor intern participation in this intervention was essential, as these interns were clinically trained to guide students in academic decline through the narrative process that included culturally sensitive discussions when exploring decision-making that impacted both academic and career goals.
Limitations

Mental health counselor interns were an essential element of the intervention program however, the interns were recruited from another institution. Many who were recruited were not familiar with the University resources or campus layout. However, their lack of resource knowledge sometimes worked in the student’s favor as interns were genuinely able to empathize with students who were not familiar with the campus and they were able to offer guidance on how to be resourceful to find office locations. From the administrative aspect, this lack of campus knowledge meant that the interns needed sufficient training prior to facilitating sessions with students, which took up to two weeks. This can be almost impossible when staffing resources are low, which was the case in this study. Additional obligations of the lead researcher to fulltime interns included weekly supervision meetings (one hour per intern) and assurance that they will meet the required hours needed for their program completion.

Data analysis of admit type relied on student self-reports. Whereas students were required to attend an orientation prior to enrolling, and the orientations were offered based on their admit type, students who enroll at the University with some college credit (e.g. advance placement or dual enrollment) sometimes misunderstood whether or not they were transfer students following their orientation to the institution. Future research that analyzes graduation rates by admit type will track official admission status.
CHAPTER SEVEN: CONCLUSION

Conclusions drawn from this analysis included three essential messages. First, this study contributed to growing evidence that females are pursuing medical-related STEM fields at a higher average rate than males (specifically at the bivariate level). Analysis of the cohort in this study showed that 16% of the participants who answered the career goal question that they were pursuing a career in medicine were female and 8% of those answering the same question were male. Additional research that is separate from career counseling, such as a focus group or survey participants from a student life skills course, may provide more in-depth narratives from women pursuing STEM degrees who struggle in math and science courses. Research that was earlier highlighted showed women’s persistence in education decreases as they begin to earn low grades. Confidence levels also decrease, which further leads to compromised decision-making patterns in their education. Additionally, research institutions are shifting their academic focus to high impact practices that help students gain co-curricular and extra-curricular experiences that help them connect skills learned in the classroom to career-based practices. These integrative learning experiences can offer mentor opportunities to female students in STEM. Griffith (2010), however, analyzed institution characteristics related to underrepresented students in STEM and results suggested that a focus on undergraduate education retain undergraduate students at a higher rate. Second, the results provided evidence that Black males on average reported considerably higher levels of anxiety associated with their course workload, though results were not significant when regressed. It is important that intervention efforts or outreach not solely focus on females when implemented. Rather, outreach should include all underrepresented groups of students. Narratives that incorporate adverse experiences differ when intersecting race,
ethnicity, gender, and sex. Outreach initiatives should offer flexibility in both the implementation and facilitation that adapt to the changing environment of education. Ultimately, academic intervention efforts should empower students to embrace their stories and actively engage in new experiences that align with their personal and professional goals. Finally, takeaways should include the ongoing need to encourage all students to have conversations with family and support systems about the high levels of pressure and anxiety they experience as a result of course workload and declared major. Key student discussions with faculty and advisors should circle back to academic obligations and whether they align with the students’ personal obligations.

Raising awareness of institutional disparities associated with historical inequalities across all disciplines and integrating intersectionality within pedagogies offers hope that history can change the direction of the future. Recognizing that this academic environment now places an emphasis on increasing research funding to sustain academic integrity (Pare, 2011), it is also imperative that universities recognize the need to support programing that supports student academic development at all stages. Concluding on this note it is important to emphasize the necessity to include all disciplines in future research, as academic decline due to anxiety and pressure is not limited to STEM majors, and rather can be viewed as a snapshot of the student’s narrative.

**Future Research**

Underrepresented STEM students in academic decline are struggling due to intersectional differences and lack access to student success and preparatory resources. Whereas significance was not found within the underrepresented races when assessments were generated, the study did find significance in the mean of self-reported levels of family pressure from White males to
pursue their current STEM major, with significantly lower levels of pressure than the underrepresented population. This significance will be explored further in future research. Assessments from this research along with cited literature highlighted a need for academic support that withstands the demands of higher education institutions, and yet adheres to the needs of all who pursue their educational dreams. Intervention planning that targets student success in STEM must acknowledge these differences. Systemic pushes for STEM at both the micro and macro levels have made unfair promises to some students who want to belong to academic and career fields that offer a future of financial stability. These promises have misled many students from underrepresented groups into believing that success would be achieved if they pursued a STEM major in college. Instead, it is becoming more evident that underrepresented students do not feel that they fit in, and their grades are suffering. Because of these circumstances, there is an increasing need for academic interventions that incorporate a holistic mission to address differential needs. Future research should include comparing graduation rate outcomes post academic intervention of those who completed calculus 1 in their senior year versus those who completed it in their freshman or sophomore year, as research cited showed that students who completed calculus 1 in high school were more likely to succeed in STEM degree completion.

Self-efficacy has been widely-studied as a predictor of academic perseverance and should be added as a variable in future research (Bandura, 97; Chemers et al, 2001; Lent et al, 2005). Additionally, capitalization has been linked to academic satisfaction and commitment, and mentoring has been linked to voluntary learning in previous literature (Blau et al, 2008; Pan et al, 2011). Incorporating motivational components such as volunteering and student organization
memberships that connect students to their initial mission and tracking reported outcomes in future studies may contribute to empirical evidence that student connections through academic intervention programming may lead to positive results in STEM undergraduate success and persistence. Historically, students who switch out of STEM majors commonly reported that their decision was due to a lack of connection or personal interest in the major (Seymour & Hewitt, 1997). This study was careful not to focus on those who switched their major and remained sensitive to helping students maintain their current academic path if that was the desired outcome. In other words, this intervention was not designed to be a dream-crusher. However, establishing an academic or psychoeducational rapport with students in the cohort often gave them a sense of accountability, not to mention a feeling that the institution cared about the individual’s outcome. This type of rapport supports autonomy and offers informative evidence that the student can utilize to explore their best academic options that align with personal values and interests. This endeavor sometimes concluded with a change of major.

Academic pressures come in all forms and can elicit scholarly motivation toward success and achievements, yet pressure and anxiety can also contribute to a decline in academics. This form of academic decline should be recognized by the institution if degree attainment by all students is genuinely the mission. Programming that recognizes significant academic decline can help reduce the number of students who go on academic probation and ultimately those who are dismissed from the institution. A collective leadership shift to one that holistically supports all students, and not just those who are regarded as highly successful scholarly researchers, would need to occur.
APPENDIX: INSTITUTIONAL REVIEW

BOARD LETTER
From: UCF Institutional Review Board #1
FWA0000351, IRB00001138

To: Dena Michelle Ford

Date: June 03, 2016

Dear Researcher:

On 06/03/2016 the IRB determined that the following proposed activity is not human research as defined by DHHS regulations at 45 CFR 46 or FDA regulations at 21 CFR 50/56:

- Type of Review: Not Human Research Determination
- Project Title: Sciences Exploration: A Pre-Med Population Analysis
- Investigator: Dena Michelle Ford
- IRB ID: SBE-16-12316
- Funding Agency: University of Central Florida
- Grant Title:
- Research ID: N/A

University of Central Florida IRB review and approval is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are to be made and there are questions about whether these activities are research involving human subjects, please contact the IRB office to discuss the proposed changes.

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

[Signature]

Signature applied by Joanne Muratori on 06/03/2016 08:33:01 AM EDT

IRB Manager
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