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A CASE STUDY OF THE SELF EFFICACY
OF HIGH SCHOOL AGED UNDERREPRESENTED MINORITY FEMALES
ENTERING THE MEDICAL PIPELINE

by

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A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
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2014

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ABSTRACT

Researchers in the field of science education recognize that increasing numbers of underrepresented minority women are successfully pursuing careers in medicine. Still, certain groups of minorities are underrepresented in the field of health sciences and additional recruitment efforts are needed. To develop solutions to this problem, researchers have explored such educational precursors as K-12 science achievement, school to health care career pathways, student motivation regarding science, and student interest in medicine. This study focused on the self-efficacy and experiences described by a purposively sampled case (n = 8) of high school-aged underrepresented minority women (URMW) as they entered the medical career pipeline through their participation in a formal medical pipeline program. The eight women were defined as a case because of their group affiliations; they traveled in the same academic and social circles and created their own informal learning community. The study was framed by three theories: intersectionality, positionality, and self-efficacy. Intersectionality allowed the researcher to consider how the intersection of race, gender, and other social identifiers of the participants impacted their medical pipeline entry. Research questions were analyzed qualitatively, using case study methods, and quantitatively, using a paired sample *t*-test.

Study data revealed that participants came into the program with high levels of self-efficacy in several self-efficacy factors. Yet, participants in the pipeline program made significant improvements in their *self-assertive efficacy*.

Analysis of other data revealed that students remained motivated and persisted in the pursuit of their aspirations in spite of challenges they encountered because of their ethnicities and gender. Also, students described a lack of engagement with science courses, indicated poor relationships with science instructors, and revealed inadequate understanding of important high science content that, along with ethnic and gendered factors, caused them to negatively position themselves in science.

This study provides valuable information to K-12 science educators, medical education institutions, and policy makers concerned with extending science education and healthcare-related career opportunities to minority women.

This dissertation is dedicated to my late grandfather, Mr. George Randolph. Though he didn't see me enter graduate school and will not be physically present as I end this phase, I have felt his presence every step of the way. His spirit joins and supports me as I now open a new chapter.

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I want to thank Dr. Carolyn W. Hopp, Dr. Monifa Green Beverly, and Dr. Malcolm Blaine Butler for serving on my dissertation committee. Their feedback and words of encouragement were welcomed and greatly appreciated.

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I am ever so blessed to have had Dr. Shelly Wyatt serve as my dissertation editor. The countless hours she spent reading and re-reading this document did not go unnoticed and I am forever indebted to her.

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LIST OF ABBREVIATIONS

AAMC Association of American Medical Colleges

ACA Affordable Care Act

HLAPP Health Leaders Academy Pipeline Project

HPSA Health professional shortage

NAEP National Assessment of Educational Progress

STEM Science, technology, engineering and math

URM Underrepresented minority

URMW Underrepresented minority women

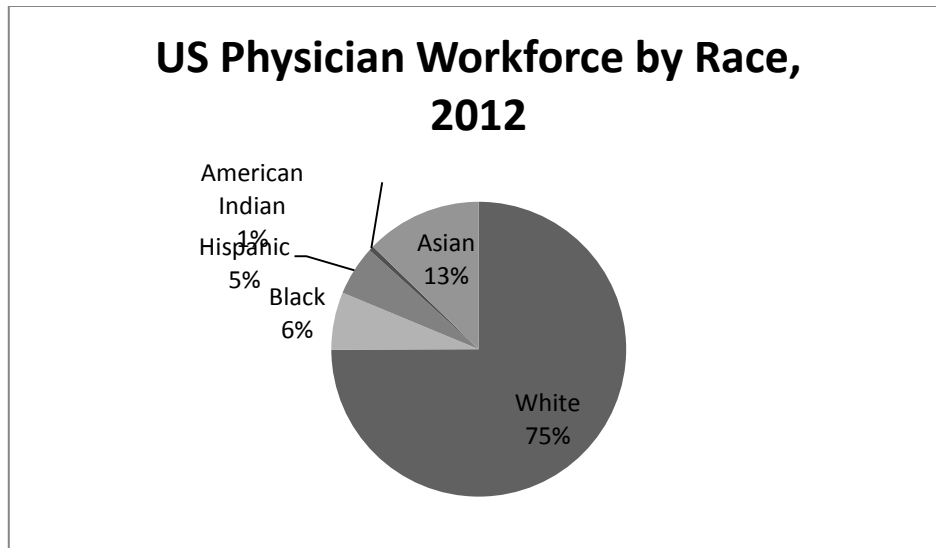
CHAPTER 1 THE PROBLEM AND ITS CLARIFYING COMPONENTS

The argument for increasing the number of diverse health care professionals is not new (Komaromy et al., 1996). In 1991, the Association of American Medical Colleges (AAMC) challenged the nation's medical schools to attract, accept, and enroll 3,000 underrepresented minority (URM) students by the year 2000. Though some progress has been achieved, medical school admissions have not met the AAMC's recruitment goals. More recent data indicate that 1 in 4 Americans qualifies as an underrepresented minority (URMs who are African American, Latino, Native American or Pacific Islander) and URMs account for 12% of the physician workforce (United States Department of Health and Human Services, 2008). Because the number of URMs in the US is projected to grow substantially, increasing the numbers of minority health professionals continues to be a priority. This makes recruitment efforts to attract and retain minorities in the health professions a vital step towards meeting the field's growth demands; studies that answer questions regarding how and why minorities enter and exit the medical pipeline are also vitally important. This study examines the self-efficacy and personal experiences of a purposively sampled case (n = 8) of high school-aged underrepresented minority women (URMW) as they entered the medical pipeline.

Underrepresented minorities face a number of challenges that impact their experience in the medical pipeline and ultimately their matriculation into medical

programs. A underrepresented minority who struggles to get through the medical pipeline is 6 times more likely be dismissed from a professional medical program, 3 times more likely to withdraw from a medical program and 3 times more likely to require six years to graduate when most other students graduate in four years (Merchant & Omary, 2010). At the start of the new millennium and following the lead of the AAMC, Rainey (2001) challenged the medical community to address the problems that URM students face regarding preparation for, admittance to, and retention in medical school. Fourteen years into the new millennium, minorities constitute just 12% of applicants accepted into medical school.

The representation of minorities in the field of medicine is displayed in Figure 1, with White physicians dominating the profession (75%), Asian American physicians constituting 13% of the field, Black and Hispanic physicians constituting 6% and 5%, respectively, and American Indian physicians making up 1% of the field (Castillo-Page, 2011).



*Figure 1. Physician Workforce, 2012. Adapted from *Diversity in the Physician Workforce: Facts & Figures 2010*, by L. Castillo-Page, 2010, Retrieved from <https://members.aamc.org>. Copyright 2010 by AAMC.*

As represented in Figure 2, Asian Americans do not qualify as an underrepresented minority in the field of medicine because the percentage of US physicians who are of Asian descent far exceeds the percentage of Asian Americans in the US population; African Americans and Hispanics qualify as underrepresented minorities because physicians who identify as African American or Hispanic constitute a percentage of US physicians that is below their representation, by percentage, in the population as a whole. These numbers may be indicative of the obstacles URM students face as they seek entry into the medical profession and supports the case for engaging potential URM health professional students while they are still in K-12 (Terrell, 2006).

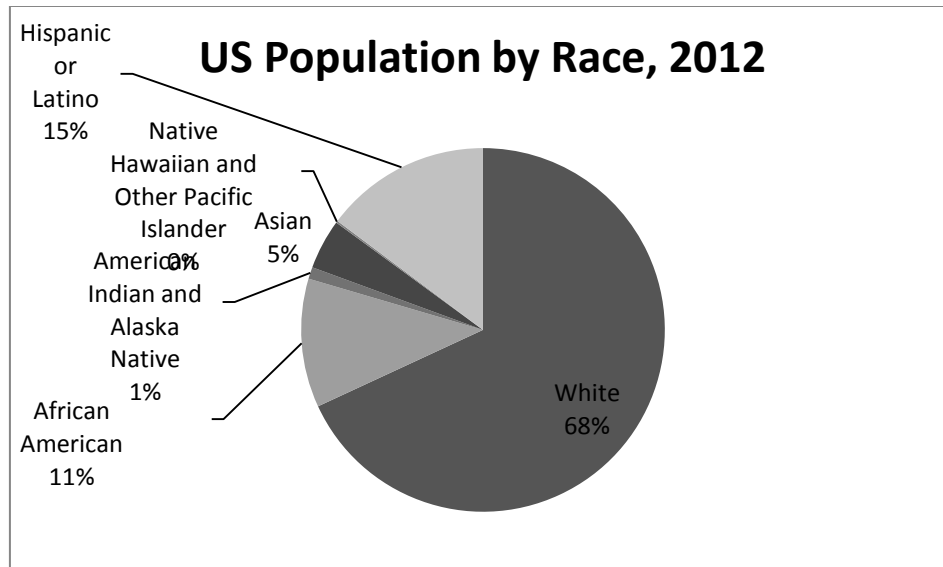
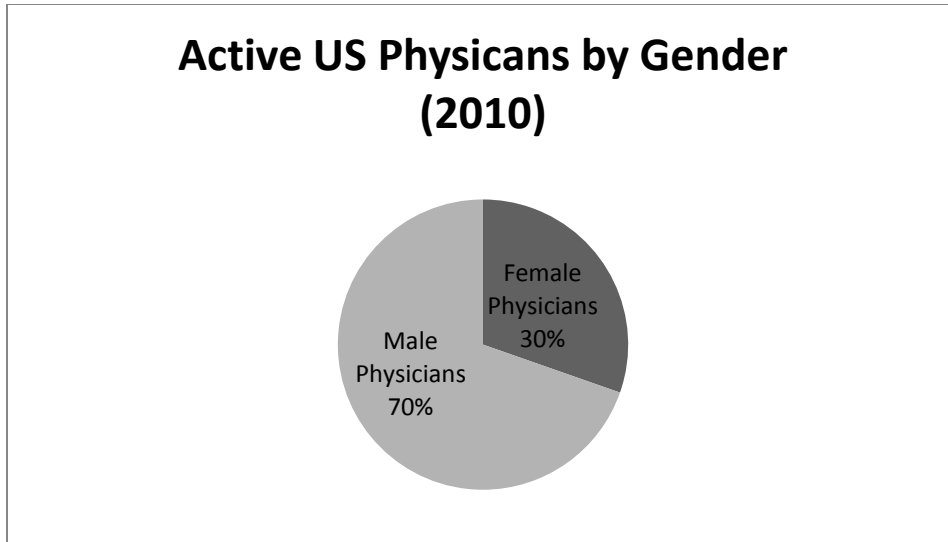


Figure 2. US Population by Race, 2012. Adapted from *USA Quick Facts*, by United States Census Bureau, 2013. Retrieved from <http://quickfacts.census.gov>. Copyright 2013 by United States Census Bureau.

Analyzing the number of active US physicians along gender lines (without regard to race or ethnicity) reveals considerably fewer female physicians than male (Figure 3).



*Figure 3. Active US Physicians by Gender, 2010. Adapted from *Diversity in the Physician Workforce: Facts & Figures 2010*, by L. Castillo-Page, 2010, Retrieved from <https://members.aamc.org>. Copyright 2010 by AAMC.*

Of the approximately 250,000 active female physicians practicing in the US, the numbers of URM women (URMW) fall significantly behind those of White women (Figure 4).

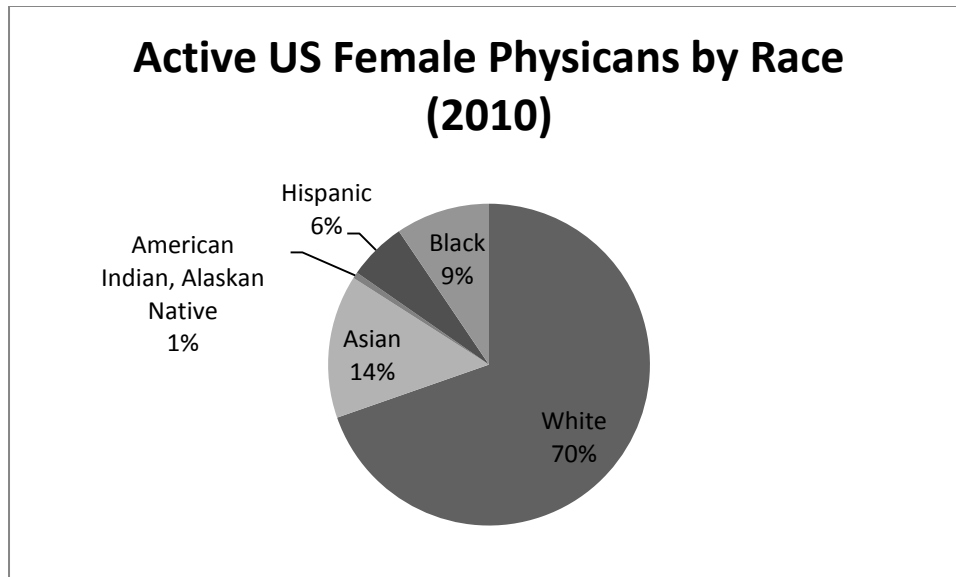


Figure 4. Active US Female Physicians by Race, 2010. Adapted from *Diversity in the Physician Workforce: Facts & Figures 2010*, by L. Castillo-Page, 2010, Retrieved from <https://members.aamc.org>. Copyright 2010 by AAMC.

The AAMC recommends that interventions aimed at helping underrepresented minority students, especially URM women (URMW), overcome challenges associated with medical school acceptance and matriculation must include input and support from K-12 educators (Nickens, Ready, & Petersdorf, 1994). To address these challenges, medical pipeline interventions introduced in secondary school have been created to provide students with opportunities for early entry into the medical pipeline. Even upon successfully entering the medical pipeline, URMW students need help managing the stressors that prevent them from succeeding in science and remaining in the pipeline. Underrepresented minority females may benefit from experiences and activities that enhance their self-efficacy, also defined as the student's belief in her ability

to succeed in a given situation (Bandura, 1997). Because self-efficacy has been documented as positively impacting career trajectories (Bandura, Barbaranelli, Caprara & Pastorelli, 2001), URMW who possess adequate self-efficacy may experience improved odds of accessing and progressing through the medical pipeline. Therefore, the exploration of changes in URMW's self-efficacy was central to this study.

The eight URMW who participated in this study were, at the same time, participants in a pipeline program referred to as Health Leaders Academy Pipeline Program (HLAPP). These eight women were defined as the research case because they created their own social and academic learning communities, attended the same courses in school and participated in HLAPP together. The goal of HLAPP is to provide URM students with academic and career support in entering the medical pipeline, with the ultimate goal of becoming physicians or other college-degreed healthcare professionals. One can argue that to increase diversity in the physician labor force, more URM students must become attracted to health science professions and be encouraged to enter the medical pipeline during their secondary school years prior; waiting until after graduation from high school is too late. Pipeline imagery captures, visually, the process an individual must go through to arrive at a desired profession. Arriving at the desired professional destination requires the following events to occur: (a) introduction to the profession, (b) successful completion of formal education, (c) admission to, and successful completion of, training, and finally (d) obtainment of employment

in the target field. While moving along the pipeline, individuals may be encouraged to participate in such activities as mentoring, tutoring and community building in an effort to retain them in the pipeline. Previous research has been conducted regarding URMs' entry into science, technology, engineering and mathematics (STEM) pipelines, law pipelines and, central to this research study, aeromedical pipelines (Calleros, 2006; Subotnik, Tai, Rickoff, & Almarode, 2009; Terrell, 2006). Though several aspects of pipelines related to the professionals have been researched, from leaks and blockages to breaks, this study focused solely on URMW's pipeline entry (Barr, Gonzalez, & Wanat, 2008; Oxendine, 2009).

Though pipeline imagery has been used to depict the process of transforming students into professionals, Johnston (2012) argues that pipeline metaphors are misleading and should be replaced by the term *garden*. Because the potential of students must be cultivated and given time to grow and develop, Johnston prefers to use garden imagery as opposed to plumbing imagery, with its accompanying connotations of waste and tortuous construction. The garden metaphor, instead, describes the role of educators in helping students bloom into scientists, doctors and other professionals. Regardless of what imagery is embraced by scholars, low levels of science achievement (National Center for Education Statistics, 2011; Rainey, 2001), issues with identity that lead to negative science positionality (Carlone, Haun-Frank, & Webb, 2011; Parsons, 1997, 2008) and inadequate relationships with science teachers in primary and

secondary school (Kitts, 2009; Ladson-Bilings, 1999) may all contribute to URMW being underprepared to meet the rigorous demands of undergraduate science programs and medical school and therefore limit their likelihood of ever entering the medical profession. This study embraces these issues as study propositions, thereby guiding data collection and analysis and highlighting the relationship between K-12 science experience and performance and medical pipeline entry.

Problem Statement

Medical schools in the US are not producing an adequate number of URM doctors; at the same time, US elementary or secondary schools are failing to produce an adequate supply of URM students who are well prepared to meet the rigors of higher education and medical training (Smedley, Butler, & Bristow, 2004). These two problems formed the foundation of this study. This study explored the self-efficacy of URMW students participating in a structured high school medical pipeline intervention designed to provide students with access to experiences, information, and support during their secondary school years to enhance their chances to someday pursue a medical profession.

The problem of having too few URM doctors in the US workforce presents not just an equity issue for the individual who wants to enter the healthcare profession, but one of health care access for populations of minority citizens (Betancourt, Green, Carrillo, & Ananeh-Firempong, 2003). Although initiatives

like the Affordable Care Act of 2010 expanded healthcare access to all Americans, access afforded to underrepresented and underserved populations may remain limited if medical schools fail to produce sufficient numbers of URM doctors (Augustin, 2010). President Barack Obama's approval of the Affordable Care Act (ACA) signaled comprehensive healthcare reform to health not seen in the US since the establishment of Medicare in 1965, meaning that millions of uninsured and underinsured Americans now have some form of health insurance. This new legislation is especially significant for underrepresented and underserved populations; 40 million people will possibly gain access to the health care system (Augustine, 2010; Hofer, Abraham, & Moscovice, 2011). Therefore, greater numbers of URM doctors must be recruited to serve this growing population of minorities who may now have access to healthcare coverage.

Even before Congress passed the ACA, in several geographic regions, health care professionals were in short supply compared to the demand for health care services; URM doctors have been, and continue to be, in short supply in most geographical regions (USDHHS, 2008; Komaromy et al., 1996). There exists an abundance of research to suggest that underserved populations are more likely to be cared for by URM doctors (Butler & Bristow, 2004; Cohen, Gabriel, & Terrell, 2002; Dreachslin, Sprainer, & Jimpson, 2002; Komaromy et al., 1996; Smedley et al., 2004; Smedley, Stith, Colburn, & Evans, 2001; Tedesco, 2001). The location of the practice, level of acceptance of Medicaid

benefits and cultural competence of URM doctors are all variables that impact the care afforded to underserved patients.

Underrepresented minority physicians are more likely to practice in the federally designated health professional shortage areas (HPSAs) where underserved groups reside (USDHHS, 2008). According to Keith, Bell, Swanson, and Williams (1985), URM physicians entering the profession are more likely to practice in HPSAs than their non-URM counterparts. This tendency falls along racial lines; African-American doctors are more likely to serve in African-American communities and Hispanic doctors are more likely to practice in Hispanic communities (Keith et al., 1985). Similarly, Moy and Bartman (1995) noted that URM physicians are more likely than their non-URM peers to accept Medicaid patients. On average 45% of the patients seen by URM doctors are Medicaid recipients (USDHHS, 2008). In addition, researchers have noted that many URM doctors possess cultural competency that allows them to care for, and connect with, their URM patients. Quite possibly because URM doctors frequently speak similar languages as their patients as well as share similar backgrounds and experiences, a bond is established between themselves and their URM patients. Therefore, to meet the medical needs of a growing population of underrepresented and underserved citizens, more URMs must enter the medical pipeline, be admitted to, and trained in, medical institutions and ultimately enter the field as health care professionals.

In this study, the terms medical or health science pipeline projects, programs, enrichment programs or pipeline programs were all used interchangeably. Likewise, the terms health science careers or health careers were used interchangeably and it was understood that medical careers represent one category of many health science career pathways.

Purpose of the Study

The purpose of this study was to examine the self-efficacy of a purposefully selected group of high school URMW as they entered the medical pipeline. By designing this study, I wanted to determine which HLAPP pipeline activities and experiences affected participants' self-efficacy. I also aimed to determine how URMW's self-efficacy beliefs changed during the course of the pipeline intervention and which constructs most contributed to self-efficacy (Bandura, 2002). Finally, I aimed to explore URMW's self-efficacy within the context of experiences in their school-based science courses. The results of this study may enhance HLAPP staff's understanding of the importance of self-efficacy as a factor URMW's success in medical pipeline programs. Additionally, this study may increase science educators' awareness of the challenges that URMW's encounter when studying science and how these challenges may impede their future participation in STEM and medical careers. Ideally, the results of this study may remind science educators of their role in shaping URMW's self-efficacy and will inform them of the ways self-efficacy may

influence their students' decisions to pursue careers in science. Lastly, this study added to our understanding of existing theories on intersectionality regarding high school aged URMW's and their ability to gain admission to medical programs and, ultimately, to excel in the medical profession.

An important component of Bandura's (1977b) social cognitive theory, which is integral to this study, is the concept of self-efficacy. Self-efficacy is defined as an individual's perceived capacity for learning or performing certain tasks (Bandura, 1997). Self-efficacy theory consists of the idea that people have the ability to exert control over their lives and will therefore alter behavior according to efficacy, thereby mitigating the amount of effort exerted to arrive at a desired result (Bandura, 1977a). Efficacy includes the length of time for which effort will be extended, particularly in the midst of obstacles. Efficacy impacts the activities in which an individual chooses to engage as well as the amount of time and effort spent on those activities, especially when faced by challenges (Bandura & Adams, 1977). Self-efficacy is not a term that can be loosely applied to any situation; instead, it is domain specific and therefore dependent on how strong or weak the individual's expectations are and the difficulty of the task at hand. Self-efficacy has been applied to, and researched, in a wide range of contexts, including education where it has been documented to positively impact student achievement (Bandura, 1997; Britner & Pajares, 2001, 2006). Data gathered to evaluate an individual's self-efficacy include: performance outcomes,

vicarious experiences, verbal persuasion, and physiological feedback (Bandura, 1997).

Not surprisingly, the concept of self-efficacy has generated continued interest in researchers and practitioners in the field of education. For example, during adolescence, students experience a number of neurological and psychological changes that impact personal goals and desires, family dynamics, school interactions, and peer affiliations; self-efficacy is shaped by these changes, affecting adolescents' course selection in school and possibly their future career path (Schunk & Meece, 2005). In addition to serving as a function of student achievement, self-efficacy plays a role in the lifestyle choices students make. When students possess positive self-efficacy, a wide range of career choices becomes available because factors including aspiration, commitment, motivation and persistence in the face of difficulty are enhanced (Bandura et al., 2001). Increased self-efficacy in relation to educational attainment can magnify the career options students consider and motivate students to prepare more effectively for the career of their choice (Bandura, 1997b).

In this study, the self-efficacy of high school aged URMW entering the medical pipeline was explored by identifying and evaluating performance outcomes, vicarious experiences, verbal persuasion and physiological feedback (Bandura, 1997a). In theory, if URMW students participating in HLAPP have high levels of self-efficacy, they should approach the difficult task of preparing for college and medical school as a challenge to master rather than a threat to be

avoided (Williams & Williams, 2010). For HLAPP staff, this study reported the ways their URMW participants described their experiences upon entering the health science pipeline and the role self-efficacy played in their medical pipeline entry. Pipeline project staff may take the findings of this study and adjust programming so that the self-efficacy of their participants is enhanced and they are appropriately supported as they enter the medical pipeline. Likewise, K-12 practitioners may use findings of this study to increase students' self-efficacy in traditionally challenging disciplines such as science and math.

Just as changes in URMW students' self-efficacy represented the main purpose of this study, intersectionality theory was important as it served as the study's theoretical underpinning. According to intersectionality theory, race, gender and other social identifiers are not isolated dimensions of identity. Underrepresented minority women cannot decide when they will choose to identify as a woman and when they will choose to identify as a minority. They are always both and instead of viewing each aspect of identity separately, researchers report that the two intersect. Crenshaw (1991) uses the theory of intersectionality to describe the intersecting patterns of racism and sexism as experienced by women of color, ultimately noting that women of color are marginalized within both identities. Crenshaw places intersectionality in both structural and political contexts as well as the ways women of color are culturally constructed.

Like any theory, intersectionality has a wide range of interpretations. Davis (2008) regards the vague and open-ended nature of intersectionality as a strength of the theory, allowing for the multiple positions and multidimensionality of women to be explored. Davis describes intersectionality as dealing with the effects of race, class and gender on women's identities and their struggle for empowerment within systems of power and control. Because the URMW of this study were affiliated with a number of social identifiers (race, class, gender) and were seeking entry into a White male dominated profession, the selection of intersectionality as the research framework was appropriate and allowed for effective representation of the differences and similarities of the participants. Additionally, intersectionality serves as the theoretical framework in public health studies and effectively situates health disparities experienced by underrepresented and underserved populations (Bowleg, 2012).

Definitions of Terms

Affordable Care Act: A federal statute signed into law by President Barack Obama on March 23, 2010 that reformed a number of health care regulations to include coverage, subsidies and Medicare and Medicaid.

Health Professional Shortage Areas (HPSAs): Areas designated by the Health Resources and Services Administration as having shortages of primary care, dental or mental health providers.

Intersectionality: Theoretical assumption that social identifiers (i.e., race, class, ethnicity, gender, disability status, or sexual orientation) are not experienced by individuals in isolation; intersection of these identifiers may heighten the oppression or marginalization experienced by the individual (Crenshaw, 1991).

Medicaid: A needs-based federal health insurance program designed to extend health care coverage to low income citizens.

National Assessment of Educational Progress (NAEP): The largest national assessment available that determines what American students know and can do in a wide variety of subjects.

Self-Efficacy: Belief in one's abilities that allow the individual to organize and take action towards a desired result (Bandura, 1997).

Social Economic Status (SES): A measure of a person's economic and social position in relation to others.

STEM: Science, technology, engineering and math courses or professions.

Underrepresented Minority (URM): An individual who is African American, Latino, Native American, Hawaiian Native or Pacific Islander.

Underrepresented minority women (URMW): A woman who is African American, Latino, Native American, Hawaiian Native or Pacific Islander.

Underserved Population: Individuals living in the US who face a variety of challenging circumstances including, but not limited to, health care access and understanding, poverty and limited English language proficiency.

Research Questions

The following research questions guided the data collection and analysis of this study:

1. How did the self-efficacy of high school aged URMW change during their participation in a medical pipeline intervention?
2. How did URMW describe the self-efficacy constructs that most impacted them?
3. How did pipeline project activities (mentoring, goal setting and skill building) affect the self-efficacy of URMW participants? Why did these activities impact URMW self-efficacy?
4. How did URMW describe their classroom science experiences? In what ways did these experiences impact their medical pipeline entry?
5. Based on intersectionality theory, how did URMW describe their positionality as related to their experiences with science in general and with entering the medical pipeline?

Overview of Methodology

These research questions were answered using case study methodology, the case defined by the eight URMW high school study participants (Yin, 2013). I selected Yin's (2013) method because it allowed for thorough analysis of data collected from multiple sources. The pipeline project at the center of this study, Health Leader's Academy Pipeline Project (HLAPP), is a program that largely contains URM students from a high school in Central Florida that also functions as a health academy. URMW participating in HLAPP were purposively sampled and defined the bound system, or case, to be researched. Health Leader's Academic Pipeline Project itself was not the focus of research in this study. Although I applied primarily qualitative methods to gather data for this study, I also used quantitative methods. Data for this study came from several sources: (a) analysis of HLAPP documents, (b) interviews (focus group, individual and survey), (c) direct and participant observations, and (d) physical artifacts. Triangulation of these multiple sources of evidence was sought to strengthen conclusions presented in Chapter 5.

Organization of the Study

This study consists of five chapters. Chapter 1 includes a presentation of the problem, provides the purpose for conducting the research, and presents the research questions. Chapter 2 reviews the relevant literature, beginning with an overview of the theoretical framework (intersectionality, self-efficacy, and

positionality). Following this review of the theoretical framework, research on the recruitment of URMW doctors and their K-12 experiences, medical pipeline programs, and research related to study propositions is presented. Chapter 3 provides a description of the case study methodology selected, including a description of the case, sample recruitment and selection, data collection and data analysis procedures. In Chapter 4, findings of the study are organized thematically answers to the research questions are presented. Chapter 5 summarizes and discusses the implications of the study and includes a review of the study's limitations. In addition, Chapter 5 presents conclusions and recommendations for K-12 practitioners, HLAPP staff and medical pipeline administrators for further study of URMW and their entry into the medical pipeline.

CHAPTER 2 LITERATURE REVIEW

Introduction

The US healthcare industry struggles to meet the needs of Americans without sufficient numbers of qualified professionals available to deliver health-related services. Today, this statement rings truer than ever now; large numbers of Americans gained access to health care through the Affordable Care Act, which includes extending health care opportunities to a greater number of minorities and to the poor. This changing healthcare landscape begs the question: how will the US educational system respond to this gaping need for more qualified and more diverse candidates for the nation's medical schools? The K-12 sector is an important variable in this equation because school systems, and especially teachers, must produce students who are prepared to successfully withstand the rigors of secondary and undergraduate science coursework, to compete for placements in medical and residency programs, and, ultimately, to fill those programs. To maintain an adequate supply of doctors who reflect the diversity of the communities they serve, medical pipeline entry points must be introduced to students at the K-12 level. Medical pipeline programs have typically been created to introduce underrepresented groups to the medical profession and support them through the initial process of gaining entry to the profession. Still, more research is needed; the factors that both promote and inhibit medical pipeline entry and how K-12 students describe their experiences

as they enter the medical pipeline need to be explored and understood if we are to increase the number minority physicians and healthcare professionals. This study explored the role self-efficacy play as high school aged underrepresented minority women (URMW) entered the medical pipeline through their participation in a structured medical pipeline program.

In this literature review, three theories coalesced to construct the conceptual framework, which explored the self-efficacy, and experiences of a group of high school aged URMW as they entered the medical pipeline. These theories, intersectionality, positionality, and self-efficacy are discussed in relation to issues faced by URMW entering the medical pipeline while in high school. Because this study examined the self-efficacy of URMW entering the medical pipeline, a review of the literature includes general information on URMW doctors and their K-12 science experiences, K-12 medical pipeline interventions and study propositions, followed by a justification of the methodology selected. Next, I present an explanation and discussion of the conceptual framework.

Conceptual Framework

The conceptual framework for this study was couched in theories - intersectionality, positionality and self-efficacy. Using these theories, my goal was to reveal how the intersection of societal factors impacted the ways URMW positioned themselves in science (Crenshaw, 1989; 1991). With the medical pipeline project Health Leaders Academy Pipeline Program (HLAPP) serving as

the backdrop, I also intended to shed light on both how and why self-efficacy impacts medical pipeline entry for the URMW participants. The conceptual framework is represented graphically in Figure 5. The graphic shows how intersecting social identifiers interact to impact the positionality of URMW in regards to science. Furthermore, the graphic represents the assistive nature of self-efficacy in helping URMW to manage the sources of oppression in their lives.

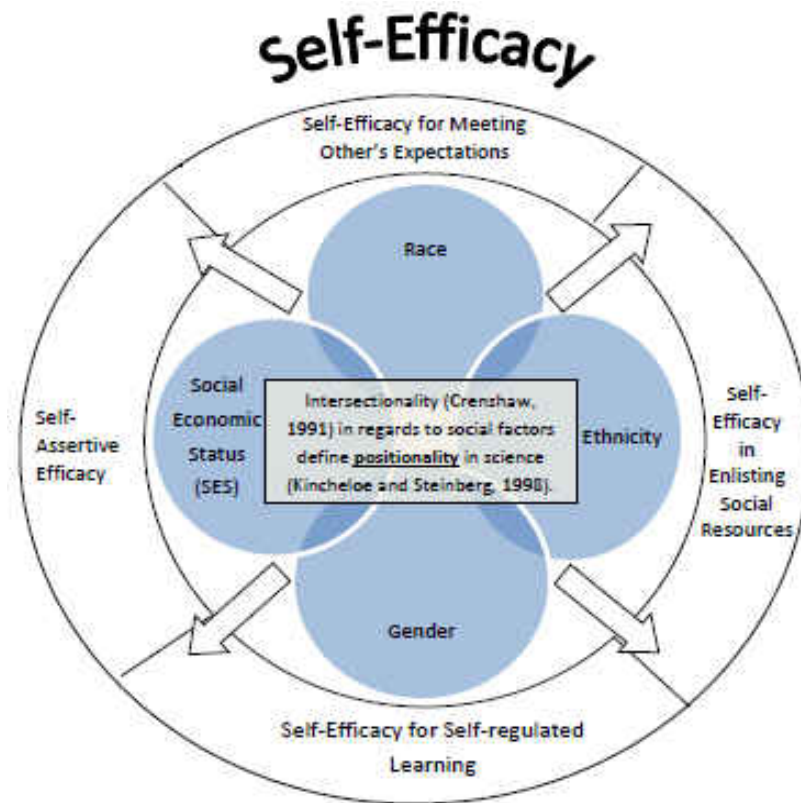


Figure 5. Graphic Representation of the Conceptual Framework.

According to Crenshaw (1991), individuals who subscribe to multiple social identifiers (i.e. a woman who is Hispanic and also disabled) may experience heightened levels of marginalization because such aspects of identity

are not experienced in isolation, but are instead experienced simultaneously. Crenshaw's work in advocating for fair treatment of minority females in the legal system evolved into intersectionality theory, a theory used to reveal how individuals with multiple minority identities experience the world and how they are perceived by others within a system based on mainstream norms and values. Because participants in this study qualified as minorities on two measures, race (non-White) and gender (female), intersectionality theory provided the most robust theoretical foundation for this research.

Similar to intersectionality theory, positionality theory has ties to feminism as Kincheloe, Steinberg, Rodriguez, and Chennault (2000) argue that positionality is related to how we see and understand the world and ourselves through socially constructed lenses. Kincheloe et al. provide an explanation of positionality based on a pedagogy of Whiteness where whiteness is regarded as orderly and rational, thereby elevating Whites to a position of control in comparison to other groups (women, minorities, etc.) who are perceived as disorderly and irrational. In both college and K-12 settings, Maher and Tetreault (1994) note that knowledge is only regarded as valid when it includes attention to the knower's position in a certain context. When it comes to the experience of science, I make the argument that the intersection of race and gender (intersectionality theory) for URMW in this study may correlate with their being negatively positioned in science coursework (positionality theory). Therefore, in

addition to intersectionality, positionality served as a second foundational layer for this research.

Additionally, this study explored the ways self-efficacy changed for the URMW study participants. Self-efficacy was selected because Bandura (1997; 2002) and others have found that adequate self-efficacy contributes to increased school achievement (Velayutham, Aldridge, & Fraser, 2011; Zimmerman, 2000; Zimmerman & Bandura, 1994). Self-efficacy can be identified and measured in relation to varying contexts; Bandura's (2006) self-efficacy scale consists of nine domains. The four self-efficacy domains most applicable to this study are: (a) self-efficacy for meeting others' expectations, (b) self-assertive efficacy, (c) self-efficacy for self-regulated learning, and (d) self-efficacy for enlisting social resources. These domains were chosen and the other five excluded because the remaining domains failed to align with the research framework, nor did they add value to the research questions.

In summary, the intersection of race and gender may contribute to the URMW, in this study, negatively positioning themselves in relation to science coursework and ultimately the field of medicine. Because adequate levels of self-efficacy have been documented to positively impact both science achievement and career trajectories, this study was designed to examine how self-efficacy evolves over time for a select group of high school aged URMW students as they access the medical pipeline. In theory, if these URMW students maintain positive self-efficacy, the marginalization they experience as a result of

their intersected identities may be reduced, allowing them to better position themselves in their science coursework and potential career opportunities healthcare.

Social Identity and Intersectionality

The idea of social identity as it relates to feminism arises from the notion that there is no singular definition of *woman*. Early feminist scholarship only addressed issues of consequence for White women, which excluded other groups. Once the issues of other groups began to be considered, race was the most common way to highlight differences between women in feminist thought (Moraga & Anzaldua, 1981). Now, social identity, which represents the social categories within which an individual claims membership, has broadened to include a number of additional identifiers. For example, URMW participants in this study were female, minority, and have low to moderate social economic status (SES). This study helped to reveal how their social identifiers individually and collectively impacted their pipeline entry.

The construct of social identity can explain group dynamics, or how individuals relate to each other within and across groups and how individuals perceive their social selves. In developing the social self, individuals develop their social identities based on the groups to which they belong or with whom they identify (Tajfel, 1982). Social identity, then, links the individual, including personal values and behavior, to circumstances that occur within the larger group

or to behavior exhibited by the group (Tyler & Blader, 2013). In his seminal work on social identity, Tajfel (1974) describes and defines “in-group” (in this study, URMW) and “out-group” (in this study, the majority group or other groups, not URMW) attitudes and dynamics, most of which are framed by social norms and politics. Within groups, Tajfel (1974) found that belongingness and affiliation were often accompanied by reciprocated discrimination and dislike of the out-group. With that being said, the actions, behavior, and possible discrimination practiced by the out-group can enhance belongingness and affiliation for the in-group.

Social identities such as race, class, gender, sexuality, religion and disability make up this social world as described by Erickson (1963), meaning people tend to view the world through social lenses which may be based on structures of privilege, power or systems of inequality (Croteau, Talbot, Lance, & Evans, 2002; Torres, 2009; Weber, 2010). For the adolescent female student who subscribes to multiple identities, navigating through such systems of power and privilege may be problematic because their achievement in school and their school-based experiences depend not only on their individual identities and attributes, but also on their socially constructed identities (Clark, 1991). Although Rowley, Sellers, Chavous, and Smith (1998) documented instances where African American and other minority students used their ethnic identities to insulate themselves from feelings of low self-esteem and oppression, the ways

groups are “othered” (oppressed) according to their social identities, even in school settings, cannot be ignored (Kumashiro, 2000).

In summary, in addition to being female, women also identify according to race or ethnicity, social class, sexual orientation or disability status. In the past, feminism was based on issues related to White woman only. Now, feminist scholars and researchers give voice to women who may embrace multiple identities simultaneously or in various combinations; for example, a woman might be black, developmentally disabled, poor and lesbian. Metaphorically, Crenshaw (1989) describes the intersection of these social identifiers as having a car accident at an intersection where traffic is flowing in four directions. If discrimination is likened to the flow of traffic, the resulting accident may have been caused by traffic (discrimination) moving in one direction or, more seriously, from traffic intersecting from multiple directions (sources of discrimination). This accident victim may, therefore, experience more damage than an accident victim with traffic (metaphorically) flowing only in one direction.

Intersectionality

The theory of intersectionality has its roots in Black feminism and was formally introduced into the scholarly literature in the “Combahee River Collective Statement” (Combahee River Collective, 1986), a key document offering legitimacy and direction to contemporary Black feminism. Framers of the Collective argued that a universal feminist platform failed to speak for all women,

particularly women of color. They argued that Black women faced oppression related to their gender, social class, race and other social identifiers and that these experiences differed from those expressed by White women. Unable to separate or isolate the many sources of their oppression, these women argued that Black women experience oppression that has been multiplied because of sexism, classism and racism that are typically experienced simultaneously. Crenshaw (1989; 1991) is credited with the early establishment of intersectionality theory because of her response to gaps in antiracist and identity politics as well as mainstream feminist theories.

Crenshaw (1989; 1991) proposed intersectionality as a theory needed to address the complex issues Black women and other women of color faced in the workplace and in the legal system. In each of these arenas, Crenshaw identified the plight of Black women, and other women of color, as being metaphorically relegated to the basement of a house, bearing on their shoulders the social pressures of race, class, gender and possibly sexuality. These women, Crenshaw argued, had little hope of even reaching the ceiling of the basement, let alone seeing level ground because of the many layers of oppression through which they are forced to dig. In addition to the oppression faced by minority women in the workplace and legal system, as noted by Crenshaw, intersectionality theory is applicable to both career counseling and mentoring (healthcare) as well as science education (Bowleg, 2012; Hazari, Sadler, & Sonnert, 2013). The intersection of the social identifiers subscribed to by the

high school aged URMW in this study may heighten the marginalization they experience in and out of school and may therefore impact their entry into the medical pipeline.

Intersectionality as Theory

At the heart of intersectionality theory is feminist scholars' acknowledgment that women are not collectively the same and, furthermore, women on the margins of society have historically been excluded from feminist scholarship (Zack, 2007). Foundational feminist theory and inquiry had been largely framed by the experiences of White, middle class, educated women until scholars such as Hull, Scott, and Smith (1982) argued for a more inclusive understanding of women's experiences to include women who identified with other races, classes or social identifiers. The exclusionary component of traditional feminist scholarship is addressed by intersectionality theory, providing feminist scholars with a platform on which to account for the absence of marginalized women in theory, practice and inquiry. This theory not only gives voice to women who deserve to be heard, but advances an agenda for equality (Matsuda, 1987; Nash, 2008).

Building on feminist scholarship, intersectionality supports the study of all aspects of women's experiences that are of interest to feminist scholars: individual experiences, theories that explain identity, and social systems or cultural discourse (Davis, 2008). The eclectic nature of intersectionality, as a

theory, can be interpreted to mean everything and possibly nothing about women and their multiple identities; in other words, its flexibility and breadth is its great strength and potentially greatest weakness (Phoenix, 2006). Davis (1986) argues that the birth of a new social theory typically appeals to a wide audience, but this does not mean there is wide agreement on the fundamental framework that supports the theory. As theories develop, they are often based on vague assumptions, may be incomplete or open ended and may lack well-defined definitions or focus.

In order to gain traction, a new theory typically challenges the status quo and adds a new twist to an old idea or brings controversy to the conversation (Davis, 1986). Although the idea of bringing to the forefront the varying experiences of non-White women is not new, intersectionality theory offers researchers a new way of looking at an old idea by allowing two schools of feminist scholarship to coexist (Combahee River Collective, 1986; Hull et al., 1986). Intersectionality allows for theories related to race, class and gender to be compatible with critical methodologies adopted by post-modern feminist theorist (Davis, 2008). In this study, intersectionality theory provided the opportunity to explore how URMW participants described their experiences associated with being minority women headed into the health science career pipeline. This theory gave them voice, allowing them to document the challenges they faced as their gender and racial identities intersected as well as to describe if, and how, they overcame their marginalization.

Intersectionality and Science Education

Any student desiring to pursue a career in the healthcare profession must first find success in K-12 science courses and in an undergraduate science program. For many years, females lagged behind males in science achievement and this shed light on why females lagged behind males in both science, technology, engineering, and math (STEM) and the medical professions (NCES, 2011). Collectively, girls' achievement in science has increased to be on par with and, in some cases, exceeds the science achievement of boys; however, minority females continue to lag behind. Even with an increase in science achievement enjoyed by some girls, neither group of girls (minority or non-minority) has realized a substantial increase in numbers regarding STEM and medical careers (NCES, 2011).

Kitts (2009) notes that current research on girls in science suggest that it is the educational systems in which female students learn that need restructuring; however, this explanation has not always been a research focus. Research on girls and their achievement and participation in science has been featured in the body of feminist science education literature for decades. The research agenda of the 1960s and 1970s focused on the science achievement gap between boys and girls (Scantlebury & Baker, 2007). Feminist movements of the 1980s celebrated the idea that although girls were strong, they were different and neither science classrooms nor science professions met or appreciated those unique needs (Barton, 1998). In the 1990s, critics of feminism

explained the underachievement of girls by using a deficit model (Baker & Leary, 1995). Underrepresented minority female students participating in this study revealed some of the same achievement challenges as documented in the research literature for URM students of science.

Currently, the scholarly literature has shifted to looking at some of the obstacles that girls face in our society and how societal forces have shaped the educational system to which these girls belong. There have been a number of feminist-based research studies in which a variety of issues relating to girls in science have been studied. Examples of topics related to girls and their science engagement have included STEM interest and participation, girls' attitudes and motivation towards science, and the science identities of girls (Baker, 2013; Farland-Smith, 2009; Tan, Barton, Kang & O'Neill, 2013; Velayutham, Aldridge & Fraser, 2012). Brotman and Moore (2008) have contributed four themes regarding girls and their science engagement: (a) equity and access, (b) curriculum and pedagogy, (c) reconstructing the nature and culture of science, and (d) identity (Brotman & Moore, 2008). Of these four themes, the one having the most bearing on this study on intersectionality and positionality is the theme related to girls and their science identities.

In addition to general feminist studies, intersectionality has emerged as an attractive framework for science educators studying the impact of identity and social identifiers on the science education experiences of girls (Atwater, 2000; Bianchini, Cavazos, & Helms, 2000; Gaskell, Hepburn, & Robeck, 1998; Gilbert

and Calvert, 2003). Focusing on more nuanced aspects of identity, scholars have identified situated cognition as factor in girls seeing their multiple identities coincide with science identities (Brickhouse, Lowery & Schultz, 2000; Brickhouse & Potter, 2001). In other instances, studies found success in making room for girls' multiple identities by defying commonly held science stereotypes (Hughes, 2001). Methodologically speaking, researchers have embraced girls' own narratives, allowing for further discussion of multiple identities as they relate to science and gender (Bianchi et al., 2000; Gaskell et al., 1998).

In summary, studies of identity in the science education research literature are present; however studies of intersectionality in science education are less common. Adding to the science education research literature, intersectionality theory was selected to provide the context with which to analyze data for this research. The intersection of participants' ethnicities and gender may impact how participants describe their experiences of entering the medical pipeline and their experiences of science in general. Intersectionality, then, was useful to frame and relate these two aspects of the study.

Positionality

There is dearth of research concerning URM girls in K-12 science education and the likelihood of their future entry into STEM fields and the medical professions. To be more precise, there is a gap in the scholarly literature related to URMW'S positionality in K-12 science that focuses on how they perceive

themselves within, and how they navigate through, systems of power. Kincheloe et al.'s (2000) definition of positionality, as an individual's socially constructed understanding of the world influenced by the complex interactions of race, class and gender, was used to frame this study along with intersectionality theory.

In their book *White Rein: Deploying Whiteness in America*, Kincheloe et al. (2000) devote their first chapter to describing, as the basis of positionality, the claim that individuals are unable to separate where they stand from what they perceive. In other words, social theory and even intersectionality theory remind us that an individual's understanding of his world is socially constructed. Therefore, it is worthwhile to study the knowledge-construction and meaning-making of individuals who affiliate with diverse groups that may diverge from the mainstream. Furthermore, the divergent positions of diverse and mainstream groups, and the power relations that follow, may bring about race and gender and other systemic inequalities. This assertion demands the consideration of the positionality of the majority in addition to the positionalities of minority groups. Kincheloe et al. go on to describe a "pedagogy of Whiteness" that emerges from the social constructs of power, colonialism, privilege and normalism. Although the authors acknowledge that the concept of "Whiteness" is not easily defined, the language, knowledge and ideology that shape White identity establishes differences between White and non-White people, thereby positioning Whites as rational and superior and non-Whites as inferior or irrational.

A mechanism, then, is necessary to overcome the power struggles and unequal relationships between majority and minority groups; positionality has grown out of the work of critical multiculturalists and feminists seeking to eradicate racism and sexism faced by minorities who must navigate through a series of power structures (Cochran-Smith, 2004; Nieto, 1999; Sleeter, 1996). Leaders in the medical field share the desire to further diversify the health science profession for the sake of equity, extending healthcare opportunities to underserved groups and extending the health science research agenda to encompass minority health issues (Cohen et al., 2002). For this reason, studies that provide information regarding the recruitment of minorities into the health science field are useful. This study examined changes to URMW's self-efficacy as they entered the medical pipeline.

Since the positionalities of minorities differ from those of the majority, such differences ought to be reflected in research. In her work on positionality, Parsons (2008) makes a case for considering African American positionality in science education research. Parsons argues that, too often, science education research related to African Americans is based on a deficit model and the naïve assumption that access to cultural, social, educational, political, and economic resources are the same for all Americans regardless of race, ethnicity, gender or social class. Like Tillman's (2002) call for making culturally sensitive research strategies the center of research of African Americans, Parsons calls for attention to be paid to the positionality of African Americans within broader society. More

specifically, Parsons follows through with this call by advocating for a theory that is based on the historical and cultural features of African American existence. It is Parson's contention that research in science education that focuses on African American subjects is not effectively conducted or analyzed if researchers fail to address the cultural-historical domain of African Americans' lived experiences.

Rooted in feminist scholarship, positionality has been used to describe a self-acknowledged position that reveals the individual's personal conception or view of humanity. According to positionality theory, we are defined by our positions that ultimately govern the amount of individual power we possess (Cooks, 2003; Harley, Jolivette, McCormich, & Tice, 2002). Positional factors have been shown to affect knowledge construction, power, and relationships in and out of the classroom (Johnson-Bailey, 2003; Maher & Tetreault, 2001). It may be possible that the URMW students participating in this study may have created cultural, gender-based, and class-based identities associated with science learning; these identities may then have impacted their success in high school and later access to the medical pipeline.

Self-Efficacy

Experts in self-efficacy research suggest that a student's self-efficacy can influence participation and persistence in science-related activities and, ultimately overall success in science (Bandura, 1997; Britner & Pajares, 2001). If this is also revealed to be true of the URMW participating in this study, their self-

efficacy beliefs may positively influence their entry into the medical pipeline. According to Bandura (1986, 1997), self-efficacy is defined by an individual's beliefs in his or her capacity to organize and execute actions needed to achieve a goal. Accordingly, motivation to perform an action depends on how successful the individual believes he will be at achieving a favorable outcome. Increased self-efficacy can positively impact students in terms of academic motivation, performance outcomes, and self-regulation; self-efficacy also can be used to predict academic success (Zimmerman, 2000). For this reason, self-efficacy is a viable component of science education reform efforts, including science interventions that target minority students. A key feature of self-efficacy deals with students and their ability to be reflective. Goal setting, self-monitoring and self-evaluation are all self-regulatory responses of students motivated because of their self-efficacy beliefs (Zimmerman, 2000). Zimmerman and Bandura (1994) note that self-efficacy and goal setting predicted final exam scores in high school students. The beliefs related to achievement and goals of 281 middle school students were positively associated with self-efficacy and self-efficacy for self-regulation, bringing researchers to conclude that self-regulatory practices lead to positive outcomes (Pajares, Britner, & Valiante, 2000). Even internationally, self-efficacy and self-regulation have been shown to impact science achievement; students' beliefs in their ability to be successful in science are related to actual performance (Velayutham et al., 2012).

In addition to self-regulation, self-efficacy has shown to influence such motivational factors as choice of activities, level of effort, persistence and reaction to emotions (Zimmerman, 2000). In a study of 47 minority students, researchers discovered that intrinsic motivation was positively associated with self-efficacy and science performance (Niehaus, Rudasill, & Adelson, 2012). Similarly, Britner (2008) determined that motivation contributed to student self-efficacy; however, differences were noted according to the type of science course taken. Chin and Pajares (2010) found that sixth graders' perceived abilities in science had both direct and indirect effects on their motivation. In addition to enhancing student motivation and performance, self-efficacy has been shown to be useful in predicting science achievement (Velayutham et al., 2011). Adding to the centrality of self-efficacy in students' academic success, Bandura (1986) argued that students' self-efficacy is a better predictor of future academic success than are actual assessments of abilities. Several studies of high school students have determined that students' self-efficacy is a more reliable predictor of science achievement than gender or ethnicity (Kupermintz, 2002; Lau & Roesner, 2002). Similar findings were observed for middle school students (Britner & Pajares, 2001, 2006; Pajaras et al., 2000).

If what has been reported in these research studies is also found in the group of URMW featured in this study, improving their self-efficacy may assist URMW with overcoming marginalization that may arise from the intersection of gender and race. Likewise, increased self-efficacy may contribute to a more

positive science positionality, all of which may assist with medical pipeline entry. I argue that the URMW in this study may express a heightened sense of marginalization because of the interaction of race and gender that may ultimately have led them to adopt negative science positionalities. Furthermore, this research may reveal that changes to participants' self-efficacy during participation in HLAPP may have helped participants to better manage the oppressive factors they experienced as they entered the medical pipeline. As noted earlier, positive self-efficacy is associated with school science achievement and has also been shown to positively impact career trajectories; adequate self-efficacy, then, may positively contribute to medical pipeline entry for the URMW participating in this study. For the remainder of this chapter, underrepresented minority doctors and K-12 science education, health science pipeline programs and study propositions are reviewed.

Recruitment of URMW Doctors

Two decades ago, the Association of American Medical Colleges (AAMC) planned to further diversify the physician workforce by challenging the nation's medical schools to attract, accept and enroll 3,000 underrepresented minority (URM) students by the year 2000. Because of the low numbers of minorities attending medical school, the AAMC made it a priority to increase the numbers of minority doctors so that physicians with more adequate cultural competence could better meet the healthcare needs of growing underserved populations

(Nickens et al., 1994). Having more minority physicians in the health science workforce is desirable for a number of reasons; some minority patients prefer to be seen by minority doctors for reasons other than convenience or location, including the cultural competence of the doctor and acceptance of Medicaid benefits (Saha, Taggart, Komoromy, & Bindman, 2000). Also, URM applicants for medical schools have been recruited as a way to extend healthcare access to URM populations. Studies tracking minority doctors have revealed that many of them deliberately seek patients from underserved communities (Castillo-Page, 2010; Smedley et al., 2004).

Medical schools in the US continue to fall short of their URM recruitment goals, particularly when assessing URMW's medical school acceptance and completion. Though women in general are pursuing college level science degrees in increasing numbers and 47% of all medical school matriculates are women, just 4% of all physicians self-identify as URMW (Castillo-Page, 2010). Recruiting efforts that prioritized increasing the numbers of URM physicians occurred in three waves. Numbers of URMs in medical school rose rapidly from 1968-1974, beginning with 2.2%. Though the healthcare needs of the larger population increased from 1975-1990, the number of URMs remained stagnant. After 1990 and the initiation of the AAMC's "3000 by 2000" goal of URM matriculates, the number of URMs in medical school began a modest increase that was well outpaced by the overall population growth of URMs. These numbers prompted the AAMC to develop the "3000 by 2000" recruiting initiative that included the

development of health sciences magnet high schools across the country, focused especially in localities with medical schools, articulation agreements between educational institutions designed to introduce and keep URM students in the medical pipeline, and science education partnerships (Nickens et al., 1994). Therefore, the AAMC acknowledges that K-12 science education is linked to the recruitment of URM doctors. The pipeline program featured in this study, HLAPP, represented science education opportunities outside of school to attract URM students to the health science profession. This study was so important because it explored URM students' experiences and changes to self-efficacy as they entered the medical pipeline. The information gained from this study may be of use as future medical pipeline programs are developed.

K-12 Medical Pipeline Interventions

A goal of the AAMC has been to increase minority representation in the health professions (Gonzalez & Stoll, 2002; Smedley et al., 2004; Sullivan, 2004). The AAMC has recommended K-12 medical pipeline programs as viable pathways for URM students to seek early entry into the medical profession, meaning the establishment of public school and university partnerships that may provide feasible solutions for increasing minority representation in health science careers. Heeding the AAMC's recommendation, K-12 pipeline projects designed to increase URM participation in the health sciences have emerged and been the topic of study. After surveying the directors of six summer enrichment programs,

Gravely, McCann, Brooks, Harman, and Schneiderman (2004) found that recruitment and retention programs were possible options for increasing URM participation in health science careers. In addition, the establishment K-12 enrichment programs may provide further support for URM students unprepared to meet the rigors of college (Bediako, McDermott, Bleich, & Colliver, 1996; Gonzales, 1999; Goodell, Visco, & Pollock, 1999). More recently, Health Leaders Academy Pipeline Project (HLAPP) was designed to attract URM students to health science professions and to provide them support as they entered the pipeline and initially enrolled in college. Program goals, intervention goals, and the nature of the partnership relationship were all addressed by HLAPP staff and were important to review in this chapter (Patterson & Carline, 2006).

Goals of K-12 Pipeline Interventions

Both federally and privately funded pipeline programs have been established to encourage minority students to enter the medical school pipeline. Although there have been numerous small-scale efforts to increase pipeline entry, five major initiatives have targeted minority high school students for medical pipeline entry over the last 50 years (Grumbach et al., 2003). These initiatives include the federally funded Health Careers Opportunities Program (HCOP), Centers of Excellence (COE) and Nursing Workforce Diversity Program. These initiatives are associated with the Bureau of Health Professionals, a component of the U.S. Department of Health and Human Services Health

Resources Administration (HRSA). The Health Professionals Partnership Initiative (HPPI) and Bridge to Employment Initiative (BTE) have been privately funded by the Robert Wood Johnson Foundation in conjunction with the W.K. Kellogg Foundation and Johnson and Johnson, respectively. Funding of HPPI ended in 2005 and federal funding for HCOP, COE and the Nursing Workforce Diversity Program has been drastically reduced. This is consistent with the 10-20 year age of many of the studies reviewed. Recent studies of large-scale programs targeting minorities for support in health education and health-oriented careers are scarce because funding for those programs is scarce.

The strongest argument for increasing the number of minority healthcare professionals emerges from changing US demographics. Beginning in 1980, the growth of African American, Hispanic, Native American, and Asian populations outpaced those of Whites and this trend continues unabated. It has been predicted that minorities will account for over 50% of the US population by 2050, supporting the argument that more minority healthcare professionals are needed to match US population shifts. Other arguments for promoting diversity in the health care industry include

- advancing the cultural competency of healthcare providers,
- increasing access of high quality health services to underserved and underrepresented populations,
- strengthening the medical research agenda,
- extending that agenda to the underserved and the underrepresented, and

- promoting optimal management of the health care system (Cohen et al., 2002).

Often, K-12 interventions offer curriculum, mentorship opportunities and real-world experiences that align to their associated goals. As far back as the 1970s, the Comprehensive Health Manpower Training Act (1971) created the Health Careers Opportunity Program (HCOP) that consisted of eight program goals: (1) student recruitment, (2) pre-entry preparation, (3) preliminary education, (4) facilitating entry, (5) curriculum, (6) field work, and (7) student evaluations (Weppner, Bowman, & Balsley, 1999). The purpose of HPPI and other initiatives was to act as a source of educational reform for minority students through the creation of community partnerships between academic medical centers, K–12 school districts and colleges and universities. Because most of the federal funding once available to initiate and sustain health science pipeline programs has decreased significantly, program staff must look to other funding sources to run their programs or must run programs on very small scales. This was true in the case of HLAPP. Whether large or small in scale, goals of these programs include: (a) encouraging and funding magnet health-science high schools, (b) creating articulation agreements and (c) instituting science education partnerships. Qualified minority students are identified, provided medical education pipeline entry, provided with enriched science and medical experiences, and offered opportunities for mentoring as well as, adequate and relevant counseling (Cohen et al., 2002).

Medical pipeline initiatives can take on a number of forms, including high school health academies, dual enrollment programs as well as workplace and college exposure and enrichment opportunities. Also, K-12 health science school and community partnerships are important features of successfully run pipeline programs. Studies of pipeline programs have included health science interest, college attendance and graduation rates, medical school matriculation and soundness of partnerships as program outcome measures.

Health Science Career Interest

Deficits in students' self-efficacy in K-12 math and science are contributing factors to the low numbers of minorities who enter math and science careers as adults (O'Brien, Martinez-Pons, & Kopala, 1999). Bandura's (1997) self-efficacy theory has been the focus of a number of research studies which have shown that students' self-efficacy mitigates a number of school-related factors, including achievement in school, the likelihood of taking advanced courses, and expressing interest in certain careers (Bandura et al., 2001). Bandura et al. (2001) explored self-efficacy as it relates to students' career trajectories, finding that self-efficacy impacts the jobs students envision themselves holding in the future. Therefore, career interest can be an outcome measure sought after by educational program leaders. Interest in health science careers has been a measure of pipeline program effectiveness in a number of medical pipeline interventions.

Survey data from the Associated Medical Schools of New York's Science and Technology Entry Program indicated that 71% of attendees (n = 258) expressed interest in medical school through selecting pre-med programs in college (Jones & Flowers, 1990). Program leaders of pipeline programs at Baylor University (Houston) used survey data collected from 1972-1990 (n = 2,4818) to discover that 54% of participants selected a health science profession as their main career goal (Petersdorf, Turner, Nickens & Ready, 1990). Paudula, Leinhass, and Dodge (2002) studied 19 high school students participating in a summer bridge program that enhanced awareness of geriatrics-related professions. At the close of the program, 57% expressed interest in pursuing the field, while 10% expressed interest in the nursing field.

In addition to data reported from surveys, career interest in medicine has also been qualitatively reported. Using written feedback from respondents, researchers determined that all 20 students participating in Baylor University's Research Apprenticeship for Minority High School Students reported that science would be their college major (Thomson, Roush, Smith, & Holcomb, 1984). Through informal verbal conversations with participants from the University of Illinois's Health Science Center Biomedical Science Program, researchers documented participant curiosity concerning the advantages and disadvantages of pursuing health careers (Lourenco, 1983). Although a number of health sciences pipeline programs have cited descriptive data as appropriate ways to document interest in health sciences, Adelman (1998) argues for the

appropriateness of pre-post measures when conducting such studies. When 23 Native American students participated in a 12th grade employment program, researchers found no statistically significant improvements in students' interest in health careers by the end of the program as interest was already high when the program started (Kokotailo, St. Clair, Lacourt, & Chewning, 1995).

Accessing the Medical Pipeline Within School

In addition to health science programs that take place outside of school, some students are able to access the medical pipeline through opportunities made available within the school. Two opportunities described in the scholarly literature include dual enrollment programs and health science high school academies. Attending career academies or health careers magnet programs housed within schools are methods by which some minority high schools students access the medical pipeline, though these programs do not typically target or deliberately recruit minorities for participation. Small high schools and health academies within larger schools offer a number of benefits including autonomy, personalization, accountability, assessment, identity and curricular focus (Cleary & English, 2005). Over 2,000 career-oriented academies are co-located within US high schools, 20% of which are health science focused. Few studies have been conducted to determine if the growing number of health science academies impact participating students' selection of college major and later career choices. Studies have been conducted that show favorability

towards connecting the work-based aspect of health care with the school career academy (Stern & Rahn, 1995).

Like career academies, dual enrollment programs provide pipeline entry points that can be accessed through school. Students participating in dual enrollment programs take college level courses at local community colleges, or in their high schools, earning college credit when the course is successfully completed. In some instances, students with enough credits earn AA degrees in addition to the high school diploma upon high school graduation. Dual enrollment programs can provide secondary students with pipeline entry points; students can complete some of their pre-med courses requirements while still enrolled in high school. Students in this study also were participants in their high school's health science academy, providing them an additional pipeline entry point.

College and Medical School Matriculation

A number of pipeline programs have used post-program college attendance as a measure of program effectiveness. Several of these programs have reported very high percentages of students who, after completing their enrichment program, have entered college; some programs reported a college entrance rate of 100%. Most, if not all, of these studies failed to differentiate between students who were going to college regardless of program participation from students who decided to attend college because of the program.

Furthermore, most studies lacked a control group of similar students who did not participate in the treatment to be used for comparison (Bauman, 1991; Beck et al., 1978; Burke, 1977; Butler et al., 1991; Cregler, 1993; Davis & Davidson, 1982; Jones & Flowers, 1990; Lorenzo, 1983; Marshall, 1973; Nickens et al., 1994; Thurmond & Cregler, 1994).

To a lesser extent, follow-up studies have included medical school matriculation and completion rates as measures of program effectiveness. Pipeline programs associated with Baylor University in Houston, Mercedes and Rio Grande (n = 2,581) reported that 4% of program graduates had completed, or were still attending, medical school at the time of the study (Butler et al., 1991; Petersdorf et al., 1990). Staff reported similar statistics associated with medical enrichment programs held at the Medical College of Georgia and the University of Southern California School of Medicine. At the Medical College of Georgia, 58% of students (n = 50) who participated in their Minority High School Student Research Apprentice Program enrolled into medical school (Thurmond & Cregler, 1994) while 6% of students who participated in the University of Southern California School of Medicine's Cluster Program (n = 410) while in high school had either enrolled in or completed medical school when the study was conducted (Nickens et al., 1994). Likewise, students participating in Ventures in Education, a New York-based medical pipeline project for minority students, had higher rates of medical school application and acceptance than the control group (Bediako et al., 1996). Although these programs were able to claim that some of

their participants became doctors, the same criticism exists for those programs using college matriculation at outcomes measures.

Without more studies with control groups, there is no way to correlate program participation rates with medical school matriculation and completion. At the conclusion of this study, the HLAPP program staff had not made plans to track their participants as they enrolled and matriculated through college nor have they made plans to determine if any students enrolled into medical school. The program staff has not engaged in any research, so no control groups have been established. The only research underway regarding HLAPP is my own which in no way evaluated the HLAPP program, but instead asked specific research questions regarding the bound case of URMW participants. If HLAPP continues, the program staff may find value in tracking students' long term and employing experimental designs that include control groups.

Study Propositions

To strengthen the conceptual framework of this study, study propositions were included so that pattern matching could be achieved (Yin, 2013). Theory-linked study propositions were devised so that inferences could be made and patterns determined from those propositions. The study propositions have been formulated to describe some of the school-based challenges that study participants faced as they entered the medical pipeline. The following case study propositions were used in this study:

1. Some URMW high school students were unprepared to meet the rigors of college-level science programs and medical school programs because of low achievement and limited experiences in K-12 science (NCES, 2011; Rainey, 2001).
2. Underrepresented minority female students may have issues with identity face challenges because of their gender and ethnicities and may fail to position themselves in science (Carlone et al., 2011; Parsons, 1995, 2008).
3. Underrepresented minority female students may describe poor relationships with their science teachers that may contribute to the disengagement in science (Kitts, 2009; Ladson-Billings, 1999).

Study Proposition 1

Study Proposition 1 was devised to address the insufficient number of URM doctors practicing in the US; the paucity of URM doctors may be directly related to the inadequate supply of URM students prepared for the rigors of higher education. This includes URMW students whose underachievement in math and science surfaces as early as the fourth grade. According to the 2009 National Assessment of Educational Progress (NAEP), 4th grade minority (African American, Hispanic, and Native American) girls scored, on average, of 31 points behind non-minority boys and girls in both math and science. Similar trends were observed for 8th grade minority female adolescents and again for 12th grade in this same group (NCES, 2011). By the time young minority women prepare to enter college, they do so having scored significantly lower than their non-minority counterparts, whether male or female, in both math and science. These

statistics provide the basis for undergraduate participation in science, math, technology and engineering (STEM). Although medical schools do not require incoming students to have earned undergraduate STEM degrees, pre-med students are required to successfully complete STEM courses. When compared to their non-minority counterparts, URMW students are less likely to enroll in STEM courses and, when they do enroll, they perform more poorly (National Science Foundation, 2009). To increase the number of URMW who enter the medical pipeline and go on to become doctors, engagement is needed at the K-12 level. More URMW must be provided early entry points into the medical pipeline (elementary and secondary school) and these students must be prepared for the future rigors of the profession.

Well before deciding on a career path, most girls have spent time in science classrooms where they have been treated differently than their male peers. These differences, whether blatant or subtle, intentional or unintentional, have impacted the science achievement of female students as moderated by race and class as well as by changing curricula and the class environments. Consequentially, these differences may further impact science achievement by altering the attitudes female students have towards science.

URMW's Science Achievement: Race and Class

Until the 1990s, studies of gender and science education were not a priority in the science research agenda and even fewer studies addressed the interplay of race and class for female students in science classrooms

(Scantlebury & Baker, 2007). Critiques from Kahle and Meece (1994) exposed, as part of the development of their deficit model, the reliance of previous studies of science and gender on emphasizing how girls failed to measure up to boys. Attention paid to gender issues in science has resulted in a closing of the gap between male and female students and, in some subjects, the gap has been completely closed. Although studies related to gender and science education abound, there have been few studies that address the intersection of race, ethnicity, sexuality or social class (Scantlebury & Baker, 2007). Likewise, few researchers have examined subgroups of women or examined how girls and adolescents vary within subgroups (i.e. suburban versus urban African American girls). When researching gender issues, to include minority subgroups, Baker (1998) found that the influences at home and in the general cultural often act as obstacles that negatively impact minority females' science participation. Ironically, Hanson (2004) found that, in spite of the barriers encountered by African American girls, their motivation towards, interest in, and positive beliefs regarding science achievement persisted and, in some cases, exceeded that of their White male counterparts (Hanson & Palmer-Johnson, 2000). Yet, this aspect of science-related self-efficacy did not correlate with increased science achievement for these African American girls whose achievement lags behind both their White male and White female peers (Hanson, 2008).

URMW's Science Achievement: Attitudes

Studies have indicated that, starting in elementary school, boys have characteristically been more interested in studying science than girls; boys have also had more positive attitudes towards studying science (Kotte, 1992). From examining NAEP data, Kahle and Lakes (1983) determined that girls used such words and phrases as “facts to memorize” and “boring” when describing their science classes. Sullins, Hernandez, Fuller, and Tashiro (1995) found that, upon entering middle school, girls’ attitudes toward science that continues to decline throughout high school. Adding to this work, Catsambis’ (1995) investigation of data from 19,000 eight graders participating in National Educational Longitudinal Study (NELS) showed that boys looked forward to science class more, were more likely to describe science as beneficial for their futures, and were less apprehensive about asking science questions than their female counterparts. These attitudes persist, even when girls are the higher achievers (Catsambis, 1995).

Weinberg’s (1995) meta-analysis and the literature review conducted by Osborne, Simon and Collins (2003) confirm that gender continues to be the differentiating factor in students’ attitudes towards science. In a study of girls’ preferences towards particular disciplines of science, Brotman and Moore (2008) determined that girls preferred biological sciences and sciences where they could see themselves helping others. Generally, students report a lack of interest in physics and girls failed to see the relevancy of physics concepts to their lives

(Murphy & Whitelegg, 2006). Another group of girls studied by Carlone (2004) acknowledged the importance of studying high school physics for college applications but admitted that they had little interest in the subject.

URMW's Science Achievement: Curriculum and Class Environment

Girls are not treated equitably by science tests that are filled with male-oriented examples and questions and, conversely, are devoid of content of interest to girls (Sadker & Sadker, 1994, 2001). Findings from a study of 16 elementary students, 47% of whom were African American, reveal that girls sought relationships and were more cooperative than boys in the classroom, complied with teachers' directions more readily, and manipulated science materials less frequently, while boys tended to behave more competitively and to engage in more exploration (Jones et al., 2000). Changes to curricula may enhance equity for girls in science classrooms, creating a more girl-friendly environment. From an analysis of a number of studies, Brotman and Moore (2000) found that curricula tended to be more engaging for girls if the curricula were based on their interests. Likewise, Baker (2013) has used the scholarly literature to compile a number of curricular strategies for increasing girls' interest and participation in science.

Study Proposition 2

Study Proposition 2 was developed to address incongruence in study participants' science identities and high school science achievement. As

intersectionality theory dictates, gender is an aspect of identity; however, gender is not the sole factor (Crenshaw, 1991). Girls within subgroups vary, making studies of identity as a function of race, ethnicity, class and sexuality so important. In their theoretical framework of situated cognition, Brickhouse and Potter (2001) argue that identity is related to a student's understanding who he or she is and who he or she wants to become; then, the individual chooses to participate in activities that allows him or her to become a part of a community. Therefore, student identity formation is critical to learning. According to Carlone (2004), students' science identities mitigate their ability to display deep understanding of relevant scientific concepts and practices as well as their ability to recognize themselves as science professionals and be recognized as a science person by others. Studies synthesized by Brotman and Moore (2004) indicate that the relationship between a student's identity and engagement in science reveal girls' complexities associated with developing identities as a person who actually does science as well as the complex nature of issues related to gender and science. Some of these issues include the construction of science identities within a community of practice, the incompatibility of the identities of some girls with science, and female images in science. The nature of science communities of practice is based on the assumption that a goal of science education is to immerse students into the practices of scientists (Brown, 2004). Science communities of practice can take place both within, and outside of, the science classroom. Outside of the school, some regard the research science

community as the most authentic community of practice, though Brickhouse et al. (2000) argue that this community of practice is too distant and too irrelevant to the students we hope to engage. In that regard, the most practical community of practice is the science classroom itself. Lave and Wenger (1991) propose that when students enter a community of practice, their identities are developed as they engage with the tasks and activities taking place within the classroom. Because many science classrooms have a hierarchy where the teacher is the authoritarian and knowledge container, students may adopt identities and attitudes towards science where content completion is favored over knowledge production and sense making, and students are not required to formulate evidence-based science explanations (Banilower, Smith, Weiss, & Pasley, 2006; Barton & Tan, 2009). Instead, stronger science identities are forged when students learn science-as-practice by acting as epistemic agents, those who take responsibility for learning and practicing within the community (Stroupe, 2014). Student science identity forged through membership in science communities of practice, in which the student is positioned as the epistemic agent, is documented in a number of studies (Engle & Conant, 2002; Warren, Ballenger, Ogonowski, Rosebery, & Hudicourt-Barnes, 2001; Warren & Rosebery, 1995).

Forming appropriate science identities can be difficult for some females, particularly minority females. Case studies conducted over 18 months of four African American girls in 7th grade examined their science identities formed in and out of school, citing girls' confidence in science connected to who they are;

however, the science classroom environment and, at times, teachers' attitudes and practices limited girls' science engagement, favoring more mainstream science identities (Brickhouse et al., 2000). Similarly, Fordham (1988) found that when African American females adopted identities along cultural lines, their teachers perceived them as loud and non-academic. Only when such students adopted identities more in line with mainstream values and norms (i.e. quiet, compliant and studious) were they validated by their teachers in terms of achievement. Buck, Cook, Quigley, Eastwood, and Lucas (2009) challenged educators to learn how to capitalize on the diverse identities students bring to the classroom. Barton et al. (2008) found success in creating third spaces; created by the instructor, these places allow students to merge their identities and discourse with the formal scientific identities and discourse both present in science content and typically subscribed to by the science instructor.

Study Proposition 3

Finally, Proposition 3 was developed because research indicates that URMW's relationships with their teachers may impact their science engagement. It has been said that education is the great equalizer, meaning that more opportunities open up to minorities when educated than when not. While education does open up opportunities, Hanson and Palmer-Johnson (2000) describes education not as a place of equal opportunity, but as a bureaucratic system based on inequalities where some students receive few educational

opportunities and experience limited access to resources. The US educational system reflects the broader societal order in which Whites enjoy power and privilege and minorities must overcome racial bias even as their hopes for success often become diminished (Ogbu, 1991). Among the factors contributing to this systemic inequality is the teacher, whose role is worthy of further exploration. Within the educational system, teachers, in some instances, serve as active perpetrators of inequality; in other cases, teachers are passive participants while others labor as minority student advocates, working against inequity.

In Milner's (2010) research, a common theme that arises is that minority students and their typically non-White instructors come from different cultures. Milner defines culture as going far beyond race or ethnicity to include how individuals experience and describes their world. Milner argues that teachers and students typically have cultural conflicts that result in strained relationships and a general sense of incompatibility that undermines learning. McLaren (2007) argues that minority culture is usually not compatible with the traditions and practices of mainstream culture, the culture favored by schools and teachers. A number of studies indicate that these competing cultural dynamics fail to promote academic collaboration between minority students and their teachers (Carter, 2005; Howard, 2010; McLaren, 2007; Milner, 2010).

Some educators subscribe to a similar deficit model theory (Banks & Banks, 1995; Milner, 2010). Scantelbury and Baker (2007) observed this trend in

the scholarly literature related to studies of women and girls in science before the 1990s: to realize improvements in academic achievement it is the minority, not the school or teacher, who should change. When studying a sample of certified urban school teachers, Burstein and Cabello (1989) found that 38% felt their culturally diverse students were members of “deficient” cultures as opposed to being members of “different” cultures. Carter (2005) recorded similar findings from a qualitative study in which students reported feeling that their teachers evaluated them as deficient based on their own personal standards of culture. When studying minority students with varying language backgrounds, Gandara (2010) determined teachers’ preferences for speaking only English allowed them to classify the divergent cultural expressions of their students as disrespectful or unfocused. The perceptions that teachers have of their minority students contribute to difficulties with teaching and learning. A study of NELS data conducted by Dee (2005) found that minority female students were more likely to be labeled as inattentive when their teachers were of the opposite sex or of other races. These negative perceptions were even more pronounced when the student was of low SES. In each of these studies, the teacher behaved as a purposeful agent of inequality; however, other teacher effects as they relate to minority students are less intentional.

Teacher quality can be a factor when it comes to minority students (Ladson-Billings, 2000). Students who are minorities and of low SES often find themselves taught by teachers with fewer years of experience, lower rates of

holding advanced degrees, and lower scores on teacher certification exams than teachers of non-minorities or students with more affluence (Oakes, Muir, & Joseph, 2000). The data further confirm that these factors are systemic conditions of urban schools, where the greatest numbers of minority and poor students attend is taught. Such unqualified and underprepared teachers remain disproportionately represented in schools across the US that serve greater numbers of low-income or minority students (NCES, 1997a).

In summation, the study propositions developed for this study were based on a preliminary data analysis of the scholarly literature and then linked to the research supported by the theories and theoretical research findings foundational to the overall conceptual framework. It also provided a means to subsequently guide final data analysis. The study propositions did not limit the scope of analysis, but were formulated to keep the study concise and direct. In the final section of this review, an overview and positioning of this research within in the context of qualitative methodology is presented.

Qualitative Paradigm

Before any research study is launched, the researcher must establish questions and then choose the appropriate methodologies for answering those questions. The researcher must also identify the worldview or paradigm within which the research will be situated. The researcher's beliefs, values, and methods chosen for the study will normally align with an established paradigm.

The framework for understanding a particular paradigm typically includes philosophy, ontology, epistemology and methodology (Creswell, 2007).

Unlike quantitative researchers, qualitative researchers use inductive reasoning and methods to study people, places, and other social and cultural manifestations. Qualitative researchers generally believe that there is no singular view of reality. They argue that reality can be socially constructed, can differ from person to person, and can evolve over time (Glesne, 2010). Qualitative researchers also recognize that their findings are not absolute, but are situational and entirely dependent upon context. Qualitative research is typically not based on numbers or statistical relationships (although quantitative methods can be used) and there is often a subjective element associated with it. The researcher acts as a tool for measurement where theories are developed as opposed to hypotheses proposed and tested. Although commonalities exist, qualitative researchers are quite diverse and there are distinct paradigms and factions within the overarching qualitative paradigm.

This qualitative research study falls under the critical theory paradigm. To arrive at the dawning of the critical theory paradigm means traveling back in time to the 1930s, to the Frankfurt School in Germany. Nazis control in Germany, pre and post war politics, and economic instability were just a few variables leading critical theorists to believe that something needed to be done about the injustices that plagued societies throughout the world. Escaping to the safety of California during the war, critical theorists like Horkheimer, Adorno, and Marcuse

challenged the rhetoric of the US egalitarian ideals and symbols when compared to the realities of racism and classism for many of its citizens (Kincheloe & McLaren, 2002). Although there is little agreement concerning the establishment of a single critical theory, general principles include the idea that knowledge, unable to be separated from existence, is a part of social relationship. Any theories falling under the critical theory paradigm must be dependent upon social consciousness. To more accurately represent critical theory, Horkeimer (1972) emphasized critical theory's roots in Marxism as well as its movement away from the mechanistic nature of Marxism. This post-Marxist theory evolution of critical theory was embraced by the new left which included a consideration of political injustice and societal inequity . . . terrain that hadn't previously been explored (Held, 1980).

Researchers embracing the critical paradigm have a duty to try to understand the experiences of the oppressed in a reasonably responsible manner while enabling them to overcome the restraints of race, class, and gender (Fay, 1987). Like all empirical studies, research falling under the critical paradigm is expected to be based on rigorous methodologies and may have goals of changing the way people think or act, revising or proposing new social theories, or critiquing prevailing research orientations, knowledge or ideologies (Creswell, 2007). In science education, researchers embracing the critical tradition have sought to expose the ways in which individuals who do not belong to the dominant classes have been marginalized and labeled by members of

dominant classes. Themes that have been presented in science education research following the critical tradition have included:

- positioning the researcher as an advocate for participants against the culture of power (Barton & Yang, 2000);
- addressing feminist issues in science education (Buck et al., 2009);
- revealing ways dominant classes have manipulated the truth to favor themselves (Scott, 1998); and
- labeling or positioning negatively marginalized groups (Carlone et al., 2011; Delpit, 1995; Parsons, 2008).

Science education researchers subscribing to critical ideology may view study participants as caught in power relationships or institutions and vulnerable to being taken advantage of by members of the dominant class who often manipulate rules to receive an unfair advantage (Anderson, 2007). Therefore, science educators' research is necessary to bring to light these ills so that changes can occur in educational policy, school organization, and instruction. The research reported in this document features a number of the aforementioned characteristics.

The Case Study

The URMW participating in this pipeline program represent a bound system; as a result of this bound system, a case study methodology was appropriate. According to Creswell (2007), in case study methodology, the

researcher investigates a bound system (defined as the case) over time using thorough data collection techniques that involve gathering multiple sources of information. Gerring (2004) presents the case study as a way to illuminate a broader class of comparable circumstances. Although the findings of case study research cannot be generalized to larger populations, by defining and studying a case, light can be shed on how others experience similar phenomena and therefore further questions may be raised and additional research may follow.

Philosophically speaking, the case study is based on the constructivist paradigm. The constructivist's contention is that reality is social constructed and therefore is both subjective and experiential (Searle, 1995). The ways individuals construct reality may be shared and vary according to background, social experience, or relationships. Because reality is more or less in the eye of the beholder, constructivists acknowledge the existence of multiple realities that can be subject to change over time depending on the context. The constructivist approach to qualitative research and, in many instances, case studies, indicates that the researcher and participant share a relationship where reality is co-constructed while participants are provided an audience for telling their stories (Crabtree & Miller, 1999).

Both Yin (2013) and Stake (1978, 1995) defend case study methodology in their writing. With more of a humanistic tone, Stake presents the case study as a way to bring social problems to light so some benefit can be realized. As opposed to studies situated in the positivist paradigm, Stake argues that when

cases of human affairs are at the heart of the inquiry, the experiences of people must be shared and understood. Research that is more positivist in nature typically fails to acknowledge the power of the human experience and does not uncover the relationship between explanation and understanding. Both of these priorities are constituents of case study research. Yin argues for using case study methodology when the researcher hopes to answer “how” and “why” questions or if the phenomena in question requires an extensive description. Yin’s approach to defining, designing, and analyzing case studies was the dominant approach used for this inquiry.

Though case study methodology has gained popularity over the years, it is not without its share of cynics. From being accosted for having too few participants to being accused of bias, case study researchers have been forced to defend their work. Early critics of case study research have since evolved to become more accepting despite initial complaints about the lack of rigor associated with the methodology (Campbell & Stanley, 1966; Eysenck, 1976). Although some have reversed their apprehensive attitudes towards case study research, lack of rigor associated with reliability and validity is still a cause for concern for others (Daft & Lewin, 1990; March, Sproull, & Tamuz, 1991). In addition to finding fault with the reliability and validity of case studies, Miles (1979) expressed concerns with the types of evidence, data collection methods, and research strategies. Questions surrounding the research design of case studies have led to further criticism regarding generalizability, especially when

sample sizes are small. The case study researcher's ability to generalize to larger populations has been questioned, demoting the case study from the ranks of sound research (Hamel, Dufour, & Fortin, 1993). As is the case in many qualitative studies, case studies have likewise been critiqued because of their subjective elements, which may result in weak explanations (Morse, 1989).

Questions of rigor regarding case study methodology must be settled because a study that lacks rigor cannot claim relevance. Campbell and Stanley (1966) recommend that researchers meet four conditions to ensure that their work qualifies as rigorous research. These standards include: (a) internal validity, (b) construct validity, (c) reliability, and (d) external validity. Case studies can satisfy the requirements of internal validity if based on a clear research framework, through pattern matching and theory triangulation (Gibbert, Ruigrok, & Wicki, 2008). Rigor can be achieved through construct validity by data triangulation (Denzin & Lincoln, 1994; Yin, 2013); this means employing a variety of data collection strategies and basing conclusions on the analysis of multiple sources of data. With reliability, the researcher focuses on reducing, if not removing entirely, random error. When these conditions are satisfied, subsequent researchers should find similar result upon repeating the study (Denzin & Lincoln, 1994). To achieve this, Yin (2013) recommends establishing a case study protocol and keeping an organized database to house data, which can be accessed for study replication.

External validity or generalizability is frequently identified as a reason for questioning the merits of case study research. Case studies are not designed to be generalizable; conclusions made in case study research are bound by time and context, making generalizability to larger groups or other settings inappropriate. Still, case study research is not absolutely without generalizability. Case study researchers are capable of assigning analytical generalizations to their work, meaning generalizability to theory can be achieved (Yin, 2013). Stake (1978) is known for his defense of case study research and describes its aims as searching after understanding, extending human experience, and increasing conviction. According to Stake, generalization to theory isn't the only aim of case study research; he argues that knowledge uncovered during the case study in and of itself is a form of generalization. He further explains that the recognition of similarities and understanding of how things are, why they are, and how people feel and act is useful knowledge that can only be captured qualitatively using such methods as those selected by case study researchers.

In the subsequent chapter, the case study methodology used in this study, including research questions, research design rationale, description of the case, data collection and data analysis procedures were presented.

CHAPTER 3 METHODOLOGY

Introduction

This study explored the role of self-efficacy in a purposely selected group of (n = 8) high school aged URMW who entered and participated in an array of activities and support functions in a medical pipeline program offered by a medical school and a college of education at a large metropolitan university. The link between increased numbers of URMW students succeeding in K-12 science and increased numbers of URMW students prepared to meet the rigors of undergraduate science and future medical schooling makes this type of study worthwhile and sheds light on how URMW described their experiences as they first enter the medical pipeline. Chapter 3 presents the research questions, purpose of the study, methods, instrumentation, and procedures. Data collection and analysis procedures, along with ethical considerations, are also discussed. The chapter concludes with an overview of major sub-topics.

Research Questions

In 2011, a pilot study was conducted that analyzed how URMW students positioned themselves in their science classes. From the analysis of this preliminary data, participants identified factors that impacted their entry into the medical pipeline. These factors included, but were not limited to, relationships with teachers, peers, and family members as well self-efficacy and extracurricular

activities and experiences. Although multiple factors impacting URMW's pipeline entry emerged in the pilot study, I decided to focus this research study on students' self-efficacy and analyze other factors such as science positionality, racial identity, and gender identity. Research Questions 1 - 3 focused on how URMW'S self-efficacy changed during participation in the pipeline intervention and which self-efficacy constructs seemed to impact them the most were analyzed.

1. How did the self-efficacy of high school aged URMW change during their participation in a medical pipeline intervention?
2. How did URMW describe the self-efficacy constructs that most impacted them?
3. How did pipeline project activities (mentoring, goal setting and skill building) affect the self-efficacy of URMW participants and why did these activities impact URMW's self-efficacy?

Research Questions 4 - 5 were created from the supporting theories that framed the study (intersectionality and positionality).

4. How did URMW describe their classroom science experiences and in what ways did these experiences impact their medical pipeline entry?
5. Based on intersectionality theory, how did URMW describe their positionality as related to their experiences with science in general and with entering the medical pipeline?

Research Design Rationale

Although this study consisted of mostly qualitative methods, quantitative data collection methods were also used. Typically, this is referred to as a mixed methods study design, but Yin (2013) argues that it is appropriate to include both quantitative and qualitative data in case studies. Descriptive statistics and a paired samples *t*-test were used to support quantitative methods used in this study. Case study methodology was used to conduct this study because the URMW participating in the pipeline program associated with this study represented a bound system. According to Creswell (2007), in case study methodology. The researcher investigates a bound system (defined as the case) over time using data collection techniques that involve gathering information from multiple sources. Gerring (2004) presents the case study as a way to illuminate a broader class of comparable circumstances. Although the findings of case study research cannot be generalized to larger populations, by defining and studying a case, light can be shed on how others experience similar phenomena and therefore further questions may be raised and additional research may follow. Because the quantitative methods were used in this study were for the sole purpose of answering specific research questions, control groups, independent and dependent variables were unnecessary.

For this study, the URMW participating in HLAPP were designated as the unit of analysis or actual “case” of the study and serve as the ultimate focus of the research (Yin, 2013). Although traditionally, case studies have designated

each individual participant as a case, allowances for small groups to serve as the unit of analysis can be made if the researcher clearly defines the beginning and end points of the case and makes a strong case for small group consideration (Platt, 1992). The small group of URMW who participated in this study qualified as a case because they functioned as a collective prior to the research study. Underrepresented minority females in this study created their own informal social and academic community prior to their participation in HLAPP. Although each study participant is unique and could represent individual cases in other studies, they collectively came from similar cultural and economic backgrounds, attended school together since grade school, traveled in the same social and academic circles, belonged to a number of the same extra-curricular organizations, and had similar magnet program and classroom experiences; all of these connections were established prior to their participation in HLAPP. The pre-established academic and social learning communities of these URMW provided the necessary support for the decision to define the small group of URMW participating in HLAPP as this study's case and therefore the unit of analysis.

Heeding Yin's (2013) warning, this case study was bound by its participants and by time. Though HLAPP had a central role in this study, it was not the subject of this analysis. This case had a clear beginning and ending point (November 2012- April 2014).

Population and Sample

Recruitment for this study was limited to 15 students participating in HLAPP (high school students in grades 9-12 attending an urban school in Central Florida). Of the population of student HLAPP participants, the URMW were purposively sampled, meaning the sample was non-random and determined by the theories (intersectionality, self-efficacy, and positionality) on which the research questions were based. In case study research, sample selection is intimately connected to case specification. Because the purpose of this study was to describe the experiences of a specific group of female students (URMW) and relate those experiences to theory, the sampling methods appropriately excluded students who were male and/or non-minority. This left 12 URMW who were invited to participate in the study. Of the 12 URMW, the parents of nine participants voluntarily gave their consent for their children's participation (Appendix A) and eight completed the study. Consistent with this study's sampling procedures, this sample of eight URMW

- aligned with the theoretical framework and research questions;
- allowed for rich information to emerge regarding the phenomena being studied;
- allowed for generalizability (generalizability to theory, but not populations in this case); and
- reflected participants who provided honest responses (Miles & Huberman, 1994).

Health Leaders Academy Pipeline Project (HLAPP)

Data collected and analyzed for this study were generated within the scope of the Health Leaders Academy Pipeline Project (HLAPP) of which the participants were a part. The project is offered to high school students attending an urban high school in central Florida as a joint venture with a central Florida medical school and a research and education center at a nearby university.

Health Leaders Academy Pipeline Project has been in existence for three years and is designed to provide early medical experiences, college readiness support, and science and math skills to high school students from underrepresented backgrounds. Additionally, program staff supports students through the undergraduate college application process. Long-term, program directors hope to increase the likelihood that their participants will succeed in undergraduate science and math programs and gain medical school acceptance.

Health Leaders Academy Pipeline Project qualified as the research site, but was not the object of the research itself. Data for this dissertation were collected from observations and documents collected over 14 months and approximately 12 individual or focus group interviews conducted in person with study participants.

Timeline

The chronological ordering of major events related to this research study include:

1. the pilot study,
2. administration of the self-efficacy pre-test,
3. observations taken and field notes created while in the field,
4. the completion and transcription of focus group and individual interviews,
5. administration of the self-efficacy post-test, and
6. data analysis is presented in the timeline that follows.

The timeline of events is displayed in Table 1.

Table 1

Timeline of the Study

| Date | Major Events |
|--------------------------|--|
| February 2011-May 2011 | Pilot Study: Positionality Described by Underrepresented Minority Females Entering the Medical Pipeline |
| November 2012 | Data Collection: Children's Self-Efficacy Scale Administered as a Pre-Test |
| November 2012-May 2013 | Data Collection: Field Notes from Saturday HLAPP sessions |
| December 2013-March 2014 | Data Collection: Field Notes from Saturday HLAPP sessions, Focus Group and Individual Interviews completed and transcribed |
| April 2014 | Data Collection: Children's Self-Efficacy Scale Administered as a Post-Test |
| February 2014-May 2014 | Data Analysis |
| June 2014 | Dissertation Defense |

Data Collection

For this study, data were collected from multiple sources. Six sources of evidence (documentation, archival records, interviews, direct observations, participant observations and physical artifacts) are typically compiled in case studies (Yin, 2013). This study utilized all six sources except for archival records. The site at the center of this research has only been in operation for two years, making the retrieval of archival records non-applicable. Additionally, program

staff did not collect students' archival records (i.e. past report cards, test scores, attendance reports), nor was this information required for program participation.

The data collected in this study are listed in Table 2.

Table 2

Sources of Evidence and Actual Data Collected

| Sources of Evidence (Yin, 2013) | Actual Data Collected or Available |
|-------------------------------------|--|
| Documentation | <ul style="list-style-type: none"> • HLAPP participant attendance records • Project goals and mission • HLAPP agendas • Calendars • Other correspondence (emails, etc.) |
| Interviews | <ul style="list-style-type: none"> • Focus group transcriptions • Individual interview transcriptions |
| Survey Instrument | <ul style="list-style-type: none"> • Children's Self-Efficacy Scale administered as pre/post test |
| Direct and Participant Observations | <ul style="list-style-type: none"> • Photographs • Running notes • Field notes |
| Physical Artifacts | <ul style="list-style-type: none"> • Participant skill assessments • Participant diaries and reflection statements • Products produced by participants during HLAPP activities (i.e. vision and story boards, math word problems, responses to writing prompts) • HLAPP curriculum |

Observations

Observations of participants were conducted during HLAPP sessions that occurred one Saturday per month. The researcher sat towards the back of the room, although on occasion, the researcher stepped into the role of participant-

observer, assisting HLAPP staff with administrative tasks (passing out papers, taking attendance, assisting with lunch, writing student responses on the board for instructors). Running notes taken during observations were expanded into full field notes. In addition to field notes, pictures documenting HLAPP activities were also taken. All data collected during observations (HLAPP documents, attendance records, pictures, field notes) were numbered, logged and stored on the online database. An observation protocol (Appendix B) was created based on a protocol developed by Dr. Natalie Underbery of UCF Digital U/CREATE and followed during each HLAPP session.

Focus Groups

Two focus groups were conducted and transcribed during the pilot study year (2011-2012) and for this case study. Vaughn, Schumm, and Sinagub (1996) describe focus groups as being best suited for exploratory research. Because the pipeline project site (HLAPP) has never been the focus of research and is in the infant stage of its development, focus group methods were appropriate. Also, focus group methods were selected as the best way to explore the phenomenon of positionality in high school science and experiences described by high school aged URMW entering the medical pipeline because both of these topics are scarce in the research literature. Focus groups also allow rich descriptions, opinions, and perspectives to emerge that may not be revealed using quantitative methodology alone (Merton & Kendall, 1946).

The focus groups undertaken in this study provided a means for effectively and efficiently exploring the issues and experiences described by URMW, permitted group interaction, while still challenging and probing for individual thinking, views, and positions (Osborne & Collins, 2001). Each focus group interview offered a natural setting and a non-threatening environment to URMW participants. Theories described in the literature review, consisting of intersectionality, positionality, and self-efficacy, provided the basis for all focus group questions.

Although focus groups promote rich conversation, when left unchecked they can facilitate overly negative critiques of the phenomena at hand or lead to a group dynamic where consensus is always sought, especially if the conversation is dominated by one individual (MacDougall & Baum, 1997; Powney & Watts, 1987). To exert control over these variables, focus group questions were formulated from pilot study transcripts and guided by theories described in the research framework. Using the pilot study transcripts allowed me to develop questions where participants were specifically asked to recall positive experiences in science and to explain what was valued about those experiences. Secondary questions allowed me to explore participants' personal contributions to their science classes and to uncover any negative feelings or experiences they may have harbored towards science. This then allowed me to explore the relationships participants had with their science teachers and to then explore how their self-efficacy beliefs impacted their perception of their current and future

successes and failures. To guard against inappropriate group consensus, I moderated the conversation, bringing back to the participants' memories of things that they had expressed during written reflections or stated in group conversations, which typically revealed divergences in their opinions.

All focus groups were recorded, transcribed, and then coded. The coding system developed for analyzing data in this study was influenced by the theories that framed the research questions. In addition, the coding system consisted of a reflexive thematic analysis of the data that included initial categorization during interviews, immersing myself in the transcripts while developing themes and then headings, and repeatedly regrouping/re-categorizing headings and themes to eliminate redundancy and capture all data under a heading or subheading (Bryman, 1988; Field & Morse, 1985; Glaser & Strauss, 1967). During this process of analysis, follow up questions were prepared based on previous responses of the participants for the final focus group. An IRB-approved focus group protocol (Appendix C) was used for each interview.

Interviews

Scheduled in between the two focus groups conducted during the participants' 2013-2014 school year were individual interviews conducted with each participant. Therefore, each participant participated in an initial focus group, independent interview, and final focus group. The focus groups provided rich descriptions of students' experiences and allowed for efficiency in

interviewing, but as described earlier, were not without limitations. MacDougall and Baum (1997) described the pitfalls researchers may face with focus groups if participants engage in groupthink. Groupthink involves focus group members responding to questions the way they think other group members will want them to answer, even if those responses are contrary to what they actually think or have experienced. MacDougall and Baum suggest planting a devil's advocate into the focus group who will encourage the group to reflect on different perspectives, ask and introduce new questions, and avoid arriving at premature solutions or conclusions. Having a student participant step into the role of devil's advocate was not appropriate for this study because I wanted each student to express her true positions and feelings; therefore, individual interviews were conducted to validate and further expand upon focus group responses. Interview questions emerged from the theoretical framework, research questions, and focus group responses and as a follow up to pilot study transcripts. For example, the analysis of pilot study transcripts revealed negative student-teacher relationships. During individual interviews, I decided to encourage participants' deeper reflection such issues by posing follow up questions and seeking further clarity. Although the focus group discussions were allowed to flow naturally and I posed some open-ended questions, individual participant interview questions were not open-ended, but structured. Questions were formulated prior to the interview, emerging naturally from previous interviews and observations. This allowed for another reliability measure because participant responses were

compared. Still, limitations exist with one-on-one interviewing, one of which is the participant's desire to say what the interviewer wants to hear (Tomm, 1988). Also, during structured interviews, the participant may desire to discuss a topic or provide insight that the researcher doesn't include as part of the interview protocol (Appendix D) (Jennings, 2005). Like the focus group interviews, individual interviews were recorded, transcribed, and coded using the reflexive thematic analysis (Bryman, 1988; Field & Morse, 1985; Glaser & Strauss 1967).

Instrumentation

The Children's Self-efficacy scale (Bandura, 2006) was used to determine how participants' self-efficacy changed during participation in HLAPP and which self-efficacy constructs were most impactful. The purpose of the Children's Self-Efficacy scale (CSES) is to measure a child's perception of their self-efficacy, defined by Bandura (1997) as the belief an individual has in his or her ability to attain something. Bandura acknowledges that an individual's self-efficacy can vary according to context. For that reason, there is no one instrument to measure self-efficacy in all contexts; therefore, instruments should be adjusted to fit the domain in question. The CSES is appropriate for school-aged adolescents and pre-adolescents. This 37 question instrument contains seven domains (Appendix E).

Before administering the survey, written permission for using the instrument in the study was acquired directly from Dr. Albert Bandura (Appendix

F). The scale was administered using a pre-post design. Students completed the survey in December of 2012 and again in December of 2013. Because participants' responses to survey questions must be matched as a requirement of a pre-post design, participants were assigned numbers so that their pre and post-test scores could be compared (Campbell & Stanley, 1966). To protect participants' privacy, names associated with these numbers were stored on a locked computer, separate from the online database used to house all of the data collected during the study. At the close of the study, all names and numbers were destroyed.

This study measured changes in the self-efficacy beliefs of participants using scores, and select subscales, from the CSES (Bandura, 2006). This scale has also been referred to as the Multidimensional Scales of Perceived Self-Efficacy (MSPSE) (Bandura, 1990a). The scale contains nine domains listed and described in Table 3.

Table 3

Bandura's (2006) Self-Efficacy Domains

| Domain | Description |
|--|--|
| Self-efficacy in enlisting social resources | A measure of the child's belief in his or her ability to access social resources. |
| Self-efficacy for academic achievement | A measure of the child's belief in his or her ability to master different subjects. |
| Self-efficacy for self-regulated learning | A measure of a child's efficacy to assemble environments beneficial to learning and to plan and organize academic activities. |
| Self-efficacy for leisure and extracurricular activities | A measure of a child's belief that they can engage in recreational and peer activities. |
| Self-regulatory efficacy | A measure of a child's belief in his or her ability to resist peer pressure and to avoid high-risk activities that may involve alcohol, drugs, and inappropriate behavior. |
| Perceived social self-efficacy | A measure of a child's belief in his or her ability to start and preserve social relationships Handle conflict with peers. |
| Self-assertive efficacy | A measure of a child's perception of their ability to offer their opinions, stand up for himself and to say no an unreasonable demand. |
| Perceived self-efficacy to meet others' expectations | A measure of a child's beliefs in their ability to meet expectations from parents, teachers, and peers and to live up to personal expectations. |
| Self-efficacy for enlisting Parental and community support | A measure of the child's belief in his or her ability to gather support from family or their community. |

The CSES was selected for use in this study because it aligns with Bandura's work regarding self-efficacy that is at the heart of this research framework. The CSES (or MSPSE) is likewise a well-respected and reliable instrument that has been used consistently in studies with adolescent

participants in both formal and informal school settings. Zimmerman, Bandura, and Martinez-Pons (1992), in one such case, used the MSPSE scale to examine models for self-motivation in response to academic attainment and self-regulated learning (two self-efficacy constructs) and how various variables influenced academic achievement. The study participants were both male ($n = 52$) and female ($n = 50$) students attending urban high schools; participants' identified as African American (34%), Hispanic (23%), White (24%), Asian (17%), and Other (2%). Zimmerman et al. (1992) reported Cronbach's alphas of 0.70 and 0.87 for academic achievement and for self-regulated learning, respectively.

The validity and reliability of the CSES (and MSPSE) has been the focus of a number of research studies. Examining both construct validity and reliability, Miller, Coombs, and Fuqua (1999) investigated 500 participants attending public high schools. The participants mainly identified as White students of moderate to high socio-economic status (SES). Although Miller et al. meticulously explored the validity and reliability of each subscale of the instrument, they conceded that Bandura likely intended for the entire instrument to represent a general academic self-efficacy factor, which they determined to have a Cronbach's alpha of .92.

Electing to formally evaluate the MSPSE, Choi, Fuqua, and Griffin (2001) used undergraduate college students from the Midwestern United States. Participants consisted of 651 undergraduates who identified as follows: 80% Caucasian, 10% Asian, 5% Native Americans, 3% African American, and 2% Hispanic. This study established the reliability and validity of the scale for use

with undergraduates. Cronbach's alphas of .63, .81, .86 and .72, respectively, were reported. Because it has been confirmed as a reliable way to quantify children's self-efficacy, it was used in this study.

Data Analysis Procedures

Quantitative Data

To analyze quantitative data, descriptive statistics and paired samples *t*-test were used. Descriptive statistics were used to report on general trends that are presented within the narrative of Chapter 4, using graphically using charts and other visuals. With the paired samples *t*-test, the researcher determines if there is a significant difference between the means of response scores taken on two separate occasions. The paired-samples *t*-test was used to analyze data from the survey instrument and thereby determined how the self-efficacy of URMW participants changed during the study.

Qualitative Data

To analyze the qualitative data in this study, study documents, field notes, and transcriptions from focus group and individual interviews were read, re-read, and coded using reflexive thematic analysis (Bryman 1988; Field & Morse, 1985; Glaser & Strauss 1967). After coding, analysis consisted of engaging in explanation-building and pattern matching, which included:

1. making an initial theoretical statement or proposition,

2. comparing findings of an initial case against the statement or proposition,
3. revising the statement or proposition, and
4. comparing other details of the case against the revision.

These steps were repeated until explanations emerged. Comparing study propositions to the findings of this case study and reporting them in the analysis section of the report achieved pattern matching. To guard against drifting too far off topic, I reduced threats to internal validity by using a case study protocol subjecting data to chain of evidence procedures (Vaughan, 1992).

So that rival explanations could be addressed during the analysis phase of the case study, the researcher acted as a skeptic towards the study when both collecting data and determining findings (Yin, 2013). When acting as a skeptic, the researcher wonders if participants are trustworthy, if enough data has been collected and if alternate propositions exist. According to Stake (1995), rival analysis has been effective when the researcher has determined that the data is unlikely to suggest something else is occurring or the reported finding wasn't produced by something else. For this study, rival explanations were included as a part of pattern matching during data analysis. An explanation equally matched with another explanation signals unreliability in the original explanation and a need to alter the proposition (Pagano, 2010). Because this study centered on URMW, the researcher considered societal prescribed gender roles and other feminist issues as rival explanations for the study propositions. For example, the researcher questioned if gender roles prescribed by the family, peers, or others

explained the disengagement some URMW experience in science and contributed to the types of relationships forged with teachers. Whenever an alternate explanation presented itself (from the research literature, theory, interviews or observations), the researcher acknowledged the alternate explanation and altered the propositions when necessary.

Validity, Reliability, and Transferability

Construct validity, internal validity, external validity, and reliability are regularly used as indicators of quality for social science research in general. More specifically, case study researchers typically adhere to such principles when conducting research and analyzing data (Yin, 2013). These four tests of quality were used in the design and execution of this case study.

Construct Validity

The goal of this case study was to confirm URMW self-efficacy as the variable being studied and to show how the measures selected in this study demonstrate changes in URMW's self-efficacy. Attention to construct validity means the study is actually investigating what the researcher intended and the researcher therefore has the ability to make legitimate inferences related to theory that arise from study operations (Denzin & Lincoln, 1994). Yin (2013) suggests meeting the test of construct validity by using multiple sources of

evidence, establishing a chain of evidence, and having key informants review drafts of case study reports.

In addition to using multiple sources of evidence, the researcher used a chain of evidence so that construct validity could be claimed in this study. When investigating crimes, law enforcement professionals follow chain of evidence procedures so that both the prosecution and defense have faith that evidence has not been tampered with, has been collected appropriately, and can be matched to the correct time, place or individual. In this study, chain of evidence procedures were followed to give the reader confidence that claims made during the analysis and conclusion segments can be traced back to the actual data collected. To this end, as data were collected, a unique number was generated based on the source of the evidence, medium, and date. This number was written on the physical document and/or saved as the file name for electronic data.

Lastly, construct validity can be claimed if participants are allowed to read final case study reports to make sure researchers have represented them correctly. Although URMW participating in this study were not asked to read the entire report, they were given copies of the transcriptions from both the focus group and individual interviews to be sure that the researcher correctly captured the conversation. The researcher noted any changes, additions, or clarifications requested from participants.

Internal Validity

Though achieving internal validity is the central threat to overall validity when the goal of a study is to explain causal relationships, satisfying the standard of internal validity emerged as a concern in this study because the researcher hoped to generate inferences related to theory (Campbell & Stanley, 1966). For this study, the researcher satisfied the standard of internal validity by establishing a clear conceptual framework through pattern matching and by addressing rival explanations (Gibbert & Ruigrok, 2010; Yin, 2013).

The conceptual framework is further strengthened when propositions are included in the study design, thereby paving the way for pattern matching (Yin, 2013). The researcher developed study propositions that connect clearly to theory so that inferences about how or why something was observed could be made. In a single case design, such as this study, patterns emerge from the study propositions. The following case study propositions guided in this study:

- Some URMW high school students are unprepared to meet the rigors of collegiate science and medical school because of low achievement and limited experiences in K-12 science (NCES, 2011; Rainey, 2001).
- Underrepresented minority women students may have issues with identity, face challenges because of their genders and ethnicities and may fail to position themselves positively in science (Carlone et al., 2011; Parsons, 1995, 2008).

- Underrepresented minority women students may describe poor relationships with their science teachers that may contribute to their disengagement in science (Kitts, 2009; Ladson-Billings, 1999).

External Validity

How appropriate it is for a researcher to generalize a case study's findings to other groups or events has been hotly debated (Eisenhardt, 1989; Yin, 1981). Generalizations to larger populations of URMW were not made in this study; however, generalizations and comparisons to theory could be made because study propositions and the research framework were designed to answer how and why (Yin, 2013). Additionally, research questions emerged from the theory, connecting to the evidence and proposing to answer how and why questions. Study propositions strengthened the research questions and guided data collection and analysis.

Reliability

The final test for judging the quality of a case study design concerns the ability of another researcher to take the data, follow the established procedures, and arrive at the same findings. Although a second researcher did not replicate the findings reported, an IRB approved human research case protocol was created and adhered to (Appendix G) and consistency in research procedures and protocols were followed. Additionally, a case study database was

established to store data for future study replication. The study database was housed online and was password protected with access limited to the researcher. Participant names were excluded from all documents posted to the site and numbers were used to identify participants where appropriate. The list of names connecting participants to those numbers was stored on a separate password-protected computer and not placed on the database. Participant names, numbers, and any other identifiers were destroyed at the close of the study.

Triangulation

As a further test of validity for case studies, most researchers hope to achieve triangulation. With triangulation the researcher designs the study so that research questions are analyzed from multiple perspectives. The researcher may show how these multiple perspectives converge or reveal inconsistencies. Although researchers feel that their studies are strengthened when a consensus emerges across their data or research approaches, Patton (2002) says that revealing inconsistencies in the data can strengthen the study as well. In the analysis section of this study, the following types of triangulation will be described: data, investigator, and methodological.

Data Triangulation

With data triangulation, the investigator explains how the sources of the data converge. Earlier in this chapter, Yin's (2013) recommendation of having multiple data sources as a test for construct validity was described. Yin further

elaborates on how the researcher has a duty to show how the sources of data either converge or diverge. This is represented using the sources of data for this study (Figure 2), which included documents, interviews, direct observations, participant observations and physical artifacts. During the analysis phase of this study, the researcher discussed the convergence or divergence of data sources. Although data convergence strengthens reliability, the researcher did not force data to converge and reported divergences. When study data diverged, new questions emerged and study propositions were adjusted.

Investigator Triangulation

With investigator triangulation, several researchers participate in the analysis and the findings of each investigator are compared to determine how each interprets the data. When researchers look at the data independently and arrive at similar conclusions, more confidence is placed in the findings of the study. Although only one researcher participated in the analysis of this study, a pilot study was conducted (2011-2012) in which three researchers analyzed the data. Consistently, the researchers identified similar codes and themes when coding the data and similar conclusions when reporting findings. The validity established during the pilot study strengthened this study, even though only one researcher collected and analyzed data.

Methodological Triangulation

In some cases, researchers employ different methods in their case studies. In this study, data from individual interviews and focus group interviews were analyzed qualitatively while survey data were analyzed quantitatively (Bandura, 2006). Data from each of these sources were compared. While commonality strengthens validity, inconsistencies still provide meaningful information and were reported in the analysis section of the research.

Transferability

In qualitative research, validity and reliability procedures must be followed if the researcher has any hope of generalizing study findings to larger populations. Although this study employed quantitative methods, the study was largely qualitative and the findings of which cannot be generalized to larger populations of high school aged URMW. Instead of generalizability to other populations, the findings of this study can be transferred to theory, other contexts or other settings (Creswell, 2007). Readers of this study who have context-specific interests including K-12 science educators, college administrators or medical professionals interested in identifying and developing student talent may formalize connections between this study and circumstances experienced in their fields.

Summary

The case study is an appropriate methodology for studying a well-defined case, bound by a certain amount of time. Yin's (2013) recommendations for case studies are most appropriate when the researcher seeks to answer how and why questions, as in the case of this study. A group of URMW (n = 8) participating in a structured pipeline project were purposively sampled and constituted the case of this study; these URMW were studied from 2012-2014. Study propositions were developed to further qualify the study and guide data collection and analysis. Following the natural science model, standards for internal and external validity and reliability were met. Data collection protocol was established and followed for all sources of evidence including study documents, observations, focus group interviews, individual interviews, and the administration of the CSES. The small sample size, sample bias, and possible errors made by the researcher limit the scope and generalizability of this study. In the upcoming chapter, presents an analysis of all data collected and an evaluation of study propositions.

For this study, permission to conduct the research was sought and approved by the University of Central Florida's Institutional Review Board (IRB) before the study commenced. IRB outcome letters were provided each year the study was renewed in addition to when the study title was changed (Appendices H-K). All data collected and analyzed reflect adherence to policies and procedures mandated by the IRB regarding the study of human subjects under

the age of 18. This included gathering student assent (though not required) and parental consent for participation in the study (Appendix A) as well as guarding the confidentiality of each participant. Additionally, the human research protocol (Appendix G), observation protocol (Appendix B) and interviewing guidelines (Appendices C-D) which framed data collection and analysis were all approved by the board before the study began. Likewise, permission was sought from Dr. Bandura for use of his Children's Self-Efficacy scale (Appendix E-F) and this addition was approved by the IRB.

In chapter 4, a review of research design rationale, description of case, research data analysis and discussion of findings are presented.

CHAPTER 4 FINDINGS

Introduction

The purpose of this case study was to explore the role of self-efficacy in a purposely selected group of (n = 8) high school aged URMW who entered and participated in an array of activities and support functions in a medical pipeline program offered by a medical school and a college of education at a large metropolitan university. Using intersectionality and positionality theories as the foundation of this study, I explored the ways gender, ethnicity, class and other social identifiers affected URMW's medical pipeline entry in addition to changes to URMW's self-efficacy during the three years of their documented participation in the pipeline program (HLAPP). Data collected from multiple sources included: (a) HLAPP documents, (b) focus group interviews, (c) individual participant interviews, (d) survey interviews, (e) direct and participant observations, and (f) physical artifacts.

Rationale for Case Study Design

According to Yin (2013), defining and binding the case is the most important feature of the case study. The URMW who participated in this study attended the same high school in a large urban district in central Florida. Several schools in this district follow high school academy or magnet school models where the school leaders have adopted a curricular theme and provide students

with thematic instruction and authentic experiences. The URMW who participated in this study attended a magnet high school; the mission and vision of this school involves exposing students to the medical profession through classroom instruction, laboratory experiences, and off-campus activities. For this study, the 8 URMW students constituted a bound case for a number of reasons:

- they attended many of the same classes, including their medical magnet electives;
- they attended school together as far back as elementary school; and
- they traveled in the same academic and social circles, thereby creating their own small learning community that remained intact within and outside of school.

Although treating each participant as an individual case may prove to be beneficial for future studies, I determined that considering these URMW as a bound case was the best choice for representing the collective voice of the group. In the primary section of this chapter, I described the URMW participants as a collective case, followed by analysis of Bandura's (2006) Children's Self-Efficacy scale. To assist with the representation of participants' voices, I employed quotations throughout the chapter, using pseudonyms to protect participant confidentiality. In the concluding section of the chapter, I present thematic findings according to each research question. Through the presentation of the bound case and narrative analysis, this study highlighted how the 8 URMW made sense of their race and gender identities and shed light on how their self-efficacy beliefs are shaped through their experiences entering the medical pipeline.

Overview of the URMW Participants (The Case)

Eight underrepresented minority females participated in this study. Six of the students identified as African American (Jocelyn, Ally, Wendy, Kara, Rhonda, and Eliza), one identified as a Puerto Rican (as opposed to Hispanic or Latina, Alicia) and the other participant identified as having Caribbean ancestry (Natasha). All names are pseudonyms. The students were all participants in HLAPP in addition to the medical magnet academy offered at their high school. During my final visit with the students, I walked into the front office of their school and could tell graduation was in the air. Looking up on the wall near the office door, I saw the graduation photos of the valedictorian, salutatorian, and students with the top ten GPAs in the senior class. The valedictorian and several other study participants were in this prestigious group. Their school administrator described them as the “best of the best.” The high school they attended had over 1000 students, 95% of whom were African American. Over the last five years, the school has received low to moderate ratings from the state regarding student achievement. The school is considered a Title I school, meaning a large percentage of students qualify for free and reduced lunch. The school features programs including the health magnet academy, a gifted and talented program, and bilingual education. The school has approximately 15 advanced placement (AP) courses including calculus, microeconomics, and statistics.

Having spent over two years with these young women, I had an opportunity to learn a great deal about them. Many of them attended the same

elementary and middle schools and in high school they were enrolled in a number of classes together. These girls traveled in the same academic and social circles. In addition to forming their own study groups, they spent time together outside of school and considered themselves a support group. At the time of our final meeting, all participants in the group had selected their college of choice and intended to enroll in the fall. Most students were not the first in their families to attend college, although two were the first. Two participants had parents who did not attend college, but siblings who did attend. The other four students had parents who attended college. When speaking of their families, all participants felt their parents supported them immensely, although the students of Latina and Caribbean ancestry felt their parents emphasized school achievement more vigorously than the parents of the other participants.

All of the students described their families as supportive, but they also faced a few challenges. Although all participants were in the top 10% of their class, most were enrolled in remedial math and reading classes alongside their AP courses. Some of the girls also described challenges in their neighborhoods, including problems associated with crime and poverty. In spite of these challenges, each participant articulated a desire to begin a health science major in college and enter a health science career later in life. Data collection began in November of 2011 and concluded in April of 2014. Along with the multiple sources of evidence already stated, URMW participated in three focus group interviews which lasted approximately 30 minutes each as well as individual

participant interviews, lasting for approximately 10 minutes each. In all, nine URMW participated in the study, with eight completing the study (one student graduated before study completion).

In the next section of this chapter, I discuss the findings associated with the Children's Self-Efficacy scale, administered in November of 2012 and again in April of 2014.

Children's Self-Efficacy Scale Analysis

Program participants completed Bandura's (2006) Children's Self Efficacy scale in November of 2012 and again in April of 2014. Bandura's self-efficacy scale has nine domains:

- Enlisting social resources,
- Academic achievement,
- Self-regulated learning,
- Leisure-time skills and extracurricular activities,
- Self-regulatory efficacy (to resist peer pressure for high risk behaviors),
- Self-efficacy to meet others' expectations,
- Social self-efficacy,
- Self-assertive efficacy, and
- Enlisting parental and community support.

Bandura (1990a, 2006) argues that the scale should be analyzed according to each domain, rather than reported as a holistic self-efficacy score. Following this

recommendation, I calculated subscale scores, using SPSS for each domain. Because self-efficacy in enlisting social resources, self-efficacy for self-regulated learning, self-efficacy to meet other's expectations, and self-assertive efficacy represented the domains most applicable to this study, they were analyzed and other domains excluded. The domains included for analysis aligned most closely with the conceptual framework and research questions.

A paired samples *t*-test represented the statistical analysis tool selected for analyzing survey data. The paired samples *t*-test is an appropriate measure when the researcher hopes to calculate the difference between scores. In this study, the *t*-test was used to detect differences between two dependent variables, the initial domain sub score (taken in November, 2012) and the final domain sub score (taken in April, 2014). The *t*-test is a robust test and requires the following conditions be met:

1. The *t*-test should be run on a single sample randomly drawn from the population.
2. Two scale measurements are required per participant.
3. The differences in scores should reflect a normal distribution.

In this study, the first requirement for *t*-test selection was not met because the sample of participants was purposively and not randomly selected. Though the first condition was not met, *t*-test analysis was still the appropriate statistic for this study. Random selection is a necessity when a goal of the research is generalizability and reporting back to a larger population. This study consists of a case study describing the experiences of a specific group of participants and

the research is bound by context and time. Survey data were collected for the purposes of informing of the self-efficacy of the participants of and for validating qualitative data, but not for generalizing to any population. Therefore, the first *t*-test requirement was not applicable to this study. The other requirements for *t*-test selection, having two scale measurements per participant and meeting tests for normality, were followed.

Because four of the nine domains were analyzed, four hypotheses were made (Table 4.)

Table 4

Research Hypotheses According to Self-Efficacy Domains

| Domain | Research Hypothesis | Null Hypothesis |
|--|---|---|
| 1: Self-Efficacy in enlisting social resources | H ₁ : Students will have a greater amount of self-efficacy (enlisting social resources) at the close of HLAPP. | H ₀ : The amount of self-efficacy (enlisting social resources) students have will not change. |
| 3: Self-Efficacy for self-regulated learning | H ₂ : Students will have a greater amount of self-efficacy (self-regulated learning) at the close of HLAPP. | H ₀₂ : The amount of self-efficacy (self-regulated learning) students have will not change |
| 6: Self-Efficacy to meet other's expectations | H ₃ : Students will have a greater amount of self-efficacy (to meet other's expectations) at the close of HLAPP. | H ₀₃ : The amount of self-efficacy (to meet other's expectations) students have will not change. |
| 8: Self Assertive efficacy | H ₄ : Students will have a greater amount of self-efficacy (self-assertive efficacy) at the close of HLAPP. | H ₀₄ : The amount of self-efficacy (self-assertive efficacy) students have will not change. |

There was not a significant difference in the sub score for self-efficacy for enlisting social resources upon initial ($M = 76.75$, $SD = 15.8$) and final ($M = 82.75$, $SD = 21.5$) testing, $t(4) = -1.760$, $p = .153$. Likewise, there was not a significant difference in the sub score for self-efficacy for self-regulated learning upon initial ($M = 84.9$, $SD = 10.14$) and final ($M = 90.0$, $SD = 8.97$) testing, $t(4) = -.976$, $p = .384$. Finally, there was not a significant difference in the sub score for

self-efficacy to meet other's expectations upon initial ($M = 84.5$, $SD = 8.73$) and final ($M = 87.25$, $SD = 17.06$) testing, $t(4) = -.486$, $p = .650$.

There was a significant difference in the sub score for self-assertive self-efficacy upon initial ($M = 83.5$, $SD = 14.9$) and final ($M = 96.75$, $SD = 6.59$) testing, $t(4) = -3.393$, $p = .027$. Rejecting null hypothesis four (H_{04}), URMW experienced an increase in the amount of self-efficacy they possessed related to self-assertive efficacy by the end of the HLAPP. I have failed to reject the other three null hypotheses (H_0 , H_{02} and H_{03}).

Cronbach's (1951) alpha is a coefficient of internal consistency and is regularly used to estimate the reliability of inferences arising from results generated by an instrument. The reliability coefficients, Cronbach's alpha, for the pretest were: .630 for self-efficacy in enlisting social resources, .882 for self-efficacy for self-regulated learning, .774 for self-efficacy to meet other's expectations and .809 for self-assertive efficacy. The reliability coefficients, Cronbach's alpha, for the posttest were: .911 for self-efficacy in enlisting social resources, .882 for self-efficacy for self-regulated learning, .904 for self-efficacy to meet other's expectations and .896 for self-assertive efficacy. These coefficients indicated a high degree of internal consistency, further validating the results of the survey and were consistent with other studies found in the research literature (Choi et al., 2001; Miller et al., 1999).

Although the t -test is a robust test that is effective for analysis of data that is somewhat normal, I must acknowledge and address the low sample size and

appropriateness of using this statistic to run data. De Winter (2013) found no objection to using the *t*-test with extremely small sample sizes. According to de Winter, sample sizes as small as two did not pose problems for analysis and furthermore, the probability of making a Type 1 error, rejecting the null hypothesis when it is actually true, remained within the 5% threshold typically accepted in statistical analysis. Although a larger sample size is typically more desirable, for this study the small sample size did not cause the *t*-test to function improperly.

Themes

The original research questions guided the analysis of the participants' experiences within the medical pipeline, providing student-based perspectives and meaning-making according to self-efficacy beliefs in addition to race and gender identity. These questions attempted to answer the question of how the intersection of race and gender impacted the self-efficacy beliefs of URMW and how they shape the health science career trajectories of these students. The following presentation focused on common thematic findings across all data collected. The outline displays thematic phrases, each of which were followed by a discussion of analytic findings.

- I. College and Health Science Pipeline
 - a. Bridges to the Health Science Pipeline
 - i. Theme 1: Enrichment Programs

- ii. Theme 2: Mentorship Relationships
 - b. Motivation, Endurance and Resilience
 - i. Theme 3: Motivation for Entering the Pipeline
 - c. Self-Efficacy Beliefs towards a future in the Health Sciences
 - i. Theme 4: Giving Back
- II. Ethnic and Gender Identity and the Medical Pipeline
 - a. Being a Minority: Coping with Otherness
 - i. Theme 5: Debunking Negative Stereotypes
 - b. Self-Assertive Efficacy: The Management of Conflict
 - i. Theme 6: Rigors of the Health Science Pipeline resolving conflict
- III. Science Positionality
 - a. Disengagement in Science
 - i. Theme 7: URMWs connectedness to science in and out of school
 - b. Perceptions of “The Science Teacher”
 - i. Theme 8: Lack of Consistent positive relationships with Science Teachers

College and Health Science Pipeline

Bridge to College and Health Science Pipeline

Theme 1: URMWs identified enrichment programs as influencing their decision to pursue a career in the health sciences.

Eliza said,

To me I think so far the most interesting part of being in a magnet is the opportunities it offers. Because we're in this health leaders and we're also in UX alliance (pseudonym) with them, so it's like even though we're in the medical field, we also get opportunities from other places. It can be either medicine but otherwise they like still look at us because we're kinda like good students. I guess because we're in the magnet, but I mean it's interesting. It offers more to it than just the medical part. We get to learn different areas. It's not just like we just don't focus on one area. We focus on different, like different ones so that's one interesting thing about it. We just do many things and it all come together.

When asked what made her want to become a physician, like Eliza,

Rhonda spoke of enrichment activities.

Well, That's a lot for me. Outside of my science class. I have Health Leaders which also is like a health, health like club. And then I'm in (inaudible) sisters, I mean Black sisters which is a minority achievement and I'm in band which takes up a lot of your time. And then also, I'm in the UX Alliance fellowship program.

When speaking of these enrichment programs, during focus groups participants seemed to express a sense of pride in being selected for participation in the school program as they discussed their futures in the health science field. Their participation in these programs has made them aware of the importance of mentorship in high school and college. With exuberance, Wendy explained how she was accepted into a competitive college enrichment program, introduced and encouraged to apply to the program through her participation in yet another high school enrichment program.

It is a scholarship program where it chooses... like compared to how many people apply for it, it's basically a few people really compared to who applies because thousands apply each year and they only choose hundreds. So, it's a scholarship program where they take in students who qualify and show the need and show that they earned it; like grades and

extracurricular activities and things like that all tie into the qualification. And, if you meet the qualification and they accept you and you're in the program for 1 1/2 to 2 years and they provide payment for your classes and your book and any other fees that come along with your education. And, not only do they help you to pay for it but they tutor you. Its extra tutoring, it's more involved in with teachers and students and everything else that goes along with the program as well.

Low numbers of minority health professionals have resulted in increased and improved recruitment efforts designed to funnel minority students into the health science pipeline and retain them within that pipeline (Petersdorf, 1992). Some of these recruitment efforts have included enrichment programs designed to help close academic skills gaps and career gaps between minorities and their White counterparts.

Theme 2: URMW participants expressed an appreciation for their mentorship relationships and were excited about the opportunity to develop rapport with health professionals.

Akin to academic advisement at the college level, mentorship in high school permitted the URMW to gain insight into the medical field and also provided them with the opportunity to discuss health science goals in addition to discussing personal issues that may impede their transition into the medical pipeline. A number of participants described the medical school mentors, provided to them through HLAPP, as one of the most meaningful features of the program. Also, a number of participants spoke highly of their health-career teachers at their high school who could be equated to a college advisor at the

high school level. As an example, Jocelyn spoke of her teacher/mentor and their relationship during a focus group interview.

My medical magnet teacher Ms. Terrell (pseudonym) kind of got me to this point because I knew I wanted to do something in medicine but I just didn't know what I was interested in. So she kind of opened me up to the different aspects of medicine and then I got to see which one I was most interested in and the medical magnet at our school.

The ability of these URMW to establish such impactful mentor relationships correlates positively to the self-efficacy for enlisting resources domain of Bandura's children's self-efficacy domain. URMW maintained a high self-efficacy score for enlisting resources according to the results of the survey. For example, Jocelyn described a connection to Ms. Terrell that had been cultivated during her medical magnet participation. Concurrently, students described their likelihood of seeking advisement and accessing necessary resources when they enroll in college. For example, when speaking of college, Kara said,

I'm pretty sure that they have clubs like the BSA (Kara was referring to Black Student Alliance) Association. And, I think that I can get involved into that and to be surrounded by people who are like me and have the same goal of being successful.

Like Kara, Rhonda also described her ability to access the people she needed to assist her with overcoming college obstacles,

Like, another friend who can help me through the situation and tell me what I need to do or an adult if needed someone I trust."

Museus and Ravello (2011) determined that academic advisement contributes to minority student success, especially for minorities who attend predominately White institutions. Museus and Ravello have determined that humanized, holistic, and proactive advising practices positively influence student outcomes.

Motivation, Resilience and Endurance

Theme 3: The experiences of the URMW participants within the context of their entry into the medical pipeline revealed stories of how they remained motivated towards and connected to their future health science career goals in the midst of challenges.

Sources of motivation offered participants encouragement in some cases and acted as a shield from difficulty in other instances.

For example, Jocelyn described her family as a source of encouragement.

Mom and Dad met young and my mom had my oldest brother very young so she always tries to tell me um you know to put school first and don't really worry about all the other stuff.

In another example, Eliza was asked what motivated her to keep working towards her goals and she also mentioned her family.

My family . . . like My mom, she always tell [sic] us that to be better, be better than her. So that's it, mainly my family.

Later, at a HLAPP session, Eliza reiterated her high level of family support and Natasha also identified her mother as her source of motivation.

Then there's support from Mom, she always tells us to be better, strive and do the best. She wished she would have went into crime and investigating (Eliza).

Because Um, well she didn't like finish college. Like or like go to school for what she wanted to do. so that's my motivation to do better (Natasha).

In each case, URMW participants depicted family support positively and described some of their family's circumstances as things to avoid, i.e. not having

children too young or being sure to finish college so that their goals remain within reach. In other cases, the motivator was depicted as a buffer against the challenges associated with entering the health science pipeline. During initial focus group interviews, I found that the URMW participants had an extremely strong connection to each other that went beyond the limits of friendship. In this example, the URMW revealed the importance of their group's affiliation.

We're always together like we go on field trips together we sit in class together all day. We're after school together. Like it's like when you're around someone so much you have no choice but to learn about them and to find out similarities within each other and ... The week days turn into the weekends and the weekends turn into the summer. You're always together and then you build that bond and then it keeps growing (Ally)

That's why all my friends are all like really girly and we were always together and um I didn't have any sisters so when I got to high school I kinda like realized that all these people sitting around this table they um, they um help me and um (begins crying) . . . They push me to become a better person. (Jocelyn)

Because, It's like you see the bond we have ... that can really help a person out if they're going through a rough time or if they need just that extra help? (Eliza)

The cultural and gender based bond and compatibility, expressed by Jocelyn, Eliza and Ally, arises from their sharing an intrinsic, intangible aspect of self that may be hard to put into words. Also, it is worth considering what affiliates these URMW as a group. Many are of the same race, they are all of the same gender, and they all share the desire to one day become a health professional. These shared experiences go beyond simply defining the group; these experiences position it as an informal learning community where the

members have an affinity for each other that can be counted on as a source of support and motivation for entering and remaining in the health science pipeline. The students' academic, social, and possibly ethnic identities influenced the formation of the group's allegiances. The group was not completely devoid of competition; however, even the competitive aspect of the group did not interfere with the stronger aspect of corporation, as the students revealed their desire for each other's success. The following exchange summarizes that desire.

Jocelyn: These people in here (referring to the other URMW). Cause they want to . . . Rhonda wants to be the valedictorian of the class and I'm not having that. (laughter) Underdog! Oh know, she's going to get it (laughter) I'm just saying . . .

Rhonda: You're not having it? You don't want me to . . .

Ally: She's happy for you, but she wants to be right up there with you.

Jocelyn: Thank you Ally, see she takes the words right out of my mouth every time. When you see all these people they just want, they want you to do good . . . but also they want you to help them get better. It's like, like a chain reaction like. Eliza has an A in Chemistry; I want to get an A in Chemistry. So, Eliza tutors me to get an A in Chemistry and so on and so forth like we help each other that's what helps like motivate each other like the other person has it and we want to be there with them we want to be at the same level they're at if not even higher.

As an additional source of strength, protection, and force pushing them to achieve, the URMW described their spirituality, the importance of their church families, and their connection to God. Ally was very open about her childhood difficulties and described her spirituality as her source of strength and an inner voice that tells her to keep striving.

Because in life I went through a lot, I've seen a lot and also learn from people's mistakes and know that's not the path I want to go in life; and also, just the faith of God. Even when I'm praying to him every day, even when I'm crying and doing homework late at night. It soothes my mind and it just gives me this feeling that everything is going to be okay and I can do it if I put my heart to it. (Ally)

When asked how she would respond to possible discrimination from others in a higher learning environment, Jocelyn said, "Pray, pray that I can get through it and just try my best." Likewise, Kara identified her church family as providing the financial and emotional support she needed to enter and succeed in the medical pipeline. The reliance on faith to mitigate tough circumstances is a historical aspect of each of the cultures represented by the URMW in this study. For African Americans, the Black church is regarded as a cultural institution where, in addition to spiritual guidance, its congregants are cared for socially, financially, and politically (Lincoln & Mamiya, 1990). Similarly both Puerto Rican (Bird & Canino, 1982) and Caribbean (Taylor, 2001) families generally have religious ties of significant cultural importance.

Throughout this study, it became obvious that participants extracted a number of internal resources to support their future academic goals. These intrinsic motivators seemed to be rooted in the foundational idea of their being responsible for their own futures. This concept is closely related to personal agency (Bandura, 1990b) and ultimately self-efficacy (Bandura 1977a). In the upcoming paragraphs, the self-efficacy beliefs of URMW participants as related to their participation in enrichment programs are explored.

Self-Efficacy towards a Future in the Health Sciences

Theme 4: URMW expressed a desire to obtain a health science career in the future and give back to the community.

Because participants of this study were purposively sampled according to their goal of one day becoming a health professional, it is not surprising that all of them described a desire to obtain a health science career in the future. None of the URMW indicated they had family members who had become doctors and therefore many of them wanted to become the first physician in their families. This was true of Eliza who introduced herself to me saying, “Hi, I’m Eliza, I want to be, I mean I am a pediatrician . . . yeah, basically, but the reason I’m doing this is because I want to be the first. Become the first doctor. We have a lot of nurses, but no doctors.” When URMW participants spoke of their reasons for wanting to become physicians, a number of them described their desires to help others or to give back to their communities.

I obviously want to be a pediatrician because I love children, especially babies, but I’ve kinda changed my mind because I really like sports so I’m considering sports medicine or something with children. I haven’t decided yet. And I want to go to medical school after I get my bachelor’s and I just want to be happy with the job I’m doing and give back to my community and be a role model (Jocelyn)

My grandma dying from cancer and I was the youngest grandchild who spent more time with her because everybody else was in their teenage years and were always going out and having fun; so, I used to bathe her. And then, I was the last want to talk to my grandfather due to him dying in the hospital; and, recently having two family deaths back to back. It kind of just made me realize that I wanted to do something where I can help them one day in their final stage and I feel like nursing will allow me to do that. And I’ve always been the type of person who like to help others. (Ally)

Because um I want to give back to my community because some kids they don't know about certain things so I feel like (inaudible) it's important to inform them about things. (Natasha)

The entire group shared Jocelyn, Ally, and Natasha's thoughts. The participants expressed a duty to give back to their families and their ethnic communities through their future work as nurses and physicians in the health care field. In these exchanges, they seemed to position themselves as agents for change as they desired to serve as role models for future students.

The desire to "give back" is a theme that frequently remains with medical students of color even after they become physicians and begin treating patients. LaVeist and Nuru-Jeter (2002) documented greater satisfaction in patients who were treated by race concordant physicians. This satisfaction may likely be reciprocated by minority physicians who, when compared to their majority counterparts, have a greater tendency to serve their communities by practicing in HSPA's where large numbers of the underserved reside (Keith et al., 1985; USDHHS, 2008). It is my sense that the URMW are eager to provide efficacious service to their communities in the future, but still understand that they must persist through adversity.

Ethnic and Gender Identity and the Medical Pipeline

Being a Minority: Coping with Otherness

Theme 5: URMW attempted to create social identities that debunked negative stereotypes and perceptions associated with living as a minority.

Analysis of field notes, focus groups, and individual interviews revealed URMW who attempted to create social identities that debunked negative stereotypes and perceptions associated with living as a minority (particularly perceptions and stereotypes associated with living as an African-American for the vast majority of participants self-identified as African-American). The concept of othering requires an understanding of self and other, whereby “self” is regarded as the norm and those unlike “self” are the “other” (Jensen, 2011). In this sense, the other group is always depicted as morally inferior. Furthermore, the concept of othering is yet another way to address aspects of intersectionality. Jensen found that though othering is certainly an additional avenue for “self” to rationalize the oppression of already marginalized groups, othering may contribute to the development of agency in individuals who are othered. As the URMW in this study shaped their own identities, they again shared stories of personal agency and self-efficacy (Bandura, 1977b, 1990b). For example, Ally and Rhonda spoke about how they have made conscious decisions to utilize their minority status as a source of motivation, as opposed to viewing it as a hindrance.

I feel that especially at the school were I'm going; it [being a minority] is going to be very difficult. But I have to let that not affect me; I have to use it as a motivation to push me to do better.(Ally)

I take it as motivation because many people say that minorities in general can't do that or shouldn't take on this challenge because we are not known for doing such things, we are known for doing the smallest things like the simple business or things like that; and in the medical field, people think that it's only for a certain type of people and I just want to break that bondage that minorities are in. So I'll just use it as motivation to keep going. (Rhonda)

Steele, Spencer, and Aronson (2002) describe the term stereotype threat as a minority's apprehension over the possibility that negative stereotypes about their group may be confirmed. This threat may interfere with academic performance and could even mean the student decides to drop out of the science or medical pipeline all together (Lujan, 2008). Jocelyn seemed to articulate her understanding of this threat.

Some people don't think (inaudible) African-Americans and they don't think that they are capable of being as successful as other races or as dedicated to fulfilling their dreams as other races. So, they're already expecting you to give up when things are too hard or too difficult for you or not to be able to understand the material that you're trying to learn.

To overcome negative stereotypes, minorities in rigorous pipelines (i.e., science, engineering, health science) may work extremely hard to distance themselves from the ethnic groups they affiliate with to adopt a more "successful" or "normalized" identity (Fordam, 1988). Underrepresented minority women in this study did not appear to reject their minority identities but did acknowledge the necessity of "working harder" as a minority to be acknowledged for the same performance as that of Whites.

Well, I have to go 10 times harder or I feel like I have to be 10 times greater than everybody that is sitting around me" (Eliza).

I think it's going to be a challenge honestly. But I think it is going to be manageable and I think that I'm going to be able to do it. I might have a little bit more difficulty than other races, especially because I'm going to a predominantly White institute. But I think that it is manageable and I think I'll be able to succeed (Jocelyn).

For some URMW, the burden of overcoming ethnic stereotypes was rationalized through the espoused belief that it is easier to matriculate through higher education if you are in fact a minority. In other words, some of the URMW contradicted their own acknowledgement of "it is harder" to be a minority and shifted to describe a system that favors minority cultures. Rhonda and Wendy's statements depicted this shift.

Yes there's going to be bumps in the road, people are going to be prejudice or whatnot and I'm prepared to deal with that when I cross that road. But as of now, I look at it as an upper hand amongst my peers because I am a minority female. (Rhonda)

I don't feel it is a challenge. I just see it as a stronghold because I'm something that many people want ... Because colleges and universities, they want minorities and they want a minority female. So I see it as something good basically that I can put on my resume, and stand strong behind it because it is going to get me to further places. Because, people are getting tired of seeing the same people, the same type of persons, the same face- I should say, in the medical field. So, I think that me being a minority female, that's an upper hand above everyone else because they want my type of person. So I don't see it as a challenge. (Wendy)

In these examples, both Wendy and Rhonda described an unfounded conviction that in higher education, systemic advantages are provided to minority groups that the majority does not receive. While this school of thought may be an indicator of adequate self-efficacy beliefs towards academic achievement on

the one hand, it may also signal difficulties for these URMW concerning the idea of stereotype threat as any benefits associated with being a minority are not isolated from the negative stereotypes that accompany the reality of living as a minority (Steele et al., 2002).

Contrarily, Jocelyn and Ally confronted the challenges associated with being both a female and a minority. As intersectionality theory dictates, Kara struggled with describing her ethnic and gender identities separately and spoke of the challenges associated with being both.

Okay... I can say both are harder. Because as far as being a female with the history that we have, as far as woman suffering and guys already thinking that "we're women" and there are some things that we just can't do. And then, as far as being African American and then being a female at the same time, this just makes it worse (Kara).

Kara described a situation in which the intersection of her race and gender could possibly worsen the potential discrimination she may feel when she goes to college and later enters the workforce. Wendy described her experiences a bit differently. Concerning the possible discrimination that she may encounter, Wendy did not differentiate her minority identity from her female minority identity.

Being a minority and a female both have the same risks that come with it - the discrimination that comes with it. So, it doesn't really matter whether you are either or the both (Wendy).

When speaking of their minority identities, URMW fully acknowledged the negative stereotypes that some choose to associate with minority culture.

Although the negative perceptions that some have of minorities may lead minorities to develop inefficacious beliefs (as with the stereotype threat), the

URMW in this study described their minority status as an aspect of identity that motivated them to enter and remain in the health science pipeline. As I describe the final theme to emerge during analysis, care will be taken to discuss how the minority and gender identities of URMW framed their science experiences within school.

Self-Assertive Efficacy: Managing Conflict

Theme 6: URMW seemed aware of and understood that withstanding the rigors of health science education and the health sciences profession required overcoming obstacles and settling conflicts.

During focus group and individual interviews, study participants expressed an awareness of the hurdles associated with entering the medical pipeline and pursuing a health science major and career. Likewise, they seemed to understand that withstanding the rigors of health science education and the health sciences profession requires overcoming obstacles and settling conflict. One goal of this research study was to determine how URMW's self-efficacy changed during their participation in HLAPP by analyzing results from Bandura's (2006) Children's Self-Efficacy scale. A second goal of the study was to obtain a deeper understanding of survey responses during interview sessions. Because survey results were analyzed during individual interviews, the theme of managing conflict emerged in participants' description of their management of conflict according to direct engagement, compromise, or by avoiding the conflict all

together. Most participants said they dealt with conflict head on. A quote from Rhonda served as an example.

I basically just state my point and my main facts and base it off of actual facts and not my opinion. I don't try to make things personal because that's how you get into an argument. And make things strictly factual and technical to get my point across. (Rhonda)

Generally speaking, the URMW seemed unafraid of conflict and described instances where they directly addressed situations informed by conflict. Mostly, participants decided to directly address situations where they felt they were being asked to do something unreasonable or inconvenient.

I kind of lay it out on the table. I kind of say that I'm going to listen to what you have to say first and then I put two and two together and I hope that can help them realize that it doesn't really make sense or that is not really convenient to what you are doing. (Ally)

Although participants met conflict directly, they still were able to resolve conflict through compromise. This was noted in Jocelyn's interview.

Well, first I tried to find a common denominator between the two of us where we can both find a way to agree with each other or find a way to disagree. If I feel that I'm right and I don't see the right in what they are saying, maybe I will just stick to what I say and I would let them stick to what they say. There is no need to go back and forth on the topic. But also, I try to see other people's point of view of things to learn more because I don't know everything and they might be right too. (Jocelyn)

Though Kara and Wendy indicated that they preferred to avoid conflict all together, each URMW seemed able to advocate for herself if the circumstance called for exercising assertiveness. All participants expressed the ability to "stand up for themselves" as noted in statements by Rhonda and Jocelyn.

I will tell them no. I am my own person so nobody can tell me what to do. I predict my actions so if I feel like I don't need to do it or if it's something bad, then I just tell them no. They can be mad or whatever but if they're my friends then they can understand why I can't do it with them. And if not, then that's them. I'm not going to do it with them to further damage myself. (Rhonda)

Personally I think I do stand up for myself when I'm being treated unfairly and that's also just speaking my mind about how I feel about me being treated unfairly, what I feel is unfair and the unfair action towards myself. And, I just explain how it makes me feel and just go from there. (Jocelyn)

In Rhonda and Jocelyn's case, they and the other URMW expressed an ability to voice their opinions, stand up to ill treatment, and refuse unreasonable or inconvenient requests. Furthermore, the girls were able to leverage their assertiveness as a communication tool that may assist them with discovering solutions to problems they will encounter in college and in their health science graduate programs. The rigors of college and medical school will likely require open communication with others that is direct, authentic, and appropriate. According to survey results, the URMW of this study maintained high levels of self-assertive efficacy throughout their participation in HLAPP. Based on their focus group and interview responses, participants are likely to carry such self-efficacy beliefs with them to university and, later, into the workforce, as self-efficacy beliefs have been positively linked to career trajectories (Bandura et al., 2001). Of the challenges that URMW expressed regarding medical pipeline entrance and eventual acceptance into medical programs, challenges association with minority identity were quite pronounced.

Science Positionality

In School and Out-of-School Science

Theme 7: URMWs' connectedness to science differed during in-school and out-of-school science and out-of-school activities posed some academic challenges.

In this study, URMW shared a number of experiences synonymous with positive self-efficacy beliefs towards remaining in the health science pipeline. These aspects of their health science programs of study included positioning sources of motivation to help them overcome challenges, utilizing assertiveness as effective communications tools for solving problems, and overcoming negative minority stereotypes through personal agency. These behaviors would seem to be positively correlated with URMW health science pipeline entrance and retention. However, when talking about their school science experiences, study participants frequently described a lack of engagement with science. When describing their science courses, words like “boring” and “hard” were mentioned throughout the focus group transcripts. Participants either really did not like science or they characterized science assessments as barriers to their academic achievement. When I asked the participants about their feelings towards science, a number of them indicated that they did not like it.

Jocelyn: I don't like science

Researcher: And why do you think that is, Jocelyn?

Jocelyn: I don't like science because it's just (laughter)

Ally: Boring . . . It seems boring sometimes.

Jocelyn: Yeah, it seems so boring like math, I love math . . . it's like so much like, once you get done with this, you have to plug it in and do this, this and that with it. And science, you're like just doing one thing at a time and goes by so slow and it's so boring. I really don't like; It just doesn't catch my attention.

Only one participant had favorable feelings towards science; when probed about her engagement, this participant could only relate to science extrinsically, saying, "I get good grades in it." I used the participants' feelings towards science as an opportunity to ask probing questions about the types of science-related activities they participated in during their science classes. Upon further questioning, I determined that many of the subsequently described science activities fell on the lower continuum of scientific inquiry. The young women were likely to describe lessons that involved rote memorization such as reciting vocabulary words or labs that involved "cookbook" type procedures that were designed to yield expected results. This was revealed through a conversation between Eliza and Rhonda.

Eliza: Ah, cuz I think, I know from the one part that was boring for me was ... when we was learning about cells.

Rhonda: Yeah I mean I got it (inaudible) but.

Researcher: What about cells were you learning about?

Essence: We were just trying to like tell the functions and just you had to like break it down. It wasn't really clicking. For me it like wasn't really clicking for me it was like "laaaa."

Researcher: And by functions you mean the function of each organelle in the cell?

Regia: You had to break it down and all that kind of stuff like where you could find the cells at (inaudible)

Essence: Telling the difference for a plant or animal cell . . . which one has. Yeah that was, Oh God!

Researcher: So did you have to memorize each definition or each part of the cell?

Regia: She tried to get us to memorize

Essence: Yeah She tried to

Although one exchange between two students doesn't reveal the day-to-day culture of their science classes, this exchange does begin to shed some light on their school science experiences. In the next example, Natasha describes the didactic nature of her science class that appeared to aggravate her lack of engagement in science.

Truthfully, I don't particularly like it. It depends on the subject and the teacher. Cause I'm a very active learner; I've got to see it and experience it and stuff. I don't really know how to do it if all you're going to do is talk about it all the time. Because just talking to me isn't going to work for me to get it. And um it has to be something interesting to me.

A question posed to participants by a member of the HLAPP staff was even more revealing. The staff member asked students, "How much opportunity do you get to be creative?" Ally talked about an out-of-school opportunity. The HLAPP staff member then said, "What about math or science classes?" Students grumbled a bit, with one student finally replying, "With the teachers we have . . . NOOOO!"

In documents like "Benchmarks for Scientific Literacy" (American Association for the Advancement of Science, 2009), rote memorization and labs

with extremely low levels of scientific inquiry are inconsistent with sound science pedagogy and are contrary to current science education reform efforts. The experiences participants associated with their science courses in school seemed to be in contrast to how science activities were presented during their participation in HLAPP, where students participated in hands-on activities that required them to engage in scientific argumentation and to defend their thinking. All program participants appeared to enjoy this type of science instruction and I even documented a student ask one of the staff members, “Why can’t we do this [type of activity] at school?” in my running notes.

Although students seemed to prefer the more engaging science instruction offered by HLAPP staff, they had difficulty conceptualizing the more rigorous concepts. During several sessions, HLAPP staff required students to engage in claim, evidence, and reasoning (CER) whenever science activities were presented. Claim, evidence, and reasoning is a science argumentation framework designed to support student engagement in scientific inquiry in addition to creating and evaluating science explanations (McNeill & Krajcik, 2008). Asides included with my running notes revealed that the URMW had difficulty in making claims and defending their explanations.

Dr. Blackwell (pseudonym) asked the students for detailed science explanations. She told them that their initial discussion will be compared to later explanations and that all students would be asked to defend their thinking.

[From their body language, puzzled looks and sidebar conversations, gather that these students seem a little uncomfortable when asked to defend their thinking]

Aside in field notes, January 26, 2013

Dr. Blackwell asked, “Where is cancer alley located and why is it called this: High rates of cancer in the area and there are debates on both sides.” Dr. Blackwell wants the students to make the connection that there are over 150 industries in this location and to expand upon why it is difficult to determine if cancer is attributable to environmental factors.

[Students don’t immediately know how to answer this question . . . difficult for them to articulate their understanding. Seems difficult for students to express claim, evidence and reasoning in writing or in class discussions.]
Aside in field notes, May 18, 2013

In addition to difficulty making claims and defending their scientific thinking, URMW also seemed to have difficulty understanding and applying high school-level science concepts and skills. Again, asides included in the margins of my field notes indicate that participants struggled with high school science concepts.

To complete the *Power of Water and Popcorn Inquiry Activity*, Dr. Blackwell told the students that they should be remembering some of this information from their Chemistry classes. A student answered her, “That was in 10th grade and I was kind of lost when I took it.”

[Students are really NOT following the instructor. Seems as though Dr. Blackwell assumed they had background knowledge about simple molecular structure, but this doesn’t seem to be the case. The visual helps a great deal. The students aren’t able to visualize what Dr. Blackwell is talking about without the visual, although they have all taken Chemistry.]
Running notes and asides, November 16, 2013

Perceptions of “The Science Teacher”

Theme 8: Lack of consistent positive relationships with their science teachers provided an additional obstacle to some URMW’s learning science.

The trouble participants demonstrated in articulating their science understanding was not a surprise as they described strained relationships with their science teachers. Ally and some of the other participants described one of their science teachers in the next example.

Ally: I have one teacher and this pertains to the field of science (laughter) and Uh It's kinda like she was good at the beginning of the school year, But as it kept going on, it's like, when you need help she gets frustrated and she tells you to go to another student. And like okay we went another student but we might not understand it because like you teach it a certain way and the other student that's teaching us. You get it with them then but then like how you do it, their way and you're like "what, what is that." But you told us to ask another student. So you can't get mad all the time at us because we still don't understand it.

Researcher: So you have in that class, you don't quite understand and then,

Ally: And plus she's like, she's like too busy with stuff like in class she be worrying about other stuff that she has to do out of school because she's over this and over that and plus she's like a BIG science teacher, so

Rhonda: It's a chair

Alicia: She's a chair

Ally: So it's like, I think she gets so frustrated with all of the other things she has to do that she kinda takes it out on us, but she might not think she do, but it seems like she do

Alicia: And she goes so fast she don't give us time to even write down what we gotta write down and she gets mad when we tell her to slow down. I like her but I'm just saying

Ally: Like her ways sometimes. It's just unnecessary

In another example, Natasha described her science teacher who also failed to meet her needs in science.

Researcher: You said sometimes, science is not your favorite. That you don't click with it. Are you thinking about how you're going to overcome that?

Natasha: Well, I need like one on one help

Researcher: One-on-one help?

Rhonda: Our teacher, she don't offer that.

Natasha: Yeah, She doesn't offer it

Researcher: So you say your teachers don't offer one-on-one help?

Rhonda: Sometimes in class they may try. But you really can't do much in class when you have other students in the class who need help. Our teacher doesn't offer, what's it after school help? She doesn't do that.

Although URMW described contentious relationships with their science teachers, all of their student-teacher interaction was not reported this way.

Participants unanimously identified their medical magnet teacher, Ms. Terrell as being kind and supportive and a number of them identified her an additional source of motivation assisting them with medical pipeline entry. Alicia spoke of this teacher in one of the focus group interviews.

Ms. Terrell um our teacher, she's she's not really, she's concerned about education but she she's more concerned about being there for you by helping you not only in medical stuff but in everything. She's like everybody's second mom. We're always in there afterschool asking her like, "oh why are you leaving us, don't leave. Stay here; help us." And she teaches us everything about medical. She quizzes us weekly on words and stuff like that not only to help us in medical but like Ally said also so to help us in Chemistry so that they'll come together and be more easier for us.

Although students admitted to having difficult relationships with some of their science teachers, they were able to cultivate a mentorship relationship with

Ms. Terrell, documenting their self-efficacy for enlisting social resources. They were able to forge a mentorship relationship with Ms. Terrell who not only offers them medical pipeline access, but also serves as a mediator to assist them through the difficulties they experience in other science classes.

In two relationships noted by participants, URMW described science teachers who were inaccessible. Often, minority students have identities that diverge from science identities; Barton et al. (2008) recommend teachers establish hybrid spaces in science classrooms where science identities and minority identities can meet. In addition to difficulty in establishing adequate science identities, the URMW of this study had the added burden of trying to capture the attention of their teachers who may have been overwhelmed with administrative tasks or challenged to meet the needs of multiple students who require their individualized assistance. These classroom management issues may have further added to the disdain these students expressed for science. The work of Ladson-Billings (2000) is of extreme importance as she argues that little has been done in teacher education programs to prepare teachers to instruct African American children. Because of this, Ladson-Billings contends that strategies must be deliberately taught to teachers to assist them with understanding the particularities of African American culture and how the teachers' personal identities can cause them to negatively position and fail to adequately assist the African American children in their classes.

The analysis of the school science theme concludes with a discussion of how these URMW positioned themselves in science. Carlone et al. (2011) conducted an ethnographic study of fourth grade science students in reform-oriented classrooms. The authors found that even high performing girls, particularly African American girls, did not position themselves as “smart science students” and could identify few characteristics that they shared with students they perceived as being smart. In both classrooms, the African American females identified the White males as being the smartest science students, explaining that it was they who knew the science words and how to perform the experiments. The work of these researches led me to pose the same question to the URMW in this study: “Who are the smart science students in your school and your classes?” Exactly as in the Carlone et al. study, URMW in this study positioned the lower performing White males as the highest science achievers. “Paul (pseudonym) . . . Cause he asks a lot of questions and he like, he reads a lot. Like, he reads ahead in like chapters and stuff like that.” The URMW went on to continue to highlight Paul’s accomplishments and called him scientific when describing his background. I monitored their science positionality only to find that it reoccurred throughout the HLAPP sessions and in focus group interviews. I recorded the following example in my field notes.

Dr. Blackwell and Ashley demonstrate and then talk to each other about the tag teaser. Continuing with the lesson, Dr. Blackwell said, “I’m going to call out facts, you tell me if you know . . . Before finishing her sentence Paul solved the tag teaser. The students in unison, say “Paul” as a sign of encouragement. Adam said, “I like puzzles.” (Paul is the same student the URMW previously identified as the smartest science student.”

Dr. Blackwell acknowledged Paul's accomplishment and then continued with the review from last session. When Natasha answered a question connecting concepts and indicating that she could apply the vocabulary presented at last session. Only one student gave her encouragement by calling her name.

[Do these URMW see themselves as smart in science as they perceive Paul to be?]

Field notes and aside, January 26, 2013.

Only after being prompted were the URMW able to identify characteristics they shared with the smart White male science students and even then only Ally positioned herself as being smart; however, Ally remained reserved when it came to labeling herself as being smart in science. "I'd say myself because in science I always have a good grade and plus like I never really even noticed."

In summary, URMW revealed a number of instances that pointed to adequate self-efficacy beliefs towards entering and remaining in the health science pipeline. These examples include the sources of motivation they relied upon, their affinity for enrichment programs, and their ability to manage conflict; all of them expressed the belief that they will be able to overcome negative race and gender stereotypes. Yet, when it came to science experiences, URMW described a lack of engagement in their school science classes and had difficulty meeting more rigorous science requirements associated with HLAPP science-oriented activities. These difficulties may contribute to negative URMW science positionality.

Findings According to Research Questions

To conclude this chapter, I provide summary statements of findings aligned with each research question.

Question 1

How did the self-efficacy of high school aged URMW change during their participation in a medical pipeline intervention?

Of the self-efficacy domains analyzed, self-efficacy in enlisting social resources, self-efficacy for self-regulated learning, self-efficacy to meet other's expectations, and self-assertive efficacy, significance was only found with the self-assertive efficacy domain (Bandura, 2006). Participants had significantly more self-assertive efficacy by the end of their participation in HLAPP than they did when they started the program.

In addition to the results of the self-efficacy scale, focus group interviews and follow-up individual interviews revealed participants who demonstrated their ability to voice their opinions and concerns and engage in self-advocacy if needed. Participants also described their ability to manage conflict through directly stating their positions, through compromise, or by avoiding the conflict all together.

Question 2

How did URMW describe the self-efficacy constructs that most impacted them?

According to Bandura's (2006) Children's Self-efficacy scale, the construct that had the most implications for URMW participants was self-assertive efficacy. The self-assertive efficacy domain includes individuals' ability to express their views or opinions, to take a stand against being mistreated, and to refuse unreasonable or inconvenient requests. Focus group and individual interviews revealed study participants who appeared aware of the rigors associated with entering the medical pipeline and pursuing a health science college major and future career. Likewise, they seemed to understand that entering and remaining in the health science pipeline will require them to manage conflict. Participants were able to utilize their assertiveness as a tool for effective communication and documented their ability to deal with conflict directly and to compromise. They also revealed their ability to speak up when they were treated inappropriately and to seek help with managing conflict when necessary. Underrepresented minority women's positioning sources of motivation to overcome challenges, utilizing assertiveness as effective communications tools for solving problems, and overcoming negative minority stereotypes through personal agency were important examples of positive self-assertive efficacy.

Question 3

How did pipeline project activities (mentoring, goal setting and skill building) affect the self-efficacy of URMW participants? Why did these activities impact URMW self-efficacy?

When URMW described HLAPP activities, they also spoke of enrichment activities as their gateway into the health science pipeline. Each participant relied on these enrichment programs for assistance with forming mentorship relationships, setting goals in the midst of challenges, and skill building. A number of the URMW identified the relationships forged during mentorship opportunities as the most important components of enrichment programs like HLAPP. The URMW's ability to establish and maintain relationships and to set goals of becoming health professionals in spite of negative perceptions of minorities reveals their self-efficacy for enlisting social resources. With this self-efficacy domain, students demonstrated confidence in their ability to locate and access resources needed for their success. Students expressed an aptitude for locating and accessing individual people, groups, or things that will allow them to manage conflict and other challenges associated with health science pipeline matriculation.

When it came to skill building, URMW effectively accessed HLAPP and other enrichment programs as a way to improve their skills, particularly their science skills. Still, participants expressed science disengagement and discord with science teachers that may indicate inadequate self-efficacy beliefs towards their science achievement.

Question 4

How did URMW describe their classroom science experiences? In what ways did these experiences impact their medical pipeline entry?

Participants generally expressed a dislike for science coursework and revealed a lack of science engagement in the school science courses. Although their science engagement improved within their enrichment programs (medical magnet courses, HLAPP), URMW showed severe deficits with understanding high school leveled science concepts and did not demonstrate their ability to defend their science understandings or to offer well-crafted science explanations backed by evidence. The URMW's attitudes towards science have not appeared to impact their health science entry at this juncture as all of them have indicated that they have been accepted to college, intend to declare a health science major, and intend to enter a graduate health science program in the future.

Question 5

Based on intersectionality theory, how did URMW describe their positionality as related to their experiences with science in general and with entering the medical pipeline?

Participants acknowledged current and future discrimination that is inseparable from minority living. When it comes to their ethnic and gender identities, URMW appeared to rely on intrinsic resources to buffer themselves from oppressive forces. These resources included the bonds established within

their informal learning community, God, family, and the personal agency that they described as their responsibility to continue moving towards their goals regardless of obstacles that may lie ahead. Also, URMW positioned enrichment programs and mentorship relationships as an added shield against the rocky road to health science matriculation. These actions seem to indicate positive self-efficacy beliefs towards the health science pipeline. Simply put, these URMW believe in their ability to one day become health science professionals. Yet, it must also be acknowledged that they expressed inadequate self-efficacy beliefs towards science attainment and achievement although science is collectively a gateway into the health science pipeline.

In the final chapter, I discuss implications of this research as well as study recommendations and limitations.

CHAPTER 5 DISCUSSION AND CONCLUSION

In this final chapter, I provide a summary of the study, an overview, limitations of the study, summary of findings, implications and recommendations for future research. I designed this research study to gain insight into the self-efficacy beliefs of high school aged URMW as they entered the health science pipeline. The conceptual framework for this study was couched in three theories- intersectionality, positionality and self-efficacy. I examined the academic progression of URMW participants upon their entry into the medical pipeline, focusing on how their experiences related to their gender and ethnic identities. For the eight URMW participants, their participation in HLAPP, as well as their medical magnet academy membership in their high school, were components of the health science pipeline that they entered as high school students.

Study Overview

The current number of Latino, African American, Native Indian, and Hawaiian or Alaskan Native physicians is not aligned with the population of those minorities residing in the US. This makes each of these minority groups underrepresented in the medical field (Castillo-Page, 2012). Past research has indicated that URM physicians are more likely to serve in the HSPA areas where underserved and underrepresented patients live and have been found to possess

the cultural competency required of physicians who effectively serve minority populations (Komaromy et al., 1996; Smedley et al., 2001; Smedley, et al., 2004). As far back as 1991, the AAMC challenged American medical institutions to attract and retain 3000 new minority physicians in medical schools by the year 2000. The AAMC did not meet this goal. Consequently, the recruitment of minorities prepared to meet the rigors of the profession remains a priority and may be even more imperative as minority populations are projected to increase (United States Census Bureau, 2012). Because the AAMC has a duty to produce more URM physicians, studies of the factors that promote and inhibit URM medical pipeline entrance and matriculation play an important role in meeting URM recruitment goals for the health science field. With special attention paid to the expression of their ethnic and gender identities, this study examined the self-efficacy changes and participation of URMW as they entered the medical pipeline.

Although this study had quantitative components, it was largely qualitative in nature and was therefore not intended to be generalizable to larger populations of high school aged URMW entering the medical pipeline. Instead, this study has theoretical implications and sheds light on how self-efficacy beliefs impacted the health science career trajectories of a select group of URMW as they transitioned from high school to college. This study adds to the research literature related to URM college students' preparation for medical school by focusing on the students' entrance into the medical pipeline, offering a pre-

college perspective of URMW who have been provided early access to the this pipeline. The experiences of these participants within the context of their health science career aspirations revealed rich and reflective discussions that can be used to expand our understanding of the factors that both widen and narrow medical pipeline accessibility, particularly when gender and race are at play. These insights can then inform decisions related to the recruitment and retention of URMWs for health science education.

The following research questions determined the formulation of this study.

1. How did the self-efficacy of high school aged URMW change during their participation in a medical pipeline intervention?
2. How did URMW describe the self-efficacy constructs that most impacted them?
3. How did pipeline project activities (mentoring, goal setting and skill building) affect the self-efficacy of URMW participants? Why did these activities impact URMW self-efficacy?
4. How did URMW describe their classroom science experiences? In what ways did these experiences impact their medical pipeline entry?
5. Based on intersectionality theory, how did URMW describe their positionality as related to their experiences with science?

Because I posed how and why questions along with a desired analysis of personal attributes, relationships, internal and external resources, and experiences related to URMW, qualitative case study methodology was used for data collection and analysis. Eight URMW who were purposively sampled for

participation in this study defined the case. Six of the participants were African American, one was Latina, and the other was of Afro-Caribbean ancestry. All of the URMW in this study attended the same high school in a large metropolitan area; their high school housed a medical magnet academy and all study participants were students in that program. In addition to their medical magnet academy, all students were participants in the Health Leaders Academy Pipeline Program (HLAPP), a medial pipeline enrichment initiative offered through a joint venture with the college of education and the medical school of a local university. HLAPP was considered the primary site of the study. By the close of the study, all students had been accepted to college and were planning to choose science or health science majors. Three URMW explained they would be the first to attend college, two others indicated their parents never finished, but their siblings attended. The other students had parents who finished college.

Yin's (2013) recommendations for formulating a case study were used in this research. These methods included collecting data from multiple sources according to the conceptual framework and study propositions. Study participants were observed during their HLAPP sessions and HLAPP documents, examples of student work and artifacts were collected for analysis. Additionally, URMW participated in approximately two hours of semi-structured focus groups and individual interviews. All of these interviews were recorded, transcribed, and stored according to policies outlined in the research protocol (Appendix G). An online, password-protected database was used for data storage and retrieval.

Later, these transcripts were coded and refined so that themes emerged. I used Dedoose, an online software interface, to conduct my analysis of the qualitative. To establish trustworthiness, standards of construct validity, internal validity, external validity, and reliability were adhered to as an integral component of establishing quality.

Study Limitations

Research studies that are largely quantitative in nature employ approaches based on standardized choices for data collection and statistical analysis, allowing for comparisons to be made between study samples and larger populations. In contrast to quantitative studies, studies using qualitative methods consist of approaches that seek deep and detailed descriptions of phenomena, requiring the researcher to act as the instrument of data analysis (Poggenpoel & Myburgh, 2003). Therefore, limitations are inherent in the ideology: qualitative research is always subjective and the researcher, as the instrument, is susceptible to possible biases. The researcher's positionality, therefore, is a component of the research, reducing the research's objectivity. Although I have made every attempt to adhere to the methodological standards and criteria established for qualitative research, I analyzed this research according to my training and experiences as an African American female researcher and science educator.

Another limitation of qualitative research is that the researcher's unavoidable participation in data collection may influence the actions and responses of study participants. In my role as researcher, I had no influence on the decisions made regarding students and their participation in HLAPP. Though student participants may have initially viewed me as a person of authority, my prolonged engagement in the field helped to establish our relationship and make participants comfortable with sharing their experiences with me.

This study is further limited by time and circumstance. This study was intended to reveal how a select group of URMW described their experiences and self-efficacy beliefs upon entering the medical pipeline in high school. This study cannot make generalizations to larger populations of URMW nor do the views or experiences expressed by these URMW speak for all URMW who may be entering the medical pipeline during high school. Other URMW may have different experiences. Also, this study describes the experiences of participants at a specific time in their lives. Over time, their experiences and descriptions of their journey through the medical pipeline may evolve.

Although the small sample size may not have been limiting for the qualitative methods used in this study, the small sample size may be problematic when discussing the quantitative analysis of this study. Had I intended to make generalizations to a larger population of URMW regarding Bandura's (2006) Children's Self-Efficacy scale, I would have sought a non-random sample of approximately 30 subjects to provide enough power to offer support for

hypothesis testing and acceptance. The results of the Children's Self-Efficacy scale were not generated for the purpose of generalization, but rather to show either the convergence or divergence of the qualitative data. Therefore, non-randomness regarding sample generation and sample size standards were not necessary for this qualitative study. In addition, there is documentation to support the argument that small sample sizes do not degrade the integrity of analysis when running a paired samples *t*-test (de Winter, 2011). Still, I acknowledge that the small sample size may be perceived as a limitation.

Summary of Findings

Possibly the most significant finding of this research is that all URMW participants successfully entered the medical pipeline as evidenced by their plans to enroll in college, deciding to major in science by the end of this study. In spite of experiences that revealed a lack of engagement in science, difficulty forming relationships with science teachers, and acknowledgement of the negative stereotypes embedded within minority existence, URMW held fast to their goal of becoming a health professional. Chapter 4 explored the role of self-efficacy in medical pipeline entry and college entrance as a function of gender and minority identity and how URMW positioned themselves in science. This study revealed the shared experiences, relationships, and principles of the URMW participants and how they were connected to their ability to make real progress towards their goals in spite of the challenges they encountered.

Medical Pipeline Entry and College Matriculation

Each of the URMW participating in this study identified an enrichment program as being responsible for providing her access to the medical pipeline. The enrichment programs served as the mechanism by which participants could practice their science skills, be given a platform to set goals and receive mentorship, all in an environment where students benefited from positive reinforcement from adults. The URMW relied heavily upon, and even boasted about, their participation in these programs. On a number of occasions, they spoke of the selectivity associated with these programs, painting them as exclusive opportunities that not everyone was offered. Because the URMW were so dependent upon their membership in these programs, I wonder if they would still have developed goals of becoming doctors without them.

In addition to describing enrichment programs as a bridge to the health science pipeline, URMW explained examples of motivation, endurance, and resilience that connected them to their goals for attaining future careers in the health sciences. Each of them spoke of their relationships with God, their families, and each other as internal resources that motivated them to enter and remain in the medical pipeline. In spite of the obstacles they encountered, the URMW expressed a sense of endurance and resilience when they spoke of their professional desires, acknowledging that the road ahead would not be easy. As the study proceeded, URMW's self-efficacy beliefs regarding their career goals (joining the health science workforce) as a way to serve their communities were

uncovered. Participants described a future sense of gratification when speaking of their reasons for becoming doctors; they believed their communities, families, and other young people like them would be positively impacted because of their career choices.

Lastly, URMW associated the mentorship relationships forged through their participation in various enrichment programs as another bridge to the health science pipeline. In HLAPP, each URMW participant was given numerous opportunities to interact with URMW enrolled in medical school. Most participants described these mentorship opportunities as the most impactful component of their enrichment programs. Participants also described the mentorship relationship they all shared with the medical academy liaison and teacher at their high school. They seemed highly connected to the maternal qualities they discovered in their teacher and spoke highly of her ability to inform them of health science opportunities, encourage and praise them, and to teach health science content so that they could understand it.

Ethnic and Gender Identity and the Medical Pipeline

The URMW participants in this study acknowledged an understanding of the negative perceptions some people have of minorities. In transcripts, participants explained the stereotypes that some associate with individuals who are minorities, most of which were contrary to attributes normally associated with a medical health professional. Most URMW depicted their minority identity as a

possible hindrance to their entry into, and remaining in, the medical pipeline; they also positioned their minority status as a source of motivation for overcoming negative stereotypes and achieving their health science career goals. Like their minority status, the women also described their genders as a second source of discrimination. As opposed to attempting to distance themselves from their minority or gender identities, URMW seemed to embrace both, explaining that they would likely have to work much harder to prove themselves than the White or male students that they would encounter (all but one student planned to attend a predominantly White institution). The students' work ethic revealed persistence and endurance. The participants appeared empowered to meet and overcome challenges they may encounter because of their minority status.

Furthermore, according to analysis of participants' responses to Bandura's (2006) Children's Self Efficacy scale, URMW displayed strong, positive self-assertive efficacy beliefs, revealing their willingness to express their opinions, stand up for themselves when being mistreated, and to reject requests that are unreasonable or inconvenient. In asserting themselves, URMW addressed conflict with others directly, through compromise or by avoiding the conflict altogether. Additionally, participants showed positive self-efficacy for accessing resources as they displayed the ability to seek assistance with managing conflict when necessary.

Science Positionality

When describing their school science experiences, URMW revealed that they lacked science engagement in school, depicting science as “boring” and loaded with “hard” words. Though their science engagement seemed to improve when I observed the URMW participating in HLAPP activities, I also observed their difficulty in understanding the general science concepts expected of high school students as well as their difficulty in defending their scientific thinking through the articulation of scientific concepts and terminology. At the same time, participants revealed strained relationships with their science teachers whom they describing as having authoritarian teaching styles that left them inaccessible to the students they teach.

Possibly all of these school science experiences have, over time, contributed to these URMW adopting negative positionalities in science. As documented in other studies of positionality, participants had a general feeling that science was “not for them” and always identified White males as the “smart science students” instead of themselves (Carlone, Haun-Frank, & Webb, 2011). At the close of the study, participants’ science positionalities seemed not to inhibit their entry into the medical pipeline, although a number of science achievement requirements will need to be met by participants if they are to remain in the health science pipeline in the future. In spite of their science disengagement, participants acknowledged the importance of science achievement as all of them intended to major in science in college.

Application to Study Propositions

The following study propositions assisted with data collection and analysis:

1. Some URMW in high school are unprepared to meet the rigors of collegiate science and medical school because of low achievement and limited experiences in K-12 science (NCES, 2011; Rainey, 2001).
2. Underrepresented minority women may have issues with identity, face challenges because of their genders and ethnicities and may fail to position themselves positively in science (Carlone et al., 2011; Parsons, 1995, 2008).
3. Underrepresented minority women may describe poor relationships with their science teachers that may contribute to their disengagement in science (Kitts, 2009; Ladson-Billings, 1999).

Study Proposition 1: URMW and Underachievement in Science

The documented science achievement of minority females in 8th and 12th grades falls significantly below that of their White counterparts, both male and female (NCES, 2011). As reported in NCES (2011), once they have completed K-12, minority women who enter college enroll with national and state administered high stakes testing scores significantly lower than their non-minority counterparts, whether male or female in both math and science. Because these trends follow minority women throughout their college years, some URMW may be unprepared to meet the rigors of medical school; this lack of preparation can

be traced to their performance in their K-12 science classes. This study proposition was confirmed in this study as the URMW study participants, while generally high-performing in high school, still revealed science disengagement and difficulty with understanding science concepts or articulating science explanations.

Study Proposition 2: URMW Identity and Science Positionality

Study Proposition 2 emerged in response to early indications that study participants failed to adopt science identities congruent with high science achievement. This was further documented throughout the study, as problems with participants' science understanding have already been noted. According to intersectionality theory, gender is an aspect of identity, although it is not the sole aspect (Crenshaw, 1991). The students in this study subscribed to multiple identities that impacted the formation of their science identities. They depicted their science class as a system of power that they had difficulty navigating. Therefore, their disengagement with science and poor interactions with science teachers contributed to their negative science positionality and general feeling that science was not meant for them (Bolshakova, Johnson, & Czerniak, 2011; Martinez & Guzman, 2013). This seems to contradict their future career desires because science can be described as a gateway into the medical pipeline. Students must demonstrate science achievement to remain in this pipeline. At the close of this study, students held on to two competing truths: they disliked

science, but still decided to major in it. Likewise, they disliked science but still aspired to one day become a doctor.

Study Proposition 3: URMW and Interactions with Science Teachers

The interactions between URMW participants and their science teachers have already been well described. Study Proposition 3 emerged out of students' descriptions of their poor interactions with their teachers. Participants depicted their science teachers as having an authoritarian classroom management style that resulted in negative student-teacher interactions (Jeanpierre, 2004). In such descriptions of their science teachers, the URMW positioned the teacher as the sole knowledge producer of the classroom, which left the students feeling as though the teacher was inaccessible. Like a domino effect, these relationships might have negatively impacted the science understanding, and ultimately the science positionality, of the URMW participants. Likewise, students may have difficulty adopting adequate science identities now and in the future as they progress through the medical pipeline.

Implications

This study examined the academic and social realities described within the context of self-efficacy from the viewpoints of eight URMW entering the medical pipeline. As a result of this study, URMW and their race and gender identity issues, along with their science positionalities, were all exposed. Though

the aim of qualitative research is not to generalize to larger populations, the findings from this study offer implications that may be useful in a number of academic settings, including K-12 education, higher education, and professional health science education. Therefore, educators representing each of these academic settings may use this study guide the evaluation of current practices, including instructional delivery, regarding URMW and their health science career trajectories so that these students' goals are better promoted. The research findings presented in this study may also inform K-12 education systems in terms of how potential members of the future health science workforce may be dropping out of the medical pipeline or fail to ever enter it at all because science attainment acts as an obstacle. Finally, this study may provide valuable insights for parents, teachers, and those who socially advocate for URMW concerning the challenges they face with pipeline entry and perseverance; interventions can be developed that might positively impact the potential of this group of young people.

Theoretical Implications

This study's results enhance the theoretical framework on which the study was based by exposing the way race and gender subtly bias the experiences URMW revealed about their desires to enter the medical pipeline. An individual's identity is largely socially constructed; the attributes of the group with whom an individual identifies are typically depicted in accordance with societal standards

and in response to power structures (Pearce, 2013; Tajfel, 1982). For example, a URMW participating in this study may be classified as African-American, female and of low SES. Each of these social identifies has historically been met by forces of oppression. According to intersectionality theory, underrepresented groups typically subscribe to multiple identities (Crenshaw, 1991). The individual who experiences these identities, and the discrimination that may accompany them, does not do so in isolation. Instead, the multiple identities subscribed to by some individuals intersect, thereby heightening the marginalization and discrimination they experience. After looking across the data, themes arose which were organized into three groups: the college and medical pipelines, gender and race identity, and the pipeline and science positionality. Each of these themes revealed how the intersection of race and gender impacted the way participants described their experiences.

The strategies the URMW engaged in to protect themselves from oppression as result of their race and gender ranged from insolence to compliance. Students shared the negative stereotypes that some choose to inflict on minorities and on women. Although in the research literature minorities seeking higher education can suffer from being “othered” or may have problems with achievement in college classes because of the stereotype threat. Underrepresented minority women in this study expressed an attitude of defiance when describing their minority identity (Jensen, 2011; Steele et al., 2002). Instead of viewing the intersection of race and gender as an oppressive force

causing them to question their belongingness, participants movingly positioned their race and gender identities, looking at them as aspects of themselves that gave them advantages over non-minorities. Most studies of intersectionality typically describe how oppressive forces contribute to the difficulties of minority life. In this study of intersectionality, the URMW participants seemed unaffected by the sources of discrimination that other female minorities in science fields described and they instead were likely to describe their minority female status as either a source of motivation or as a source of benefit (Johnson, Brown, Carlone, & Cuevas, 2011; Murphy, Acosta, & Kennedy-Lewis, 2013). Possibly because these students attended a school that was 95% minority and their neighborhoods were largely minority, they may have had few experiences interacting with non-minorities. As stated earlier, this study was bound by time and circumstance and it is possible that these participants, many of whom will attend predominately White institutions, may have different experiences in the future.

The URMW participants revealed their negative science positionality throughout the study. Consistently, study participants described their dislike of science as well as poor relationships with science teachers; they also failed to identify themselves as smart science students, although most study participants were in the top 10% of their senior class. Early analysis hinted at negative science positionality and upon further probing, students exposed troubling aspects of their science classes within school. Each participant described an authoritarian science teacher whose instructional strategies included traditional

lectures, the memorization of science vocabulary and science facts, and cook-book style labs and activities that yielded expected results or confirmed things read in the science textbook. According to Kelly (2007), teachers with such an authoritarian science discourse position themselves as the only knowledge container within the science classroom, leaving the students outside of the scientific realm. Underrepresented minority women in this study manifested their position on the outskirts of their science classes by saying such things as, “science is not for me.” Kelly has found that the “othering” that authoritarian science teachers appear to inflict on their science students is most problematic for female or minority students (Jensen, 2011). The gender and ethnic identities that the URMW brought into their science classroom seemed at odds with the academic science identities preferred by the authoritarian science teacher. When using intersectionality as the theoretical underpinning to describe the school science phenomena experienced by the URMW of this study, participants described situations in which their negative placement in science became even more problematic because of the intersection of their science identities. In addition to the gender roles present in the science classroom, students may have also been “othered” according to their minority identities by their science teachers (Kitts, 2009).

The Importance of Self-Efficacy

Though analysis of Bandura's Children's Self-Efficacy scale indicated that self-assertive efficacy increased during this study, the personal experiences of these participants revealed during observations, focus group interviews, and individual interviews produced valuable insights of their personalities, morals, and principles that would not have been revealed with quantitative methods alone. Analysis of study data revealed the URMW's self-efficacy, resiliency, and self-assertion as they relate to the achievement of their educational and professional goals. Attributes of self-efficacy were disclosed by URMW in varying manors and degrees; study participants did not describe circumstances that indicated they were born with self-efficacy. Instead, they described situations that allowed for the development of their self-efficacy beliefs. If this theory holds for other URMs, then the development of adequate self-efficacy beliefs may possibly encourage URM students to seek the post-secondary pathways that lead to the health sciences pipeline. Therefore, the development of self-efficacy beliefs in URMs may then serve as an intervention against some of the challenges faced by these students and act as a viable option for increasing the numbers of URMs who enter and are retained within the medical pipeline. Parents, teachers, and other adults share the responsibility of manipulating a student's environment so that their school performance is enhanced Pollard (2002). Educational enrichment programs that offer authentic teaching experiences, opportunities for self-reflection, and a classroom climate in

which students have the freedom to express themselves have all been identified as factors that promote self-efficacy. Furthermore, when teachers in the classroom move away from focusing on students' deficits to encouraging students and highlighting what students *can* do, self-efficacy is also positively impacted (van Dinther, Dochy, & Segers, 2011). Likewise, classroom environments and teacher actions that contribute to students' realizing success in subjects they fear or do not understand have been shown to enhance students' self-efficacy (Bandura 1995; Pajares, 1996). Also, parents play a role in developing self-efficacy: parents' self-efficacy and aspirations for their children impact their children's self-efficacy and career trajectories (Bandura et al., 2001). Interestingly, a child's perceived self-efficacy and not actual academic achievement mediated career choice (Bandura et al., 2001). When schools, teachers, and parents work together to offer students authentic learning experiences along with high expectations, self-efficacy is promoted which can substantially positively contribute to academic goal formation and attainment.

K-12, College and Medical School Partnerships and Pipeline Matriculation

This study revealed that the participants traveled along well-considered and planned pathways towards entering and completing college and moving ahead to medical school. Instead of having to figure out everything on their own, participants in this study were provided support as they entered the medical pipeline which included being offered early experiences in medicine, being

introduced to general academic as well as college of medicine mentors, and being given time to practice science skills. Participation in HLAPP meant the URMW participants had support with pipeline entry because of a partnership with their high school, a local university, and a local medical school. Without this support system, the URMW in this study may have had no other choice but to locate and navigate the college and medical pipelines without the guidance of adults and mentors who could assist them with identifying and accessing resources. Although the transition from public school to college and beyond should be smooth, the K-12 education system and higher learning environments often have competing goals coupled with poor communication or collaboration between the entities.

Venezia, Kirst, and Antonio (2003) have argued for improving the collaboration between public schools and higher learning systems which they also contend can reduce college attendance rates from minorities and disrupt collect pipeline matriculation. In contrast to instances described by Venezi et al., the URMW in this study described healthy transitions from high school to college that typically included either sustained membership in an enrichment program or the enrichment program was described as the gateway to the college or medical pipeline. Even if the URMW participants did not indicate plans to enter higher education enrichment programs where they would further benefit from mentorship and other sources of support, they recognized and appreciated the foundation that has been provided them as result of their high school

experiences in an enrichment program. Possibly, in the future, these URMW will be able to seek out enrichment programs independently.

Although HLAPPP program was not a main focus of this research, for supportive partnerships such as HLAPP to work, these partnerships must be established and maintained between the local school staff, health professionals, parents, community organizations, colleges and universities, and medical and other health science institutions. Elements of successful partnerships include collaboration, institutional commitment, a partnership governance structure, strategic planning, and appropriate and effective partnership activities (Terrell, 2006). In a number of instances, partners with various interests work together to share a broader vision of education (Cleveland, 2006). Although collaboration is important, stakeholders do not always feel part of the process. Sometimes teachers and school administrators do not feel consulted or treated as partners in decision-making (Carline & Patterson, 2003). Similarly, college and university officials associated with pipeline programs also describe some difficulty with the school and university partnership. Misalignments between high school and college goals in addition to cultural differences between the K-12 sector and universities have been identified as obstacles to achieving an effective partnership (Chenweth, 2000; Cleveland, 2006; Patterson & Carline, 2006). Further deepening the divide between high school and university staff, high school rigor has been identified as one of the factors impacting health science education both within the pipeline program and beyond (Chenoweth, 2000;

Klopott & Martinez, 2004). This issue of high school rigor is highly impactful as the quality of high school curricula is the greatest predictor of college completion (Adelman, 1998). Possibly placing more focus on developing sound partnerships among all stakeholders may assist with URMW's recruitment for the medical profession.

The K-12 System's Role in Pushing College Attendance

The URMW in this study were fully aware of the requirements and expectations associated with college attendance and completion. Unanimously, they identified K-12 enrichment programs as the information source from which they made conscious decisions about college choice. The K-12 enrichment program also disclosed to students procedures to follow for college admission and for locating funding. All of the URMW in this study described supportive families who pushed college attendance even if they had not attended themselves. Although the participants may have still planned to attend college if they had never participated in any enrichment program, HLAPP leadership highly promoted college attendance which seemed to further push the participants towards their goals. The question that remains is if local secondary schools proactively promote college attendance for all students, even those who do not participate in K-12 entrenchment programs.

Of course enrichment programs provide an additional layer of support for students who are hopefully college bound; still, methods for promoting college

attendance for all students should be embraced by secondary school systems. Dychtwald, Erickson, and Morison (2013) note that more college graduates will be needed in the near future to fill the highly-skilled careers that are replacing the less-skilled positions that once flooded the labor market. With that being said, the K-12 sector will soon be called on to produce students prepared to meet the rigors of a new labor environment. High school students would benefit from distinctly defined systems that encourage college and career readiness. This may include the distribution of college testing information coupled with test preparation, financial aid resources, and on the job training offering authentic experiences in specific disciplines. All students, including minority students, should be able to make a seamless transition from high school to college because of partnerships and coordination between the two systems of K-12 education and higher education.

The transition from high school to college is much more difficult when students have not been prepared for the rigorous academic standards applied on most college campuses. Although the participants were considered high performing by their teachers and administrators, most were enrolled in remedial reading courses and their difficulties in mastering science concepts were well documented throughout study. Because the advanced placement (AP) courses in their high school had open enrollment, it would not be uncommon to find a student in an AP calculus or physics course that was also mandated to take a course in remedial reading. A number of study participants fit under this

category. Such circumstances should sound a grand alarm for K-12 practitioners who have students ready to exit the system with fundamental weaknesses in reading and other areas. It goes without saying that the medical professional community is absolutely dependent upon teachers who from kindergarten through twelfth grade must produce students capable of successfully matriculating through the medical pipeline.

Just as school systems have already recognized their accountability regarding student learning, accountability for establishing high expectations for college attendance after high school is needed. These opportunities must be afforded to all students regardless of race, ethnicity, gender, or class. The two-tiered academic system of the past which prepared most young people for immediate entrance into the workforce, reserving college for a select few, is antiquated and should be relegated to the dustbin of the US education system.

The Need for Diverse Science Teachers and Culturally Relevant Science Pedagogy

Though the URMW in this study seemed to meet with resilience the challenges they faced because of their ethnicities and gender, they also shared academic experiences in school in which their science teachers seemed to miss the mark. From offering didactic instruction based on the memorization of facts to being unavailable to answer questions, some of the science educators depicted by URMW participants failed to support them within the science classroom, let alone supporting them in their decisions to become health science

professionals. As result of their teachers' authoritarian teaching styles, URMW participants seemed so distanced from science that they were unable to positively position themselves within science disciplines, although many recognize science as the gatekeeper for careers in medicine.

All educators, particularly those in science, should evaluate their preconceptions of minority students and their entitlement to gain admittance to rigorous college programs and, later, high paying or prominent STEM professions. With such depressed numbers of URMW in such professions as the health science profession, we cannot permit teachers to misrepresent a student's social role, thereby adversely impacting their future possibilities. Instead, teachers who understand multiculturalist issues and embrace culturally relevant pedagogy are needed to instruct minority children.

Starting with teacher education programs, there is a need to infuse social advocacy and cultural understanding into teacher preparation curriculum. Beginning teachers cannot enter the teaching profession with inappropriate conceptions of the race, ethnicity, gender, or class of the students they will teach. Bryan and Atwater (2002) have indicated that the teacher's beliefs establish what the teacher will teach to which students, profoundly impacting science teaching and learning. Just as demographics are shifting to include greater numbers of minorities, so must educational structures change to reflect the purposeful inclusion of minority students. Although the URMW in this study often described contentious relationships with their science teachers, they specifically identified

one of those teachers as positively impacting their academic trajectories. They were all profoundly impacted by this teacher, so much so that many students credited her with influencing their decisions to go to college and become doctors.

Even with all of the diverse factors students bring to the classroom, the profound effect teachers have on learning cannot be ignored. The work of Ladson-Billings (1999) reminds us that teachers require special training to teach students of certain minority affiliations, particularly African American children.

Suggestions for Future Research

The findings presented in this study provide insights into the cultural implications for knowledge transactions within and outside of the science classroom. In addition, findings of this study indicate that self-efficacy manifestations impacted the medical pipeline entry for a select group of high school aged URMW. The data indicated that the participants possessed multifaceted ethnic and gender identities. Although these identities may have culturally placed them at odds with mainstream science, participants developed strategies and coping mechanisms for dealing with such contrariety, constructively creating hybrid identities that allowed them to enter and begin navigating the health science pipeline.

Additional research on URMW and their academic progression through the health science pipeline is needed. Previous studies of URMW in science have looked at gender, ethnicity, and other social factors in isolation. More

studies on the degree to which these factors intersect are needed to paint a more complete picture of how URMW navigate the systems of power that exist within academic systems or professions where science acquisition or application is central. Also, because URMW are not monolithic, studies comparing URMW of varying cultural backgrounds as well as cultural differences within minority groups are also needed to further the current body of research as it relates to URMW and their health science aspirations.

A clearer understanding of how the ethnic and gender issues of URMW affect their science achievement and progress through health science pipeline may help both K-12 instructors as well as college administrators. For example, science teachers may realize the critical role they play in making the health science pipeline accessible to their diverse student populations. Similarly, this research may help college administrators realize that diversity will improve the learning experiences of their student bodies as well as the scientific community that these students desire to join. Likewise, continued research on the diverse identities that students bring to the college classroom may assist professors of science in becoming more effective instructors by employing instructional strategies that better meet minority students' learning needs.

As for the medical pipeline itself, continued research is warranted if the AAMC is ever to meet its goals of attracting more URMW to the profession. Policy changes which have reduced the influence of affirmative action, changes to admission policies, reductions in federal financial aid, increases in student loan

debt levels, and the influx of African American females into the college pipeline are all topics worthy of further study. Also, studies of URM at various stages of the medical pipeline may provide further insights into refining recruitment efforts targeting URMs for the medical profession. Future qualitative studies, particularly ethnographic accounts that reveal the experiences of URMW who have successfully navigated the medical pipeline, may provide insight into K-12 curricular and policy changes that may increase the number of URMW prepared to meet the rigors of future medical education.

Conclusion

The growing numbers of URMW who are aspiring to careers in medicine is promising, yet these trends should be met with cautious optimism. Though URMW are gaining ground when compared to underrepresented minority men (URMM), collectively the numbers of URM health professionals is not consistent with the growing population of URMs in the US. For URMW to continue their positive momentum in the health professions, they must be prepared for the precision demanded of the profession. Because science acts almost as a portal, allowing or denying access to the medical pipeline, URMW must develop identities compatible with academic science. Even with their difficulties in science, the participants in this study expressed positive self-efficacy beliefs towards their health science career trajectories. This is promising in that Bandura (1995) argued that perceived self-efficacy can influence career

trajectories more than academic performance. The stories shared by URMW participants reveal that they are ready to face whatever challenges arise when they soon enroll in college. I argue that even with their positive self-efficacy beliefs, K-12 practitioners must do everything in their power to equip them to face those challenges. This includes addressing their issues with science achievement and helping to ease the transition from high school to college. Whether or not the women of this study will one day become physicians remains to be seen and is certainly a topic for future study. As a result of observing study participants meet the expectations of academic science, I am encouraged that their spirits and desires to succeed have not been diminished in spite of their negative school science experiences. This study revealed that participants have the self-efficacy beliefs required to think of themselves as scientists. Hopefully their self-efficacy beliefs will offer the possibility of participants' positively positioning themselves in science while we as K-12 educators continue to acknowledge that for some, science has disqualifying qualities.

APPENDIX A
PARENTAL CONSENT FORM



Informed Consent

Study title: The Self-Efficacy of High School Aged Underrepresented Minority Women Entering the Medical Pipeline

Principal Investigator: *Jennifer Dames, Science Education Doctoral Student*

Faculty Supervisor: *Dr. Bobby Jeanpierre, PhD*

Investigational Site: Center for Research in Education, Arts and Technology (CREATE)

How to return this Consent Form: Please return this consent form to Dr. Carolyn Hopp, Pipeline Project Coordinator

Introduction: Researchers at the University of Central Florida (UCF) study many topics. To do this, we need the help of people like you who agree to take part in research studies. Your child is being invited to take part in this research study because he or she is already participating in the [REDACTED] High School Pipeline Project at the Center for Research in Education, Arts and Technology (CREATE). You are being asked to allow your child to take part in this study and you can ask questions about the research. You must be an emancipated minor according to the laws of the State of Florida or an adult 18 years of age or older to be able to give this permission and sign this form for your child to take part in this research study.

The person doing this research is Mrs. Jennifer Dames of the Science Education Department of the Science Education Department at UCF. Because Mrs. Dames is a graduate student at UCF, she is being supervised by Dr. Carolyn Hopp and Dr. Bobby Jeanpierre of the College of Education.

What you should know about a research study:

- Someone will explain this research study to you.
- A research study is something you volunteer for.
- Whether or not you take part is up to you.
- You should allow your child to take part in this study only because you want to.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.
- Whatever you decide it will not be held against you or your child.
- Feel free to ask all the questions you want before you decide.

Permission to Take Part in a Human Research Study

Purpose of the research study: The purpose of this study is to understand how minority females in a high school medical academy pipeline project position themselves in regards to their present and future achievement in science.

The study will attempt to answer the following research questions:

1. How do girls in the medical academy characterize their experiences in science?
2. In what ways are the cultures that these girls may identify with at odds with mainstream science?
3. How do these girls describe their interactions with their teachers or other adults and to what extent do these interactions impact their achievement in science?

What your child will be asked to do in the study:

Your child will be asked to participate in focus groups that will be audio taped. The transcriptions will be used for data analysis. Your child may also be observed as they participate in the pipeline project.

- *Your child will be observed during 7 Saturday sessions of the Pipeline Project and participate in 3 focus group interviews.*
- *Your child may be asked to provide written responses to survey questions about their study habits, school achievement and motivation to complete tasks.*
- *Your child will interact with the researchers and the other underrepresented minority females that have been recruited for participation in the study.*
- *Your child does not have to answer every question or complete every task. You or your child will not lose any benefits if your child skips questions or tasks.*

Location: Center for Research in Education, Arts and Technology (CREATE)

Time required: We expect that your child will be in this research study for 3 focus group sessions during November of 2013 – July of 2014. The focus group interviews they will participate in will last for approximately 15-30 minutes.

Audio taping:

Your child will be audio taped during this study. If you do not want your child to be audio taped, your child will not be able to be in the study. Discuss this with the researcher or a research team member. If your child is audio taped, the tape will be kept in a locked, safe place. The tape will be erased or destroyed at the close of the study

Risks:

There are no expected risks for taking part in this study. There are no reasonably foreseeable risks or discomforts involved in taking part in this study. There are no anticipated physical risks to participants. Focus group members will be asked to keep the information provided in the groups confidential. The only possible risk for taking part in this study is potential breach of confidentiality. Your child does not have to answer every question or complete every task. Neither you nor your child will lose any benefits if your child skips questions or tasks.

Permission to Take Part in a Human Research Study

Benefits:

There are no expected benefits to your child for taking part in this study. We cannot promise any benefits to you, your child, or others from your child taking part in this research. Your child will not benefit directly for taking part in this research, besides learning more about how research is conducted.

Compensation or payment:

There is no compensation or other payment to you or your child for your child's part in this study. There is no compensation, payment or extra credit for your child's part in this study.

Confidentiality: We will limit your personal data collected in this study. Efforts will be made to limit your child's personal information to people who have a need to review this information. We cannot promise complete secrecy. Organizations that may inspect and copy your information include the IRB and other representatives of UCF.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints talk to Jennifer Dames, Science Education Program, College of Education, (904) 612-1560 or by email jdames@knights.ucf.edu or Dr. Carolyn Hopp, CREATE affiliate and College of Education Instructor, (407) 823-0392 (Office) or by e-mail Carolyn.Hopp@ucf.edu.

IRB contact about you and your child's rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901. You may also talk to them for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

Withdrawing from the study:

You may decide not to have your child continue in the research study at any time without it being held against you or your child. If you decide to have your child leave the research, your child may still participate in the Pipeline Project. If you decide to have your child leave the study, contact the investigator so that the investigator can terminate your child from the project.

The person in charge of the research study can remove your child from the research study without your approval. Possible reasons for removal include: failure to follow instructions of the research staff, if the person in charge decides that the research study is no longer in your best interest. We will tell you and your child about any new information that may affect your child's health, welfare or your choice to have your child stay in the research.

Permission to Take Part in a Human Research Study

Your signature below indicates your permission for the child named below to take part in this research.

DO NOT SIGN THIS FORM AFTER THE IRB EXPIRATION DATE BELOW

| | |
|------------------------------------|--|
| <hr/> | |
| Name of participant | |
| <hr/> | |
| Signature of parent or guardian | Date |
| <hr/> | <hr/> |
| Printed name of parent or guardian | <input type="checkbox"/> Parent |
| <hr/> | <input type="checkbox"/> Guardian (See note below) |
| <hr/> | <hr/> |

Assent Obtained

Note on permission by guardians: An individual may provide permission for a child only if that individual can provide a written document indicating that he or she is legally authorized to consent to the child's general medical care. Attach the documentation to the signed document.

APPENDIX B
OBSERVATION PROTOCOL

Observation Protocol
Adapted from the original model by
Dr. Natalie Underberg, UCF Digital U/CREATE

There are multiple dimensions of observation in specific situations (Underberg, 2008). Teachers in classrooms are in the unique position to observe their students in different settings and contexts. These observations help to form a “picture” of the student, which can be applied to teaching and learning strategies. The dimensions below should not be answered in any particular order, but instead guide the researcher to include all dimensions in field notes

Dimensions of Observation

- I. **Space:** describe the physical setting. What is located where? Describe objects in the physical setting? What is their purpose/function?
- II. **Participants:** describe the student(s); give specific demographic information (how many, gender, age, ethnicity), what they are wearing, especially if the activity requires a certain kind of clothing. Also describe how the students interact.
- III. **Activity:** describe what the student(s) is/are doing. Are they working together? If so what are they doing? Are they enthusiastic and actively engaged?
- IV. **Actions:** what is/are the student(s) doing over the course of time of observation?
- V. **Events:** describe related activities in which the student(s) is/are engaged. Is progress being made on the designated task?
- VI. **Time:** describe sequence of events; whom does what when?
- VII. **Goal:** describe the goal(s) of the lesson or activity in which the student(s) is/are engaged. Is the goal of the activity or lesson reached?
- VIII. **Feeling:** what emotions were observed (frustration, laughter, sadness, excitement). Did student(s) get along or were there conflicts? (Feelings, reflections, questions will be written as asides in the margins of the field notes)

APPENDIX C
FOCUS GROUP GUIDELINES

Focus Group Questions

Focus groups will be audio taped and transcribed.

When audio tape starts and before the session begins speak the name of the number, date, and time of the focus group. Also speak the first names of the individuals present in the focus group. Although the names of students may be heard during the focus group interviews as the participants interact with each other and the researchers, pseudonyms will be used in the place of actual student names during transcription. Only underrepresented minority females whose parents have given consent for them to participate in the research will take part in focus group interviews. No other Pipeline Project participants will take part in the focus group interviews.

- What is your background?

- What has been the most interesting part of your journey in the medical magnet program?

- What are your long-term goals?

- Who/what motivates you to stay on the path toward your goal(s)?

- Tell me what your feelings are towards science.
 - Probe for both positive and negative feelings.

- What challenges or obstacles have you faced in science?

- How did you overcome those challenges or obstacles?

- Which people in your science classes do you consider to be smart science students?
 - Probe for what characteristics those students have
 - Note if student includes herself in the list and if not probe to see if student identifies with any of the characteristics named.

- What do you do outside of your academics? How do you maintain balance?

APPENDIX D
EXAMPLES OF INTERVIEW QUESTIONS

1. Tell me about where you're headed after graduation.
2. What person, group of people or thing do you feel most contributed to you getting to this point?
3. How do you express yourself when your classmates disagree with you?
4. Do you stand up for yourself when you feel as though you're being treated unfairly . . . How do you do this?
5. What things do you do to get others to stop annoying you or hurting your feelings?
6. Do you stand up to people if they ask you to do something that you think is unreasonable or inconvenient? How do you do this?
7. Tell me what it is like for you as a minority female about to enter a science field.
8. Probe for challenges/difficulty with being a female or being a minority . . . or both.

APPENDIX E
BANDURA'S SELF-EFFICACY SCALE

Children's Self-Efficacy Scale

This questionnaire is designed to help us get a better understanding of the kinds of things that are difficult for students. Please rate how certain you are that you can do each of the things described below by writing the appropriate number. Your answers will be kept strictly confidential and will not be identified by name.

Rate your degree of confidence by recording a number from 0 to 100 using the scale given below:

| | | | | | | | | | | |
|---------------------|----|----|----|----|----------------------|----|----|----|--------------------------|-----|
| 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Cannot do at all | | | | | Moderately can do | | | | Highly certain can do | |

**Confidence
(0-100)**

Self-Efficacy in Enlisting Social Resources

| | |
|---|-------|
| Get teachers to help me when I get stuck on schoolwork | _____ |
| Get another student to help me when I get stuck on schoolwork | _____ |
| Get adults to help me when I have social problems | _____ |
| Get a friend to help me when I have social problems | _____ |

Self-Efficacy for Academic Achievement

| | |
|---|-------|
| Learn general mathematics | _____ |
| Learn algebra | _____ |
| Learn science | _____ |
| Learn biology | _____ |
| Learn reading, writing, and language skills | _____ |
| Learn to use computers | _____ |
| Learn a foreign language | _____ |
| Learn social studies | _____ |
| Learn English grammar | _____ |

Self-Efficacy for Self-Regulated Learning

| | |
|---|-------|
| Finish my homework assignments by deadlines | _____ |
| Get myself to study when there are other interesting things to do | _____ |
| Always concentrate on school subjects during class | _____ |
| Take good notes during class instruction | _____ |
| Use the library to get information for class assignments | _____ |
| Plan my schoolwork for the day | _____ |
| Organize my schoolwork | _____ |
| Remember well information presented in class and textbooks | _____ |
| Arrange a place to study without distractions | _____ |
| Get myself to do school work | _____ |

APPENDIX F
PERMISSION TO USE INSTRUMENT (CHILDREN'S SELF-EFFICACY SCALE)

Outlook Calendar People ... Jennifer Dames ?

Children's Self Efficacy Scale.

Albert Bandura <bandura@stanford.edu>
Mon 3/4/2013 5:03 PM
Inbox
mark as unread

Permission granted!

Albert Bandura

← REPLY ← REPLY ALL → FORWARD ...

Jennifer Dames
Fri 2/22/2013 3:47 PM
Sent Items
mark as unread

To: karen.saltzman@stanford.edu;

Good afternoon Ms. Saltzman,

I aquired your email from the Psychology Department's website at Stanford. The website indicates that you are an assistant to Dr. Bandura, so I hope you can help me. I am interested in using Dr. Bandura's self-efficacy scale for my dissertation and sent him the email below.

Although the scale is readily available on the web (the entire chapter is posted in numerous locations) I still need some sort of permission statement to satisfy my IRB office. Can you point me in the correct direction to obtain a permission statement? I had no luck with the publisher.

Thanks in advance,
Jennifer Dames

Bandura 1 of 6

APPENDIX G
HUMAN RESEARCH PROTOCOL



Human Research Protocol

1) Protocol Title

Study title: The Self-Efficacy of High School Aged Underrepresented Minority Women Entering the Medical Pipeline

2) Investigator(s) Jennifer Dames

3) Objectives

The purpose of this case study is to understand how URMFs in a high school medical academy describe their self-efficacy themselves in regards to their present and future achievement in science. Additionally, the study will explore how girls in the medical academy characterize their experiences in science and to what extent their cultures impact those experiences.

4) Background

The [redacted]s High School Medical Arts Magnet provides students with a curriculum that familiarizes them with basic medical skills, introduces them to real medical courses to include anatomy, genetics and health science and encourages internships in [redacted]h facilities. The Jones High School Pipeline Project is held monthly at the Center for Research and Education in Arts, Technology and Entertainment (CREATE) and is spearheaded by Dr. Carolyn Hopp, a CREATE affiliate from the UCF College of Education and Dr. Lisa Barkley [redacted] UCF College of Medicine. The Jones High School Pipeline Project is designed to encourage the p[redacted]ticipation of underrepresented minority students from the Jones High School Medical Arts Magnet program so that these students are encouraged to pursue college majors and careers in the medical field, science field and/or engineering.

5) Setting of the Human Research

The research will take place at the Center for Research and Education in Arts, Technology and Entertainment (CREATE). CREATE is the location of all of the Pipeline Project meetings.

6) Resources available to conduct the Human Research

Resources available include space provided by CREATE. The research will take place from November 2013 - July of 2014. CREATE project manager Victor Randle assists with the regular activities students complete during the Jones High School Pipeline Project. Victor Randle is not a member of the research team and is not listed on the IRB application. Dr. Carolyn Hopp is a CREATE affiliate from the UCF College of Education, Pipeline Project program coordinator and is a member of the research team listed on the IRB application. The researchers will devote approximately 80 hours for data collection and analysis.

7) Study Design

a) Recruitment Methods

The program coordinator, Dr. Carolyn Hopp will discuss the research with the students during the Saturday sessions of the Pipeline Project. Dr. Carolyn Hopp will distribute forms directly to the parents of the participants when they drop off or pick up their children during the Saturday Sessions of the Pipeline Project. Dr. Hopp will also collect the informed consent forms. A total of ten high school (grades 9-12) minority female students will be identified and purposely recruited for participation in the study.

b) Inclusion and Exclusion Criteria

Underrepresented minority females in high school (grades 9-12) will be included

N/A

d) Procedures involved in the Human Research.

1. Students will take Bandura's Children's Self-Efficacy scale in November before observations have taken place. Responses from the scale will be used to determine how student self-efficacy changes throughout their participation in the project and will guide focus group questions.
2. Observation 1: Researchers will observe students during their normal activities of the Pipeline Project. Examples of normal activities of the Pipeline Project include group discussions of goals and road blocks, the creation of personal story boards, the creation of video biography questions and the recording of actual video biographies. Researchers will document some of these activities by conducting observations and recording data as field notes. Students will not be tape recorded or videotaped for research purposes during their normal Pipeline Project activities. Students will be observed for approximately 1-2 hours before the focus group takes place.

3. Focus Group 1: Focus group sessions will take place immediately following observation periods. Researchers will use the prepared focus group questions and gather students participating in the research project for the focus group. Only under represented female minority students whose parents have given consent for participation in the research project will be gathered for participation in the focus group. Other students in the Pipeline Project, but not a part of the research group will not be included in the focus group. The focus group session 1 extends beyond the normal Pipeline project activities and is voluntary. Focus group session 1 will be audio taped. Focus groups session 1 will last for approximately 30-45 minutes.
4. Following the observation period and focus group interview, field notes will be compiled and the focus group interview will be transcribed.
5. Researcher Collaboration: Jennifer Dames and Dr. Carolyn Hopp will meet to review initial field notes and focus group transcripts. Initial analysis of the data against the research questions will take place to guide the focus of the next observation and focus group interview. Focus group interview questions will be based on the same questions asked during focus group 1, probing for additional information revealed through the transcripts.
6. Observations 2-7: Researchers will observe students during their normal activities of the Pipeline Project. Examples of normal activities of the Pipeline Project include group discussions of goals and road blocks, the creation of personal story boards, the creation of video biography questions and the recording of actual video biographies. Researchers will document some of these activities by conducting observations and recording data as field notes. Students will not be tape recorded or videotaped for research purposes during their normal Pipeline Project activities. Students will be observed for approximately 1-2 hours before the focus group takes place.
7. Focus Groups 2-3: Focus group sessions will take place immediately following observation periods. Researchers will probe for additional information using the original prepared focus group questions as a guide. Questions will be altered slightly according to the transcripts from focus group 1. Only under represented female minority students whose parents have given consent for participation in the research project will be gathered for participation in the focus group. Other students in the Pipeline Project, but not a part of the research group will not be included in the focus group. The focus group session 2 extends beyond the normal Pipeline project activities and is voluntary. Focus group session 2 will be audio taped. Focus groups session 2 will last for approximately 30-45 minutes.
8. Following the observation period and focus group interview, field notes will be compiled and the focus group interview will be transcribed.

9. Researcher Collaboration: Jennifer Dames and Dr. Carolyn Hopp will meet to review field notes and focus group transcripts. Final analysis of the data against the research questions will take place.

10. During the final observation session, students will again take Bandura's Children's Self Efficacy scale and final responses will be compared to initial responses.

e) Data management

Field notes and transcriptions of focus groups will be stored on a password protected computer. Audio tapes will be stored in a locked cabinet. After transcription and at the close of the project, audio tapes will be erased or destroyed.

f) Provisions to monitor the data for the safety of participants (Required when Human Research involves more than minimal risk to participants.)

N/A

g) Withdrawal of participants

There is no penalty for withdrawal. Students who choose not to participate in the research project may still participate in the Pipeline Project.

8) Risks to participants

There are little to no risks involved with participating in this project, aside for the unlikely breach of confidentiality. Students do not have to answer every question nor do they have to complete every task. Students will not lose benefits if they choose to skip a question or task. Students do not have to answer questions that make them feel uncomfortable.

9) Potential benefits to participants

Students will not directly benefit from participation, besides learning more about how research is conducted. Students may also benefit by sharing their voice as it relates to how they achieve in science.

10) Provisions to protect the privacy interests of participants

Pseudonyms will be used in the place of actual student names. Audio recordings will be transcribed and stored on a password protected computer. Audio tapes will be stored under lock and key and all tapes will be destroyed at the close of the project.

11) Provisions to maintain the confidentiality of data

Pseudonyms will be used in the place of names. Consent forms, audio and video tapes will be kept under lock and key in the research advisor's office.

12) Medical care and compensation for injury

N/A

13) Cost to participants

There is no cost for participating in this project.

14) Consent process

Consent forms will be distributed by Dr. Carolyn Hopp to parents. Parents must give consent for us to work with their children. Student information forms will also be provided. The researcher will read information forms to the participant and they can verbally agree or not agree to participate.

15) Process to document consent in writing

An informed consent form must be completed by all parents. Student information forms will be read to participants and they will verbally agree or not agree to participate.

16) Vulnerable populations (Pregnant Women, Minors, Prisoners, Decisionally compromised adults, others)

This population is under the age of 18.

17) Drugs or Devices

No drugs or devices will be used

18) Multi-site Human Research

N/A

19) Sharing of results with participants

Results will not be shared with participants. However, results will be shared with the school. Student identities will be withheld.

APPENDIX H
IRB OUTCOME LETTER



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

Approval of Human Research

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

To: **Jennifer T. Dames and Co-PI: Meera Ravikumar**

Date: **November 09, 2011**

Dear Researcher:

On 11/9/11 the IRB approved the following human participant research until 11/8/2012 inclusive:

Type of Review: UCF Initial Review Submission Form
Expedited Review Category # 7

Project Title: Can you hear me now? Black Female Positionality in a High
School Medical Academy

Investigator: Jennifer T. Dames

IRB Number: SBE-11-07982

Funding Agency:

Grant Title:

Research ID: N/A

The Continuing Review Application must be submitted 30days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 11/8/2012, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

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

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

Signature applied by Joanne Muratori on 11/09/2011 11:32:31 AM EST

IRB Coordinator

APPENDIX I
IRB OUTCOME LETTER 2



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

Approval of Human Research

From: UCF Institutional Review Board #1
FWA00000351, IRB00001138
To: Jennifer T. Dames
Date: October 18, 2012

Dear Researcher:

On 10/18/2012 the IRB approved the following human participant research until 10/17/2013 inclusive:

Type of Review: IRB Continuing Review Application Form
Project Title: Study title: Can you hear me now?: A Study of the self efficacy of high school aged underrepresented minority females (URMFs) entering the medical pipeline
Investigator: Jennifer T. Dames
IRB Number: SBE-11-07982
Funding Agency:
Grant Title:
Research ID: N/A

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form cannot be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 10/17/2013, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a signed and dated copy of the consent form(s).

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

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

Signature applied by Patria Davis on 10/18/2012 12:48:27 PM EDT

IRB Coordinator

APPENDIX J
IRB OUTCOME LETTER 3



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

Approval of Human Research

From: UCF Institutional Review Board #1
FWA00000351, IRB00001138
To: Jennifer T. Dames
Date: October 07, 2013

Dear Researcher:

On 10/7/2013 the IRB approved the following modifications to human participant research until 10/06/2014 inclusive:

| | |
|--------------------|---|
| Type of Review: | Submission Response for IRB Continuing Review Application Form |
| Modification Type: | Addition of a survey instrument and increase in sample size |
| Project Title: | Study title: Can you hear me now?: A Study of the self efficacy of high school aged underrepresented minority females (URMFs) entering the medical pipeline |
| Investigator: | Jennifer T. Dames |
| IRB Number: | SBE-11-07982 |
| Funding Agency: | |
| Grant Title: | |
| Research ID: | N/A |

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form cannot be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 10/06/2014, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

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

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

Signature applied by Patria Davis on 10/07/2013 02:33:52 PM EDT

IRB Coordinator

APPENDIX K
IRB OUTCOME LETTER 4



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

Approval of Human Research

From: UCF Institutional Review Board #1
FWA00000351, IRB00001138

To: Jennifer T. Dames

Date: June 05, 2014

Dear Researcher:

On 06/05/2014, the IRB approved the following minor modification to human participant research until 10/06/2014 inclusive:

Type of Review: IRB Addendum and Modification Request Form
Modification Type: The study title has been changed from "Can you hear me now?: A Study of the self efficacy of high school aged underrepresented minority females (URMFs) entering the medical pipeline" to "The Self-efficacy of High School Aged Underrepresented Minority Women Entering the Medical Pipeline". A revised Protocol was uploaded and a revised Informed Consent has been approved for use.
Project Title: The Self-efficacy of High School Aged Underrepresented Minority Women Entering the Medical Pipeline
Investigator: Jennifer T. Dames
IRB Number: SBE-11-07982
Funding Agency:
Grant Title:
Research ID: N/A

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form cannot be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 10/06/2014, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

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

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

Kanielle Chay

IRB Coordinator

REFERENCES

- Adelman, C. (1998). *Women and men of the engineering path: A model for analyses of undergraduate careers*. Washington, DC: US Government Printing Office.
- American Association for the Advancement of Science. (2009). *Benchmarks for science Literacy*. Retrieved from <http://www.project2061.org/publications/bsl/online/index.php>
- Anderson, K. (2007). *Race and the crisis of humanism*. Abingdon, VA: Routledge.
- Atwater, M. M. (2000). Females in science education: White is the norm and class, language, lifestyle, and religion are nonissues. *Journal of Research in Science Teaching*, 37(4), 386-387.
- Augustin, F. (2010). *Policy recommendation: "Pipeline to the health professions" employing health professions pipeline programs to produce and prepare future healthcare professionals, diversify the healthcare workforce, and improve the health of our nation* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Database. (UMI 3434396).
- Baker, D. (1998). Equity issues in science education. In B. Fraser & K. Tobin (Eds.), *International handbook of science education* (pp. 869-895). Dordrecht, the Netherlands: Kluwer Academic.

- Baker, D. (2013). What works: Using curriculum and pedagogy to increase girls' interest and participation in science and engineering. *Special Issue Theory into Practice*, 52(1), 14-20.
- Baker, D., & Leary, R. (1995). Letting girls speak out about science. *Journal of Research in Science Teaching*, 32(1), 3-27.
- Bandura, A. (1977a). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84, 191-215.
- Bandura, A. (1977b). *Social learning theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (1990a). *Multidimensional Scales of Perceived Self-Efficacy*. Stanford, CA: Stanford University.
- Bandura, A. (1990b). Perceived self-efficacy in the exercise of personal agency. *Journal of Applied Sport Psychology*, 2(2), 128-163.
- Bandura, A. (Ed.). (1995). *Self-efficacy in changing societies*. New York: Cambridge University Press.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.
- Bandura, A. (2002). Social cognitive theory in cultural context. *Applied Psychology*, 51(2), 269-290.

- Bandura, A. (2006). Guide for constructing self-efficacy scales. In F. Pajaras & T. Urduan (Eds.). *Self-efficacy beliefs of adolescents* (Vol. 5, pp. 307-337). Greenwich, CT: Information Age.
- Bandura, A., & Adams, N. E. (1977). Analysis of self-efficacy theory of behavioral change. *Cognitive Therapy and Research*, 1(4), 287-310.
- Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C. (2001). Self-efficacy beliefs as shapers of children's aspirations and career trajectories. *Child Development*, 72(1), 187-206.
- Banilower, E. R., Smith, P. S., Weiss, I. R., & Pasley, J. D. (2006). The status of K-12 science teaching in the United States. In D. W. Sunal & E. L. Wright (Eds.), *The impact of state and national standards on K-12 science teaching* (pp. 83-122). Charlotte, NC: IAP.
- Banks, J. A., & Banks, C. A. M. (Eds.). (1995). *Handbook of research on multicultural education*. New York, NY: Macmillan.
- Barr, D. A., Gonzalez, M. E., & Wanat, S. F. (2008). The leaky pipeline: Factors associated with early decline in interest in premedical studies among underrepresented minority undergraduate students. *Academic Medicine*, 83(5), 503-511.
- Barton, A. (1998). *Feminist science education*. New York, NY: Teachers College Press.
- Barton, A. C., & Tan, E. (2009). Funds of knowledge and discourses and hybrid space. *Journal of Research in Science Teaching*, 46(1), 50-73.

- Barton, A. C., Tan, E., & Rivet, A. (2008). Creating hybrid spaces for engaging school science among urban middle school girls. *American Educational Research Journal*, 45(1), 68-103.
- Barton, A. C., & Yang, K. (2000). The culture of power and science education: Learning from Miguel. *Journal of Research in Science Teaching*, 37(8), 871-889.
- Bauman, R. (1991). Minority students and the health professions: The organizational changes required to attract and retain them. *Equity & Excellence in Education*, 25(2-4), 22-30.
- Beck, P., Githens, J. H., Clinkscales, D., Yamamoto, D., Riley, C. M., & Ward, H. P. (1978). Recruitment and retention program for minority and disadvantaged students. *Academic Medicine*, 53(8), 651-7.
- Bediako, M., McDermott, B., Bleich, M., & Colliver, J. (1996). Ventures in education: A pipeline to medical education for minority and economically disadvantaged students. *Journal of the Association of American Medical Colleges*, 71(2), 190-192.
- Betancourt, J. R., Green, A. R., Carrillo, J. E., & Ananeh-Firempong, O. (2003). Defining cultural competence: A practical framework for addressing racial/ethnic disparities in health and health care. *Public Health Reports*, 118(4), 293.
- Bianchini, J. A., Cavazos, L. M., & Helms, J. V. (2000). From professional lives to inclusive practice: Science teachers and scientists' views of gender and

- ethnicity in science education. *Journal of Research in Science Teaching*, 37(6), 511-547.
- Bird, H. R., & Canino, G. (1982). The Puerto Rican family: Cultural factors and family intervention strategies. *The Journal of the American Academy of Psychoanalysis*, 10(2), 257.
- Bolshakova, V. L., Johnson, C. C., & Czerniak, C. M. (2011). "It depends on what science teacher you got:" Urban science self-efficacy from teacher and student voices. *Cultural Studies of Science Education*, 6(4), 961-997.
- Bowleg, L. (2012). The problem with the phrase women and minorities: Intersectionality—an important theoretical framework for public health. *American Journal Of Public Health*, 102(7), 1267-1273.
- Brickhouse, N., Lowery, P., & Schultz, K. (2000). What kind of a girl does science? The construction of school science identities. *Journal of Research in Science Teaching*, 37, 441–458.
- Brickhouse, N., & Potter, J. (2001). Young women's scientific identity formation in an urban context. *Journal of Research in Science Teaching*, 38, 965–980.
- Britner, S. L. (2008). Motivation in high school science students: A comparison of gender differences in life, physical, and earth science classes. *Journal of Research in Science Teaching*, 45(8), 955-970.

- Britner, S. L., & Pajares, F. (2001). Self-efficacy beliefs, motivation, race, and gender in middle school science. *Journal of Women and Minorities in Science and Engineering, 7*, 271–285.
- Britner, S. L., & Pajares, F. (2006). Sources of science self- efficacy beliefs of middle school students. *Journal of Research in Science Teaching, 43*(5), 485-499.
- Brotman, J. S., & Moore, F. M. (2008). Girls and science: A review of four themes in the science education literature. *Journal of Research In Science Teaching, 45*(9), 971-1002.
- Brown, B. A. (2004). Discursive identity: Assimilation into the culture of science and its implications for minority students. *Journal of Research in Science Teaching, 41*(8), 810-834.
- Bryan, L. A., & Atwater, M. M. (2002). Teacher beliefs and cultural models: A challenge for science teacher preparation programs. *Science Education, 86*(6), 821-839.
- Bryman, A. (1988). *Quantity and quality in social research*. London, England: Unwin Hyman.
- Buck, G., Cook, K., Quigley, C., Eastwood, J., & Lucas, Y. (2009). Profiles of urban, low SES, African American girls' attitudes toward science: A sequential explanatory mixed methods study. *Journal of Mixed Methods Research, 3*(4), 386-410

- Burstein, N. D., & Cabello, B. (1989). Preparing teachers to work with culturally diverse students: A teacher education model, *Journal of Teacher Education*, 40(5), 9–16.
- Butler, W., Thomson, W., Morrissey, C., Miller, L., & Smith, Q. (1991). Baylor's program to attract minority students and others to science and medicine. *Academic Medicine*, 66, 305-311.
- Calleros, C. R. (2006). Patching leaks in the diversity pipeline to law school and the bar. *California Western Law Review*, 43, 131 - 148.
- Campbell, D. T., & Stanley, J. C. (1966). *Experimental and quasi-experimental designs for research*. Chicago, IL: Rand McNally.
- Carline, J. & Patterson, D. (2003). Characteristics of health professions schools, public school systems, and community-based organizations in successful partnerships to increase the numbers of underrepresented minority students entering health professions education. *Academic Medicine*, 78(5), 467-482.
- Carlone, H. (2004). The cultural production of science in reform-based physics: Girls' access, participation, and resistance. *Journal of Research in Science Teaching*, 41(4), 392-414.
- Carlone, H., Haun-Frank, J., & Webb, A. (2011). Assessing equity beyond knowledge and skills based outcomes: A comparative ethnography of two fourth grade reform-based science classrooms. *Journal of Research in Science Teaching*, 48(5), 459-86.

- Carter, P. L. (2005). *Keepin' it real: School success beyond Black and White*. New York, NY: Oxford University Press.
- Cassidy, W., & Jackson, M. (2005). The need for equality in education: An intersectionality examination of labeling and zero tolerance practices. *McGill Journal of Education, 40*(3), 445 - 466.
- Castillo-Page, L. (2010). *Diversity in the physician workforce: Facts & figures 2010*. Retrieved from <https://members.aamc.org/eweb/upload/Diversity%20in%20the%20Physician%20Workforce%20Facts%20and%20Figures%202010.pdf>
- Catsambis, S. (1995). Gender, race, ethnicity, and science education in the middle grades. *Journal of Research in Science Teaching, 32*(3), 243-257.
- Chenoweth, K. (2000). Thinking K-16. *Black Issues in Higher Education, 14*, 16.
- Chin, J., & Pajares, F. (2010). Implicit theories of ability of grade 6 science students: Relation to epistemological beliefs and academic motivation and achievement in science. *Contemporary Educational Psychology, 35*(1), 75-87.
- Choi, N., Fuqua, D. R., & Griffin, B. W. (2001). Exploratory analysis of the structure of scores from the multidimensional scales of perceived self-efficacy. *Educational and Psychological Measurement, 61*(3), 475-489.
- Clark, M. L. (1991). Social identity peer relations, and academic competence of African-American adolescents. *Education and Urban Society, 24*(1), 41-52.

- Cleary, M., & English, G. (2005). The small schools movement: Implications for health education. *Journal of School Health, 75*(7), 243-247.
- Cleveland, E. F. (2006). Telling the stories of the health professions partnership initiative. *Academic Medicine, 81*(6), S15-S16.
- Cochran-Smith, M. (2004). *Walking the road: Race, diversity, and social justice in teacher education*. New York, NY: Teachers College Press.
- Cohen, J. J., Gabriel, B. A., & Terrell, C. (2002). The case for diversity in the health care workforce. *Health Affairs, 21*(5), 90-102.
- Combahee River Collective. (1986). *The Combahee River Collective Statement: Black feminist organizing in the seventies and eighties*. Latham, NY: Kitchen Table, Women of Color Press.
- Cooks, L. (2003). Pedagogy, performance, and positionality: Teaching about witnesses in interracial communication. *Communication Education, 52*(3-4), 245-257.
- Crabtree, B. F., & Miller, W. L. (1999). Using codes and code manuals: A template organizing style of interpretation. *Doing Qualitative Research, 2*, 163-177.
- Cregler, L. (1993). Enrichment programs to create a pipeline to biomedical science careers. *Journal of the Association for Academic Minority Physicians, 4*(4), 127-131.

- Crenshaw, K. (1989) Demarginalizing the intersection of race and sex: A black feminist critique of antidiscrimination doctrine, feminist theory, and antiracist politics. *University of Chicago Legal Forum*, 139 - 167.
- Crenshaw, K. (1991). Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford Law Review*, 1241-1299.
- Creswell, J. (2007). *Qualitative inquiry and research design*. Thousand Oaks, CA: Sage.
- Croteau, J. M., Talbot, D. M., Lance, T. S., & Evans, N. J. (2002). A qualitative study of the interplay between privilege and oppression. *Journal of Multicultural Counseling and Development*, 30(4), 239-258.
- Daft, R. L., & Lewin, A. Y. (1990). Can organization studies begin to break out of the normal science straitjacket? An editorial essay. *Organization Science*, 1(1), 1-9.
- Davis, J. A., & Davidson, C. P. (1982). The Med-COR study: Preparing high school students for health careers. *Academic Medicine*, 57(7), 527-34.
- Davis, K. (2008). Intersectionality as buzzword: A sociology of science perspective on what makes a feminist theory successful. *Feminist Theory*, 9(1), 67-85.
- Davis, M. (1986) "That's classic!" The phenomenology and rhetoric of successful social theories. *Philosophy of the Social Sciences*, 16, 285–301.
- Dee, T. S. (2005). A teacher like me: Does race, ethnicity, or gender matter? *American Economic Review*, 95(2), 158 – 165.

- De Winter, J. (2013). Using the students' *t*-test with extremely small sample sizes. *Practical Assessment, Research and Evaluation*, 10(18), 1-12.
Retrieved from <http://pareonline.net/pdf/v18n10.pdf>
- Delpit, L. (1995). *Other people's children: Cultural conflict in the classroom*. New York, NY: New Press.
- Denzin, N. K., & Lincoln, Y. S. (1994). Introduction: Entering the field of qualitative research. In N.K. Denzin & Y.S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 1-17). Thousand Oaks, CA: Sage.
- Dreachslin, J. L., Sprainer, E., & Jimpson, G. (2002). Communication: Bridging the racial and ethnic divide in health care management. *The Health Care Manager*, 20(4), 10-18.
- Dychtwald, K., Erickson, T. J., & Morison, R. (2013). *Workforce crisis: How to beat the coming shortage of skills and talent*. Cambridge, MA: Harvard Business Press.
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532-550.
- Engle, R. A., & Conant, F. R. (2002). Guiding principles for fostering productive disciplinary engagement: Explaining an emergent argument in a community of learners classroom. *Cognition and Instruction*, 20(4), 399-483.
- Erikson, E. (1963). *Childhood and society*. New York, NY: Norton.

- Eysenck, H. J. (1976). Introduction. In H. J. Eysenck (Ed.), *Case studies in behaviour therapy* (pp. 1-15). London, England: Routledge.
- Farland- Smith, D. (2009). Exploring middle school girls' science identities: Examining attitudes and perceptions of scientists when working "side-by-side" with scientists. *School Science and Mathematics, 109*(7), 415-427.
- Fay, B. (1987). *Critical social science: Liberation and its limits*. Ithaca, NY: Cornell University Press.
- Field, P. A., & Morse, J. M. (1985). *Nursing research: The application of qualitative approaches*. London, England: Croom Helm.
- Fordham, S. (1988). Racelessness as a factor in Black students' school success: Pragmatic strategy or Pyrrhic victory? *Harvard Educational Review, 58*(1), 54-84.
- Gandara, P. (2010). The Latino education crisis. *Educational Leadership, 67*(5), 24-30.
- Gaskell, P. J., Hepburn, G., & Robeck, E. (1998). Re/presenting a gender equity project: Contrasting visions and versions. *Journal of Research in Science Teaching, 35*(8), 859-876.
- Gerring, J. (2004). What is a case study and what is it good for? *American Political Science Review, 98*(2), 341-354.

- Gibbert, M., & Ruigrok, W. (2010). The what and how of case study rigor: Three strategies based on published work. *Organizational Research Methods*, 13(4), 710-737.
- Gibbert, M., Ruigrok, W., & Wicki, B. (2008). What passes as a rigorous case study? *Strategic Management Journal*, 29(13), 1465-1474.
- Gibson, M. A., & Ogbu, J. U. (1991). *Minority status and schooling: A comparative study of immigrant and involuntary minorities*. New York, NY: Garland.
- Gilbert, J., & Calvert, S. (2003). Challenging accepted wisdom: Looking at the gender and science education question through a different lens. *International Journal of Science Education*, 25(7), 861-878.
- Glaser, B. G., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago, IL: Aldine.
- Glesne, C. (2010). *Becoming qualitative researchers: An introduction* (4th ed.). New York, NY: Prentice Hall.
- Gonzales, C. Q. (1999). Achieving high-quality health care and access for all. *Academic Medicine*, 74, 305-307.
- Gonzalez, P., & Stoll, B. (2002). *The color of medicine: Strategies for increasing diversity in the US physician workforce*. Boston, MA: Community Catalyst.
- Goodell, E., Visco, R., & Pollock, P. (1999). A program to enhance K-12 science education in ten rural New York school districts. *Academic Medicine*, 74, 332-335.

- Gravely, T., McCann, A., Brooks, E., Harman, W., & Schneiderman, E. (2004). Enrichment and recruitment programs at dental schools: Impact on enrollment of underrepresented minority students. *Journal of Dental Education, 68*(5), 542-552.
- Grumbach, K., Muñoz, C., Coffman, J., Rosenoff, E., Gándara, P., & Sepulveda, E. (2003). *Strategies for improving the diversity of health professions, as report of the California Endowment*. San Francisco, CA: Center for California Health Workforce Studies.
- Hamel, J., Dufour, S., & Fortin, D. (1993). *Case study methods*. Newbury Park, CA: Sage.
- Hanson, S. (2004). African American women in science: Experiences from high school through the post-secondary years and beyond. *NWSA Journal, 16*(1), 96-115.
- Hanson, S. (2008). *Swimming against the tide: African American girls and science education*. Philadelphia, PA: Temple University Press.
- Hanson, S. & Palmer-Johnson, E. (2000). Expecting the unexpected: A comparative study of African American women's experiences in science during the high school years. *Journal of Women and Minorities in Science and Engineering, 6*(4), 265–294.
- Harley, D. A., Jolivette, K., McCormick, K., & Tice, K. (2002). Race, class, and gender: A constellation of positionalities with implications for counseling. *Journal of Multicultural Counseling and Development, 30*(4), 216 – 238.

- Hazari, Z., Sadler, P. M., & Sonnert, G. (2013). The science identity of college students: Exploring the intersection of gender, race, and ethnicity. *Journal of College Science Teaching*, 42(5), 82.
- Held, D. (1980). *Introduction to critical theory: Horkheimer to Habermas* (Vol. 261). Ewing, NJ: University of California Press.
- Hofer, A. N., Abraham, J., & Moscivice, I. (2011). Expansion of coverage under the Patient Protection and Affordable Care Act and primary care utilization. *Milbank Quarterly*, 89(1), 69 – 89.
- Horkheimer, M. (1972). *Traditional and critical theory*. New York, NY: Herder and Herder.
- Howard, T. C. (2010). *Why race and culture matter in school: Closing the achievement gap in America's classrooms*. New York, NY: Teachers College Press.
- Hughes, G. (2001). Exploring the availability of student scientist identities within curriculum discourse: An anti-essentialist approach to gender-inclusive science, *Gender and Education*, 13(3), 275–290.
- Hull, G., Scott, P., & Smith, B. (Eds.). (1982). *All the women are White, all the Blacks are men, but some of us are brave: Black women's studies*. Old Westbury, NY: Feminist Press.
- Jeanpierre, B. J. (2004). Two urban elementary science classrooms: The interplay between student interactions and classroom management practices. *Education*, 124(4), 664-675.

- Jensen, S. Q. (2011). Othering, identity formation and agency. *Qualitative Studies, 2*(2), 63-78.
- Jennings, G. R. (2005). Interviewing: A focus on qualitative techniques. In B. W. Ritchie, P. Burns, and C. Palmer (Eds.), *Tourism research methods: Integrating theory with practice* (pp. 99 – 118). Wallingford, England: CAL International.
- Johnson, A., Brown, J., Carlone, H., & Cuevas, A. K. (2011). authoring identity amidst the treacherous terrain of science: A multiracial feminist examination of the journeys of three women of color in science. *Journal Of Research In Science Teaching, 48*(4), 339-366.
- Johnson-Bailey, J. (2003). Everyday perspectives on feminism: African American women speak out. *Race, Gender & Class, 10*(3), 82-99.
- Johnston, A. (2012). Pipelines: Why metaphors matter. [Web log post]. Retrieved from <http://writescience.wordpress.com/author/adamtjohnston/>
- Jones, F., & Flowers, J. (1990). New York's statewide approach to increase the number of minority applicants to medical school. *Academic Medicine, 65*, 671-674.
- Jones, G., Brader-Araje, L., Carboni, L., Carter, G., Rua, M., Banilower, E., & Hatch, H. (2000). Tool time: Gender and students' use of tools, control and authority. *Journal of Research in Science Teaching, 37*, 760-783.
- Kahle, J. B., & Lakes, M. K. (1983). The myth of equality in science classrooms. *Journal of Research in Science Teaching, 20*(2), 131-140.

- Kahle, J. B., & Meece, J. (1994). Research on gender issues in the classroom. In D. Gabel (Ed.), *Handbook of research on science teaching and learning* (pp. 542-576). Washington, DC: National Science Teachers Association.
- Kelly, G. J. (2007). Discourse in science classrooms. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 443 – 470). Mahwah, NJ: Lawrence Erlbaum.
- Kincheloe, J. L., & McLaren, P. (2002). Rethinking critical theory and qualitative research. In Y. Zou & E. Trueba (Eds.), *Ethnography and schools: Qualitative approaches to the study of education* (pp. 87-138). Lanham, MD: Rowman and Littlefield.
- Kincheloe, J. L., Steinberg, S. R., Rodriguez, N. M., & Chennault, R. E. (Eds.). (2000). *White reign: Deploying whiteness in America*. New York, NY: Palgrave Macmillan.
- Kitts, K. (2009). The paradox of middle and high school students' attitudes towards science versus their attitudes about science as a career. *Journal of Geoscience Education*, 57(2), 159-164.
- Klopott, S., & Martinez, M. (2004). Improving college access for minority, low-income, and first-generation students. *Pacific Resources for Education and Learning*. Retrieved from <http://inpathways.net/improvingcollege.pdf>
- Kokotailo, R., St. Clair, D., Lacourt, J., & Chewing, B. (1995). A pilot video intervention to promote health careers among Native American youth. *Journal of School Health*, 65(3), 113-114.

- Komaromy, M., Grumbach, K., Drake, M., Vranizan, K., Lurie, N., Keane, D., & Bindman, A. B. (1996). The role of black and Hispanic physicians in providing health care for underserved populations. *New England Journal of Medicine*, 334(20), 1305-1310.
- Kotte, D. (1992). *Gender differences in science achievement in 10 countries*. Frankfurt, Germany: Peter Lang.
- Kumashiro, K. (2000). Toward a theory of anti-oppressive education. *Review of Educational Research*, 70(1), 25-53.
- Kupermintz, H. (2002). Affective and conative factors as aptitude resources in high school science achievement. *Educational Assessment*, 8, 123-137.
- Ladson-Billings, G. (1999). Preparing teachers for diverse student populations: A critical race theory perspective. *Review of Research in Education*, 24, 211 – 247.
- Ladson-Billings, G. (2000). Fighting for our lives: Preparing teachers to teach African American students. *Journal of Teacher Education*, 51, 206-214.
- Lau, S. & Roesner, R. (2002). Cognitive abilities and motivational processes in high school students' situational engagement and achievement in science. *Educational Assessment*, 8, 139-162.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York, NY: Cambridge University Press.

- LaVeist, T. A., & Nuru-Jeter, A. (2002). Is doctor-patient race concordance associated with greater satisfaction with care? *Journal of Health and Social Behavior*, 43(3), 296-306.
- Lincoln, C. E., & Mamiya, L. H. (1990). *The Black church in the African American experience*. Durham, NC: Duke University Press.
- Lourenco, S. (1983). Early outreach: Career awareness for health professions. *Journal of Medical Education*, 58, 39-44.
- Lujan, V. B. (2008). *Education biographies from the science pipeline: An analysis of Latino/a student perspectives on ethnic and gender identity in higher education* (Doctoral dissertation). Available from Proquest Dissertations and Theses database.
- MacDougall, C., & Baum, F. (1997). The devil's advocate: A strategy to avoid groupthink and stimulate discussion in focus groups. *Qualitative Health Research*, 7(4), 532-541.
- Maher, F. A., & Tetreault, M. K. T. (2001). *The feminist classroom: Dynamics of gender, race, and privilege*. New York, NY: Rowman & Littlefield.
- March, J. G., Sproull, L. S., & Tamuz, M. (1991). Learning from samples of one or fewer. *Organization Science*, 2(1), 1-13.
- Marshall, C. (1973). Minority students for medicine and the hazards of high school. *Journal of Medical Education*, 48(2), 134-140.

- Martinez, S., & Guzman, S. (2013). Gender and racial/ethnic differences in self-reported levels of engagement in high school math and science courses. *Hispanic Journal of Behavioral Sciences, 35*(3), 407-427.
- Matsuda, M. (1987). Looking to the bottom: Critical legal studies and reparations. *Harvard Civil Rights-Civil Liberties Law Review, 22*, 323-399.
- McLaren, P. (2007). *Life in schools: An introduction to critical pedagogy in the foundations of education*. New York, NY: Pearson.
- McNeill, K. L., & Krajcik, J. (2008). Scientific explanations: Characterizing and evaluating the effects of teachers' instructional practices on student learning. *Journal of Research in Science Teaching, 45*(1), 53-78.
- Merchant, J. L., & Omary, M. B. (2010). Underrepresentation of underrepresented minorities in academic medicine: the need to enhance the pipeline and the pipe. *Gastroenterology, 138*(1), 19-26.
- Merton, R. K., & Kendall, P. L. (1946). The focused interview. *American Journal of Sociology, 54*, 541-557.
- Miles, M. B. (1979). Qualitative data as an attractive nuisance: The problem of analysis. *Administrative Science Quarterly, 24*, 590-601.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Beverly Hills, CA: Sage.
- Miller, J. W., Coombs, W. T., & Fuqua, D. R. (1999). An examination of psychometric properties of Bandura's Multidimensional Scales of

- Perceived Self-Efficacy. *Measurement and Evaluation in Counseling and Development*, 31(4), 186.
- Milner, H. R. (2010). *Start where you are, but don't stay there: Understanding diversity, opportunity gaps, and teaching in today's classrooms*. Cambridge, MA: Harvard Education Press.
- Moraga, C., & Anzaldúa, G. (1981). *This bridge called my back: Writings by radical women of color*. Watertown, MA: Persephone.
- Morse, J. (1989). Qualitative nursing research: A free-for-all? In J. M. Morse (Ed.), *Qualitative nursing research: A contemporary dialogue* (pp. 14 – 22). Rockville, MD: Aspen.
- Moy, E., & Bartman, B. (1995). Physician race and care of minority and medically indigent patients. *Journal of the American Medical Association*, 273(19), 1515-1520.
- Murphy, A. S., Acosta, M. A., & Kennedy-Lewis, B. L. (2013). "I'm not running around with my pants sagging, so how am I not acting like a lady?" Intersections of race and gender in the experiences of female middle school troublemakers. *The Urban Review*, 45(5), 586-610.
- Murphy, P., & Whitelegg, E. (2006). Girls and physics: Continuing barriers to 'belonging.' *The Curriculum Journal*, 17(3), 281-305.
- Museus, S., & Ravello, J. (2010). Characteristics of academic advising that contribute to racial and ethnic minority student success at predominantly white institutions. *NACADA Journal*, 30(1), 47-58.

- Nash, J. C. (2008). Re-thinking intersectionality. *Feminist Review*, 89(1), 1-15.
- National Center for Education Statistics. (2011). *The nation's report card: Science 2009* (NCES 2011-451). Washington, DC: United States Department of Education.
- National Science Foundation. (2009). *Females, minorities, and persons with disabilities in science and engineering*. Retrieved from www.nsf.gov/statistics/wmpd/
- Nickens, H., Ready, T., & Petersdorf, R. (1994). Project 3000 by 2000: Racial and ethnic diversity in US medical schools. *The New England Journal of Medicine*, 331(7), 472-476.
- Niehaus, K., Rudasill, K., & Adelson, J. (2012). Self-efficacy, intrinsic motivation and academic outcomes among Latino middle school students participating in an after-school program. *Hispanic Journal of Behavior Sciences*, 34(1), 118-136.
- Nieto, S. (1999). *The light in their eyes: Creating multicultural learning communities*. New York, NY: Teachers College Press.
- Oakes, J., Muir, K., Joseph, R. (2000). *Course-taking and achievement in mathematics and science: Inequalities that endure and change*. Paper presented at the National Institute for Science Forum, Detroit, MI.
- O'Brien, V., Martinez-Pons, M., & Kopala, M. (1999). Mathematics self-efficacy, ethnic identity, gender, and career interests related to mathematics and science. *The Journal of Educational Research*, 92(4), 231-235.

- Ogbu, J. U. (1991). Low school performance as an adaptation: The case of Blacks in Stockton, California. In M. A. Gibson & J. U. Ogbu (Eds.), *Minority status and schooling: A comparative study of immigrants and involuntary minorities* (pp. 249 – 285). New York, NY: Garland.
- Osborne, J., & Collins, S. (2001). Pupils' views of the role and value of the science curriculum: A focus-group study. *International Journal of Science Education*, 23(5), 441-467.
- Oxendine, J. (2009). *A comprehensive approach to increase health workforce and diversity*. Retrieved from <https://alpha.confex.com/apha/135am/recordingredirect.cgi/id/18595>
- Padula, C., Leinhass, M., & Dodge, K. (2002). Linking minority and disadvantaged high school students with health professions training: A win-win situation for students and adults. *Educational Gerontology*, 28(6), 529-547.
- Pagano, M. (2010). Healthcare practice guidelines and case studies. In A. Mills, G. Durepos, & E. Wiebe (Eds.), *Encyclopedia of case study research* (Vol. 1), (pp. 443 – 435). Newbury Park, CA: Sage.
- Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research*, 66(4), 543-578.
- Pajares, F., Britner, S., & Valiante, G. (2000). Relation between achievement goals and self beliefs of middle school students in writing and science. *Contemporary Educational Psychology*, 25(4), 406-422.

- Parsons, E. (1997). Black high school females' images of the scientist: Expression of culture. *Journal of Research in Science Teaching*, 34, 745–768.
- Parsons, E. (2008). Positionality of African Americans and a theoretical accommodation of it: Rethinking science education research. *Science Education*, 92(6), 1127-1144.
- Patterson, D. G., & Carline, J. D. (2006). Promoting minority access to health careers through health profession-public school partnerships: A review of the literature. *Academic Medicine*, 81(6), S5-S10.
- Patton, M. Q. (2002). *Qualitative research and evaluation methods*. Thousand Oaks, CA: Sage.
- Petersdorf, R. (1992). Not a choice, an obligation. *Academic Medicine*, 67(2), 73-79.
- Petersdorf, R., Turner, K., Nickens, H. & Ready, T. (1990). Minorities in medicine: Past, present and future. *Academic Medicine*, 65, 663-670.
- Phoenix, A. (2006) Intersectionality [Editorial]. *European Journal of Women's Studies*, 13(3), 187–92.
- Platt, J. (1992). Case study in American methodological thought. *Current Sociology*, 40(1), 17-48.
- Pollard, D. S. (2002). Who will socialize African American students in contemporary public schools? *Advances in Education in Diverse Communities: Research, Policy and Praxis*, 2, 3-21.

- Poggenpoel, M., & Myburgh, C. (2003). The Researcher as research instrument in educational research: A possible threat to trustworthiness? *Education*, 124(2), 418-421.
- Powney, J., & Watts, M. (1987). *Interviewing in educational research*. London, England: Routledge & Kegan Paul.
- Rainey, M. (2001). How do we retain minority health professions students? In Nickens Symposium Advisory Committee (Eds.), *The right thing to do, the smart thing to do: Enhancing diversity in health professions--Summary of the Symposium on Diversity in Health Professions in Honor of Herbert W. Nickens, MD* (pp. 328-360). Washington, DC: National Academy Press.
- Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.
- Rowley, S. J., Sellers, R. M., Chavous, T. M., & Smith, M. A. (1998). The relationship between racial identity and self-esteem in African American college and high school students. *Journal of Personality and Social Psychology*, 74(3), 715.
- Sadker, M., & Sadker, D. (1994). *Failing at fairness: How our schools cheat girls*. New York, NY: Touchstone.
- Sadker, D., & Sadker, M. (2001). Gender bias: From colonial America to today's classrooms. *Multicultural Education: Issues and Perspectives*, 125-151.
- Saha, S., Taggart, S., Komaromy, M., & Bindman, A. (2000). Do patients choose physicians of their own race? *Health Affairs*, 19(4), 76–83.

- Scantlebury, K., & Baker, D. (2007). Gender Issues in science education research: Remembering where the difference lies. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 257-285). Mahwah, NJ: Lawrence Erlbaum.
- Schunk, D. H., & Meece, J. (2005). Self-efficacy development in adolescence. In F. Pajares & T. Urdan (Eds.), *Self-efficacy beliefs during adolescence* (pp. 71–96). Greenwich, CT: Information Age.
- Scott, J. C. (1998). *Seeing like a state: How certain schemes to improve human conditions have failed*. New Haven, CT: Yale University Press.
- Searle, J. R. (1995). *The construction of social reality*. New York, NY: Simon and Schuster.
- Sleeter, C. E. (1996). *Multicultural education as social activism*. Albany, NY: SUNY Press.
- Smedley, B. D., Butler, A. S., & Bristow, L. R. (2004). *In the nation's compelling interest: Ensuring diversity in the health care workforce*. Washington, DC: National Academies Press.
- Smedley, B. D., Stith, A. Y., Colburn, L., & Evans, C. H. (2001). *The right thing to do, the smart thing to do: Enhancing diversity in health professions-- Summary of the Symposium on Diversity in Health Professions in Honor of Herbert W. Nickens, MD*. Washington, DC: National Academies Press.
- Stake, R. E. (1978). The case study method in social inquiry. *Educational Researcher*, 7(2), 5-8.

- Stake, R. E. (1995). *The art of case research*. Newbury Park, CA: Sage.
- Steele, C. M., Spencer, S. J., & Aronson, J. (2002). Contending with group image: The psychology of stereotype and social identity threat. In M. Zanna (Ed.), *Advanced in experimental social psychology* (Vol. 34, pp. 379-440). New York, NY: Academic Press.
- Stern, D., & Rahn, M. (1995). How health career academies provide work-based learning. *Educational Leadership*, 52(8), 37-40.
- Stroupe, D. (2014). Examining classroom science practice communities: How teachers and students negotiate epistemic agency and learn science- as-practice. *Science Education*, 98(3), 487-516.
- Subotnik, R. F., Tai, R. H., Rickoff, R., & Almarode, J. (2009). Specialized public high schools of science, mathematics, and technology and the STEM pipeline: What do we know now and what will we know in 5 years? *Roeper Review*, 32(1), 7-16.
- Sullins, E. S., Hernandez, D., Fuller, C., & Tashiro, J. S. (1995). Predicting who will major in a science discipline: Expectancy–value theory as part of an ecological model for studying academic communities. *Journal of Research in Science Teaching*, 32(1), 99-119.
- Sullivan, L. W. (2004). *Missing persons: Minorities in the health professions. A report of the Sullivan Commission on diversity in the healthcare workforce*. Retrieved from <http://admissions.duhs.duke.edu/sullivancommission/index.cfm>

- Tajfel, H. (1974). Social identity and intergroup behavior. *Social Science Information, 13*, 65-93.
- Tajfel, H. (1982). Social psychology of intergroup relations. *Annual Review of Psychology, 33*(1), 1-39.
- Tan, E., Barton, A. C., Kang, H., & O'Neill, T. (2013). Desiring a career in STEM- related fields: How middle school girls articulate and negotiate identities- in- practice in science. *Journal of Research in Science Teaching, 50*(10), 1143-1179.
- Taylor, P. (Ed.). (2001). *Nation dance: Religion, identity, and cultural difference in the Caribbean*. Bloomington, IN: Indiana University Press.
- Tedesco, L. (2001). The role of diversity in the training of health professionals. In B. D., Smedley, et al. (Eds.), *The right thing to do, the smart thing to do: Enhancing diversity in the health professions*. Washington, DC: National Academy Press.
- Terrell, C. (2006). Foreword: The health professions partnership initiative and working toward diversity in the health care workforce. *Academic Medicine, 81*(6), S2-S4.
- Thomsom, W., Roush, R., Smith, Q., & Holcomb, J. (1984). Enhancing career opportunities in medicine and the sciences for minority students. *Journal of Medical Education, 59*, 675-677.

- Thurmond, V., & Cregler, L. (1994). Career choices of minority high school student research apprentices at a health science center. *Academic Medicine, 69*(6), 507.
- Tillman, L. C. (2002). Culturally sensitive research approaches: An African American perspective. *Educational Researcher, 31*(9), 3–12.
- Tomm, K. (1988). Interventive interviewing: Part III. Intending to ask lineal, circular, strategic, or reflexive questions? *Family Process, 27*(1), 1 – 15.
- Torres, V. (2009). The developmental dimensions of recognizing racism. *Journal of College Student Development, 50*, 504-520.
- Tyler, T., & Blader, S. (2013). *Cooperation in groups: Procedural justice, social identity, and behavioral engagement*. Philadelphia, PA: Psychology Press.
- United States Census Bureau. (2012). *United States Census Bureau projections show a slower growing, older, more diverse nation a half century from now*. Retrieved from <http://www.census.gov/newsroom/releases/archives/population/cb12-243.html>
- United States Department of Health and Human Services. (2008). *The physician workforce: Projections and research into current issues affecting supply and demand*. Retrieved from <http://bhpr.hrsa.gov/healthworkforce/reports/physwfiissues.pdf>

- Van Dinther, M. V., Dochy, F., & Segers, M. (2011). Factors affecting students' self-efficacy in higher education. *Educational Research Review*, 6(2), 95-108.
- Vaughn, D. (1992). Theory elaboration: The heuristics of case analysis. In C. Ragin & H. Becker (Eds.), *What is a case* (pp. 173 – 202)? New York, NY: Cambridge University Press.
- Vaughn, S., Schumm, J., & Sinagub, J. (1996). *Focus group interviews in education and psychology*. Thousand Oaks, CA: Sage.
- Velayutham, S., Aldridge, J. M., & Fraser, B. (2012). Gender differences in student motivation and self-regulation in science learning: A multi-group structural equation modeling analysis. *International Journal Of Science And Mathematics Education*, 10(6), 1347-1368.
- Venezia, A., Kirst, M., & Antonio, A. (2003). Betraying the college dream. *The Bridge Project Stanford Institute for Higher Education*, 2-12.
- Warren, B., Ballenger, C., Ogonowski, M., Rosebery, A., & Hudicourt-Barnes, J. (2001). Rethinking diversity in learning science: The logic of everyday sensemaking. *Journal of Research in Science Teaching*, 38, 529–552.
- Warren, B., & Rosebery, A. S. (1995). Equity in the future tense: Redefining relationships among teachers, students, and science in linguistic minority classrooms. In W. Secada, E. Fennema, & L. Adajain (Eds.), *New directions for equity in mathematics education* (pp. 298-328). New York, NY: Cambridge University Press.

- Weber, L. (2010). *Understanding race, class, gender, and sexuality* (2nd ed.). New York, NY: Oxford University Press.
- Weinberg, M. (1995). Gender differences in student attitudes toward science: A meta-analysis of the literature from 1970 to 1991. *Journal of Research in Science Teaching*, 32(4), 387-398.
- Weppner, R., Bowman, S., & Balsley, R. (1999). A review of the evaluation literature on health professions training and enrichment programs for minority/disadvantaged students. *The Journal of Health Administration Education*, 17(1), 1-14.
- Williams, T., & Williams, K. (2010). Self-efficacy and performance in mathematics: Reciprocal determinism in 33 nations. *Journal of Educational Psychology*, 102(2), 453.
- Yin, R. (2013). *Case study research: Design and methods* (5th ed.). Thousand Oaks, CA: Sage.
- Yin, R. K. (1981). The case study crisis: Some answers. *Administrative Science Quarterly*, 26(1), 58 – 65.
- Zack, N. (2007). Can third wave feminism be inclusive? Intersectionality, its problems, and new directions. In L. M. Alcoff & E. F. Kittay (Eds.), *Feminist philosophy* (pp. 193–207). Oxford: Blackwell.
- Zimmerman, B. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, 25, 82-91.

Zimmerman, B., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. *American Educational Research Journal*, 31, 845-862.

Zimmerman, B., Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Educational Research Journal*, 29(3), 663-676.