PURDUE UNIVERSITY
GRADUATE SCHOOL
Thesis/Dissertation Acceptance

This is to certify that the thesis/dissertation prepared

By Brittini R. Brown

Entitled
A Case Study Analysis of Minority Students' Negotiation of STEM, Racial/Ethnic, and Graduate Student Identities

For the degree of   Doctor of Philosophy

Is approved by the final examining committee:

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A CASE STUDY ANALYSIS OF MINORITY STUDENTS' NEGOTIATION OF

STEM, RACIAL/ETHNIC, AND GRADUATE STUDENT IDENTITIES

A Dissertation

Submitted to the Faculty

of

Purdue University

by

Brittini R. Brown

In Partial Fulfillment of the

Requirements for the Degree

of

Doctor of Philosophy

August 2016

Purdue University

West Lafayette, Indiana

ProQuest Number: 10170577

ProQuest 10170577

This dissertation is dedicated to my great-grandmother, the late Dorothy Foley Carr.

Thank you for instilling in our family your passion for education.

Four generations of Black educators and counting…

ACKNOWLEDGEMENTS

To my parents, Bobby and Dorothy Brown – Thank you for always letting me spread my wings to fly. I am forever grateful for your love and support. You are the wind beneath my wings. I love you!

To my brother, Jordan – Thank you for being the most loving little, big brother in the world. I hope I have set a great example for you to follow. I love you!

To my family – You are the greatest!! Thank you for your unyielding love and encouragement. You are my inspiration and the foundation on which I stand. I love you!

To Kristen and Nicole – Thank you for being my biggest fans and supporters. Throughout this journey you have answered every call, responded to every text, celebrated every milestone, and encouraged me when the going got tough. I love you guys!

To Torrie, Amonte, Abby, Brandon, Quincy, Elise, and Alli – You guys are nothing short of amazing! You guys made my experience at Purdue a great one! Thanks for the love and the laughs!

To the YDAE Family – Thank you for welcoming me to Purdue with open arms. You made the cold days a little warmer, and the dreary days a bit brighter! Boiler Up!

To Dr. Knobloch – Thank you for always challenging me to a match of intellectual ping-pong. Because of you, I am a better thinker and a stronger scholar. I look forward to more coffee conversations that turn into brainstorming on napkins that turn into AMAZING ideas. The best is yet to come!

To Dr. Tucker – Thank you for introducing me to the sociology of education. Because of you, I view the world through a more critical lens. Thank you for always encouraging me to be curious and to push the envelope. The world needs more cool, "Chuck Taylor Wearing" professors like you!

To Dr. Haywood – Thank you for socializing me into the community of Higher Education. Because of you, I have seamlessly transitioned from Agriculture to the Academy. Thank you!!

To Dr. Esters – I don't know if words can truly articulate how grateful I am for your encouragement, support, guidance, and tough love. Your mentorship has been nothing short of amazing and without you, I know my doctoral journey wouldn't have been the same. Thank you for pushing me to pursue excellence in all things at all times. I look forward to continuing our work together, there is much left to be done!

Dear God,

What a journey this has been! Thank you for allowing me the privilege of being able to pursue, with passion, the purpose that you have divinely assigned to my life. Thank you for praying family and friends. Thank you for knowledgeable mentors and

advisors. Thank you for the gifts that you have bestowed upon me to be used for a

purpose much larger than I could ever imagine. My cup runneth over.

Amen.

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ABSTRACT

Brown, Brittini R., Ph.D., Purdue University, August 2016. A Case Study Analysis of Minority Students' Negotiation of STEM, Racial/Ethnic, And Graduate Student Identities. Major Professor: Levon T. Esters.

In order for the United States to retain its prominence in the global economy and meet workforce demands, the President's Council of Advisors on Science and Technology report an estimated need to produce one million more United States STEM professionals in the next decade, a 34% increase over current rates. As the demographic composition of the U.S. continues to shift, it is also critical that many of the individuals filling these STEM occupations are from URM groups as non-Hispanic whites will be outnumbered by 2035 and Latino Americans and African Americans will become the collective majority by 2050. Experts suggest that transitioning STEM baccalaureate recipients to graduate study at leading research universities is critical as these students will contribute to STEM research and spearhead the nation's STEM efforts. Recently, a small body of literature has begun to explore identity and its influence on the persistence of URM graduate students pursuing STEM degrees. The purpose of this study was to explore the negotiation of STEM, racial/ethnic, and graduate student identities among URM graduate students pursuing STEM degrees at a predominantly white research institution. Further, this study sought to explore the role of mentoring and campus climate in the negotiation of STEM, racial/ethnic, and graduate student identities.

This study was guided by six research questions, two topical questions which provided context about the university where the study was conducted, and four questions which focused on how students negotiated and made meaning of their multiple identities as well as the role of campus climate and mentoring in the negotiation process. Two theoretical perspectives informed the study, Institutional Agents Framework and Intersectionality. Two rounds of interviews were conducted with 10 URM graduate students pursuing STEM degrees at a predominantly white research institution. Topic and pattern coding were used to analyze data utilizing NVivo qualitative data analysis software. There were five conclusions for the study. First, race/ethnicity was the single most influential factor in how the study participants behaved and interacted with URM and non-URM peers and faculty. Second, faculty and peer mentors proved to be critical not only in helping students to negotiate their STEM, racial/ethnic, and graduate student identities, but also in providing the instrumental and psychosocial support necessary to help the participants succeed academically. Third, institutional support programs were critical to shaping the perception of campus climate for URM graduate students in the STEM disciplines. Fourth, URM graduate students in STEM understand and make meaning of their STEM and graduate student identities absent from their racial/ethnic identity. Fifth, participants encountered difficulty with the notion of negotiating their STEM, racial/ethnic, and graduate student identities and often opted to engage in a practice called code-shifting.

CHAPTER 1. INTRODUCTION

1.1   Chapter Overview

In this chapter, existing literature will be used to demonstrate the United States'

need to broaden participation of underrepresented minority (URM) groups in Science,

Technology, Engineering, and Mathematics (STEM). This chapter will also discuss

identity and how it can be used as an analytic lens to explore persistence of URM

graduate students in STEM disciplines. Additionally, this chapter will outline the purpose

and research questions for the study as well as address the significance of the study and

its implications for theory and practice. Finally, the chapter concludes with a list of terms

and definitions that were used throughout the study.

1.2   Introduction

In order for the United States to retain its prominence in the global economy and

meet workforce demands, the President's Council of Advisors on Science and

Technology report an estimated need to produce one million more United States STEM

professionals in the next decade, a 34% increase over current rates (Olson & Riordan,

2012). As the demographic composition of the U.S. continues to shift, it is also critical

that many of the individuals filling these STEM occupations are from URM groups. In

fact, statistics indicate that non-Hispanic whites will be outnumbered by 2035 (ESRI,

2012) and Latino Americans and African Americans[1] will become the collective majority by 2050 (U.S. Census Bureau, 2013). While STEM education attainment at all academic levels is important, Carnavale, Smith, and Melton (2011) reported that at least 65% of all STEM jobs will require a bachelor's degree or higher. Further, experts suggested that transitioning STEM baccalaureate recipients to graduate study at leading research universities is critical as these students will contribute to STEM research and spearhead the nation's STEM efforts (NRC, 2011). However, attainment gaps between URM students and majority students are exacerbated at the graduate and professional level, particularly in the STEM disciplines (Strayhorn, 2010). For example, more than half of students who begin doctoral programs in STEM do not reach degree completion, and Blacks, Latinos, and Native Americans are the least likely to complete their graduate degrees (CGS, 2008). In fact, while Whites earned 61% of master's and 69% of doctoral degrees in science and engineering, African Americans earned only 10% of masters and 5% of doctorate degrees and Latino Americans received only 8% of master's and 6% of doctoral degrees (NSB, 2014).

Given the critical need to produce more advanced post-secondary degree holders in STEM and the paltry numbers of URM students actually reaching completion, it is becoming increasingly important to understand factors that both cultivate and challenge URM degree completion. Furthermore, because graduate student experiences greatly influence progression through graduate programs and ultimate completion (Nettles & Millett, 2006), it is especially important that factors that shape these experiences be

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[1] The terms African-American and Black will be used interchangeably throughout the study.

explored. A small body of literature has begun to explore identity and its influence on the

persistence of URM graduate students pursuing STEM degrees (Carlone & Johnson,

2007; Tran, Herrera, & Gasiewski, 2011).

1.3   Identity as an Analytic Lens

Though widely contested and defined across various disciplines and theoretical

orientations, the construct of identity provides a robust analytic lens with which to

explore how people learn, think, and behave in various contexts (Carlone & Johnson,

2007; Hall & Burns, 2009; Gee, 2000). In psychology, Erikson (1968) once described

identity as a single and stable cognitive construct. However, sociocultural and

anthropological notions suggest that identity is fluid, multilayered, and continuously

constructed and re-constructed over time (Egan-Robertson, 1998). In fact, multiple

scholars have explored and developed theoretical frameworks specifically focused on the

development of various social and academic identities. For example, Chickering's Theory

of Identity Development proposes seven vectors of psychological development that

students experience during their matriculation through college (Chickering, 1969). The

current study, however, will not explore identity development, but instead will focus on

identities that students already possess by virtue of their racial/ethnic identity, their

current status as a graduate student, and their pursuit of a degree in a STEM discipline.

As such, this study will draw from the work of Gee (2000) who suggests that identity is,

"being recognized as a certain kind of person in a given context" (p. 99). Additionally,

Gee's perspective emphasizes that identity is not only how individuals characterize

themselves, but also how individuals are positioned and characterized by the people

around them. Finally, Gee's definition of identity allows for the exploration of the multiple identities held by a single individual. Therefore, Gee's definition of identity was chosen as the most appropriate analytic lens to explore how URM graduate students pursuing STEM degrees negotiate their STEM, racial/ethnic, and graduate student identities.

1.3.1   STEM Identity

Science education scholars argue that employing identity as an investigative lens allows researchers to explore how persons or groups are promoted or marginalized by science teaching (Cobb, 2004), how students are socialized into the culture and disciplinary practices of science (Brown, 2004), and how science disciplines can be taught more equitably across race/ethnicity and gender (Brickhouse & Potter, 2001; Gilbert & Yerrick, 2000; Olitsky, 2006). Rather recently, researchers sought to answer the question, "How do women of color experience, negotiate, and persist in science? (Carlone & Johnson, 2007). Using science education literature as a foundation and Gee's definition of identity (2000), the authors developed the first conceptual framework of science identity, capturing three interrelated dimensions: performance, recognition, and competence. Performance refers to one's ability to demonstrate relevant scientific practices through communication and use of tools. Recognition refers to one's ability to recognize oneself as a scientist as well as gaining recognition of others as being a scientist. Finally, competence denotes meaningful and in-depth understanding of scientific subject matter. Hererra, Hurtado, Garcia, and Gasiewski (2013) sought to further operationalize Carlone and Johnson's (2007) conceptual framework of science

identity by creating a more flexible and inclusive STEM identity that could be applied to all STEM disciplines. To that end, rather than using the phrase "science identity" which seemingly considers only science disciplines, "STEM identity" was used in this study to acknowledge the inclusion of science, technology, engineering, and math disciplines.

STEM identity has been identified as an influential factor in STEM persistence. For example, Cobb (2004) found that a key reason students who demonstrate success in the sciences yet depart from the discipline is due to the dissonance they experience between their emerging science identity and the enduring sense of who they are and want to become. If students do not depart, at the very least, they will struggle in identifying with STEM if they do not see a link to their lives and goals (Kozoll & Osborne, 2004). This is a notable observation when considering URM students in STEM because STEM disciplinary culture and curriculum typically reflect values of the white majority and excludes culturally relevant discussions aimed at communities that URM students intend to serve (Bonous-Hammarth, 2000; Cobb, 2004).

The initial development of Carlone and Johnson's (2007) model catalyzed the exploration of STEM identity in conjunction with other social identities such as race/ethnicity (Herrera, Hurtado, Garcia & Gasiewski, 2013; Tran, Herrera, & Gasiewski, 2011). In fact, Tran, Herrera, and Gasiewski (2011) sought to determine how students negotiated their emerging STEM identities and social identities. Their findings revealed that students reconceptualized their own definitions of what it meant to be both a scientist and a person of color, emphasizing both altruistic goals and improving communities of color. In another study exploring how URM students experience science, researchers

found that URM students pursuing STEM degrees who attended a Historically Black College or University (HBCU) described their experience as supportive and collaborative (Hurtado et. al, 2009). Conversely, Malone and Barabino (2009) investigated how minority graduate students develop science identity in laboratory settings at a predominantly white university and found that students expressed feelings of isolation and lack of inclusion specifically related to race. These findings demonstrate the role that race plays in developing science identity. Collectively, previous studies indicate that an intersection exists between race and the development and negotiation of STEM identity. The most notable observation is that STEM identity, particularly for URM students, cannot be developed in a vacuum, but only in concert and negotiation with racial/ethnic identity.

1.3.2 Graduate Student Identity

Though studies have been conducted on graduate student socialization and how discipline and racial/ethnic identity can influence the degree to which graduate students are socialized into the graduate environment, to date, there is no literature that operationalizes those experiences as an identity. In his seminal work on using identity as an analytic lens for educational research, Gee (2000) discusses four approaches to view identity, one of which is called the institutional perspective. Using this perspective, Gee posited that identity is a position within an institution that receives its power from an authorized set of rules, laws, traditions, and principles. Hence, the label of graduate student is not simply an indicator of progression through advanced post-secondary study,

but rather a position or identity that receives its power from departmental and institutional authority.

Carlone and Johnson (2007) acknowledged that effective adaptation into the role of a graduate student and scientist requires students to negotiate new identities. Previous research has also shown that graduate students must adapt to new norms, practices, and habits of interaction that are recognized and valued within their discipline (Wortham, 2004). For example, doctoral programs have been found to have specific models of behavior and definitions of what it means to be both a researcher and student (Zhao, Golde, & McCormick, 2007). Furthermore, faculty in graduate programs, namely doctoral studies, traditionally believe that students should work in isolation as the major milestones of preliminary exams, dissertation proposal, and defense, demonstrate individual knowledge, skills, and abilities (Calvert & Casey, 2004; Lovitts, 2005). This is a noteworthy observation for URM students, namely students from African American and Latino cultures because they tend to be more cooperative and community-oriented rather than competitive and individualistic as seen in white majority cultures (Seymour & Hewitt, 1997).

Using Gee's perspective on institutional identity coupled with empirical literature on the socialization and academic expectations of graduate students, it is proposed that graduate student identity is an identity in its own right with its own set of norms, traditions, expectations, and challenges. Therefore, it is likely that URM students pursuing advanced post-secondary degrees in STEM disciplines at predominantly white research institutions experience the multiplicative effects of the challenges associated

with negotiating STEM, racial/ethnic, and graduate student identities. Furthermore, it is paramount that the intersection of these identities is explored collectively.

1.3.3   Racial/Ethnic Identity

Often used interchangeably, race and ethnicity are terms that both represent different meanings and constructs (McEwen, 1996). The definition of race is often contested as it retains both biologically and socially constructed dimensions. Biologically, the definition of race is derived from physical features and genetic characteristics and qualities (Spickard, 1992). Socially, however, racial identity refers to an individual's perception that he or she share a common heritage with a particular racial group (Helms, 1993). Similar to race, ethnicity also retains multiple dimensions. Historically, ethnicity has been defined by demographic characteristics including factors like common language, national origin, and culture (Quintana, 2007). As a social construction, however, ethnic identity refers to an individual's conscious or unconscious bond with "a segment of a larger society whose members are thought, by themselves or others, to have a common origin and share segments of a common culture and who, in addition, participate in shared activities in which the common origin and culture are significant ingredients" (Yinger, 1976, p. 200; Ott, 1989).

The development of racial and ethnic identity has been explored by multiple scholars and has provided significant insight into how the processes associated with identifying with a particular race or ethnicity are understood. For example, the Cross Model of Psychological Nigrescence (Cross, 1971) described the resocialization experience of African Americans from non-Afrocentrism to multiculturalism. Another

model is Phinney's Model of Ethnic Identity Development that describes the process by which minority youth understand and make decisions about the implications of their ethnicity and its role in their lives (Phinney, 1990). Though understanding the processes associated with racial and ethnic identity development are important, for this study, it is vital to understand and acknowledge the social implications of self-identifying or being identified by others as a member of a particular racial or ethnic group.

In the context of URM graduate students pursuing degrees in STEM, the consideration of racial/ethnic identity is important because research has demonstrated the ways in which STEM disciplines and graduate programs are socialized by White majority culture, behaviors, and norms and may present challenges for URM students (Cobb, 2004; Lovitts, 2005). In fact, research has demonstrated that URM students may encounter difficulty in STEM departments because their disciplinary culture mirrors that of the majority culture in teaching, learning, and practice and therefore has the ability to promote dominant groups and marginalize minority identities (Cobb, 2004). As such, URM students may face challenges in STEM graduate programs since the culture of minority communities tends to be more cooperative and community oriented (Seymour & Hewitt, 1997) rather than competitive and individualistic. Considering the literature available on race/ethnicity and how it influences URM students in STEM, it is important that it be explored in conjunction with STEM and graduate student identities.

1.4   Factors Influencing Persistence Among URM Students in STEM

Multiple factors have been identified as influential to URM students pursuing STEM degrees. For example, negative racial experiences, highly competitive academic

environments, and lack of structural diversity have been identified as factors related to the attrition of URM students pursuing STEM degrees (Chang, Eagan, Lin, & Hurtado, 2011; Hurtado, Cabrera, Lin, Arellano, & Espinosa, 2009; Palmer, Maramba, & Dancy, 2011). Additionally, sense of belonging has been found to be a significant predictor of persistence, particularly in relation to self-esteem, mattering, and success in STEM (Strayhorn, 2012). Further, recognizing that sense of belonging is a basic human need (Maslow, 1962), it is argued that this construct is important for the success of college students, particularly students of color in STEM disciplines who may find themselves marginalized in collegiate environments (Hurtado & Carter, 1997). A factor closely related to sense of belonging, is climate, both within individual STEM departments and campus-wide. Though campus climate in itself is important for predicting student success (Harper & Hurtado, 2007), the climate of individual STEM departments is equally important (Museus, Palmer, Davis, & Maramba, 2011). In fact, while some factors associated with attrition may be personal, the deeply embedded climate and culture of PWIs and STEM disciplines greatly influences the challenges and barriers that exist for URM students pursuing STEM degrees (Museus, Palmer, Davis, & Maramba, 2011). Further, research shows that URM students pursuing graduate degrees in STEM report a chilly, hostile, and often less supportive campus climate experience (Museus, Palmer, Davis, & Maramba, 2011). Finally, a recent study on the graduate experiences of URM students in STEM found that students felt they lacked sufficient guidance from faculty advisors that left them feeling lost (Figueroa, 2015).

Mentoring has been identified as one approach to help increase persistence and overcome institutional challenges experienced by URM students in graduate programs

(Dixon-Reeves, 2003; Fedynich & Bain, 2011). In fact, in a study conducted on a URM graduate student mentoring institute at the University of Virginia, researchers found that program participants identified mentoring as a critical factor in their adjustment to the campus community and a significant contributor to overall academic success (Spivey-Mooring & Apprey, 2014). Mentoring has also been found to address feelings of loneliness and lack of sense of community within the student's graduate program (Gardner, 2009) by providing intellectual stimulation and creating an environment where supportive peers and faculty are easily identifiable (Gardner 2008; Golde 2005). Additionally, mentors have been found to have the most influence in the process of graduate student socialization for URM doctoral students as they are often the first in their families to attain a doctoral degree and come from low-income families who are not familiar with the graduate school process (Gasiewski et al., 2011; Hoffer et al., 2004; NSF, 2015). Given these findings, it is clear that mentoring is a key factor in helping to mitigate negative experiences that have been found to lead to graduate student attrition. Moreover, previous findings demonstrate the importance of mentoring for URM students pursuing graduate degrees in STEM.

1.5   Problem Statement

There is limited understanding on the role that identity plays in the persistence of URM students pursuing graduate degrees in the STEM disciplines. Existing scholarship suggests that STEM identity cannot be developed nor defined without the consideration of race (Tran, Herrera, & Gasiewski, 2011). Further, while the literature does highlight the importance of graduate student socialization, to date, the literature is silent on

defining the role of a graduate student as actual identity. Therefore, the intersection of graduate student identity in conjunction with STEM and racial/ethnic identity is an area of scholarship that has yet to be explored.

Little is also known about how mentoring and campus climate together may influence the collective negotiation of STEM, racial/ethnic, and graduate student identities. Some research has indicated that climate influences the degree to which students are socialized to the norms, expectations, and culture of being a graduate student (Figueroa & Hurtado, 2014). The literature has also identified mentoring as an influential factor in enhancing campus climate as mentors can serve as institutional agents to help successfully socialize graduate students into the departmental, campus, and disciplinary environment, particularly for URM students. (Figueroa & Hurtado, 2014; Gasiewski, Herrera, Mosqueda, Hurtado, & Chang, 2011; Maton & Hrabrowski, 2004; Stanton-Salazar, 2011). Collectively, mentoring and campus climate are two critical factors that influence the persistence of URM graduate students pursuing STEM degrees.

Though studies have been conducted on mentoring, campus climate, and the intersection of STEM identity and racial/ethnic identity, and how they each singularly influence the persistence of URM graduate students in STEM disciplines, to date, no studies were found that have explored these factors collectively. Further, previous research suggests a connection among STEM, racial/ethnic, and graduate student identities and how the negotiation of these identities might be influenced by campus climate and mentoring. Therefore, developing an understanding of how these components interact is important as it could catalyze institutional and disciplinary practices that

enhance the retention and completion of URM students pursuing advanced post-secondary degrees in STEM disciplines.

1.6   Significance

With few studies utilizing identity as an analytic lens to explore the persistence of URM graduate students pursuing STEM disciplines and exploring institutional factors that contribute to persistence, the present study makes a valuable contribution to the higher education community with respect to both theory and practice. At the theoretical level, this study is significant for three reasons: 1) this study uses intersectionality as a theoretical perspective to explore three identities not previously explored collectively, 2) this study expands the use of intersectionality to other social and academic identities beyond race and gender, and 3) this study utilizes a social capital framework to explore the role of mentoring for URM graduate students. First, this study will explore the negotiation of multiple identities including STEM identity, racial/ethnic identity, and graduate student identity. To date, these identities have not been explored collectively. Second, this study expands the ways in which intersectionality can be used to explore social and academic identities beyond race and gender. Further, the use of intersectionality highlights the oppressive nature of STEM disciplines and graduate school environments for URM students. Finally, this study will explore persistence through a social capital lens which emphasizes the value of social and cultural capital in successfully navigating academic institutions, rather than student- and personal-level characteristics such as grade point average and motivation.

With respect to practice, this study is significant for the following reasons: 1) It enhances the knowledge available to universities and STEM departments on how to effectively cultivate environments that foster the successful negotiation of the multiple identities held by URM graduate students pursuing STEM degrees; 2) this study can be used to transform graduate education in a manner that equitably serves students from diverse backgrounds; and 3) this study can be used to challenge universities to explore and addresss the ways in which institutional structures and norms promote dominant groups while oppressing minority populations. First, the findings of this study are significant as they provide research-based, tangible solutions for helping universities and STEM departments develop and implement programs and initiatives designed to foster successful identity negotiation, and hence, persistence among URM students pursuing graduate degrees in STEM disciplines. Second, this study can inform the ways in which graduate education is delivered to minority populations by acknowledging and reforming traditional practices and protocols that may create challenges and barriers for URM graduate students such as the lack of structural diversity and the emphasis on individual achievement and competition. Finally, this study is significant to practice as it challenges universities to reflect upon their institutional structure as a factor that may influence the recruitment, retention, and persistence of URM graduate students pursuing STEM, and therefore, the presence of advanced STEM degree holders in the U.S. workforce.

1.7   Purpose

The purpose of this study was to explore the negotiation of STEM, racial/ethnic, and graduate student identities among URM graduate students pursuing STEM degrees at

a predominantly white research institution. Further, this study sought to explore the role of mentoring and campus climate in the negotiation of STEM, racial/ethnic, and graduate student identities.

1.8   Research Questions

1. What are the student and faculty demographic characteristics in the STEM departments of the predominantly white research institution in this study?

2. What are the completion rates of the URM graduate students majoring in STEM disciplines at the predominantly white research institution in this study?

3. How do URM graduate students pursuing STEM degrees make meaning of their STEM, racial/ethnic, and graduate student identities?

4. How do URM graduate students pursuing STEM degrees negotiate their STEM, racial/ethnic, and graduate student identities?

5. What role does campus climate play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

6. What role does mentoring play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

1.9   Assumptions

1. The researcher was informed by a pragmatist paradigm. The pragmatist paradigm suggests that the researcher employed a mixed methods approach, drawing liberally from both qualitative and quantitative assumptions, in research design,

methodology, and analysis. Pragmatists reject the forced notion to choose between postpositivism and constructivism, but instead focus on the research questions and the most appropriate and practical method to address them (Creswell, 2014; Patton, 2015; Tashakkori & Teddlie, 2003).

2. This study was conducted in the most trustworthy manner possible given the nature of the research and the methodological approaches employed.

3. Participants were involved in active mentoring relationships with faculty and/or peers throughout the length of the study.

4. The data collected accurately reflects the participants' honest thoughts, beliefs, and experiences.

5. All data were collected using reliable and valid instruments.

1.10 Limitations

There were several limitations to this study regarding the research design, rigor, and trustworthiness of the study. First, the participants in the study were self-selected, therefore, individual characteristics may affect how students' negotiated their STEM, racial/ethnic, and graduate student identities. Further, individual student characteristics may also affect students' perceptions of campus climate and mentoring. Additionally, though the researcher worked to establish a positive rapport with the study participants and negotiated entry through a respected member of the community of URM students pursuing graduate degrees at the university, engaging in cross-racial or cross-cultural interviewing as well as interviewing individuals of a different gender, class, and age can introduce tensions that hinder an effective interview (Seidman, 2013). Further, since the

study focused on URM students, participants may have been hesitant to speak openly and freely about their experiences due to perceived negative reactions from the researcher or feelings of negative repercussions from the university. Second, students in the study were all doctoral students and were varied in the number of years spent at the study site and in the various STEM departments. Therefore, the experiences of the students in the sample do not generally represent the experiences of all URM graduate students in STEM at the institution included in this study. Additionally, the experiences of the students in the sample should not be assumed to be the same as the experiences of other URM graduate students pursuing STEM degrees at other predominantly white research institutions. Finally, when conducting a case study, it is important to collect multiple forms of data to allow for triangulation. This study was conducted by one individual in a limited time frame, which did not allow for more prolonged engagement and more data collected from multiple sources.

1.11 Definition of Terms

The following is a list of terms used throughout the study:

1. **Campus Climate:** the interaction of the historical legacy, structural diversity, psychological climate, and behavioral dimensions of the college environment. This definition posits that institutions educate students, socially and academically, in racial contexts (Hurtado, 1994b). For this study, campus climate and campus racial climate will be used interchangeably.

2. **Graduate Student**: refers to a student pursuing a non-professional master's or doctoral degree.

3. **Identity**: being recognized by yourself or by others as being a certain kind of person in a given context (Gee, 2000).

4. **Instrumental Support:** providing access to career-related opportunities that enhance skills and expand professional networks (Davidson & Foster-Johnson, 2001). The term is also referred to as career development.

5. **Intersectionality**: theorizes that individuals possess multiple dimensions of identity that are not isolated from one another, but intermingle or interact in ways that affect perceptions, experiences, behaviors, and actions as well as how one is viewed by others (Crenshaw, 1989; Tannenbaum, 2015).

6. **Mentoring**: an interaction between a more experienced individual who sets out to assist or guide a less experienced individual and includes instrumental and psychosocial support (George & Neale, 2006; Noe, 1988).

7. **Predominantly White Institution (PWI)**: institutions of higher education whose majority enrollment is composed of white students (Lomotey, 2010).

8. **Psychosocial Support:** addresses the personal needs of the less experienced individual or protégé by providing psychological support, social support or both (Davidson & Foster-Johnson, 2001). It can also be referred to as intrinsic support.

9. **Race/Ethnicity**: refers to individuals' self-identified race and/or ethnicity.

10. **Sense of Belonging**: generally refers to a feeling of connectedness that one is important or matters to others (Strayhorn, 2012).

11. **STEM**: disciplines and related disciplines of Science, Technology, Engineering, and Mathematics.

12. **Underrepresented Minority (URM)**: a group of individuals whose percentage of the population is lower in the STEM disciplines than their percentage of population in the country (NSF, 2015). For this study, African-Americans and Hispanic/Latino are underrepresented minority individuals.

CHAPTER 2. REVIEW OF LITERATURE

2.1   Chapter Overview

This chapter will provide an overview of URMs pursuing graduate degrees in the STEM disciplines. The chapter will also review the literature of three major topic areas: 1) identity, 2) campus racial climate, and 3) mentoring. Additionally, this chapter will discuss the conceptual and theoretical frameworks used to inform the study followed by a brief summary of the chapter.

2.2   Literature Review Methodology

This study was informed by literature across several academic disciplines utilizing a variety of search methods. References were found using Google Scholar as well as the Purdue University Library catalog, e-journal database, direct search, and interlibrary loan service. Examples of search terms and phrases included: "STEM + minorities," "STEM + minority graduate students," "identity," "science identity," "science identity + minorities," "mentoring," "mentoring + graduate students," "mentoring + STEM," "mentoring + STEM graduate students," "campus climate + minorities," "campus climate + STEM," "campus climate + STEM + minority graduate students, "intersectionality," and "intersectionality + minorities."

2.3   Purpose of the Study

The purpose of this study was to explore the negotiation of STEM, racial/ethnic, and graduate student identities among URM graduate students pursuing STEM degrees at a predominantly white research institution. Further, this study sought to explore the role of mentoring and campus climate in the negotiation of STEM, racial/ethnic, and graduate student identities.

2.4   Research Questions

1. What are the student and faculty demographic characteristics in the STEM departments of the predominantly white research institution in this study?

2. What are the completion rates of the URM graduate students majoring in STEM disciplines at the predominantly white research institution in this study?

3. How do URM graduate students pursuing STEM degrees make meaning of their STEM, racial/ethnic, and graduate student identities?

4. How do URM graduate students pursuing STEM degrees negotiate their STEM, racial/ethnic, and graduate student identities?

5. What role does campus climate play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

6. What role does mentoring play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

2.5   URMs and Graduate Education

Graduate education has been touted as a vital part of the U.S. education system as it contributes significantly to the economic development, national security, and prosperity of this country (Council of Graduate Schools, 2007). Unfortunately, however, research has demonstrated that students of color are significantly underrepresented in graduate programs, particularly in the STEM disciplines (Davidson & Foster-Johnson, 2001; Maton, Kohout, Wicherski, Leary, & Vinokurov, 2006; National Science Board, 2014). In fact, in 2014 Whites accounted for over 50% of students enrolled in graduate programs while African Americans, Latinos, and American Indian/Alaskan Natives combined accounted for only 17% of students enrolled in graduate programs (Allum & Okahana, 2015). Attainment gaps between URM students and majority students are also exacerbated at the graduate and professional level (Strayhorn, 2010). For example, in 2012, whites earned 61% of master's and 69% of doctoral degrees in science and engineering, whereas, African Americans received only 10% of master's and 5% of doctoral degrees respectively. It is promising to report however, that URMs accounted for 24% of first-time graduate students, with Latino students showing a 6.8% increase since the fall of 2013 (Allum & Okahana, 2015). In light of these statistics, it is important that the higher education community gain a better understanding of the factors that contribute to the retention and completion of URM students in graduate programs, particularly in STEM.

Many studies have explored factors that contribute to student attrition and completion in graduate programs (Burnett, 1999; Gardner 2009; Lovitts, 2001). However,

little research on attrition and completion has focused specifically on URM students. Notwithstanding the contributions that Lovitts and others have made to our understanding of graduate student attrition and retention, it is only appropriate to critique their findings, as they are based on traditional, majority students and therefore may not be robust enough to adequately characterize minority populations. Still, the research available on graduate students provide an important foundation on which to explore student experiences in graduate education.

In a study investigating the role departments play in doctoral student attrition, Golde (2005) conducted case studies on four respective departments, two science and two humanities, at a Midwestern university. The findings revealed that student attrition is attributed to six major themes: 1) mismatch between research practices and students' strengths, 2) poor fit of expectations between the student and the department, 3) mismatch between student and advisor, 4) incongruity between student career aspirations and faculty life, 5) student perception of poor job market, and 6) structural isolation of the student. Additional research has shown that students have a difficult time transitioning to graduate work as it is isolating in nature, particularly in doctoral programs (Lovitts, 2001). In fact, Lovitts (2005) posited theoretical perspectives on factors that both facilitate and impede the transition to doctoral study. Further, she highlighted factors that contribute to a student's production of original, creative research (Lovitts, 2005). The article suggests that multiple factors contribute to both program completion and the production of original research, including the culture of graduate education, the culture of the department, peers and faculty, the advisor, and individual

resources such as intelligence, motivation, knowledge, personality, and thinking style (Lovitts, 2005). The literature has also cited insufficient funding, motivational factors, family demands, poor advising and mentoring, lack of disciplinary integration, and feelings of isolation as factors related to graduate student attrition (Burnett, 1999; Gardner, 2009; Lovitts, 2001; Wright & Cochrane, 2000). Researchers have also found that effective mentoring and graduate student socialization can offset the factors leading to attrition and contribute to graduate student persistence and completion (Figueroa & Hurtado, 2014; Tennenbaum, Crosby, & Glidner, 2001). For example, in a study exploring graduate student experiences, researchers found that mentoring not only increased academic productivity in the form of publications and posters, but also contributed positively to graduate student satisfaction (Tennenbaum, Crosby, & Glidner, 2001).

Few studies have focused specifically on the factors that influence attrition and completion of URM graduate students. In fact, studies exploring the experiences of URM students in graduate programs did not begin until the late 1970s (Bruce, 1977; Carrington & Sedlacek, 1977; Wilson, 1979). The few studies available do, however, provide an excellent springboard for continued exploration of factors that influence persistence of URM students pursuing graduate degrees. Carrington and Sedlacek (1977) explored the attitudes and characteristics of Black doctoral students. They found that Black students felt that the racial climate was generally tense. Students reported that one of the characteristics they liked least about the university was the racism they experienced. In fact, when asked what they would like to see changed at their university, 12% of Black

students stated a change in the racist attitudes and practices of faculty, staff, and students. However, the authors also found that students felt that the Black faculty who were present seemed interested in the Black students. In another study exploring the personal and background characteristics of persisting and non-persisting Black and Hispanic graduate students, Clewell (1987) found that supportive advisors and other faculty members were critical factors in helping URM students to complete their graduate degrees. Similarly, Nettles (1990) examined the differences in doctoral experiences among Black, Hispanic, and White doctoral students at four major universities. The findings indicated Black and Hispanic students perceived more feelings of racial discrimination than did White students. Finally, in a more recent study of primarily URM recent graduates, master's and doctoral-level students, Strayhorn (2012) found that not only is graduate student socialization important, but that it leads to enhanced sense of belonging and persistence within graduate programs.

Though little scholarship exists on URM students pursuing graduate education, the research available on overall graduate student experiences provides clarity regarding the factors that may influence attrition and completion among URM graduate students. In addition to the challenges that are faced by all graduate students, it appears that URM graduate students may experience additional challenges associated with race/ethnicity. Conversely, the collective research also helps to provide insight into interventions that may contribute to completion of URM students pursuing graduate degrees.

2.5.1 URMs Pursuing STEM Graduate Degrees

A snapshot of U.S. demographic realities and STEM workforce needs demonstrates the importance of increasing participation of URM students in STEM graduate education. In fact, a report produced by the American Association for the Advancement of Science (AAAS) suggested that the U.S. may find itself in jeopardy without an increased production of trained domestic scientists, engineers, and mathematicians (George, Neale, Van Horn, & Malcolm, 2001). Unfortunately, however, there is a dearth of research that explores the factors that contribute to the retention and completion of URM graduate students pursuing STEM degrees. Consequently, a great deal of the knowledge available on URM experiences in the STEM disciplines is informed by research focused on the undergraduate student population.

Multiple studies have explored factors that influence the attrition and completion of URM undergraduate students pursuing STEM degrees (Hurtado, Cabrera, Lin, Arellano, & Espinosa, 2009; Palmer, Maramba, & Dancy, 2011; Millett & Nettles, 2006). In a study investigating factors influencing retention and persistence, researchers found that peer support, strong pre-college preparation, and involvement in STEM-related extracurricular activities were all related to the persistence of URM students in STEM (Palmer, Maramba, & Dancy, 2011). Another study conducted by Essien-Wood and Wood (2011) explored the differential experiences of URM students pursuing STEM degrees at HBCU and non-HBCU campuses, with particular interest in academic and social integration. Findings from this study indicated that URM students at HBCUs experience significantly higher levels of academic integration than their non-HBCU

counterparts. Further, the researchers concluded that HBCU students have more academic and non-academic interactions with faculty members than do non-HBCU URM students. These findings are not surprising as HBCUs contribute significantly to the STEM workforce, producing 22% of baccalaureate degrees awarded to African Americans in the STEM disciplines despite representing only three percent of U.S. institutions of higher education (Lee & Keys, 2013). Hurtado and colleagues (2009) sought to explore how URM students experience science at four different universities. Their findings revealed that URM students in STEM departments often face a competitive environment. While this environment served as a source of motivation for some students, others found the competitive environment to be disempowering and negative. Additional findings from studies focused on the persistence of URM students in STEM disciplines have indicated that negative racial experiences, highly competitive academic environments, and lack of structural diversity as factors related to the attrition of URM students pursuing STEM degrees (Chang, Eagan, Lin, & Hurtado, 2011; Fries-Britt, Younger, & Hall, 2010; Hurtado et al., 2009).

Few studies have explored factors influencing the persistence of URM graduate students pursuing STEM degrees. While previously cited studies have provided a foundation for the experiences of URM students in STEM disciplines, it is likely that URM students pursuing graduate degrees in STEM have unique or different experiences as the nature of graduate study is different from that of undergraduate study (Lovitts, 2005). Therefore, the following section will review the scant literature available on URM graduate students pursuing STEM degrees.

Millett and Nettles (2006) found that mentoring is an important factor in the persistence of Hispanic doctoral students. This finding is well aligned with the mentoring literature that has suggested mentoring is significantly and positively related to student persistence and graduation in STEM majors (Maton & Hrabowski, 2004). Mwenda (2010) explored the influence of financial support and relationships with faculty advisors and peers on experience and progress through a STEM doctoral program. Findings revealed that financial support in the form of fellowships and assistantships enabled students to develop successful relationships with both faculty and peers and hence, helped students to become more integrated into their academic programs and departments. Figueroa and Hurtado (2014) also found that despite racial concerns, peers and faculty members are key components to helping URM graduate students in STEM adjust to the graduate environment and ultimately persist in their graduate programs. Collectively, these findings highlight the importance of strong peer and faculty mentoring relationships as a way to provide support and socialization into STEM graduate environments.

2.6   URMs and Identity Negotiation

Wortham (2004) considers the interrelations between social identification and learning where he posits that social identities influence academic learning and therefore, the development of academic identities. Other researchers have also come to similar conclusions, finding that students tend to bring ethnic identities into the classroom (Fordham & Ogbu, 1986). Collectively, this research demonstrates that racial/ethnic identity plays a pivotal role in how students develop and negotiate additional academic

and social identities. Recognizing that both the nature of graduate programs and STEM disciplinary practices are socialized by white majority culture, it is important to understand how URM graduate students in STEM disciplines negotiate and make meaning of their URM identity in concert with their STEM identity and graduate student identity.

2.6.1   Identity

Gee (2003) posited that the use of identity as an analytic lens is a powerful tool for providing insight into schools and society as it allowed for a more comprehensive and dynamic exploration of how social identities like race, gender, and socioeconomic status interact with other social and academic identities. The concept of identity has been characterized in a variety of ways throughout the literature in many disciplines. However, using Gee's work as a foundation, the concept of identity employed in this study is defined as being recognized as a certain "kind of person," in a given context (Gee, 2003). Therefore, an individual has multiple identities that are defined across multiple contexts. To provide clarity on his characterization of identity, Gee outlined four ways to perceive what it means to be a "certain kind of person:" 1) Nature-identity, 2) Institution-identity, 3) Discourse-identity, and 4) Affinity-identity (Table 2.1)

Table 2.1

Four Ways to View Identity

Identity	Process	Power	Source of Power
1. Nature-Identity: a state	developed from	forces	in nature
2. Institution-Identity: a position	authorized by	authorities	within institutions
3. Discourse-Identity: an individual trait	recognized in	discourse/dialogue	of/with "rational" individuals
4. Affinity-Identity: experiences	shared in	the practice	of "affinity groups"

Note. Adapted from Gee's (1989) Concept of Identity.

Nature-identity refers to a state of being that receives its power from forces in

nature and cannot be controlled by the individual. Nature-identity manifests itself beyond

the control of the individual, and therefore, is controlled by its perception in society. In

fact, institutions, discourses, and affinity groups, the other three forces that constitute

identity, are the groups with which nature-identity gains force. When considering URM

graduate students pursuing STEM degrees, their nature-identity is their race/ethnicity.

Not only was their race/ethnicity selected by nature, outside of their own control, but

also, their racial/ethnic identity only becomes an identity when it is recognized through

institutions, dialogue, and affinity groups.

Institution-identity refers to a position that receives its power from a set of

authorities administered by an institution. Institution-identity manifests itself through

laws, rules and traditions that both guide the position and the person occupying the

position. Individuals occupying positions constituted by institution-identity can operate

on a continuum of active and passive roles. In fact, institution-identities can be viewed as either a calling or an imposition. For example, becoming a career faculty member can be considered a calling, whereas, being imprisoned can be considered an imposition. Both positions, however, are governed by a set of authorities. The institution-identity of a URM graduate student pursuing a STEM degree is their identity as a graduate student. Both the position and the person occupying the position of graduate student are guided by laws, rules, and traditions authorized by the university and its respective STEM departments. Further, it is only under the authorization of these rules and traditions that graduate students receive their power. It is noteworthy to mention, however, that unlike nature-identity, institution identity can be temporary. For example, graduate students will complete their programs at a given point, and therefore, will no longer possess their identity as a graduate student.

The third type of identity, *discourse-identity*, refers to an individual trait that receives its power from the discourse and dialogue of rational individuals. Discourse-identity operates through a process by which rational people recognize an individual trait and treat, talk about, and interact with a person based on that individual trait. It is key to mention that the power of discourse identity comes from "rational" individuals. Rationality indicates that the discourse and dialogue occurred as a result of reasoning rather than obligation through an authoritative force. This observation is key as it differentiates an institution-identity from a discourse-identity. The discourse identity of a URM student pursuing a graduate degree in STEM is his or her identity as a STEM scientist. Only when rational individuals begin to recognize and interact with an

individual as a STEM scientist through discourse and dialogue, is their identity as a STEM scientist given power. Gee's final identity perspective, *affinity-identity*, refers to a distinct set of experiences that receive their power from allegiance, access, and participation in specific practices carried out by a group of people. Affinity-identities operate through a process by which individuals participate or share in similar experiences. Affinity group members display their membership in a two-fold manner, first by allegiance to a set of common practices, and second, to other people who share culture or traits. Affinity groups may consist of many individuals in a similar space or across a large space composed of multiple states, universities, and countries. It is posited here that the affinity-identity for URM graduate students pursuing STEM degrees, is the collective identity that is created as a result of being a URM, a graduate student, and a STEM scientist. Collectively, research shows that this population of students not only encounters unique common experiences while matriculating through STEM graduate programs at PWIs (Chang, Eagan, Lin, & Hurtado, 2011), but also come together in special ways to support one another through peer mentorship. Another example of an affinity-identity may include participation in discipline-specific professional organizations such as the National Society of Black Engineers.

2.6.2 Intersection of Racial/Ethnic Identity and STEM Identity

The seminal study investigating racial/ethnic identity and STEM identity began with Carlone and Johnson (2007) when they explored the experiences of 15 undergraduate and graduate women of color as they progressed to graduation and into science-related careers. Not only did their research lead to the development of the first

conceptual model of science identity, but it also provided insight into how students of color develop and negotiate their racial/ethnic identities in various contexts. The three dimensions of the science identity conceptual framework are competence, performance, and recognition. Competence denotes meaningful and in-depth understanding of scientific subject matter. Performance refers to one's ability to demonstrate relevant scientific practices through communication and use of tools. Recognition refers to one's ability to recognize oneself as a scientist as well as gaining recognition of others as being a scientist. An examination of the grade point averages of participants revealed no significant patterns related to competence. Further, because the study was largely based upon interviews and not observations, no conclusions could be drawn based on performance. Therefore, recognition became the key component with which to determine the development of science identity. Three types of science identity trajectories were revealed: research, altruistic, and disrupted. Though racial/ethnic identity did not appear to be a salient factor in the development of the research scientist trajectory, both the altruistic and disrupted identity trajectories were directly impacted by the race/ethnicity of the participants. For example, many participants identified as altruistic scientists who used their racial/ethnic background as a context to redefine their definition of science, to characterize what it meant to be a scientist of color, and to determine whose recognition was important to them. Conversely, participants who identified as having disrupted science identities felt that their negative experiences were related to either race/ethnicity, gender, or both. Carlone and Johnson's (2007) study is important to the exploration of URM students in STEM disciplines because it highlights the ways in which social

identities, such as race/ethnicity and gender, may problematize the development of STEM identity and complicate recognition as a scientist.

The development of the science identity conceptual framework by Carlone and Johnson (2007) catalyzed the exploration of science identity in concert with other social identities and illuminated the importance of using identity as a lens to explore persistence of URM students in the STEM disciples. Herrera and colleagues (2011) extended the science identity framework a step further to include technology, engineering, and math disciplines as a means to provide a more holistic and robust analytical and methodological direction for future studies of STEM identity (Herrera, Hurtado, Garcia, & Gasiewski). Another important contribution using identity as an analytic lens is Tran's (2011) work that explored the intersection of STEM identity with other social identities. Tran's findings align with the work of Bonous-Hammarth (2000) which acknowledged that STEM curriculum is socialized by majority white culture, and therefore, is void of conversations that are socially and culturally relevant to URM students. Further, similar to Carlone and Johnson, the findings concluded that the narrow and detached nature of STEM classrooms caused URM students to encounter difficulty when developing STEM identity in conjunction with their racial/ethnic identity (Tran, 2011). A novel finding by Tran was that URM students also redefine science, not only for altruistic aims reflected in the work of Carlone and Johnson, but also for social justice aims, focused on improving conditions for URM communities.

Though few studies explore racial/ethnic identity and STEM identity together, the literature available clearly demonstrates that these identities neither develop nor operate

separately, but collectively. As scholars continue to explore factors that influence

persistence and attrition for URM graduate students in the STEM disciplines, it is

important to gain a better understanding of how social and academic identities interact.

Further, it is important to understand how campus racial climate and mentoring may

impact the negotiation of these identities.

2.7 Campus Climate for URMs in Graduate Education

Like much of the scholarship discussed in previous sections of this chapter,

graduate students have rarely been the focus of studies exploring campus racial climate.

Unlike previous research, however, since campus climate is directly related to issues of

race/ethnicity, the research that does exist around climate and graduate students,

inherently focuses on graduate students of color. Though the body of literature on

graduate students is growing, much of the research available is focused on factors that

contribute to graduate student success such as financial issues, relationships with faculty,

curricular requirements, and personal issues (Harper & Hurtado, 2007; Hirt & Muffo,

1998). As a result, many of the studies on the topic of campus racial climate and its

influence on graduate students was deduced indirectly from research on graduate student

success (Hirt & Muffo, 1998). In light of more recent research findings that allude to

institutional elements like departmental culture and institutional climate as factors that

influence graduate student success (Gasiewski, Herrera, Mosqueda, Hurtado, & Chang,

2011; Hurtado 1994a; Museus, Palmer, Davis, & Maramba, 2011), it is becoming more

important that scholars begin to explore institutional-level factors and their influence on

the attrition and completion of graduate students, particularly URM graduate students in

STEM disciplines.

2.7.1   Campus Racial Climate

Until the 1990s, little research explored the role of campus racial climate in the

success and persistence of URM students. While the higher education community was

familiar with research on URM students, particularly Black students, campus climate was

not explored as it was deemed too intangible and difficult to comprehend (Crosson, 1988;

Green, 1989). Hurtado (1992) conducted one of the most influential studies exploring

campus racial climate and URM students. Though the study provided several salient

findings, perhaps one of the most influential is the conclusion that white students were

less likely than Black or Hispanic students to perceive racial tension on campus, as most

believed that racism was no longer a societal problem. Just two years after Hurtado's

seminal work on campus racial climate, she presented a framework for campus racial

climate (Hurtado, 1994b). This framework enabled an enhanced understanding of the

multiple dimensions of campus climate and provided a structure to more deeply and

accurately investigate campus climate, particularly for URM students.

In this study, climate was operationalized using Hurtado's (1994b)

conceptualization of campus racial climate as it provided a framework that allows for

concrete and measurable observation of both institutions and individuals (Hurtado,

Milem, Clayton-Pedersen, & Allen, 1999). Further, unlike other frameworks, this

framework is multidimensional and offers a more holistic approach to understanding the

factors that encompass campus climate (Figure 2.1). Essential to the understanding of

Hurtado's framework is the argument that institutions educate students, socially and academically, in racial contexts. In short, this means that race/ethnicity plays a major role in how students are educated in higher education. These higher education contexts, college campuses specifically, are influenced by both internal and external forces. External forces include government programs, policies, and initiatives like affirmative action and financial aid. External forces also include sociohistorical contexts which refer to not only how institutions of higher education respond to the entrance of diverse students on their campuses, but also how individuals structure their educational environments. The institutional context is composed of four related parts: *historical legacy*, *structural diversity*, *psychological climate*, and *behavioral dimension*. *Historical legacy* refers to a university's history of inclusion and exclusion of various racial/ethnic groups. *Structural diversity* denotes to the number of students, faculty, and staff that belong to various racial/ethnic groups. *Psychological climate* discusses the perceptions of discrimination, tension, and attitudes between and among groups. Finally, the *behavioral dimension* refers to interactions among groups in classrooms and in social settings. Perhaps equally as important as each of the individual parts is the understanding that these components are not mutually exclusive, but connected and influence one another.

Elements Influencing the Climate for Racial/Ethnic Diversity

GOVERNMENT/POLICY CONTEXT   SOCIOHISTORICAL CONTEXT

INSTITUTIONAL CONTEXT

Historical Legacy of Inclusion/Exclusion

- Resistance to desegregation
- Mission
- Policies

Structural Diversity

- Diverse student enrollments
- Diverse faculty and staff

Psychological Climate

- Perceptions of racial/ethnic tension
- Perceptions of discrimination
- Attitudes and reduction of prejudice

Behavioral Dimension

- Social interaction across race/ethnicity
- Campus involvement and diversity
- Classroom Diversity

Figure 2.1 Elements Influencing the Climate for Racial/Ethnic Diversity (Hurtado, 1994b)

Since the development of Hurtado's framework, the body of research on campus racial climate has grown. In fact, in a synthesis of literature focused on campus racial climate, researchers cited over 30 articles that have been published since 1992 (Harper & Hurtado, 2007). In one study exploring campus racial climate and its influence on students' adjustment to college, researchers found that in comparison to white students, African-American students' exposure to prejudice on campus was directly related to their commitment to the institution (Cabrera, Nora, Terenzini, Pascarellea, & Hagedorn, 1999). Stated simply, the more a student demonstrated commitment to the institution, the less they perceived prejudice on campus. In another study exploring how students from different racial groups experienced campus climate at ten different campuses, scholars

concluded that students of color perceived the climate as more racist than white students and experienced higher incidences of harassment (Rankin & Reason, 2005). In a multi-university qualitative study, Harper and Hurtado (2007) explored how students experience racial climates in terms of perception, experiences with race and racism at PWIs, and the benefits associated with campuses that facilitate cross-racial engagement. Their study resulted in nine common themes which included: 1) cross-race consensus regarding institutional negligence regarding racism, 2) infrequency of conversations about race, 3) racial segregation among students, 4) racial gaps in social satisfaction, 5) reputational legacies of racism among universities, 6) overestimation of minority student satisfaction by white students, 7) pervasive white culture in space, curricula, and activities, 8) the paradox of consciousness and powerlessness among racial/ethnic minority staff, and 9) unexplored qualitative realities of race in institutional assessment. The findings of these studies and others demonstrate the need to further explore the influence of campus racial climate on the persistence of URM students. Further, recognizing the difficulties associated with navigating both graduate and STEM environments, it is increasingly important to begin to exploring how campus racial climate may affect URM students pursuing graduate degrees in STEM disciplines.

2.7.2   Campus Racial Climate and URM Students in STEM

Through the research of Hurtado (1992, 1994a, 1994b) and other scholars, the importance of campus racial climate and its influence on URM students has been well documented. However, little is known about the role campus racial climate may play in the persistence of URM graduate students pursuing degrees in the STEM disciplines. The

lack of literature available on campus racial climate and URM undergraduate students pursuing STEM degrees will inform the current research. In a study focused on how campus climate influences STEM students at HBCUs, Strayhorn (2013) found that students who maintained a grade point average (GPA) of 2.00 or higher and persisted in their STEM major perceived a welcoming environment and had higher frequency of interactions with students from a different racial background. The study also revealed that many HBCU students described the overall climate at HBCUs as supportive and family-like (Strayhorn, 2013). Further, students emphasized the importance of supportive departmental cultures that provided students with meaningful opportunities to engage with both students and faculty. In another study exploring collegiate experiences that contribute to persistence in STEM, findings revealed that for URM women in STEM, the college environment and college experiences were more influential to STEM persistence than high school performance or family background characteristics (Espinosa, 2011). Finally, in a study exploring campus racial climate perceptions and sense of belonging of women in STEM disciplines, results indicated that participants' positive perceptions of racial climate were significantly related to sense of belonging. This is an important finding as research has demonstrated that positive perceptions of overall campus racial climate may combat the negative racial culture present in STEM departments as has been reported by participants in prior studies (Johnson, 2012).

2.8   Mentoring of URMs in Graduate Education

Graduate students of color often encounter many of the same issues as their counterparts in the K-12 education system including isolation, culturally irrelevant

curriculum, and uncaring and culturally insensitive professors (Gay, 2004). In fact,

research has demonstrated that the reason many students forgo graduate education is

because of negative secondary and post-secondary educational experiences due to race

(Lang, 1986). Effective mentoring has been identified as an approach to increase the

number of URM students who successfully matriculate through graduate programs

(Fedynich & Bain, 2011). Further, providing mentorship to students of color is

imperative to increasing the presence of URM university faculty (Gregory, 2001).

Mentoring has been found to address feelings of loneliness and lack of sense of

community by providing intellectual stimulation and creating an environment where

supportive peers and faculty are easily identifiable (Gardner, 2008; Golde, 2005).

Further, mentoring provides opportunities for students to learn about professional

development opportunities, network with other professionals and scholars within the

discipline, and become familiar with and develop skills to meet requirements for the

graduate program (Davidson & Foster-Johnson, 2001). The literature available on

mentoring URM graduate students is scant at best (Bodden, 2014). However, research on

mentoring graduate students overall provides insight into how mentoring may influence

URM graduate students.

In an empirical study investigating mentoring and advisor and advisee

relationships, Tenenbaum, Crosby, and Gliner (2001) found that instrumental support

such as practical help statistically predicted students' productivity in terms of peer-

reviewed publications. The findings also indicated that graduate student satisfaction with

their advisor and with the overall graduate school experience was positively associated

with receipt of psychosocial support. Reddick and colleagues (2012) explored mentoring

from the perspective of the graduate student mentor. The authors concluded that

mentoring relationships are reciprocal in nature. Specifically, graduate student

participants expressed that being a mentor not only provided them with enhanced

understanding of their academic discipline, but also provided an opportunity to better

understand themselves as a student. Additionally, the researchers found that graduate

student mentors felt that their mentorship would contribute to an increase in the number

of diverse students pursuing graduate degrees. In a phenomenological study exploring

mentoring experiences of African American women in graduate and professional

programs, Patton (2009) found that mentors not only helped the study participants

network and serve as role models, but also had the ability to understand and "care about

the whole person" (p. 521). Study participants emphasized the need for mentors to be

experienced as they can help graduate students navigate institutional systems. Previous

research has also explored the role of mentoring in the identity development of doctoral

students (Hall & Burns, 2009). The authors found that becoming a professional

researcher requires the negotiation of new identities whereby students must learn to be

both people and professionals. This work further suggests that successful negotiation of

these identities may depend on how well graduate students enact identities that are valued

by their advisors. Thus, it is important that advisors become more aware of identity

formation and the methods by which they mentor students and socialize them into their

disciplines and departments. These findings align with the work of Zhao, Golde, and

McCormick (2007) who posited that doctoral students must learn behaviors and roles

associated with being both researcher and student. Though much of the mentoring

literature focuses on the benefits of mentoring for graduate students, it is important to

note that mentoring has also been found to be a mechanism that can oppress URM

students as the large majority of faculty members are white men and often view other

white men as ideal graduate students (Glazer-Raymo, 2001; 2008). Noy and Ray (2012)

investigated the notion of systematic disadvantage in mentoring relationships and found

that URM students' advisors were less respectful of their ideas in comparison with their

white counterparts. This study also revealed that students in the physical and biological

sciences reported their advisors to be less supportive than advisors in the social sciences

and humanities. Though negative, it is important to highlight this study as it emphasizes

how mentoring can be detrimental to students if not employed equitably across race and

academic discipline.

2.8.1   Definition of Mentoring

Mentoring has been identified as an effective strategy to improve the retention of

both students and faculty where historical underrepresentation has occurred (Girves,

Zepeda, & Gwathmey, 2005). Kram (1988) posited that mentoring not only helps

protégé's to develop a sense of professional identity and personal competence, but also a

sense of purpose. Kram also suggested that mentoring relationships must be characterized

by mutual liking, attraction, and identification. Additionally, the relationships must meet

the needs of both the mentor and the mentee (Kram, 1988). For this study, mentoring was

defined as an interaction between a more experienced individual who sets out to assist or

guide a less experienced individual and includes instrumental and psychosocial support

(George & Neale, 2006; Noe, 1988). Psychosocial support is also referred to as intrinsic

support and addresses the personal needs of the less experienced individual or protégé by

providing psychological support, social support or both. Instrumental support can also be referred to as career development and includes providing access to career-related opportunities that enhance skills and expand professional networks (Davidson & Foster-Johnson, 2001).

The complexity of mentoring has made it difficult for scholars to agree upon a single widely accepted definition (Crisp & Cruz, 2009). As such, Jacobi (1991) highlighted commonalities across the literature regarding mentoring. She found that mentoring included the following components: 1) the relationship is focused on achievement or acquisition of knowledge; 2) it contains three components: emotional and psychological support, professional development, and role modeling; 3) the relationship is reciprocal; 4) the relationship is personal in nature; and 5) mentors have greater experience, influence, and achievement in a given discipline, environment, or organization. Additionally, Jacobi (1991) discussed the importance of mentoring to academic success as well as specific mentoring functions that contribute to the success of college students.

Not all mentoring relationships are the same. Mentoring relationships can be both formal and informal. Formal relationships are typically sanctioned or structured by educational institutions whereby mentors and mentees are matched based on a set of criteria (Allen, Eby, & Lentz, 2006; Chao, Walz, & Gardner, 1992). Informal mentoring relationships, however, typically develop organically and occur as a result of both the mentor and mentee seeking each other out (Campbell & Campbell, 1997). Mentoring, in academic settings, should also not be limited to relationships between faculty and students as peer mentoring relationships have been cited as important for the academic

success of URM students as well (Patton, 2009; Zalaquett & Lopez, 2006). In fact, in a study exploring the effects of a graduate student peer mentoring program, the researchers found that peer mentoring relationships result in higher levels of instrumental and psychosocial support and were more satisfied with their peer mentoring relationships than mentoring relationships with faculty (Grant-Vallone & Ensher, 2000). Relationships can also vary in length with some lasting for as little as one meeting and others lasting over decades (Kram & Isabella, 1985).

2.8.2 Mentoring of URMs in STEM Graduate Education

Little research has specifically explored the role of mentoring on URM graduate students pursuing STEM degrees. Notwithstanding the knowledge that we have gained about the influence of mentoring, much of it was gleaned indirectly from studies exploring the experiences of URM graduate students in STEM. Hence, it is increasingly important that scholars begin to intentionally explore the role of mentoring in the persistence of URM students pursuing graduate degrees. Below is a brief review of literature available on mentoring and its influence on URM graduate students in STEM.

Figueroa and Hurtado (2014) found that faculty support and mentoring are essential to success in the graduate environment, regardless of race/ethnicity or discipline. Further, their study revealed that students who feel they can rely on others are well positioned to successfully adjust to the graduate school environment. In another study, Figueroa (2015) explored the experiences of URM graduate students in STEM across PWIs, HBCUs, and HSIs. Overall, participants in this study described positive experiences with their advisors. For example, participants appreciated the quality of their

advisors being accessible and approachable, their desire to support students by providing

them with training opportunities and connections to important resources, the tailored

advisement style that best met the needs of the student, and the free expression of support

and encouragement. While the study did not characterize these interactions and activities

as mentoring, by definition, these activities are well aligned with both instrumental and

psychosocial support. Similarly, Gray (2013) explored the role of HBCU faculty in

promoting STEM doctoral education. Although the author did not explore mentoring

specifically, he found that the study participants attributed their interest and persistence in

doctoral study to positive experiences with faculty during their undergraduate

matriculation at an HBCU. Further, participants cited accessibility of faculty, exposure to

science through undergraduate research programs, role modeling, and the sharing of

career and academic advice as contributors to the eventual doctoral success in STEM.

Again, while the study did not define these interactions and experiences as mentoring,

they too, aligned with the concepts of both instrumental and psychosocial support.

Recently, scholars explored the mentoring perceptions of URM graduate students

pursuing STEM and agricultural and life science degrees (Brown, Cropps, Coy, Esters, &

Knobloch, 2016). The authors found that peer mentoring relationships were the most

beneficial to the students as they not only provided instrumental support in helping

students to navigate their academic departments and the institution as a whole, but they

also provided personal friendship and psychosocial support during periods of difficulty.

Furthermore, the study found that students who attended HBCUs or who participated in

undergraduate research programs for URM students in STEM had enhanced expectations

of mentoring relationships with faculty when entering their graduate programs. While the

previous studies demonstrate the importance of mentoring to URM graduate students in STEM, the Council of Graduate Schools found that although 89% of STEM programs permitted students to have multiple faculty mentors, only 36% offered targeted mentoring programs or peer mentoring programs (Sowell, Allum, & Okahana, 2015). This lack of availability of mentoring programs demonstrates the need to further explore institutional factors that influence persistence and attrition among URM students pursuing STEM graduate degrees.

2.9   Conceptual Framework

The conceptual framework for this study was developed by the researcher to demonstrate the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees and the role of campus climate and mentoring in the negotiation process (Figure 2.2). As depicted, mentoring occurs within the broader context of the campus climate. Together, these factors may influence the ways in which URM graduate students in STEM disciplines negotiate their racial/ethnic, STEM, and graduate student identities.

Campus Climate

Negotiation of Identities

STEM
Identity

Racial/Ethnic
Identity

Mentoring

Graduate Student
Identity
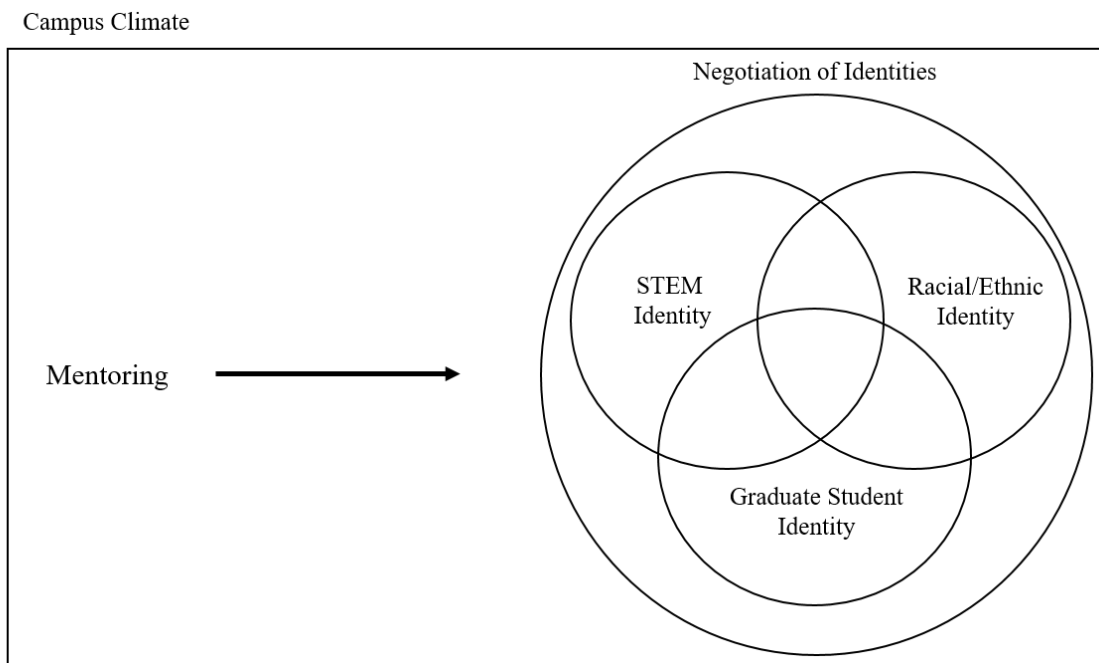
Figure 2.2 Negotiation of STEM, Racial/Ethnic, and Graduate Student Identities as Influenced by Campus Climate and Mentoring

2.10   Theoretical Perspectives

Social and cultural knowledge about how institutions function can be important, particularly in helping students navigate educational institutions (Calarco, 2011). Research has shown that education systems frequently reward students with particular skills and dispositions and marginalize those who do not possess similar skills (Gardner & Holley, 2011). Research also suggests that lack of social and cultural knowledge can lead to difficulty in developing and negotiating social and academic identities (Carlone & Johnson, 2007; Curl, Lareau, & Wu, 2012; Hall & Burns, 2009). Collectively, these findings suggest that individuals who do not possess the social and cultural knowledge about how institutions function may not only encounter challenges on how to make institutions work to their advantage, but also may be penalized for their lack of social and

cultural knowledge on how to navigate such institutions. Further, individuals' lack of

knowledge may also result in difficulty developing and negotiating academic and social

identities that could be pivotal to their persistence in the educational environment. In

order to explore how URM students pursuing graduate degrees in STEM negotiate

multiple identities and to investigate how that negotiation may be influenced by

mentoring and campus climate, this study was informed by two theoretical perspectives;

intersectionality (Crenshaw, 1989) and Stanton-Salazar's institutional agents framework

(Stanton-Salazar, 2011).

2.10.1 Intersectionality

Literature on academic and racial/ethnic identities indicates that minority students

often believe it is necessary to choose between a positive racial/ethnic identity and a

strong academic identity (Nasir & Saxe, 2003). In fact, research has demonstrated that

students of color sometimes feel the need to become "raceless' or mask their ethnicities

in classroom settings in order to achieve academic success (Davidson, 1996; Fordham &

Ogbu, 1986). Since the development of the science identity conceptual framework, a

growing body of research has begun to explore the concept of science identity in concert

with other social identities (Carlone & Johnson, 2007; Herrara, Hurtado, Garcia, &

Gasiewski, 2012; Tran, Herrera, and Gasiewski, 2011). Not only has this research better

informed how academic and social identities are developed, this research has also found

that URM graduate students in STEM may experience conflict when attempting to

reconcile their racial/ethnic identity with their identity as a scientist (Tran, Herrera, &

Gasiewski, 2011). In fact, Cobb (2004) found that some URM students who have

achieved academic success in STEM disciplines, but ultimately depart, do so because of the dissonance they experience between their racial/ethnic and STEM identities. Furthermore, the literature suggests that negotiation of multiple identities may influence the degree to which URM graduate students pursuing STEM degrees persist in educational settings. In light of the collective findings on racial/ethnic identity and STEM identity and how they influence the academic performance and persistence of URM graduate students, it is becoming increasingly important to understand how these students negotiate multiple identities. Therefore, the construct of intersectionality was used to inform how URM graduate students pursuing STEM degrees at PWIs negotiate their STEM, racial/ethnic, and graduate student identities.

Coined by critical race theorist, Kimberle` Crenshaw, intersectionality refers to various ways in which race and gender interact to shape the multiple dimensions of the experiences of Black women (Crenshaw, 1989; 1991). Since the concept was first introduced, however, various disciplines such as sociology (Anthias, 2013; Bonilla-Silva, 2013), feminist studies (Cho, Crenshaw, & McCall, 2013), and higher education (Fries-Britt, Johnson, & Burt, 2013; Museus & Griffin, 2011) have used intersectionality to explore other socially constructed identities and categories of differences such as institutional arrangements and social practices (Davis, 2008). Other identities that have been considered through the use of intersectionality include professional and academic identities or those associated with a career or academic discipline (Carlone, 2012; Herrera, Hurtado, Garcia & Gaiewski, 2013; Tannenbaum, 2015). Additionally, the concept of intersectionality has been advanced to recognize that an individual can possess

marginalized and privileged identities simultaneously (Collins, 1990) such as Black men

having male privilege, but not racial privilege. The central tenet of intersectionality posits

that multiple identities, like race and gender, are not separate, binary identities, but

instead collectively create a unique and complex interplay of identity with its own set of

distinctive issues (Crenshaw, 1991; Reynolds & Pope, 1991 Tannenbaum, 2015; Tran,

Herrera, & Gasiewski, 2011). Also important to the understanding of intersectionality is

the concept of power and how it shapes life opportunities and experiences of individuals

who possess multiple marginalized identities (Núñez, 2014).

2.10.1.1 Intersectionality in Higher Education

It is important to understand how the power dynamics embedded in institutions of

higher education influence the persistence of URM graduate students pursuing STEM

degrees. Employing an intersectionality lens to this study allowed the researcher not only

to consider these power dynamics, but also, take into account the structural oppression

that occurs for URM students pursuing STEM graduate degrees as they negotiate their

STEM, racial/ethnic, and graduate student identities (Núñez, 2015). Though not explicitly

stated as "intersectionality," higher education scholars have explored how the intersection

of multiple identities like race and gender have influenced the experiences of students

and faculty members in the academy. For example, Griffin and Reddick (2011) employed

intersectionality as a conceptual lens when they explored the mentoring patterns of Black

male and female faculty at PWIs. They found that sexism and racism played a role in

whether and how Black faculty mentored their male and female students. Additionally,

higher education scholars have used intersectionality and mixed methods approaches to

explore the complexities associated with how mixed heritage students identify both racially and ethnically (Harper, 2011). Furthermore, the intersection of race, gender, and social class have also been explored in the context of STEM disciplines (Fries-Britt, Johnson, & Burt, 2013).

2.10.1.2 Marginalized and Privileged Nature of STEM and Graduate Student Identities

One component of intersectionality is the exploration of social identities that can experience oppression and privilege simultaneously (Collins, 1990). Though the power, privilege, and social implications of race have been researched, explored, and documented in various disciplines from sociology to higher education, it is critical for this study to outline how both STEM and graduate student identity may be perceived as identities that can be considered both marginalized and oppressed in the context of STEM and the graduate education environment. STEM identity may be perceived as an oppressive or marginalized state because: 1) the normative and accepted definition of what it means to be a scientist is narrow, exclusive, and privileges certain dispositions and behaviors while dismissing others, (Carlone, 2012); 2) the benchmarks for being deemed a successful scientist are limiting in that they are implicitly structured by the lives of men and do not take into account marriage and parenthood (Grant, Kennelly, & Ward, 2000); and 3) the culture of STEM is largely socialized by majority populations and has the potential to promote dominant groups and marginalize minority individuals (Cobb, 2004). Collectively, these aforementioned points suggest that the definition of what it means to be a STEM scientist, what it means to be successful in STEM, and how STEM culture is socialized, is restrictive and limiting to individuals that may practice and

pursue science outside of accepted scientific norms, to women, or to marginalized populations.

In addition to STEM identity, graduate student identity may also be perceived as marginalized in the context of higher education because: 1) the overall graduate education experience and timely completion of the graduate degree are largely based upon the relationship with an advisor who is superior to the student in level of education and in the hierarchy of the university (Zhao, Golde, & McCormick, 2007); 2) the graduate advisor of a student is also often the boss or supervisor or a research or teaching assistantship (Zhao, Golde, & McCormick, 2007); and 3) like STEM, the graduate environment is largely socialized by the majority population and may result in the marginalization of minority students (Lovitts, 2005). Collectively, these points suggest that the successful matriculation of graduate students is largely dependent upon the discretion of an advisor who holds more social status and power in the educational hierarchy of the university. Additionally, students of underrepresented populations in graduate school may be marginalized which has been found to lead to attrition (Gay, 2004). Though the oppressive nature of both STEM and graduate student identities have been outlined, it is also key to emphasize that being a STEM scientist and graduate student can also be considered identities of privilege as they too, may increase both the social status and power of the individuals possessing the identities. To that end, intersectionality proved to be an appropriate theoretical perspective for this study as it allowed the researcher to examine the power dynamics associated with racial/ethnic,

STEM, and graduate student identities, but also provided a framework to guide the investigation of the unique interactions that occurs among the three identities.

2.10.2 Institutional Agents Framework

Research has shown that institutional agents can be a critical factor in the academic success of URM students (Museus & Neville, 2012; Museus & Quaye, 2009; Museus & Ravello, 2010). Defined through a social capital lens, an institutional agent is as an individual who possesses high levels of social and cultural capital and has the capacity to work on behalf of others to facilitate or transmit valuable resources, privileges, opportunities, and services (Stanton-Salazar, 2011). For URM students pursuing graduate degrees in STEM, the acquisition of social and cultural capital is key as it provides them with access to resources and opportunities that can influence how they negotiate the academic and disciplinary environments and their ultimate persistence as a graduate student (Gasiewski, Herrera, Mosqueda, Hurtado, & Chang, 2011). Social capital is defined as the sum of actual and potential resources that can be mobilized through membership in social networks, whereas, cultural capital is described as long standing dispositions and habits that are acquired through the socialization process (Anheier, Gerhards, & Romo, 1995). In the context of graduate students pursuing STEM degrees, social and cultural capital can include institutional discourses that are recognized by other peers and scholars, knowledge about the operation of the educational system, and access to influential people or groups in the scientific community (Gasiewski et al., 2011). In fact, some scholars have referred to institutional discourses as "identity kits" that demonstrate how to act, talk, and write in a manner that is recognized by the majority

(Gee, 1989). Acknowledging that many URM graduate students are the first in their families to obtain advanced post-secondary degrees, particularly doctoral degrees, the social and cultural capital available to them, and hence, their knowledge about how to make academic institutions work to their advantage is often lacking (Hoffer et.al, 2003). However, for STEM students pursuing graduate degrees, individuals such as faculty members, upperclassmen, peers, and post-doctoral researchers, can serve as institutional agents, thereby increasing social and cultural capital and positively influencing the likelihood of academic success. Many of the characteristics and activities associated with serving as an institutional agent are well aligned with the literature and scholarship of mentoring. In fact, in his early work on institutional agents, Stanton-Salazar (1997) outlined six key forms of institutional support informed by the mentoring literature which included: 1) the provision of various funds of knowledge, 2) bridging, 3) advocacy, 4) role modeling, 5) emotional and moral support, and 6) evaluative feedback, advice, and guidance. Consequently, Stanton-Salazar's framework, which is heavily influenced by the mentoring literature, was used to operationalize the role of mentoring in this study (Stanton-Salazar, 1997).

Institutional Agents Framework (IAF) is a social capital framework originally developed through research focused on the academic achievement and empowerment of low income and minority youths in K-12 educational settings. IAF describes the means by which institutional agents can provide institutional support and resources to marginalized individuals to enhance social and cultural capital, hence, increasing their likelihood for academic success. Institutional support enables individuals to become active participants within an institutional structure and to gain access to networks that

support social mobility, achievement, and empowerment (Stanton-Salazar, 2011).

Resources provided by institutional agents are available in two forms, positional and

personal. Positional resources are those that are specifically tied to the position held by

the institutional agent, whereas, personal resources are those held by the institutional

agents themselves and are unrelated to a position within an organization. In the context of

URM students pursuing graduate degrees in STEM disciplines, institutional agents are

key to helping individuals gain the social and cultural capital necessary to successfully

navigate and advance through both universities and STEM departments.

In addition to providing institutional support, institutional agents can also perform

multiple roles to meet multiple institutional support needs. IAF defines four types of

institutional support, and defines 14 distinct roles by which individuals can serve as

institutional agents (Figure 2.3). The four types of institutional support include: 1) direct

support, 2) integrative support, 3) system developer support, and 4) system linkage and

networking support. The 14 institutional agent roles include: 1) resource agent, 2)

knowledge agent, 3) advisor, 4) advocate, 5) networking coach, 6) integrative agent,

7) cultural guide, 8) program developer, 9) lobbyist, 10) political advocate, 11) recruiter,

12) bridging agent, 13) institutional broker, and 14) coordinator (Table 2.2). In addition

to the types of institutional support and various agent roles defined by IAF, the

framework also postulates that an institutional agent can engage in both multistranded

and multiplex relationships. Multistranded relationships are characterized by a

relationship wherein the institutional agent plays multiple roles such as teacher, coach,

counselor, advocate, etc. Multiplex relationships are complementary to multistranded

relationships and are characterized as relationships that can provide a spectrum of institutional support to students such as direct and integrative support. By definition, the classic role of mentor encompasses both multistranded and multiplex relationships (Stanton-Salazar, 2011). For URM students pursuing graduate degrees in STEM, the complementary definitions of multistranded and multiplex relationships indicate that an academic advisor, for example, can also serve as a resource, knowledge agent, and cultural guide while also providing forms of direct, integrative, and networking support.
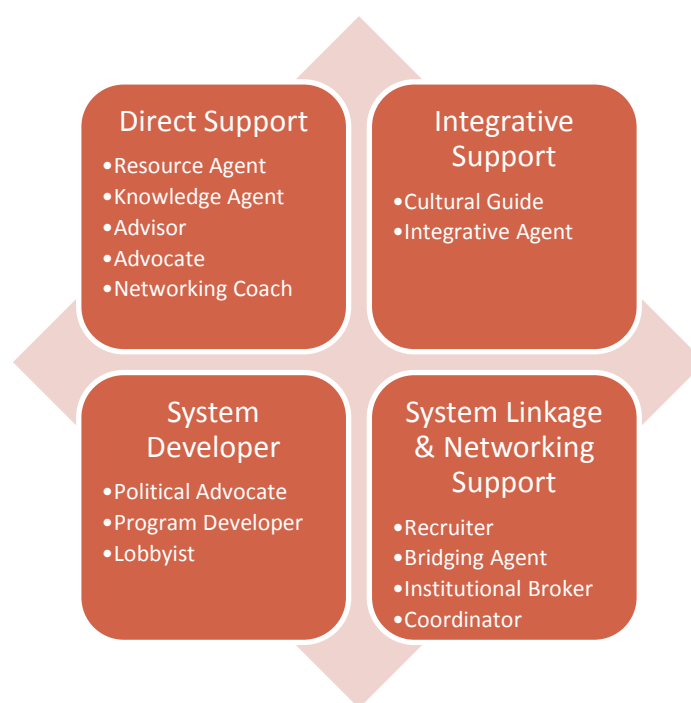
Figure 2.3 Institutional Agent Types and Roles

The Institutional Agents Framework was selected as an appropriate theoretical perspective for this study as it is largely influenced by mentoring scholarship and allows the close examination of the role that institutional agents play in the persistence of URM students pursuing graduate degrees in STEM disciplines. Since the Institutional Agents

Framework is a social capital framework, it also permits the opportunity to explore how social relationships and enhanced social capital may be associated with successfully navigating educational institutions and attaining academic success (Stanton-Salazar, 2004), particularly for URM students pursuing graduate degrees in STEM disciplines.

Table 2.2
Institutional Agent Roles and Characteristics

Type of Support	Role	Description
	Resource Agent	Provides or utilizes personal and positional resources to students.
		Teaches students to network.
	Networking Coach	Models networking behavior.
		Develops relationships with influential people.
Direct Support		Guides decision making.
	Advisor	Helps students gather information.
		Assesses problems and solutions collaboratively.
	Advocate	Promotes and protects their students.
	Knowledge Agent	Knows the system and provides knowledge about navigating the system.
	Cultural Guide	Guides students through new social situations.
Integrative Support		Teaches students to identify key people in in a particular cultural sphere.
	Integrative Agent	Coordinates students' integration and participation in disciplinary networks.

Table 2.2 continued

System Developer	Political Advocate	Joins political action groups that advocate for policies and resources that benefit targeted groups of students.
	Program Developer	Develops programs that embed students in a system of agents, resources, and opportunities.
	Lobbyist	Lobbies for organization resources to be directed toward recruiting and supporting students.
System Linkage & Networking Support	Recruiter	Actively recruits students into programs, departments, etc. Introduces students to institutional agents.
	Bridging Agent	Has strong social network. Familiar with what key players' behavior.
	Institutional Broker	Negotiates introductions and agreements between parties. Knows available resources and who controls them. Assesses students' needs. Identifies resources to address student needs.
	Coordinator	Provides or accesses institutional resources on behalf of students. Ensures students utilize resources effectively.

Note. Adapted from Stanton-Salazar (2011) Institutional Agents Framework and Bensimon & Dowd (2012).

2.11   Need for the Study

Transitioning baccalaureate graduates to advanced post-secondary studies in top graduate programs is key to helping the U.S. maintain its global influence in science and technology (NRC, 2007). Further, as the need to diversify and grow the U.S. STEM workforce becomes increasingly important (NRC, 2011), it is essential that scholars begin to focus more on the factors that both support and hinder the persistence of URM students in STEM graduate programs (Figueroa, 2015). However, as expressed throughout the chapter, there is little research that explores URM graduate students pursuing STEM degrees. Therefore, the current study contributes to the body of scholarship on the experiences of URMs pursuing graduate degrees in STEM disciplines.

Additionally, understanding how URM graduate students pursuing STEM degrees negotiate their racial/ethnic, STEM, and graduate student identities is important. Both STEM identity and racial/ethnic identity have been established in the literature, and have been explored collectively. In fact, one reason that URM students who perform well in the sciences but ultimately leave is because of the disconnect they feel between who they are and who they want to become (Cobb, 2004). Additionally, research has found that students of color often feel the need to mask their race/ethnicity to be successful in the sciences (Fordham & Ogbu, 1986). However, to date, no studies were found that operationalized the role, position, and expectations of graduate students as an identity in itself. Therefore, no studies were found that explore the intersection of STEM identity, racial/ethnic identity, and graduate student identity collectively. As such, the current

study will help to enhance understanding around how students successfully negotiate their collective racial/ethnic, STEM, and graduate students identities.

Finally, few studies have explored the URM graduate student STEM population, and even fewer focus on how institutional factors, like campus climate and mentoring, may influence URMs pursuing graduate degrees in STEM disciplines. Available scholarship has demonstrated that campus racial climate does influence, both negatively and positively, the persistence of URM students pursuing STEM degrees (Espinosa, 2011; Strayhorn, 2013). Additionally, the literature demonstrates that mentoring can help to overcome the challenges associated with being a URM, a graduate student, and a STEM student (Figueroa & Hurtado, 2014, Gardner 2008; Golde 2005), therefore, it can be presumed that effective mentoring can be beneficial to students who possess all three identities. There is a paucity of research, however, that specifically explores the role of campus climate and mentoring on URM graduate students pursuing STEM degrees. This study will be important as it will help to fill the gaps in the literature focused on URM graduate students pursuing STEM degrees and the degree to which campus climate and mentoring influence students' ability to negotiate multiple identities.

2.12   Chapter Summary

This chapter included the literature review methodology, purpose of the study, and research questions. It also provided literature on the current state of affairs for URM students pursuing STEM graduate degrees, specifically, barriers and challenges associated with persistence in graduate programs. This study also included literature

specific to URMs in the STEM disciplines. These challenges include "chilly" climate, lack of mentoring, lack of disciplinary integration, and feelings of isolation.

This chapter also provided a review of literature on three primary topics, identity, campus racial climate, and mentoring. The concept of identity was operationalized using Gee's (2000) framework. Literature on campus racial climate was also reviewed where Hurtado's (1994b) framework for campus racial climate was highlighted. This framework suggests that campus racial climate is composed of multidimensional contexts including institutional context and external context. Finally, mentoring literature was reviewed where Jacobi's (1991) five characteristics of mentoring were shared as well as information on types of mentoring including formal and informal mentoring and peer mentoring and faculty mentoring.

Intersectionality (Crenshaw, 1989) and the Institutional Agents Framework (Stanton-Salazar, 2011) were presented as theoretical perspectives to guide the study. Intersectionality aims to explain how binary identities come together to form a unique interplay of identities. IAF describes how institutional agents can provide institutional support to individuals by playing multiple roles in multiple contexts. Collectively, these theoretical perspectives inform the conceptual framework for the study which suggests that mentoring within a larger context of campus racial climate may play a role in the negotiation of racial/ethnic, STEM, and graduate student identities for URM graduate students pursuing STEM degrees.

CHAPTER 3. METHODOLOGY

3.1   Chapter Overview

This chapter provides an overview of the research procedures and methods employed to conduct this study. Specifically, this chapter will describe the methods and procedures employed along with the rationale as to why they were deemed most appropriate to address the research questions. It will also describe the site of the data collection and the participants selected for the study. Additionally, it will address the method employed to collect data and the measures utilized to ensure trustworthiness of the study. Finally, the chapter will conclude with a section on the role of the researcher as well as the description of data management and data analysis techniques.

3.2   Purpose of the Study

The purpose of this study was to explore the negotiation of STEM, racial/ethnic, and graduate student identities among URM graduate students pursuing STEM degrees at a predominantly white research institution. Further, this study sought to explore the role of mentoring and campus climate in the negotiation of STEM, racial/ethnic, and graduate student identities.

3.3   Research Questions

1. What are the student and faculty demographic characteristics in the STEM departments of the predominantly white research institution in this study?

2. What are the completion rates of the URM graduate students majoring in STEM disciplines at the predominantly white research institution in this study?

3. How do URM graduate students pursuing STEM degrees make meaning of their STEM, racial/ethnic, and graduate student identities?

4. How do URM graduate students pursuing STEM degrees negotiate their STEM, racial/ethnic, and graduate student identities?

5. What role does campus climate play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

6. What role does mentoring play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

3.4   Qualitative Methodology

Qualitative methodology was selected for this study as it was deemed the most appropriate approach to address the research questions. Qualitative research, as defined by Denzin and Lincoln (2005), is "a situated activity that locates the observer in the world" (p. 3). As characterized by Patton (2015), qualitative inquiry explores how people construct and attach meaning to experiences, captures stories and narratives to help understand people's experiences and perspectives, and provides insight into why and how context matters. Qualitative research is also described as naturalistic, meaning that the

researcher observes the phenomenon of interest in its natural context with little manipulation to the setting of the research and with no preconceived hypotheses as established by the researcher (Patton, 2015). Perhaps, one of the most distinct features of qualitative research is its focus on garnering rich descriptions of individuals' experiences in the social world as opposed to generating generalizable, statistical based conclusions of quantitative inquiry.

3.4.1 Case Study

A case study design was deemed most appropriate for this research. A case study is defined as an empirical inquiry about a contemporary phenomenon within its real-world context where the boundaries between phenomenon and context are not clearly distinct (Yin, 2009). Case studies are often employed when researchers are interested in gaining an in-depth understanding about a real-life occurrence where context is highly pertinent to the phenomenon under study (Yin & Davis, 2007). Additionally, since the delineation between context and phenomenon is not always apparent, case studies benefit from theoretical perspectives which help to guide data collection and analysis (Yin, 2009). The purpose of using a case study design was not to generalize results to other PWIs, but rather to explore the specific and unique factors that contribute to the successful negotiation of racial/ethnic, STEM, and graduate student identities of URM students pursuing STEM graduate degrees at PWIs, a goal that is well-supported by case study methodology (Merriam, 1998). This study was a single case study design with embedded units of analysis, where the case is defined as the academic environment for URM graduate students pursuing STEM degrees and the embedded units of analysis

being the actual students. The rationale for using a single case design focused on a single

higher education institution is two-fold: 1) this case is unique as it has a history of

producing a significant number of URM students with degrees in the STEM disciplines,

and 2) the case is revelatory as campus climate and mentoring have not been explored in

terms of their influence on the identity negotiation of URM students pursuing STEM

graduate degrees.

3.5 Data Collection

In accordance with Yin (2009), before conducting a case study, the development

of a data collection protocol is key as it enhances the reliability of the study and provides

guidance for the researcher. Additionally, Yin highlighted the importance of collecting

multiple sources of evidence to enable triangulation. Therefore, this section will discuss

the case selected for the study, sampling methodology used to recruit study participants,

and the interview procedures and questions. This section will also address research

questions one and two as they were designed to garner information needed for the

description of the case. These questions are what Stake (1995) refers to as topical

research questions.

3.5.1 Case Selection

The case selected for this study is a public, predominately white university

classified by the Carnegie Foundation as a research university with high research capacity

located on the East Coast. The university enrolls approximately 14,000 students,

consisting of 11,000 undergraduate and 3,000 graduate students. The undergraduate

population is 44% White, 20% Asian, 17% Black, and 6% Hispanic. The gender

breakdown is about 50% male and 50% female. The graduate population is similar with

49% White, 12% Black, 8% Asian, and 4% Hispanic. The gender breakdown for the

graduate population is also similar with 51% male and 49% female. The percentage of

Native American and Native Hawaiian/Pacific Islander students in both the

undergraduate and graduate populations is less than one percent. The university was

selected for this study as it has a national reputation not only for successfully producing

URM students in the STEM disciplines, but producing the largest number of African-

American baccalaureate degree recipients that go on to receive doctoral degrees in the

STEM disciplines. The site was also selected as it is well-known for its programs and

initiatives that provide instrumental and psychosocial support to URM graduate students

in an effort to enhance the number and diversity of doctoral recipients in the STEM

disciplines.

3.5.1.1   Student and Faculty Demographics in STEM Graduate Programs

Demographic data for enrollment in STEM graduate programs was provided by

the Office of Institutional Research at the study site. While enrollment data was provided

for all graduate programs, the data of interest for this study was limited to the enrollment

of students in STEM graduate programs. A total of 19 programs were identified and

include: Applied Mathematics, Atmospheric Physics, Biochemistry, Biological Sciences,

Chemical and Biological Engineering, Chemistry, Computer Engineering, Computer

Science, Electrical Engineering, Environmental Engineering, Human-Centered

Computing, Information Systems, Marine-Estuarine Environmental Science, Mechanical

Engineering, Molecular and Cell Biology, Neurosciences and Cognitive Sciences,

Physics, Statistics, and System Engineering. The demographic data in Figure 3.1 is based

on the Fall 2015 enrollment of the study site. As depicted, international students comprise

the largest category of students enrolled in STEM graduate programs at the study site

with a total of 452 students, followed by White students with a total of 323 students.

Black and Asian enrollments are the same with 65 graduate students enrolled

respectively. Hispanic enrollment is 23 students followed by nine students who identify

as Two or More Races, four students who identify as Native Hawaiian/Pacific Islander,

and two students identifying as Native American.
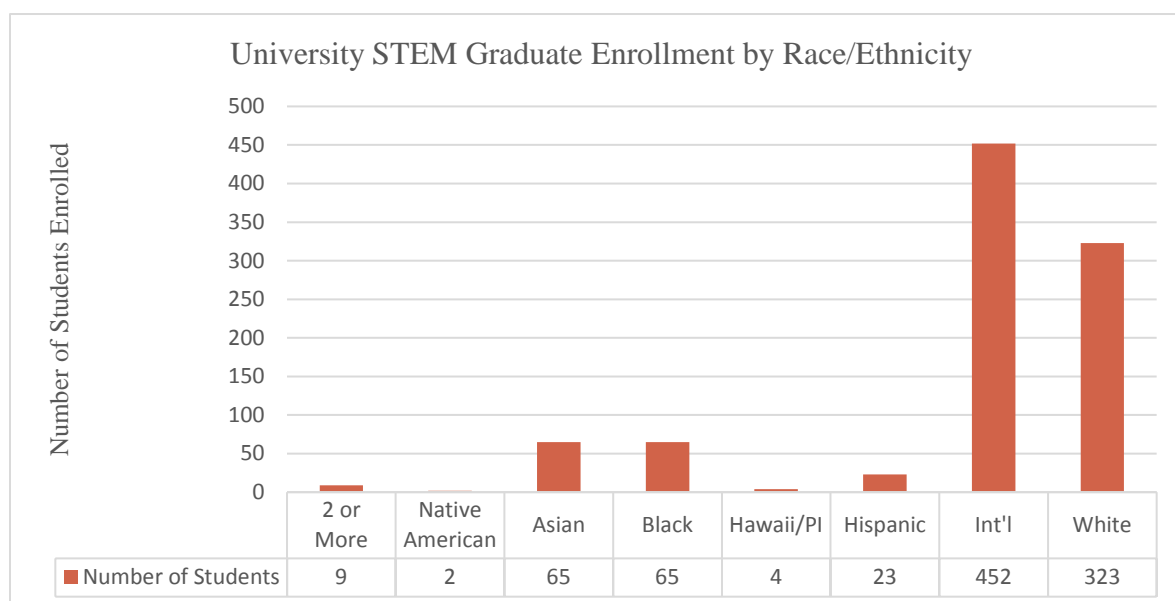
Figure 3.1 University STEM Graduate Enrollment by Race/Ethnicity

Demographic data for faculty specifically in STEM graduate programs was not

provided by the university. However, overall faculty demographic data was available and

is depicted in Figure 3.2 below. This data was also provided by the Office of Institutional

Research at the study site. As depicted, the largest number of faculty members are White

with 387 faculty members, followed by Asian faculty members at 75. There are 33 Black

faculty members followed by 16 Hispanic, 14 international, and two who identify as 2 or

More Races. According to the data, there are no faculty members who identify as Native

American or Hawaiian/Pacific Islander.
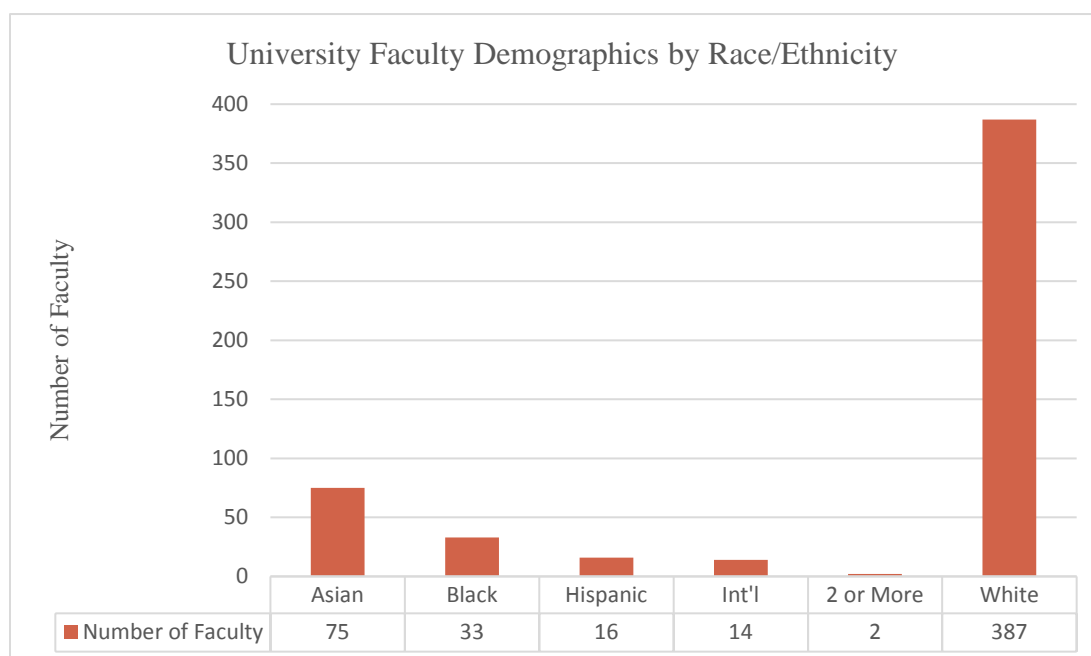
Figure 3.2 University Faculty Demographics by Race/Ethnicity

3.5.1.2   Completion for URM STEM Students in Graduate Programs

Completion data for enrollment in STEM graduate programs was provided by the

Office of Institutional Research at the study site. While completion data was provided

for all graduate programs, the data of interest for this study was only the completion of

URM students in STEM graduate programs. A total of 19 programs were identified and

include: Applied Mathematics, Atmospheric Physics, Biochemistry, Biological Sciences,

Chemical and Biological Engineering, Chemistry, Computer Engineering, Computer

Science, Electrical Engineering, Environmental Engineering, Human-Centered

Computing, Information Systems, Marine-Estuarine Environmental Science, Mechanical

Engineering, Molecular and Cell Biology, Neurosciences and Cognitive Sciences,

Physics, Statistics, and System Engineering. As depicted in Figure 3.3, all of the

racial/ethnic groups, with the exception of Native Americans and Hawaiian/Pacific

Islanders, experienced an overall increase in completion from 2011-2015. In terms of

URM students, Blacks have the largest number of students reaching completion with a

total of 27 followed by Hispanics with a total of 3 students reaching completion in 2015.

University URM STEM Completion, 2011-2015

	2011	2012	2013	2014	2015
Native American	1	0	0	1	0
Asian	17	20	19	16	25
Black	22	20	20	18	27
Hawaii/Pacific Islander	3	0	1	1	0
Hispanic	2	4	5	3	3
Int'l	93	102	103	80	138
White	70	109	90	87	94
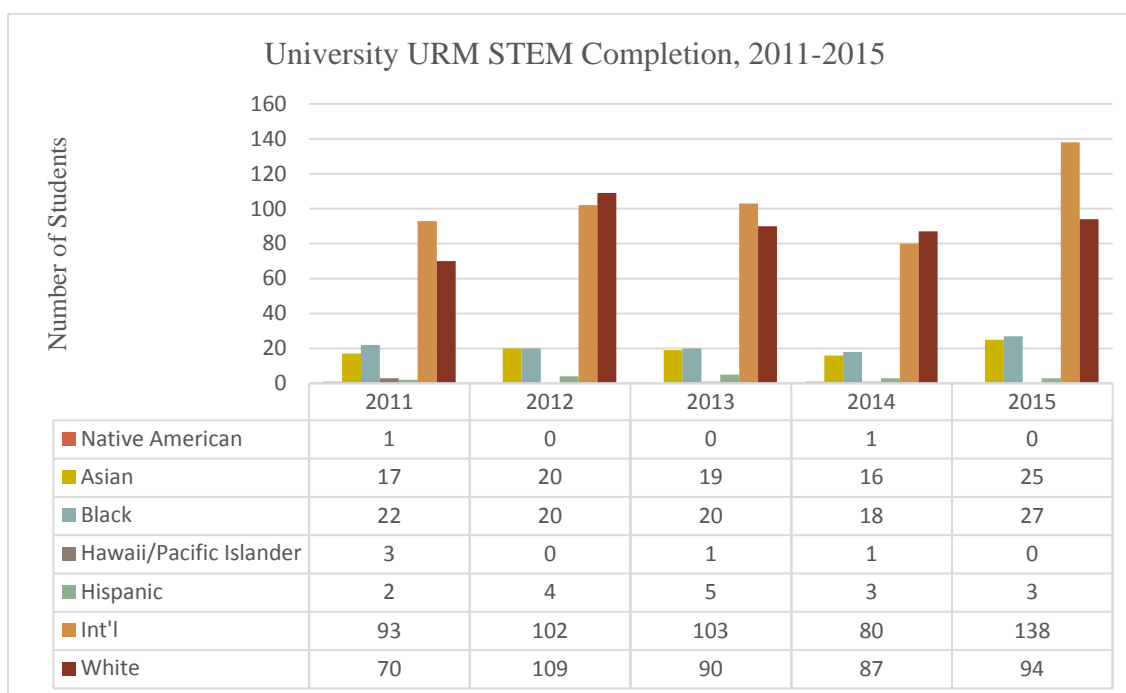
Figure 3.3 University URM STEM Completion, 2011-2015

3.5.2   Study Participants

Purposive sampling was used to recruit study participants (embedded units of

analysis) for this single-case study. Not only is purposive sampling a key design strategy

for qualitative research, but it also allows the researcher to select information-rich cases,

that by nature and substance, will illuminate the research questions being explored

(Patton, 2015). In qualitative research, because information-rich cases are more important

than sample size (Patton, 2015), 10 participants were targeted for recruitment and

inclusion in the study in an effort to meet Seidman's (2013) criteria of sufficiency and

saturation. Sufficiency refers to an adequate number of participants that reflect the range

of participants and saturation refers to the point at which the researcher begins to gather

the same information during data collection (Seidman, 2013). Ten participants not only

allowed the inclusion of at least two individuals from each STEM discipline, but also

provided an opportunity for equal representation of all URM groups and gender. URM

students pursuing a graduate degree in a STEM discipline at the university selected as the

case for the study were the target population. Study participants also had to meet the

following criteria to be selected for the study: 1) were a full-time and domestic student, 2)

were enrolled in a master's or doctoral degree program for at least one year, and 3) were

a URM student (African-American, Hispanic, Native American, and Native

Hawaiian/Pacific Islander). Study participants were recruited through a government-

funded grant program designed to increase the presence of URM doctoral degree

recipients in the STEM disciplines. The researcher worked closely with the program

director of one institutional support program for URM graduate students in STEM to gain

endorsement and to cultivate trust with the program participants (Marshall & Rossman,

2011). The program director disseminated the invitation to participate in the study via an

email listserv that provides information to all program participants (Appendix A).

Specifically, the program director copied and pasted the invitation to participate in an

email bearing her signature, demonstrating her endorsement and support for students to

volunteer as study participants. Students who met the criteria and who were willing to participate were instructed to contact the researcher directly, where they were provided with additional details about the study and information about the scheduling of interviews. A total of 13 students volunteered to participate in the study, however, due to scheduling conflicts, a total of ten students participated in the study. Upon confirmation of the first interview, the participants were also sent reminder emails on the morning of their scheduled interview. Demographic information for the study participants is provided in Table 3.1.

Table 3.1

Demographic Characteristics of Study Participants

Pseudonym	Sex	Race/Ethnicity	Major	Classification
Alana	Female	African-American & Asian	Chemistry	Doctoral Student
Angelina	Female	African-American	Neurosciences & Cognitive Sciences	Doctoral Student
Ayax	Male	Hispanic	Mechanical Engineering	Doctoral Student
Carlos	Male	Hispanic	Biological Sciences	Doctoral Student
Dave	Male	African-American	Human-Centered Computing	Doctoral Student
Lacy	Female	African-American	Analytical Chemistry	Doctoral Student
James	Male	African-American	Mechanical Engineering	Doctoral Student
Michael	Male	African-American	Human-Centered Computing	Doctoral Student
Sonny	Male	Hispanic	Mechanical Engineering	Doctoral Student
Summer Bright	Female	African-American	Biochemistry	Doctoral Student

3.5.3 Data Collection Methods

As discussed by Yin (2009) and Stake (2005), the collection of multiple sources of data to enable triangulation is important in conducting case studies. In-depth, guided interviews were used as the primary method of data collection in this study.

Documentation and casual direct observation were also used to collect data. Additionally, a questionnaire was used to collect demographic and educational background information from the participants such as race, gender, classification, and educational attainment. (Appendix B). The participants also selected their own pseudonyms during the completion of the demographic and educational background questionnaire.

A phenomenological approach was used to conduct in-depth guided interviews. Seidman (2013) suggested that the goal of in-depth interviewing is not to simply get answers to questions, but to gain an understanding of an individual's experience and how he or she makes meaning of the experience. The goal of phenomenological interviewing is to have participants reconstruct and recount experiences within the topic of interest by asking open-ended questions. As such, using a phenomenological approach to interviewing allowed the researcher to focus on how URM students pursuing graduate degrees in STEM disciplines negotiate multiple identities, but also how they make meaning of that experience (Seidman, 2013). It is important that researchers using a phenomenological approach acknowledge and bracket their own experiences from those they are interviewing to gain clarity on any personal preconceptions. This phase of the research is called epoche' and can be found at the conclusion of this chapter.

In qualitative inquiry, interviews are used to gain insight and understanding into another person's perspective and experiences (Patton, 2015). The guided interview approach, a method by which the researcher plans to cover pre-selected topics, issues, and questions, was used to conduct interviews (Patton, 2015). Additionally, a modified version of Siedman's (2013) three-interview series was employed. Prior to the first

interview, participants were asked to read and sign a consent form outlining the purpose

of the research, the benefits and risks associated with participation, and details related to

confidentiality. The consent form also clearly stated that participation was strictly

voluntary and that participants' were free to withdraw at any time (Appendix C). Upon

signing the consent form, each participant also completed a student information

questionnaire including demographic and educational background information. After

completion of the student information form, the researcher briefly described the research

project, introduced herself and described her path to becoming a doctoral student, and

proceeded with the first interview. Each participant was interviewed in two, one-hour,

face-to-face sessions. The first interview was designed to build rapport with the

participant, and to learn about the background of the participant, how they came to their

current position as a graduate student pursuing a STEM degree, and their experience as a

URM graduate student pursuing a STEM degree. The interview protocol and questions

can be found in Appendix D. The first interview was called the life history and

experience interview (Seidman, 2013). The purpose of the second interview was to

explore what it meant to the participants to be a URM graduate student pursuing a STEM

degree and how he/she make sense of their experiences (Seidman, 2013). This interview

is referred to as the reflection and meaning interview. The interview protocol and

questions can be found in Appendix E. Each of the interviews was audio recorded and

transcribed by a third party service. The researcher also took notes during the interviews

to capture the body language and expressions of the participants that the audio recording

could not capture. The time between interview one and two was approximately one

week. This time interval is recommended by Seidman (2013) as it allowed time for the

participant to think about the previous interview, but not lose connection between the two.

Yin (2009) has suggested that documentation is likely relevant to any case study. Including university documentation in the case study data not only provides broad coverage of the institution over time, but is exact and not subject to the bias of the researcher. Hence, institutional research data was used to address research questions one and two. Stake (1995) suggested that topical questions should be included as research questions to call for information that is important to provide context and description of the case. As such, the institutional data from the study site were used to provide context into graduate student and faculty demographics and retention and graduation rates of URM graduate students pursuing STEM degrees.

3.6   Data Analysis

All of the interviews were transcribed by a third party transcription service, checked for accuracy, and imported into NVivo 11 qualitative software to aid in data management and analysis. This software allowed the researcher to highlight portions of the transcripts that represented each code and also allowed for categorization of the coded text into thematic labels. In addition to organizing the data by codes and themes, the software also allowed the researcher to go back to the original transcript to view the original context from which the quotes were taken.

To begin the coding of the data, the transcripts were first read line by line to enhance familiarity with the data. Also, reading the transcripts allowed the researcher to

pre-code the data by circling, highlighting, and underlining phrases and quotes that were

notable and could be used as evidence when presenting results (Layder, 1998). A

preliminary review of the data enabled the researcher to write down words and phrases

for analytic consideration later in the analysis of the data (Saldaña, 2013). Both inductive

and deductive approaches were used to analyze the interview transcripts and identify

emerging codes and themes. First, codes and themes were gleaned from the conceptual

framework and theoretical perspectives used to guide the study which included

"mentoring," "campus climate," "STEM identity," "racial/ethnic identity," and "graduate

student identity." Codes and themes related to the intersections of the identities were

gleaned deductively as well including, "intersection between STEM and graduate student

identity," intersection between STEM and racial/ethnic identity," "intersection between

graduate student and racial/ethnic identity," and "intersection between STEM,

racial/ethnic, and graduate student identities. Descriptive coding methodology (Miles &

Huberman, 1994; Saldana, 2003; Wolcott, 1994) was also used to identify recurring

codes and themes found throughout the transcripts. A few examples of codes gleaned

inductively include "intersection between race and gender," "identity conflict between

race and discipline, "independent and isolating nature of STEM and graduate student

identities." This methodology is also referred to as topic coding and focuses on what is

written or talked about, rather than the content of the substance of the message.

Collectively, the codes and themes garnered through these processes were used to begin

developing a codebook. Through several iterations, the codes were defined and re-

defined to describe the characteristics for each code and to ensure consistency throughout

the coding process (Charmaz, 2006). This information was also used to create 'nodes' in

the qualitative software to enable chunks or portions of texts to be selected and

categorized during the coding process. The second cycle of coding was completed using

pattern coding (Miles & Huberman, 1994). This methodology is complementary to

descriptive coding and provides a way for grouping data and gleaning themes and

constructs.

3.7 Trustworthiness of the Study

Lincoln and Guba's (1985) four criteria for trustworthiness: credibility,

confirmability, transferability, and dependability, were used to design the study and

analyze the data. Credibility can be established by employing strategies such as

prolonged engagement, member checking, and triangulation. For this study, prolonged

engagement was achieved by conducting two, 60-minute interviews with each of the

study participants over a two-week time period. After each interview, the researcher

summarized the interview in a one-page document and shared it with the participant

requesting that he or she review for accuracy; this process helped to achieve credibility

through a strategy called member checking. Additionally, as described above, the

researcher triangulated the data by collecting and analyzing multiple sources of data such

as the institutional data and the interview data. Confirmability is characterized as the

researcher's ability to conduct a study in a manner that is objective. As such, not only

was a protocol for the case study developed, but individual protocols for each of the

interviews were also developed. Additionally, Patton (2015) has suggested that

identifying and recording emergent insights during data collection are important

components of fieldwork and analysis. Therefore, field and observation notes were

summarized after each interview to capture the researcher's immediate perceptions of each interview session. Due to the nature of qualitative inquiry, transferability is a component that is problematic in nature as qualitative research is not designed to make broad generalizations. However, to achieve transferability to the best extent possible, this study employed triangulation to help corroborate the research in question (Marshall & Rossman, 2011). Also, the coding methodologies employed allowed the researcher to provide thick descriptions of the participants' experiences, hence, enabling other researchers to apply what Kennedy (1979) refers to as second decision span generalizing. This places the onus of transferability on the researcher who is attempting to transfer the findings, not on the researcher who conducted the original research. Dependability refers to the consistency and repeatability of the findings. This was established through the maintenance of written and electronic notes outlining the rationale and subsequent execution of all phases of the study.

3.8   Role of the Researcher

The nature of qualitative inquiry not only requires that researchers themselves serve as the instrument by which data is collected and analyzed, but asserts that the inquirer must be sensitive to his or her own identities, culture, and personal experiences as they may shape interpretations of the data (Creswell, 2014; Marshall & Rossman, 2011). As such, several academic experiences have influenced my interest in studying URM graduate students pursuing STEM degrees at predominantly white research institutions. Further, these experiences played a major role in why I specifically explored identity negotiation, mentoring, and campus climate. First, as an undergraduate student at

an HBCU, I majored in a STEM-based agricultural science discipline and my identity both as an African American and STEM-scientist was nurtured and supported by mentors and peers who shared similar cultural experiences with me. Faculty members provided instrumental support that socialized me to the discourses that were recognized in my discipline, gave me access to other career STEM scientists, and employed culturally relevant pedagogy which allowed me to see myself and my culture throughout the curriculum. Through student groups and organizations, my peers were not competitive, but provided the psychosocial support required to help me overcome personal and academic challenges. These experiences not only prepared me academically and personally, but gave me the social capital required to successfully pursue and complete a graduate degree at a PWI.

Second, when I became a master's student pursuing a STEM-based agricultural degree at a PWI, I quickly realized that the faculty, the student body, and the curriculum were largely devoid of color, and therefore lacked cultural relevance to what I hoped would be my professional career. Through peer mentorship and several faculty mentors of varying ages, race/ethnicities, sex, and professional backgrounds, I received the tools that helped to negate and overcome feelings of isolation, tense racial climate, and loneliness often encountered by URM graduate students pursuing STEM degrees at PWIs. My interaction with peers also helped me to realize that my positive experiences were an exception to the countless negative experiences faced by other URM students.

Finally, as an African American doctoral student, through personal experience, discussions with peers, and conducting research, I am well aware of the barriers and

challenges associated with pursuing a graduate degree. However, I am also mindful of the advantages of having mentors who provide me with the academic and professional resources that enhance my social capital and enable me to successfully navigate social and disciplinary circles. Additionally, I am aware of the experiences that taught me how to successfully negotiate the many institutional contexts that I find myself in as a URM student, as a graduate student, and as a scientist. Collectively, these experiences shaped the way in which I interpreted the data collected for this study. Furthermore, these experiences guided the ways in which I gained entry and cultivated trust with the participants in this study.

3.9   Limitations

Despite the steps taken to ensure rigor and trustworthiness of the study, it is important to consider the limitations when reviewing the findings of the study in the following chapter. First, although the researcher worked to establish a positive rapport with the study participants and negotiated entry through a respected member of the community of URM students pursuing graduate degrees at the university, engaging in cross-racial or cross cultural interviewing as well as interviewing individuals of a different gender, class, and age can introduce tensions that hinder an effective interview (Seidman, 2013). Further, because the study focused on URM students, participants may have been hesitant to speak openly and freely about their experiences due to perceived negative reactions from the researcher or feelings of negative repercussions. Finally, when conducting a case study, it is important to collect multiple forms of data to allow for triangulation. However, this study was conducted by one individual in a limited time

frame, which did not allow for more prolonged engagement and more data collected from multiple sources.

CHAPTER 4. RESULTS

4.1   Chapter Overview

This chapter will present the findings of this qualitative case study. First, the chapter will provide a review of the purpose of study as well as the research questions that guided the study. In an effort to understand how URM graduate students in STEM negotiate and make meaning of multiple identities, findings will be presented in four thematic areas: 1) how students understand their multiple identities, 2) how students' identities intersect and the behaviors students' use to negotiate multiple identities, 3) institutional support mechanisms that shape students' perspective of campus climate, and 4) mentors as institutional agents. These thematic areas will address research questions three through six, as research questions one and two were topical questions and were addressed in chapter three. It is important to note that the participants referenced the names of two institutional support programs throughout the duration of their interviews. In an effort to maintain the confidentiality of the study site and the participants, the programs will be referred to as Institutional Support Program 1 (ISSP 1) and Institutional Support Program 2 (ISSP 2).

The first theme, *Understanding My Identities*, highlights how the study participants described the characteristics, roles and responsibilities, and experiences they associated with their STEM and graduate student identities. The second theme

Intersection and Negotiation will describe the study participants' experience with the intersection of multiple identities as well as strategies and behaviors utilized to negotiate multiple identities. The third theme, *Institutional Support Mechanisms that Shape Perception of Campus Climate* will describe the ways in which support programs targeted for URM graduate students in STEM shape the perception of campus climate. Finally, the fourth theme, *Mentors as Institutional Agents* will illustrate the importance of mentoring by highlighting characteristics of mentors, defining who they are, and the role they play in helping students negotiate multiple identities.

4.2   Purpose of the Study

The purpose of this study was to explore the negotiation of STEM, racial/ethnic, and graduate student identities among URM graduate students pursuing STEM degrees at a predominantly white research institution. Further, this study sought to explore the role of mentoring and campus climate in the negotiation of STEM, racial/ethnic, and graduate student identities.

4.3   Research Questions

1. What are the student and faculty demographic characteristics in the STEM departments of the predominantly white research institution in this study?

2. What are the completion rates of the URM graduate students majoring in STEM disciplines at the predominantly white research institution in this study?

3. How do URM graduate students pursuing STEM degrees make meaning of their STEM, racial/ethnic, and graduate student identities?

4. How do URM graduate students pursuing STEM degrees negotiate their STEM, racial/ethnic, and graduate student identities?

5. What role does campus climate play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

6. What role does mentoring play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

4.4 Understanding My Identities

To understand how URM graduate students in STEM negotiate multiple identities, it is important to first understand how they make meaning of each of the identities separately. During the interview, the students were asked to describe characteristics of a scientist and graduate student as well as the experiences that impacted how they made meaning of each of these identities. Their responses not only demonstrated how they understood the identities, but also revealed a focus on the independent, but isolating nature of being a graduate student and STEM scientist. Students' did not speak about their race/ethnicity as a separate identity, but rather in conjunction with other identities. As a result, racial/ethnic identity will be discussed in the context of the second thematic area, *Intersection and Negotiation*. Therefore, three sub-themes emerged from the students' responses regarding the understanding of their identities: 1) Graduate Student – Manager of Many Things, 2) STEM Scientist – Creator of Knowledge, and 3) Independent and Isolated. The findings presented in this theme

addressed the third research question, "How do URM graduate students pursuing STEM degrees make meaning of their STEM, racial/ethnic, and graduate student identities?

4.4.1   Graduate Student – Manager of Many Things

When asked to describe a day in the life of a graduate student, the study participants provided an extensive list of roles and responsibilities that characterized their experiences. Among the tasks listed, students' cited serving as a teaching assistant, completing coursework, conducting research, managing projects, mentoring undergraduate students, and attending meetings associated with a research group or with a targeted support program for URM graduate students pursuing STEM degrees. It became clear throughout the discussion that the identity related to being a graduate student was not associated with intellectual ability, but rather, the ability to manage many tasks simultaneously. Essentially, graduate student identity was aligned with university and departmental expectations and requirements of graduate students. Summer Bright, a Black biochemistry student, described the role of a graduate student by simply saying, "...understanding you're going to become a manager of a lot of different things." She elaborated later in the conversation saying:

> In the first two years, we have to do coursework, then you have research
> responsibilities, then you're going to have your teaching responsibilities, and then
> your teaching responsibility also encompasses many other personalities. I think
> you definitely have to be a manager of people and time. Then also…realizing that
> you can also get easily burned out, so you have to manage all of those things

appropriately so that you can [have] some time to ensure you're taking care of yourself as well.

Dave, a Black student in Human-Computer Interaction, used an analogy to describe his experience as a graduate student:

The analogy I give everyone is actually about time management. We just kind of do the same thing because time management is huge. It's like you're drowning, but you're trying to stay above water. If you're doing okay at time management, you're above water. If you're drowning, then you're failing in some sort of way…It's like figuring out what's important and focusing on that. Then something maybe don't get done as well because you're juggling class. For me, because I'm still in my first year, you're juggling class and then you're juggling research and then whatever else.

Sonny, a Hispanic doctoral student in Mechanical Engineering, discussed the challenge of balancing the roles and responsibilities of being a graduate student. He stated:

The thing is, I'm having a hard time balancing between class and research. I feel like if I put in too much time in research, I'm not putting enough time on class. If I'm ignoring research a little bit, I'm falling behind in the research, and I feel like I've really fallen behind in the class as well. The balance is a little hard. Definitely…you have to learn how to balance time. It's easier said than done. It's a lot of hard work.

While most students' descriptions about the identity of a graduate student encompassed coursework and research related activities, some students also mentioned their experiences with navigating the hierarchy that exists within research labs. While the hierarchy doesn't appear to present challenges to the students, it is clear that students are aware of its existence and adhere to the norms that exist within the hierarchy. Michael, a Black student in Human-Computer Interaction, shared:

> There's a hierarchy that is not necessarily explicit and it's not as defined here as I think it might be at other places, but there's definitely [a hierarchy]. There's the professors, there's grad students, there's undergrads, and then there's everyone else. Within the grad student [environment], there's you, there's PhD and then there's master's students, but they're not quite on two different levels of responsibility. It depends on experience. If you're a PhD student, then everyone assumes that you can handle higher level responsibility, so immediately with the title you are now qualified or you can now handle managing undergrads, managing master's students, and reporting to your advisor who's almost a colleague.

Alana, a Biracial (Black and Asian) student in Chemistry shared her experience with the hierarchy in terms of availability to mentoring. She shared, "The only way I think about it is in between the undergraduates and the post-docs where you are able to get some mentorship, but you're also providing a lot to younger students and stuff."

Angelina, a Black student in Neurosciences and Cognitive Sciences, also mentioned providing mentorship to younger students as one facet of her graduate student

identity as well as participating in required activities hosted by targeted programs for URMs in STEM disciplines. She shared:

> Probably mentoring undergraduate students takes a lot of time. Right now, I don't have any undergrads necessarily relying on me, but I did before a lot in the summer. That takes in a lot of time too. I didn't know that would be such an integral part of the research, even though I was in undergrad in the lab before.

She later stated:

> I'm also a part of the [ISSP 2] program, and I was part of the Bridge to Doctorate Program. Those two groups have certain requirements. Aside from just research and TA-ing, I have to attend meetings or different events about funding. That's probably the other chunk of my time. It's mostly going to meetings, giving presentations…they want you to get that experience.

4.4.2   STEM Identity – Creator of Knowledge

Different from the characterization of graduate student identity, STEM identity was described less by one's ability to juggle multiple tasks and responsibilities, but more by one's capacity to think independently and create new knowledge. Conducting independent research and having the flexibility to pursue one's own research questions was a salient finding across all study participants when asked to discuss their STEM identity. Additionally, aligned with Gee's (2000) perspective of discourse identity, study participants' recognized themselves and others as STEM scientists only when they were engaged and recognized through disciplinary discourse, by peers, faculty members, and

researchers. When asked to describe the characteristics of a STEM scientist, Lacy, a Black student in Analytical Chemistry, remarked:

> For me it means to be able to take the problem or issue or concern and actually evaluate it with a scientific method…evaluating where the problem is and coming up with a hypothesis and how you can test the hypothesis and then developing some type of results, whether good or bad.

Angelina similarly stated:

> Someone who thinks well on their feet, can put out what are the important questions in a field that need to be addressed, and then…plot a logical course of action for addressing those questions…working off of whatever resources you have in your grant. Taking the best course of action to discover something or a good critical thinker.

Dave simply stated, "Somebody who looks and thinks critically at things, and they search for answers or things that can be…I guess generalized."

Reaching the point at which students' could conduct research independently was the event that catalyzed self-recognition of their STEM identity for many students. For some students, this identity was acknowledged only after successfully passing the preliminary exam and reaching doctoral candidacy. Carlos, a Hispanic student in Biological Sciences shared:

> I guess advancing to candidacy, that was huge, because I really felt that after that she [advisor] felt comfortable essentially putting the whole lab in my hands. I run

it now…Well, I guess the pre-lim is one event, but just over time she's given me more freedom…she'll still advise me, but there's a bigger sense of freedom to actually do my own ideas and be more independent.

Carlos later stated:

Now that I passed it, in terms of how I do science, I think I do try to be really careful with my experiments. I try to justify everything I do. I think that's helped my confidence just knowing that as far as my day-to-day work, I'm taking it, not more seriously, but I'm taking more responsibility for the decisions I make and more conviction.

When discussing his STEM identity and post preliminary exam experience, James stated:

Coming in, I was taking classes and I was reading to get up to speed, but my work was really focused on the coding…Now, I have to form my own ideas. I have to defend them. I have to propose them and I have to evaluate, see if they're actually correct. That's something I'm getting more used to now. I'll come in and then I'll say, "If I look at these papers, they have these findings. I don't think that the mechanism that we talked before, I don't think that it really connects.

For other study participants, passing the preliminary exam was not the sole event that prompted students to embrace their STEM identity. For example, Lacy, embraced her STEM identity when she had the ability to explain, independently, scientific concepts to others. She said:

> Maybe after I started in my undergrad doing research and I had some good results and was able to not only talk about why I was doing it, and the impact, but I was able to explain the data and be questioned by outsiders that weren't familiar with our project.

Michael explained that he felt like a scientist before the preliminary exam, but not an independent scientist. He stated:

> I felt like a scientist before becoming an independent researcher, but I felt like a scientist as part of a team. Now, at this point, I feel like more of a scientist who's interested in my own problems. I feel a lot more of a scientist who's interested in my own problems…it's not that I'm executing someone else's vision or some else's interests.

Some of the study participants associated their STEM identity to engaging with and being recognized by academic peers in their discipline. For example, in his description of a STEM scientist, Dave shared,

> I think one of the things is creating new knowledge, building off of previous knowledge. I think a sign of success as a scientist is publishing work. Basically something that your academic peers have looked at and they've said that this is a valuable contribution. That this is a valuable contribution to whatever field it's in.

Accordingly, Summer Bright attributed her STEM identity to accomplishments and milestones that were a direct result of acknowledgment from peers. She shared:

I did a committee meeting follow-up, and I can't forget one of the committee

members at the end stood up and was like, "I must say, I've seen you present a lot

of times and this is by far one of your best presentations." Then to working to do a

F31 [research grant] and then getting it successfully funded. Then I had several

experiences where I presented at different conferences, and then there were

competitions…and I won them.

She continued saying:

Then to eventually, I think, starting to have a few different students who would

actually come to me for my opinion, "I know this is not your field, but what do

you think about this? What are your thoughts on this?" Or to where I would start

the writing process with my mentor for publication.

She summed up her statement saying, "I think those are some of the moments that really

solidified my acceptance that I am an independent, critical thinker."

Though not salient among all study participants, it is important to note two unique

findings regarding STEM identity. For one student, Angelina, passing preliminary exams

and recognition by peers were not evidence enough to consider herself a scientist. In fact,

not only did she not consider herself a scientist, but linked her STEM identity to

receiving her doctoral degree. Her perspective was the following, "I feel like you're not

really a scientist until you get the title. Until then, I feel like I'm someone who just comes

and does experiments, but I don't refer to myself in that way yet." Another unique

sentiment was shared by Sonny. He expressed that he's felt like a scientist since he was a small child. In fact, he stated:

> Since I was little, I've always thought of myself as a scientist, just out of curiosity. I'm always playing with things or I'm always interested in how things work. I think I've always been a scientist in a way. I guess the way it's manifesting right now is a little different, like I'm actually doing work, I'm actually doing research, I want to see what's going to happen, not just playing around and let me see if this fails. I think definitely, I'm a scientist.

Sonny's response to being a STEM scientist indicates that for him, his STEM identity is linked more to critical and analytical dispositions as described by Tran (2011).

4.4.3   Independent and Isolated

Independence and isolation were common threads in students' characterizations and descriptions of being both a graduate student and a STEM scientist. In terms of STEM identity, not only was it important for students to become independent thinkers as discussed in the previous section, but in order to facilitate progress through major programmatic milestones in their respective graduate programs, it appears that it is essential for students to be the primary, independent, drivers of their own progress. Consequently, as a by-product of the independence required to successfully matriculate through their graduate programs, study participants also felt isolated. Perhaps the essence of this sentiment was expressed by Sonny when he stated, "A typical day for me is lonely. Usually, I'm either in my office or in the lab. I'm still taking classes so I'm either

studying or working on research. Later he also commented, "It's a lonely feat. It's lonely…it's a lot of hard work, dedication, times in which you want to give up…there's been many times this semester that I just wanted to throw in the towel." Summer Bright shared similar feelings saying, "I do feel sometimes isolated, as a graduate student. It's just our nature, so whether you're in [ISSP 2] or not…it can be a very isolating thing." James described the nature of his experience saying, "…it really requires a lot of independent work, a lot of reading the papers and just getting up to speed with the research that other people have done." Michael likened his experience as a graduate student to having a traditional job saying, "It became more like a full-time job, and a lot less structured time, but a lot more independence."

Graduate programs, particularly doctoral programs, and STEM disciplines are socialized by majority culture and therefore, value competitive and individualistic culture over the community-based culture that is valued by many URM racial/ethnic groups (Bonous-Hammarth, 2000). Some of the study participants in this expressed challenges with adapting to the competitive culture of both the university and their STEM graduate programs. Ayax, a Hispanic student in Mechanical Engineering, simply stated, "A lot of grad students, and I think this is a common thing, and I guess it's just the mindset of academia, that they're really protective of their stuff." Lacy, who attended a Historically Black College/University (HBCU), expressed tremendous challenges when first enrolling at the university. She passionately shared:

> I had a very hard time transitioning to [study site] for many reasons. One, because I did come from an HBCU, which is a small university to [study site], but also the

atmosphere was very different when I first came here because for me, at the HBCU, the whole campus is more of a community, so you have everybody rooting for you, everybody in your classes. We all help each other. It wasn't like anybody was competing. But more in this environment, it's very, very competitive. I felt like…it was every man for himself. Because I hadn't been used to that for the past five years, it was kind of hard for me.

Aligning with the research on the independent nature of graduate study (Lovitts, 2001), study participants expressed the importance of driving your own progress. When describing the characteristics of being a graduate student, Summer Bright shared:

I think it's understanding when you are in this process, you need to be the primary driver of everything...even in terms of classes, you've got to be the driver. If you don't know something, you can't just sit down…you have to be that driver. When it comes to research, it's the same thing…the expectation is that at the end you want to be an independent researcher. For you to be that, you also have to develop this process of knowing how to drive things to completion.

When describing how she took ownership of her graduate school experience, Summer Bright explained:

I felt like I had to advocate for what I needed. So from the get-go, I was like, listen, I'm a hard worker, this is what I can get done, but also, too, here's what I need. So I was just very direct from the beginning, and so as time progressed, I

just kept on being direct, and I also let him know that I like the space to think, to

try to come up with my own ideas.

In closing, the three sub-themes presented in *Understanding My Identities*

provided in-depth insight not only into how the study participants characterize graduate

students and STEM scientists, but also how students make meaning of the identities

through their experiences. While the identity of being a graduate student is closely linked

to the ability to manage multiple tasks that are guided by university and departmental

expectations, STEM identity is more closely related to the ability to create knowledge

that is recognized and accepted by disciplinary peers. While the nature of each identity

was defined by different conditions, there was a common and underlying theme of

independence and isolation related to each identity. Collectively, these sub-themes

demonstrate that, while challenging and isolating, the participants have aligned

themselves to the individualistic and independent nature of graduate student and STEM

identities as they make meaning of both identities through demonstrations of individual

accomplishments and acknowledgements.

4.5   Intersection and Negotiation

The primary focus of this study was to explore how URM graduate students in

STEM negotiate their STEM, racial/ethnic, and graduate student identities. The findings

revealed that the study participants made meaning of their racial/ethnic identity only

when it intersected with other identities such as STEM identity, graduate student identity,

and gender. In fact, it appears that in instances where racial/ethnic identity intersected

with STEM identity, graduate student identity, or both, students' behaviors and

interactions with same race and different race peers were most influenced by their racial/ethnic identity. It is important to recognize that over half of the study participants were second generation immigrants to the United States, therefore, negotiating the expectations and norms related to their racial/ethnic identity in the U.S. versus the expectations and norms in their home countries presented challenges. However, these challenges were revealed only in discussions focused on the intersection of race/ethnicity with other identities. During the interview, students were also asked to discuss the intersection of the STEM and graduate student identities absent of race/ethnicity. Responses suggested that this intersection and negotiation was perhaps one of the most challenging intersections to negotiate. Four sub-themes emerged from study participants' responses to the intersection of multiple identities and the behaviors and strategies students used to negotiate them: 1) Race and Everything Else, 2) Intersection between STEM and Graduate Student Identities, 3) Gender Matters, and 4) Additional Influential Identities. The findings presented in this theme addressed the fourth research question, "How do URM graduate students pursuing STEM degrees negotiate their STEM, racial/ethnic, and graduate student identities?

4.5.1   Race and Everything Else

In the previous theme, students expressed how they made meaning of their STEM and graduate student identities. However, it appears that students were better able to make meaning of their racial/ethnic identity when it intersected with their graduate student identity, STEM identity, or both. For example, one way participants made meaning of their racial/ethnic identity was by pursuing or engaging in activities that

connected them with URM youth, peers, and communities. Also, when discussing the intersection of study participants' racial/ethnic identity with their STEM and graduate student identities, the ways in which the study participants behaved and interacted with URM and non-URM individuals was largely influenced by self-awareness of their racial/ethnic identity and how they might be perceived by non-URMs. Specifically, one common sentiment across many of the study participants was the need to represent their racial/ethnic group in a positive manner by demonstrating socially appropriate behavior in academic and disciplinary settings. Study participants also shared experiences with overt discrimination and microaggressions that they perceived were the result of their racial/ethnic identity. Perhaps the best way to capture the essence of this sub-theme, Race and Everything Else, is through the words of Angelina. She stated, "Race…is everything."

In the context of this study, participants made meaning of their racial/ethnic identity by making connections between their race/ethnicity and their identity as a STEM scientist or a graduate student. For example, Ayax was born in southern California, but raised in Mexico. Therefore, when creating new products with his advisor, he considers availability and cost of the product in other countries. He stated, "…I grew up in Mexico, so every time I think of something, I go, okay, this would be cool, but how can you make it accessible in Latin America?" Some study participants connected their race/ethnicity to their STEM identity through the desire to raise awareness about STEM careers to URM youth and through pursuing research questions and conducting research projects with URM student populations. Summer Bright shared:

I do feel the responsibility to educate younger students about the potential for careers in science, particularly STEM, because I do know of the lack of diversity there…I do have that role that I need to go out there and get some more people in STEM.

Dave indicated that his race/ethnicity influenced the populations of people that he focuses on when conducting research. He explained:

I think it's had an impact on the types of research questions that I'm trying to answer, and maybe the populations of people that I'm interested in helping…as an example, some of my research right now is working with underprivileged youth, and exposing them to technology. To me, I think I find that kinda of personally rewarding because it lets the students that I'm working with see somebody who's kinda like them, but somebody who went on to college, that went on to pursue graduate studies.

Angelina also discussed the connection between her research and her racial/ethnic identity. She stated:

Knowing that a lot of minorities reside in the specific cities, it's important to me to try to understand at the basic science level why there might be different health outcomes or health disparities among other communities that I can relate to.

Some study participants are not currently conducting research or participating in projects that are connected to URM communities, however, the desire to pursue projects that do have a racial/ethnic connection is present. For example, Sonny shared:

I think as a future scientist…I would like to find students with similar backgrounds as myself because I know that the potential is there. You just have to spark it. I think in the future that's what I would like to do. I would like to help people that went through the same struggles that I've went through.

Similarly, Lacy said:

I still want to create this dream job where I'm still associated with the academic in some perspective. Whether that be younger interns in the lab, or in some way just paying it forward. Again, to increase the number of underrepresented minorities, specifically in chemistry.

She added, "…when I graduate and I'm able to have more flexibility in what I choose, it [racial/ethnic identity] might definitely play a role into the topics that I can actually choose at that point." Patrick also shared that he pursues connections with the URM community by engaging in diversity activities and initiatives within his discipline. He stated, "So at our major conference there is a diversity lunch or something like that, or breakfast. Those events are more to bring the community together from a more national perspective." He also engages with other African American professors and doctoral students in computer science through an email listserv which serves as a way to build community and relationships within the discipline. He recounted one experience at a conference saying, "We kept making the joke when everyone would ask, they're like, "How do you guys know each other so well?" It was like because there's 12 of us in HCI [Human-Computer Interaction], so we know what everyone's doing." Two of the study participants also recounted personally rewarding experiences when they were able to

connect their racial/ethnic identity to their STEM identity through language. Ayax recounted two separate experiences, the first of which he excitedly discussed here:

> It's really cool when you relate to someone where you show up and it's like, they're talking about a project, and all of a sudden, they go, oh, these guys are from, I don't know, Colombia, and you go like, Hey! You start asking, you start going on, then whoa, just talking to them in Spanish, and asking more stuff.

Ayax also shared an experience that allowed him to assist his advisor at a Spanish-speaking conference. In fact, he likened translating for his advisor like being a judge in a ping-pong match. To capture his feelings about the experience, he simply stated, "It was for me to see that being Mexican, being part of the community, it helps out." Another student, Sonny, had a similar experience. He shared:

> I met some scientists from Puerto Rico. They came and they were interested in my poster and I was like, "Man, you guys are Latino," saying me and you just click, and I gave them my whole presentation in Spanish…Then right there, that made me feel like, "Wow," I do have a second role, I'm not just a scientist." That's when I guess, I first…I think it was the first time I ever noticed.

> Finally, study participants also make meaning of their racial/ethnic identity through seeking relationships and engaging in activities with other URM peers. When speaking about interactions with other graduate students, Dave shared:

> I don't know why, but I guess there's a trend where a lot of the minorities stick together, because we can ... I don't want to say that it's easier to relate to them, but

sometimes if there are frustrations, like maybe someone such and such doesn't understand about something, we tend to congregate together. Maybe in some cases, even having similar backgrounds or upbringing, it makes it easier to relate. Because not that diversity is bad, diversity is a good thing, it exposes you to a lot, it teaches you a lot. Sometimes it's harder to relate to other people just because I personally have no experience with whatever they're talking about, and I just have no idea so I'm just sitting there. So it's nice to have those people.

Sonny shared similar sentiments saying:

In an academic setting, and if I see another grad [uate] student who is Latino, or who could resemble me in some way, I feel like I tend to click easier with that person than I think Caucasian peers…I've never viewed myself as being prejudice, or racist, or anything, but it's, I think, an area of comfort. Latinos like…event if it's just another minority, I feel more comfortable being with another minority than being with…[fades off].

While racial/ethnic identity was an influential factor in helping the study participants make meaning of their STEM and graduate student identities, participants shared how race/ethnicity also influenced how study participants behaved and interacted with non-URM peers, colleagues, and faculty members. Some study participants felt responsible for representing their race in a positive manner by demonstrating what they perceived as socially acceptable behavior. For example, when describing interactions with white faculty members, Carlos shared:

You kind of have to represent yourself in a positive way because you're not only…like if you were to just be an idiot, you're not only embarrassing yourself, but you are, in a way, representing your people. Because there are so few of us in there, that they might look at you and be like, "Are they all like that?" It's like you are in a small way an ambassador of your people…especially when you're so underrepresented.

Similarly, Dave stated:

…you kind of feel like you don't want to embarrass yourself, because it's like there's a door and you're in the door, and you don't want to close it for other people. Again, that can really be for anyone in any situation, but it's because there's so few of you and you really, at the end of the day, you don't know how people will feel about you, or how they *really* feel about you, you want to not make a fool out of yourself, because they maybe will associate that with… "Oh, look, the African American doesn't know what he's doing or he can't do a good job…"

Some study participants also shared that they refrained from behaviors they felt would perpetuate negative stereotypes about people from URM communities. Furthermore, this participant, in particular, felt that he would be able to behave more naturally if he had an African-American advisor who would better understand his behaviors and not be threatened by them. Michael stated:

I feel like a lot of the time, I have to tone down whatever reaction I have to things, because people will perceive it a different way. If I'm upset about something, I can't be overly upset about it, otherwise it may be perceived as hostility or something like that.

He went on to say:

…If my advisor was also an African-American, and I talked to them outside of school, I could talk to them slightly differently. Or I could react a certain way and it wouldn't be perceived as you know, "Are you okay, is there something wrong, do we need to talk about it?

Angelina's approach to graduate school is largely influenced by how she thinks she may be perceived by non-URM individuals. In fact, throughout the discussion, it appears that the impetus behind many of her behaviors are to avoid personifying common negative stereotypes about African Americans. She shared:

For me, I think I have a timid approach to graduate school just because I feel like I don't ... Sometimes, I just feel like I am not…am I? You feel like you're sneaking in, like you're not really supposed to be here. You'll be like, "If I raise my hand a lot, then people will know I'm not supposed to be here," and stuff like that. That's not the point of graduate school, but I think, maybe, for me, racially, you already look different and then if you just draw attention to that. It's such a small environment where there aren't that many…there's way fewer graduate students than undergrads and way fewer people in your program and then within

your lab, it's even smaller. I think, for me, it changes how I approach graduate
school.

Later in the conversation she shared:

I think maybe I don't want people to think I'm a slacker because I'm African-
American compared to, for instance, if you're an Asian scientist. I think,
generally, everyone has their stereotypes for every group. There are usually
positive stereotypes, for instance, for Asian people. They're smart. They're
hardworking. They're determined and all that stuff. I think, popular media and
everything, you usually get a lot of the media feeding you like African-American
people can tend to be slackers or lazier. They're always late. When I'm going to
meetings, I feel like I have to always be early. If I'm late, even if it's because of
miscommunication that wasn't even my fault, it just irritates me. I think that
affects how I do science and the students that I mentor. If they're late, I'll be
irritated without telling them, especially if they're African-American, because I
just feel like as a scientist, where you're already in such a small pool, and as an
African-American person, even going out into the world, you can't do that. I think
that stuff, it affects how I see myself, I guess, as a scientist, because I feel like you
are working against some of that stuff that not even people are consciously
thinking, but it's ingrained by the way society puts the images that puts forth of
African-American people. It's a little distracting from your work to have all that in
the back of your mind.

Some study participants also discussed how their race/ethnicity influenced their work ethic, either through motivation or pressure to perform well. Summer Bright shared:

> I felt like, it just made me, from everything I do, from how I thought about my question to the work ethic I have coming in in the mornings. I was like, "Okay, you know what? Since they already think this of me, I can't be like you who can just come in willy nilly…and just be all, whatever." No, that means I need to be coming in here and spending more hours. If I need to be here on the weekend, I'm going to be here.

Later in the conversation she elaborated saying:

> I always feel like I need to be the best, because just to be blunt, oftentimes people, because you're a minority and I'm a double minority, unfortunately sometimes some of the stereotypes do hold true in the sense where people are like, "Okay, what's she going to do? Why is she here? Is she really here because she deserves to be here or is it because of affirmative action or some of these programs." So my thought process is, okay, they can think, but I'm not going to give them no reason to maintain that thought process, so I always feel like I need to be on top and I just don't have time to…failure's not an option. It's just not.

Michael also stated, "I feel like there's an additional pressure, since I'm an African American scientist in computing, that there's a little bit more pressure for me to be successful." In his closing comment, he summed up the sentiment stating:

I could be a really successful researcher, or I could do what this person says, and

be a really successful student…But because I'm in the middle, I have to do both.

If I let either one slip, then African Americans aren't good researchers. If I let the

other one slip, African Americans aren't good students.

During the interview, some of the study participants also shared their experiences

with overt discrimination and microaggressions that they perceived were caused by their

racial/ethnic identity. Summer Bright described several interactions with non-URM

faculty members. She first recounted a story from when she interviewed with faculty

members for a joint doctoral program involving two campuses. She shared that a White,

male faculty member first asked her, "Are you sure this is what you want to do?" He

followed up by saying, "…you get a B, I'm not sure you'll make it here as a graduate

student." Once gaining to admission to graduate school, Summer Bright, had a similar

experience with the faculty member leading her lab. He asked her, "Why don't you just

be done with a master's?" Lacy also shared multiple challenging experiences with what

she perceived as overt racism. One experience occurred early in her graduate program

when students in her program were required to rotate to several labs before officially

joining a research lab.

> The first lab I visited, I was so excited. He had great work, great resources,
>
> everything. He straight out told me that I couldn't join his lab, and I wasn't going
>
> to make it in graduate school. That right there was enough for me, I literally, I
>
> went to the director's office at the [ISSP 2] and I was like, "I can't do

this."…Before grad school, I never cried…I got there and I was like, "I can't do

this." He just straight out told me, "I know you won't make it here.

Lacy also shared her experiences with microaggressions from her advisor. After

an experience that required her to assert herself, Lacy shared that her advisor would

consistently make "subliminal" jokes about the situation when discussing topics like

networking and interacting with other people. She shared:

> My advisor swears he's a comedian, so then he makes these subliminal jokes all
>
> the time in group meeting… He'll just say little things because I have quote,
>
> unquote been aggressive to their standards, I guess. These jokes that he makes,
>
> sometimes I just have to laugh and let it go.

Alana also shared an experience with non-URM members in her lab group that she

believed was a result of being a member of the [ISSP 2], a program specifically for

minority graduate students pursuing doctoral degrees. She stated:

> It's almost like you have a target on your back to people who are not [ISSP 2].
>
> Anytime I had a [ISSP 2] meeting or something separate I had to go to. There was
>
> just this, "Here she goes talking about [ISSP 2], she can't hang with us because
>
> she's [ISSP 2]." Almost like, you have this special treatment, so you can't hang
>
> with us. …That definitely made me aware of okay, there's definitely some
>
> separation here."

In addition to learning about how racial/ethnic identity influenced graduate

students' behaviors and interactions with faculty and peers, it was also important to learn

about the behaviors students' employed to negotiate their STEM, racial/ethnic, and graduate student identities. Two findings that were salient among negotiation behaviors were keeping the identities separate and emphasizing the identity that is most appropriate for the context. When discussing the negotiation of multiple identities, Alana shared, "I think I do think of them separately, almost. Just to make it easier." Carlos had similar sentiments saying:

> I guess in my brain, I have to sort of think about them one at a time. I don't know if I think too hard about me being a Latino in this field. I mean, it's in my mind, but I don't…it's not something that's always in my head. I think right now what I'm focusing more on is developing a stronger identity as a scientist. Even as a grad student, that's kind of back there, but that's not a big deal. Right now, I'm, in my brain, I'm like, I really want to develop as a strong, independent scientist because to me, that is the most important thing right now.

James said:

> I want to keep everything separate. I have certain relationships with certain people, other relationships with other people, and I think, for me, that's the most comfortable thing to do because I know that I'm behaving correctly depending on the context.

He later stated:

> I think it's a little easier to think about things separately, for me, to compartmentalize, like oh, this is me as a grad student, this is me as a Black

person, and this is me as a scientist. Versus, okay, I have to think about how they all inform.

When asked about negotiating his identities, Dave said:

> I think maybe one at a time. The reason I say that, so like, today all day in school, I didn't see myself as an African American researcher or student, I just saw myself as a researcher, you know. I was doing research…I was not really worried about the differences between us, but maybe if something happens then it will sensitize me to the fact that I'm an African American and then I'm like, oh yeah, I remember that I'm different or that they don't understand or something like that. It's not something that I would say that I keep on my mind every day.

Some students also suggested that they may emphasize particular identities depending on context. For example, Michael said:

> In meetings, sometimes, it's emphasized that I am a student or emphasized that I am a scientist or I am an independent researcher. If we have visitors in the lab, then it's up-sell that I'm a student and an independent scientist that has my own work in this space. Versus in like a meeting with the rest of my cohort, or the rest of the lab, or the rest of the department, then I'm a student who I work with that professor.

Dave negotiates his multiple identities by "finding the common ground" based upon context. He shared:

> If I'm sitting at a table with more of my colleagues who are minorities, the things
> that we bring up maybe because we've had similar experiences or we have…in
> some cases, maybe we have more similar taste in, I don't know, music or movies
> or whatever that is, we can talk about those things. But when I'm with the general
> population in I don't know, my department, bringing that up would get me
> nowhere, because people wouldn't know or wouldn't care or something like that.
> So then in that case, I would talk to them about school, but I guess that's not
> necessarily downplaying any identity because that's what I would say I don't do
> at all, but I would say maybe emphasizing one to foster relationships or something
> like that. I would do that.

Angelina's responses indicate that she tends to think of her identities separately except when she is in larger public settings. In those settings, she becomes more aware of her racial/ethnic identity, which, she shared, influences her behavior. She explained:

> Day-to-day, I probably just focus on coming to lab and doing my experiments…I
> feel like my race impacts maybe my performance or my decisions more when I'm
> in a larger setting like a conference or a presentation. Day-to-day, I feel like race
> gets put aside because I'm mostly work by myself, sitting at my desk and stuff…I
> can just focus on the science. It's when you begin to interact with other scientists
> or other graduate students that I just remember maybe I'll feel insecure. I think
> it's how far as how I put it all together. I think race comes to the surface when I

least want it to, when I'm most nervous or already in a stressful situation. That's in the back of my mind even as I'm in the lab or just interacting with other grad students and stuff.

Summer Bright was the only student who spoke about how she negotiates her identities collectively by being authentic to herself. She stated:

I reside on knowing that no matter what I do, you will always have some people who don't like me, so one thing that I try to do when I engage is to be authentic to myself, and be me, regardless of who is there. People are either going to like me or not like me. Then another thing is I reside on what I know I can do well. Just don't apologize for that. I can be an extremely assertive person, and I just learned to just be okay with that, because it's one thing if you're being assertive for the right reasons versus misusing that assertion. Once I'm using it all in context, then I've really become unapologetic about it, and know that, in this world that I am in, unfortunately there are politics that you've got to play. So I play to those politics sometimes, I'm not going to lie to you, but at the same time still remaining true to myself, if that makes sense. So knowing how to do that I feel like it's helping me to serve my purposes…

Summer Bright went on to explain that one approach she uses when negotiating her identities is to remove race/ethnicity and sometimes gender from the equation to eliminate any feelings of inferiority. She shared:

…this is going to sound really weird when I think about it now, it's sounding

weird in my mind, but I have kind of removed color a lot from the equation a lot

of the time. If I see you as...and even gender too. If I see you as White male and

then I'm going to...Sometimes I feel like that gives me an inferiority complex,

since that I see you as a human being. When I see as a human being, there's

nothing that really separates me and you except yeah, our genetic code may be a

little different, but we're still people. So when I reside in that, I realize I don't have

as much fear and then I'm really able to move through in a capacity that really

serves my agenda.

When concluding the discussion regarding the intersection of multiple identities,

the study participants were asked to share their thoughts and feelings about possessing all

three identities. The responses indicated that considering all identities collectively and

thinking about how to negotiate them can be an emotional and challenging exercise for

the study participants. Some study participants, however, shared that collectively

possessing STEM, racial/ethnic, and graduate student identities presented opportunities

and made them feel special. Angelina shared:

I feel like it gives me more opportunities because you know that there are so few.

Minority scientists are underrepresented in the field overall. I think that it gives

me an advantage in the fact that a lot of the funding opportunities are saying, "If

you're a woman or an underrepresented minority or you have disabilities, we

encourage you to apply.

Alana shared similar sentiments when she said:

> The first that that comes to mind is that it makes me feel kind of special because there's not going to be many people in the field, in STEM, that identify with these three different things at the same time and stuff. So it does make me feel special, but also kind of like, I have a lot of pressure.

Michael shared, "I really like the fact that I am an African-American scientist in computing, in a graduate program, because there aren't many people like me. Summer Bright stated:

> So now I really assumed all those identities and seen them as just how I will get to my end goal, and so my end goal is to…I can't change how I am, so I'm Black, but to really be a Black, independent thinker who really brings about a lot of good, and so, for me, I see this graduate school process as a part of my journey towards that.

James, Sonny, and Lacy all expressed challenges with negotiating their STEM, racial/ethnic, and graduate student identities. For example, James shared:

> …it can get pretty dark with the idea of what we're supposed to do, what we can do, what I was supposed to have done, where I should be right now, and the idea of the thoughts, of, okay, I'm a Black scientist graduate student kind of takes you there…So yeah, it just requires a little bit of faith…this is hard, because you have to revisit some things that I don't think I want to deal with every day or think about every day.

Unlike James, Sonny's challenges are related to feeling like he doesn't belong. He explained:

> I feel sometimes, because of affirmative action I feel maybe other people…I mean other professionals would see me as just a benchmark that they have to meet. They didn't care that I'm a scientist or whatever. They just care that I'm a minority, I'm a male in this field, and I'm helping then to reach a certain benchmark, that's it.

Lacy characterized her possession of multiple identities as emotional. She stated simply, "It is a mouthful…it is an emotional process, but I definitely feel accomplished because it's very difficult to juggle all three."

4.5.2   Intersection between STEM and Graduate Student Identities

During the interview, the study participants were asked to discuss the intersection between their STEM and graduate student identities absent of their racial/ethnic identity. The responses suggested this intersection was one of the most challenging to negotiate, and that study participants take on the perspective that they are always learning in any context, even when they are in positions of authority, to allow seamless transition from one identity to the other. The responses also indicated that confidence played a role in the study participants' ability to negotiate between STEM and graduate student identity. In his response, Michael shared that not only is the intersection between his STEM and graduate student identity one of the most challenging, but also that a physical change of scenery helps him to transition from one identity to the other. He stated:

Balancing, being a student and an independent researcher scientist. I think that's

one of the hardest, one of the hardest balancing acts that I have to do. Like last

semester, I TA-ed a class. I was in the TA role, where there is a professor who's

lecturing, I'm sitting in the class, and the students regard me as the TA. I run all

the discussion sessions…When we weren't in class, the professor's also on my

committee. I have that, okay, now that we're in your office, we're talking as

equals, instructors of the class. I think those times are always really weird to me.

The interplay is a little awkward sometimes. It's a change. Okay, now we're on

the elevator. The language changes…or what really helps is a change of scenery.

When discussing the interaction between his STEM identity and graduate student

identity, Sonny stated:

That's where I'm having a hard time…My peers can just switch on and off. Like

go from high gear to low gear seamlessly…so if I'm taking a course, and I'm

mentally dedicated to this course, it's very hard for me to play a different role

than a student. It takes me a bit of a time to readjust of, "You know what? I have

to put this aside, and start working on my research." It's something I do struggle

with.

Some study participants indicated that they position themselves as learners to help

them seamlessly transition from their STEM identity to the graduate student identity and

vice versa. For example, Summer Bright shared her approach when attending

conferences:

Oftentimes, how I have perceived going to conferences is a place where I can get potential solutions for places in my projects that are difficult or so that's how I've always perceived that. In perceiving it that way, I don't necessarily fully assert myself as being a full-on expert, but then at the same time, at least for things I've done, for those things I'm an expert, but I'm also in a place where I'm willing to hear feedback.

When discussing how she negotiates her identity as a graduate student and STEM scientist, Summer Bright later shared that being honest with herself about the knowledge she possesses and does not possess has been helpful. She shared:

For me, I think that has always served me well, to understand that I am learning, to know that there will be things that I know and know very well, there'll be things that I know but not quite well, and then there will be things that I don't know. I think once I had that sort of thought process, then it really made going into the different identities very seamless, because, for example, in a given conversation with my mentor, I know that when it comes to the practical details of day-to-day stuff, I know that. There's no debating there. In terms of maybe seeing the concept or the bigger picture, then I know that I'll have a thought process, I'll put it to him, but then he may be able to add to that. So I see it as more so a dynamic sort of identity, where I can simultaneously teach and learn, and I think it's also in all the other avenues as well.

James shared his experience, saying:

> I think you can be a student as both somebody's who teaching people because you're learning how to become a better educator, and I think you can also be a student in the sense that you're learning to become a better researcher.

Finally, some study participants talked about confidence playing a role in negotiating between being a graduate student and a STEM scientist. When discussing being challenged about her research and approaches she's taken as a scientist, Lacy shared:

> I just tell them the same thing or the same theories and the same approaches that I talked to my advisor about. I just kind of approach it the same way. Of course, we're all going to have different opinions, but just being confident in what I chose and why.

When discussing confidence as a teaching assistant and confidence as a scientist, Alana shared the following:

> It's really a confidence thing. I just feel so confident getting in front of students and telling them, "This is how you're going to do this step. If you're confused, come talk to me." On the other side of things, I go to my advisor and I get nervous and all of those sorts of things.

Alana also shared an experience from a disciplinary conference when she served as a judge for a poster competition. She said:

> It was a minority conference this past year and I was one of the judges, but most of the people who were judging were professors and stuff like that. So that was just this sort of awkward situation. We introduced ourselves and stuff, everybody's an associate professor here, an assistant professor there, and then I get up," I'm a third year graduate student." It goes back to, what are they thinking about me? They probably think I can't judge these posters and stuff and that they're responses and feedback are going to be. Mainly, I did kind of notice that I would be waiting to speak to a student and they'd see me and they would take their time even more. Even when they were getting ready to wrap up. They could sense, okay, it's getting close to the end. Then they see and start asking more questions, so that is a little bit uncomfortable. It kind of doesn't necessarily make you feel as welcome.

When Ayax spoke about confidence and interaction with is advisor, he said:

> In graduate school I've learned that, and some other grad students have said it, it gets to the point where you know more about a certain thing than your supervisor, advisor, mentor. Then it's like, you're the one telling them what to do. So I kind of adopted that early, where if I knew it, I would do it. I would just say it that way.

Angelina shared her challenge of negotiating both identities in the presence of her committee, she explained:

> For me, maybe the closest thing I can think of, that I have experienced is probably my committee meetings because you're talking to people who are really accomplished and you're trying to show them that you know what you know, but at the same time, you have to be humble because you don't know everything. Sometimes, you think you know stuff that you don't actually know. For me, and even talking with my mentor ... I'm still trying to figure out the balance. For me, the problem is there is an imbalance, but it's usually me thinking that I know less than I know or not being confident with my ideas. I feel like that's a foundation of a good scientist. If you don't believe in your ideas, then no one else is going to be convinced by them, but you also have to be humble enough to know when your ideas are crap. For me, I'm still finding that balance. I'm not sure that I found it yet, even though I realize it's an expectation to actually find it.

4.5.3 Gender Matters

Though not salient across all women who participated in the study, it is important to mention that some of the women in the study acknowledged challenges associated with the intersection between their race and gender identity, indicative of the traditional definition of intersectionality (Crenshaw, 1989). In fact, one male participant acknowledged challenges that may be related to being a URM woman pursuing a graduate degree in the STEM disciplines. In addition to acknowledging the challenges

associated with being a URM female in STEM, some of the female participants discussed

the influence that female mentors and advisors have had on their academic careers.

When discussing challenges related to their identity as Black women, both

Summer Bright and Lacy shared their experiences. Lacy shared:

> …they use this term aggressive, she was aggressive. I think that's an expectation
>
> because I am Black, and for many years, I'd never said anything. I was really
>
> quiet, and they probably were expecting at some point like, when is she going to
>
> get angry. I don't know if they were, but the one time that I did it, it shocked
>
> everybody. I think that I did it because I was fed up. Like I said, I was really
>
> holding back, or biting the bullet from small things that were done…

Summer Bright shared a similar sentiment saying:

> Because it's kind of like we can't win. On the one hand, I'm Black, but on the
>
> other hand, I'm a female. So if you go in and you're all bossy about things, you get
>
> labeled as a B-I-T-C-H, right? So for me, I reside on knowing that no matter what
>
> I do, you will always have some people who don't like me, so one thing that I try
>
> to do when I engage is to be authentic to myself, and be me, regardless of who is
>
> there. People are either going to like me or not like me.

James also acknowledged the challenges that he thought URM women might have as

graduate students in STEM. He said:

> I don't see a lot of people who look like me. I think it's a little bit easier to me
>
> because I'm a guy, so I think if I was a Black woman, I'd be really, I guess, kind

of alone, except for my advisor, because my advisor's also a woman, so there might be something there, but you just don't see anyone at all, even ... You just don't see people who look like you.

In addition to acknowledging the challenges associated with being a URM woman in STEM, two study participants also discussed the influence of their female mentors or advisors. Lacy indicated that Black women researchers at her undergraduate university influenced her decision to pursue a career in research. She shared:

One of the reasons why I actually started to dive into research, because of the African American or the Black women scientists from my undergraduate university. Initially, I started off wanting to go in more of the medical, dentistry field, but when I was introduced to research and the impacts that it made, like the broader impacts, implications, I was sold at that point. So their influence impacted my decisions here, and I would say in turn, I definitely want to pay it forward…

Angelina also shared her feelings about seeing female scientists in her department. She stated:

My research mentor is a woman, and the lady that's office is next to hers is a woman. I have heard [study site] talk about bringing in women scientists. Having them around me, I think ... Maybe it's an artificial environment. I don't know if it's like that in other institutions, but having people on my committee ... I guess my committee's evenly a couple of women and a couple of men. It helps me that there's been this environment created where it's a little bit more inclusive.

4.5.4   Additional Influential Identities

The study participants also mentioned other identities that were influential in the negotiation of the STEM, racial/ethnic, and graduate student identities. Over half of the study participants were second generation immigrants to the United States. This means that the study participants have at least one parent that immigrated to the United States (Pew Research Center, 2013). This is important to mention because many of these study participants discussed the challenges of identifying with their race/ethnicity in America, as opposed to their home countries. A few other identities were also discussed by study participants including their identities as mothers and divorcees. Additionally, one participant also discussed the conflict between his disciplinary identities and his racial/ethnic identity. When discussing his racial/ethnic identity, Sonny alluded to challenges connecting with other Latino professors because of their lack of understanding issues related to being a Latino American. He shared:

> I remember going through [baccalaureate university] and there wasn't really many Latino professors that I had, but some of the Latino professors that I did know of, I don't believe that they could really understand where I was coming from. Because usually, these professors were like from Argentina, Mexico, and they were, in the standards, like well off. I don't believe that they could ever understand or relate to the struggles of a Latino living in the states as not a well-off person, but I guess just being like lower, mid-class, or almost at poverty.

He continued on saying, "Latinos from elsewhere in the world who are more privileged and then Latinos from the US who don't experience those privileges." Another Latino participant, Carlos, shared similar sentiments. He said:

> So there's people, like Latinos here, but they're from I guess their first generation because they're coming from their countries. So they were well off in country and then they came here but my parents…, I mean they weren't like peasants but they weren't the elite from their country. So they came here. You really, really don't see second generation Hispanics in [academia] ... it's so rare.

He continued:

> You want to be able to show like, "We can do it." People ... children of immigrants that came here, especially immigrants that weren't too well off. Both my parents were refugees from wars in their countries. They came here and it was kind of a rough time to get life started here. That's the same story for a lot of second generation people, actually most I would dare say. Especially from Central America, which is where my parents are from. So it's kind of like ... it's like a "we can do it" kind of thing. But yeah ... so it's interesting. It's so rare to see second generation.

Alana, who identifies as half Black and half Asian, shared her experiences about how her race/ethnicity has been perceived by other students on campus, "I've had people come up to me and say, "Oh, you know you're just Asian" or "Oh, you know you're just Black." But no, I've got two different cultures." She later stated:

> Having to even kind of merge those two things has been an interesting process because, especially ... Having to merge those two things ... Even the language and stuff, like speaking Tagalog versus the English and stuff… Growing up, I would be speaking Tagalog to other kids, not noticing that they only speak English and stuff like that.

While Carlos hasn't experienced challenges negotiating his Latino American and Latino identities as an adult, he did recount his experience as a child. He shared:

> …because my parents are immigrants and then, so all…my church community, they're all pretty much immigrants and stuff. I guess it was kind of hard as a kid growing up, especially as a teenager, where you have to negotiate…you were born here so you're American, but at the same time, you'll always be a little bit…I mean…not outsider, but kind of different because you are Latino, but…so that was a little though growing up. Kind of, "Who am I?" But now I'm more comfortable with that, you know. I know from here, but at the same time, I'm comfortable with both aspects of my identity.

One student in the study also discussed challenges negotiating other identities while also negotiating her STEM, racial/ethnic, and graduate study identity. Summer Bright discussed her additional identities by sharing:

> I'm getting a divorce and I have a kid, so that was kind of hard for me, actually, because now ... before you had so much identities on the table. Now, in addition,

you've got to add another one, actually two others, because now I'm divorced,

you're getting divorced and now, oh wait, I'm a mom, and it's so hard.

Finally, one participant also discussed the identity conflict that he experienced between

his racial/ethnic identity and his disciplinary identity. Michael, a computer scientist,

shared:

I feel like a lot of the time I have to negotiate between this is how a professional

African-American is, and this is how a professional in computing is. Those two

things are sometimes very different. A professional African-American is very,

you know, quintessential definition of professional. A professional in computing

wears flip-flops and shorts all the time. It's really challenging. I enjoy getting

dressed up for things. I wear a suit when I have to. I feel like one of the most

interesting things to me is that when, as African-Americans in my community,

and things like that, you dress up, you go to church. You dress up, you go to

work. You dress up to do all these things, but when you're hanging out, you wear

regular clothes. At work, in my field, you wear regular clothes everywhere. I don't

have to, you don't have to change the way that you're dressed. You can dress

however you want. If you enjoy wearing suits, that's what you want to wear all the

time, you can do that. In the tech field, in certain places, it's almost like why are

you wearing a suit? That's kind of frowned upon, or you stand out in not a great

way. It's like you're an outsider. You're clearly an outsider because you're wearing

a suit. Versus other places, you wear a suit to fit in with everyone else. They're

kind of opposite of everything that I've been taught. It's like you have to present

yourself professionally, meaning you have to talk about the things that you're doing, and show people the work that you're doing. In this field, it's very much we know you by the work you do, not by, necessarily, by how you dress, or show, or present yourself ... That just adds to who you are, but everyone kind of gets to know you as a person.

In closing, the four sub-themes: 1) Race and Everything Else, 2) Intersection between STEM and Graduate Student Identities, 3) Gender Matters, and 4) Additional Influential Identities, described the intersection of the study participants' STEM, racial/ethnic, and graduate students' identities intersected and the behaviors that study participants' use to negotiate these identities. This theme, *Intersection and Negotiation*, also demonstrated that the study participants' racial/ethnic identity was the primary influence of how they interacted and behaved among URM and non-URM peers and faculty members. Study participants also perceived that their racial/ethnic identity was the reason for some acts of overt discrimination and microaggressions. Finally, this theme described the challenge of negotiating STEM and graduate student identities absent of race and discussed additional identities that students negotiated including their gender identity, other identities related to parenting and marriage, as well as, discipline specific identities.

4.6   Institutional Support Mechanisms that Shape Perception of Campus Climate

One research question of this study was to explore the role of campus climate in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students in STEM. The findings revealed that institutional mechanisms, specifically

targeted programs and initiatives designed to enhance persistence of URM graduate students in the STEM disciplines, helped to shape the perception of campus climate for the study participants. The responses revealed that participation in the various support programs on campus helped them to develop a sense of belonging by building community among URM graduate students. For study participants who did not attend the [study site] for their undergraduate study, these support programs were particularly important because graduate students tend to be disconnected from mainstream campus life. The responses also revealed that the targeted institutional support programs for URMs in STEM were deliberate in their efforts to provide instrumental and psychosocial support to the students engaged in the programs. Hence, providing a feeling of safety, comfort, and support for the participants in the study. Therefore, two sub-themes were revealed in exploring the role of campus climate in the negotiation of STEM, racial/ethnic, and graduate student identities, 1) Building Community, and 2) Incorporating and Delivering Instrumental and Psychosocial Support. The findings presented for this theme addressed the fifth research question, "What role does campus climate play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

4.6.1   Building Community

The findings of the study revealed that engagement and participation in institutional programs designed to support URM graduate students in STEM helped the study participants build community and therefore, enhance their sense of belonging and their perception of campus climate. As a result, study participants suggested that they

were in an environment that was safe to not only discuss their multiple identities, but navigate them. Perhaps James stated the impact of institutional support programs most simply when he shared "If I wasn't Black, I wouldn't be in the [ISSP 2]. I think that'd be something really unfortunate. The [ISSP 2] is fantastic." When discussing the role of targeted institutional support programs, Alana said:

> I think in the [ISSP 2] and those sorts of…[ISSP 1]…and those sorts of area. I think those are the places where I do feel the safest just because there's people like me, they're doing the same things, struggling through the same things and stuff. So that's probably where I feel the safest.

Summer Bright described how targeted institutional support programs not only provided a safe space to explore identity negotiation, but also helped her to feel less isolated. She explained:

> …because I was a part of some of these programs, then those were safe spaces, but had I not had those different places, I'm not sure. I'm not sure I would be able to freely think about how to even negotiate some of those things, because from some of the insights that I had from other students, what seems to be the trend is, as I mentioned before, graduate school can be extremely isolating.

Michael described the impact of institutional support program on campus climate here:

> …there is a community of underrepresented minority students on campus that…so there's a lot of different support and a lot of different things that are directed towards minorities on campus to provide support and things like that, and

so I feel like I'm a part of that community. Being part of that community means that I can get support for myself from other people who have similar backgrounds to me.

When discussing campus climate with Angelina, she suggested that her undergraduate university did not provide the same level of support for students of color. She shared her feelings about the transition here:

I think, coming from an institution, maybe where I got a different message of just…I'm not even sure what the message was. Sometimes, it was blatant, like you don't belong here. Other times, it was as subtle as just ignoring that you're here like we're just going to go about our business and pretend you're not here kind of thing. I think that message is really different from this current message.

She continued on saying:

As far as my graduate experience in the [ISSP 2], I think that helps foster a sense of community both racially and stuff, but also within your different programs because it spans a number of programs that are all STEM or biomedical or research-related. Within, I think, [ISSP 2] is a community to me. Specifically, the [ISSP 2]s that are in Biology is a community to me. It, I guess, in my mind, helps me be a part of concentric communities that are all related and help me feel like I belong here, when I didn't have that as an undergrad.

In Angelina's final comments about the campus climate and its role in helping her to negotiate her STEM, racial/ethnic, and graduate student identities, she said:

I feel like it's definitely a lot safer to think about those things and stuff. When I was an undergraduate, I only thought about it or talked about it with my other friends who were feeling the same way, so then you can get angry and feel like you're isolated and stuff. Here, I feel like it's a much more relaxed environment, where it's actively acknowledged by a lot of people that's the situation. If anything, even my mentor, she's not the same race as me, but she'll encourage me to take advantage. Apply for as much stuff as I can, because you have this advantage, in a sense, so why not use it. I think it's a more productive environment for helping me navigate these different identities, whereas before, it was just a breeding ground for animosity, almost, because you had to navigate these different identities in a place that wasn't really conducive to your success. I think it's definitely better here. I can sit and just muse about it when I'm in a meeting surrounded by other people that I know who are experiencing similar things.

When discussing the campus climate with Lacy, she suggested that institutional support programs helped the campus feel friendlier. She shared, "For graduate students, it wasn't as friendly." She also expressed that institutional support programs for URMs in STEM and disciplinary clubs act as a home for her. She stated:

I had these extra communities that act as more like a home, like those extra programs, and then I have to come back to reality with my department that is different. Even with getting involved in my chemistry graduate student association, I made a lot of relationships with my peers, colleagues, and that has

been helpful as well. I think every part of my experience has definitely helped me identify with all of them…identities.She later elaborated saying:

I would say, if it wasn't for programs like [ISSP 1] by [Director of ISSP 1] and the [ISSP 2], I would not enjoy the climate around here because, again, like I was saying, it's not very friendly. It was very competitive for graduate students.

4.6.2 Incorporating and Delivering Instrumental and Psychosocial Support

When describing the activities associated with institutional support programs like the [ISSP 2] and the [ISSP 1], students cited activities that are well aligned with two tenets of mentoring, instrumental and psychosocial support. Therefore, the findings indicate that not only do these programs provide professional development and academic support designed to help prepare students for successful matriculation and entering the workforce, but also that these programs foster a sense of support, camaraderie, and friendship among its participants. Summer Bright described the instrumental support she received as a result of being a member of the [ISSP 2] and [ISSP 1] programs by mentioning:

…I'm proud to say yes, it has helped me, because just to be honest with you, that process of trying to navigate moving labs, it could have gone quite differently had I not had the help of the program and even the director from the [ISSP 1] Program. Just real talk. Like, I've set out to do some goals in terms of, you know, I've wanted to go to more conferences and stuff, and before I had my fellowships, my F31 Fellowship, I was supported for my first year by the [ISSP 2], but one of

the continued perks of that program is that if you go to a conference that you

present, they will fund you for that.

Some students also shared their experiences of attending seminars that helped them to

gain knowledge regarding graduate program deadlines as well as hone their public

speaking and networking skills. Lacy recounted her experience here saying:

The dissertation house is definitely a big one. They take us off campus and we

write for a week or so, they offer professional development…They offer us

opportunities to present off campus for smaller conferences and that's basically

how I sharpened some of my presentation skills, just going to smaller conferences

and presenting, or visiting another university and doing our presentations.

When preparing for her preliminary exams, Summer Bright shared how she sought

assistance through the [ISSP 2]. She stated:

…because public speaking is a big thing, I then enlisted the [ISSP 2] group again

and I talked to the personnel about, okay, can you give just a couple students who

could really be really good students to pick me apart so that I can be strong.

Carlos also discussed the workshops and seminars offered through the institutional

support programs:

I know with [ISSP 1], they basically have little seminars for everything, but I

think two of the ones that I take most advantage of is number is the writing one.

They have the thesis workshop that they have every once in a while, and I did it

last summer, where you literally lock yourself for all day and just write. I used

that to write my pre-lim document. So writing, that was a very good program.

They also have a lot of programs where they try to sort of tell students how to

negotiate their relationship between you and your mentor. There's a famous

workshop called, "When Professor's Say X, They Mean Y, so I've been to several

of those.

He continued saying:

With [ISSP 2], they have a lot of programs where they tell you the next step out of

grad school, so they bring speakers in to tell you about post-docs in industry or

what you need to get into…or if you want to stay in academia, basically all sorts

of careers paths, so that's been interesting.

James also discussed how the program help to build a community of knowledge. He

shared:

When do you want to defend, when do you want to take your test, when do you

want to…who do you need to be on your committee, do you need four people, do

you need five people, do you need one person who's external to the department?

Now your professor might tell you all these things. Mine did for a few of those,

but there are things that you kind of have to figure out on your own. The [ISSP 2]

itself provides some kind of community knowledge. There's someone that you

can talk to who's done the things that you want to do or will do or has done things

you're going to do or in the middle of doing it themselves. That knowledge

exchange in the official capacity of the [ISSP 2] is really helpful.

The study participants also discussed the psychosocial support that is provided through the institutional support programs.

Alana shared:

> There's one fellowship here that's specifically for the minority students. That definitely has shaped my experience. It gives you this family to fall back on when you're feeling down and stuff and people who are outside of your lab, outside of your disciplines and stuff. I think that's definitely shaped my experience.

She continued saying:

> The ski trip that I was just on was with the [ISSP 2] group and the lab as a collaborative thing. We cooked together. We skied together. If somebody's fallen down, somebody's there to help you stand up. Just even in the local areas, it gives you girlfriends to spend time with. Part of the [ISSP 2] is you have this opportunity before your first year of graduate school to live on campus, get a research rotation done, but while you're living on campus, you're living together with other [ISSP 2]s [participants]. You're immersed in that from the get-go. That just helps to give you that family feeling. We have cook-outs. We do all sorts of stuff together.

Summer Bright shared similar sentiments. She said:

> I just really connected with other graduate students... a lot of them tend to be [ISSP 2], but one thing that did for me was that it just lets you realize really

quickly that the struggle's just not yours. Other people are going through the

same, so don't feel so bad, or don't think that you're just all in it by yourself.

She later shared, "One thing I'll say is, I'm definitely grateful to the [ISSP 2] because

some of my close friends that I have had from graduate school came out of that

program." Dave also discussed a component of the [ISSP 1] program that provided

psychosocial support as well as motivation for URM graduate students in STEM

matriculating through their graduate programs. He described the program saying:

> …the Summer Success Institute, which is a big event that they have every
>
> summer where people from all over the [University System] come together. It's
>
> like to motivate each other, and they have like workshops, and those types of
>
> things…they have a picnic at the end of the summer which is similar. It's like a
>
> motivational thing they have.

Two study participants also described how attending and participating in events designed

to provide instrumental support, subsequently provide psychosocial support as well.

Angelina said:

> I think presenting at the different events actually helps because you end up seeing
>
> the same people who are in your department, who are involved in those programs,
>
> as well as other people, and learning more about their work and getting to discuss
>
> it with them, which helps you forge the relationship more. That helps. Just seeing
>
> each other at the different workshops we have to go to. Before the workshop

starts, there's time to discuss and just spend time with each other and formulate

relationships.

She continued:

> I think it's just being together at specific things together. It just helps you feel like
> you're walking into a room, you pretty much know who you're going to see. Even
> if you don't know every person's name, you just feel like, "These are the same
> people I usually see when we have meetings and stuff." It's mainly meetings,
> presentations, workshops. It's just not feeling like you're not going into
> something blind, so to speak, is nice. That makes you feel more comfortable.

Summer Bright recounted an experience that, perhaps, demonstrates the ideal

demonstration of the instrumental and psychosocial support provided through

institutional support programs. She shared:

> …the [ISSP 1] Program provides a dissertation house, right. So dissertation house
> is just for a couple of days, they fund it where you literally go and you write.
> They have a dissertation coach who literally will give you tips on writing and all
> of that. I can't forget, "Remember, I'm a recent mom," the director of the [ISSP
> 1] Program, she contacted me and she's like, yeah, remember you said you were
> trying to finish, and I was like yeah, I really want to go, but then I have my baby
> and I'm a single mom, I don't know. She's like, okay, how about you bring your
> baby with you? We're talking about, I went at night with my baby, and at one

time, I was trying to write and he was really fussy and she just took my baby for me so I could write.

She continued:

Then the dissertation coach that they have, I have been working back and forth with her where she's just really giving me tips about how to mitigate certain things., how to work through different processes, and the fact that I have a baby, how to really balance all of that. Today, I sit with a almost completed dissertation, but it really took a lot of that. Yes, my mentor has been helpful, but that program and both of those personnels have provided support that I couldn't get in any other way.

In closing, this theme, *Institutional Support Mechanisms that Shape Perception of Campus Climate*, described the ways in which institutional support mechanisms, primarily support programs targeted toward URM graduate students in the STEM disciplines, helped to shape the perception of campus climate for the study participants. As demonstrated through the responses, graduate study can be isolating and disconnected from the mainstream campus experience. However, through engagement and participation in activities related to [ISSP 1] and [ISSP 2], the study participants were able to build community and receive instrumental and psychosocial support, hence, shaping their perception of the campus climate at the [study site]. It appears that these institutional support programs not only exposed the study participants to activities that would help them to develop academically and professionally, but also help them to develop a sense of belonging within the university and the graduate school community.

4.7   Mentors as Institutional Agents

During the interviews, study participants were asked not only to describe characteristics of mentors, but also to discuss who they identified as mentors and the ways in which these mentors helped them to negotiate their STEM, racial/ethnic, and graduate student identities. The responses revealed that the study participants received mentoring support from a variety of individuals that they interface with on campus ranging from the president of the university to peers in their research labs. The responses also revealed that while faculty and staff provided mentorship to the study participants, peers were also key mentors. Finally, the findings revealed that mentors, both peer mentors and faculty and staff mentors, were crucial to helping students negotiate multiple identities as well as navigate the various facets of graduate school. Therefore, three sub-themes were revealed in exploring the role of mentoring in the negotiation of STEM, racial/ethnic, and graduate student identities: 1) Characteristics of Mentors, 2) Peers at Primary Mentors, and 3) Mentors as Playbooks for Success. The findings presented in this theme addressed the sixth research question, "What role does mentoring play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

4.7.1   Characteristics of Mentors

When asked to describe characteristics of mentors, the findings revealed that although the formal definition of mentoring includes the delivery of both instrumental and psychosocial support, study participants used the term very loosely and applied it to any individual that provided them with instrumental support, psychosocial support, or

both. In essence, the definition of mentor for many of the study participants was more closely related to one's willingness to provide guidance of any kind, not the combination of instrumental and psychosocial support. When asked to describe characteristics of a mentor, Lacy shared the following:

> I would say someone who's honest and that knows how to use tact when it comes to criticism…is not as harsh, constructive if you will, availability and someone that can actually relate to where you're coming from, and a good listener. Yeah, I guess a good leader and follower type. They can listen and give good advice.

Angelina described a mentor saying:

> Someone who communicates well would be number one. Someone who is a good communicator, a good planner. Someone you feel comfortable with. Someone you think cares about you personally and professionally to a certain degree. Obviously, professionally is probably the bigger thing, but you do want them to pay attention to you in that way and be invested in your success The last thing, just probably someone that you think complements your personality, whatever that means for you.

Like Lacy and Angelina, Dave also believes that communication is key component of a mentoring relationship. He stated:

> I think there is mentorship in that they have like a direct line of communication with that person. The person is there to like listen and give feedback, maybe objectively and not like criticize them….I think that's a good part of mentorship.

Summer Bright described her mentor as one helped her to foster a sense of independence.

She shared:

> So with this particular mentor, I wanted to be independent and he really fostered
> and allowed me to do that, and it was mind-boggling compared to my previous
> experience. It really gave me the confidence to be a much more critical thinker
> and more confident in being a scientist and then, unlike my other lab, he actually
> recommended that I applied for a fellowship.

She continued saying:

> …that was just really encouraging to know that someone just really trusted me
> enough to be independent, but also gave me the guidance that I needed and just
> give me that platform where I can really see what my strengths and my
> weaknesses are in a safe place.

While many of the study participants discussed mentors providing the instrumental support that helped them to develop professionally, some study participants emphasized that mentors should be individuals that help to resolve personal matters as well. In fact, Angelina felt like she should be able to approach a mentor about many topics. She said, "I would think a mentor is someone that you feel really comfortable going to about a lot of things." Michael shared Angelina's sentiment sharing that he could talk to his advisor about anything happening in his life. He shared, "I could go to my advisor and ask or talk about anything going on in life. My life is getting really crazy right now, I have so much to do at home, do you have any advice, and I could get some advice."

In addition to advisors serving as mentors to many of the study participants, participants also indicated they were also involved in mentoring relationships with other

administrators, faculty, and staff on campus. In fact, Dave attributed his decision to attend graduate school to the president of the university. He stated:

> I met [The President] my junior year, and then he became my mentor, and then that's how I met [Director of ISSP 1], but not everybody meets him… I probably wouldn't have gone to graduate school if I didn't meet him.

Another student, Michael, also spoke about his mentoring relationship with the president of the university. He shared:

> I've met with [The President] all through my undergrad and I'm overdue for a meeting with him right now to talk more about mentorship and kind of things and avenues I'm trying to kind of gauge what it means and kind of adding meaning to what I do outside of my paper I published.

Summer Bright also shared the importance of the mentoring relationship she shares with the Director of the [ISSP 1] Program, she explained:

> I think one thing for me with her, you know, you can have difficulties and you can have setbacks, but that doesn't mean you can't rise to even better places. She's really helped me with that, to like, "Hey, okay, this didn't work out, let's go to Plan B."

Sonny shared similar sentiments about the Director of the [ISSP 1] Program. When discussing how she has helped him to resolve programs, he shared, "She is amazing. Anytime I've run into problems, I always run into her. I'll tell her, "I'm going through this, what should I do?"

Though some of the study participants used the term mentor synonymously with advisor, some were very clear that advisors provided only professional and academic

support. In fact, Dave characterized the difference between an advisor and a mentor as a "disconnect." He said, "I think it's because they're your boss, there is that disconnect. Then somebody like [Director of ISSP 1], on the other hand, they are not your boss. It's like you can talk to them about anything." He goes on to describe the difference between a mentor and an advisor here:

> I think, because there is advising and then there is mentoring. I think those are two different things. I guess the difference for me as an undergraduate student you receive advising sort of stuff. You go visit this person once a semester, yeah, once a semester and they tell you what classes to take or they give you permission. For me, they just gave me permission. They didn't ask how classes are going, or if you had any problems. There is no like personal relationship. They don't remember who you are.

He then provided an example of how he goes to his advisor as an academic mentor. He said:

> As far as if I want to figure out the best way to maybe become a member of my like academic community or at conferences being introduced to people, or just like giving guidance on submission for papers, those types of things. Like if I'm trying to design a study it's like, "I think you're not looking at the big picture. You should look at it," so like an academic mentor, but only an academic mentor.

He continued saying:

> I guess we can separate school, and like we're friendly and we talk about stuff, but
> we don't like add each other on Facebook and be like I have other personal stuff
> going on. I'm not going to them about that. I'm going to talk to them about school.

James shared similar sentiments about the relationship between him and his advisor. He said:

> …in that case, it's really just career based for me and my advisor. I don't talk to
> too many other people about life stuff… It's not like I don't think I can feel
> comfortable with her, I just don't think I would ... I think my calculus would be
> different. Does that make sense? My decision making calculus would just be
> different and I don't think it would make sense for me to ask her, definitely not
> personal questions.

4.7.2   Peers as Primary Mentors

When describing mentoring relationships, study participants cited mentoring relationships with their peers being influential relationships in their academic careers. The findings revealed that peer mentoring relationships were not only key in providing both instrumental and psychosocial support, but they were also reciprocal in nature. The study participants indicated that many of the peer mentoring relationships were cultivated through the targeted instrumental support programs designed for URM graduate students in STEM as well as through lab research groups. They also indicated peer mentors played multiple roles in the lives of the study participants such as friend, lab mate, and significant other. One demonstration of the importance of peer mentorship was simply

stated by Summer Bright. She shared, "So it's definitely the support of a lot of students that have really helped me to where I am today."

The study participants revealed that peer mentorship was a key component preparing for and completing required milestones in the doctoral program. Lacy shared:

I have some peer mentors within my actual department that are other Black girls, and that definitely helps because they actually passed some of those progression exams and milestones before I did so that was very helpful for them to pass down tips, things that I should do to decompress, things that I need to be making sure I'm doing weekly, daily, and we still have good relationships now.

Angelina also discussed the importance of peer mentorships when thinking through research challenges. She stated:

I think that my peers also serve as mentors. Discussing experiments with them, it's maybe less pressure than talking to your advisor and you feel like, you're like, "I can't say anything stupid." You feel a little more comfortable.

Summer Bright also recounted an experience where her peers helped to her to prepare for her preliminary exams by grading assignments for a class where she served as the teaching assistant. She shared the following story:

This particular student, he's actually a guy, he was rotating in my lab at the same time and we were there, and he just saw that I was really overwhelmed and I was just like, yeah, I just don't know how I'll make all of this. Because there were deadlines for those, but then my exam was coming up, and he was like, okay, or, "What can I do? I'll grade for you," and then he started helping me grade. Then it turned from him grading to then by the end of the day, everyone in the lab started

helping me grade, just because I would never ... I'm not going to get the time off, and I have to be here and I have to do all of that, so the entire lab helped me to grade all the quizzes that I had to grade and so that I could then go on Monday to TA, then not have to worry. Just go home, rest, and go for my exam.

Alana also shared that her peer mentors were invaluable in helping her to prepare for the oral portion of her preliminary exam. When comparing the assistance she received from her advisor with the assistance she received from her lab mates, she shared the following:

I had a lot of help actually more so from the post-docs and other graduate students. They really, really helped to make my presentation to be more clear and gave me things to think about as far as the questions that my committee might ask during the oral portion of the exam.

Lacy described how her peer mentors where there to help her cope both personally and academically when she did not successfully complete her preliminary exams the first time. She said:

When I didn't pass, they were there to help me decompress…They were also there to help me revamp my talk and really grill me on questions and go over it several times and laughs and tears and whatever, but they were there for me not passing, pretty much.

The study participants also revealed that their peer mentors also serve multiple roles in their lives such as significant other and friend. In fact, Alana's significant other

not only identifies as half African American and half Asian like her, but also works alongside her in the lab. When describing peers, she spoke of him saying:

> It's kind of interesting. My boyfriend is actually half Black and half Filipino. So having that person there to kind of talk about you know, "Oh, I miss this sort of food." That sort of thing just helps to keep you sane and remind you of home and stuff like that while being a graduate student and understanding that struggle. At the same time, being in the same lab so we can bounce ideas off of each other. That has been a saving grace for me. Just having someone there that really gets the different details and all of the different aspects.

She also shared, "He gets to see me all the time. He can't run away. I generally will go to him." She continued saying, "…my boyfriend, he gets the whole gamut of everything." Some study participants also indicated that their peer mentors have become friends. When discussing the peer mentors in her lab, Summer Bright shared:

> I feel like I've really made friendships here, lasting friendship here in this particular lab, and I think was really good, just feeling like you can go to work and knowing that it's a supportive environment.

Dave shared similar sentiments saying, "Some of the best friends I've made here in grad school were people who went through the Bridge to Doctorate Program." Michael also described the importance of friends and peer mentors that are in different disciplines and pursuing different degrees. He shared the following:

Having friends in all these different departments makes it cool because when we get together we can't talk about specifically what our work is because I'll tell you what I'm doing, you won't understand. You'll tell me what you're doing and I'll fall asleep, so it's really important to be able to come out of that and not have the pressure of talking about it. You can just… "I'm in my third year. Did you do your proposal yet? Do you want me to listen as someone who knows nothing about what you're doing? I can be that ear."

4.7.3   Mentors as Playbooks for Success

The study participants revealed that administrators, faculty, staff, and peer mentors were critical to helping them negotiate their STEM, racial/ethnic, and graduate student identities. Responses indicated that mentors were not only helpful in providing guidance and direction on how to navigate the graduate environment, but also how to behave and interact in various contexts. For example, Lacy explained how her peer mentors helped her to negotiate her identities and navigate the graduate environment. She said:

I would say maybe the peer mentors sometimes, they know the here and now, so they might just be a year or two ahead of me, so they might know, okay, "He's going to ask you about this so be ready." Especially the ones in my department. They know the current climate of the department as opposed to faculty, they may be farther removed, so that's always good to have that."

Michael actually prides himself in seeking out new graduate students in his department to share with them the stages and feelings they might experience during their matriculation. He shared:

> Every time new students come in, I usually try and find out who they are. I have kind of made it a point to know as many people in my department as I can, and to, for the most part, be available as someone who's been here or been through it. So when new people come in, I tell them there's a four-step process to what you're about to go through. You're going to go through your first semester and be really excited, second semester you're going to freak out and it's okay, you can get over it, third semester, you'll start to get it together, and by fourth semester you'll be fine. Then you just keep going.

He continued:

> It's helped a lot of people to do that, and it's something that I didn't have when I came in that would have been helpful when our five-person cohort became a four-person cohort during the second semester freak-out. So over the course of going through that, the five of us kind of came up with that there was this process, and we see the new people come in and we see it happen again and again. From seeing it happen more than once, we've learned that it's the process in this department that things might happen that way, as people start to realize how things work, and that being able to talk to someone else about it while they're ahead of you, behind you, doesn't matter, as long as you have someone else who is either going through it or knows that there's another side.

Consequently, Dave and Michael are in the same graduate program. Dave specifically talked about the mentorship he received from Michael when he said:

> Michael is in my program. He is my lab. He is ahead of me, but like he is somebody I can go to with questions about like, when you get to graduate school then you realize that there are like departmental politics, and all of these other things that you didn't realize existed, but they can help you in how to navigate them. Then they will tell you things that maybe the teachers won't. It's like, "Oh this class, with a comprehensive exam, something like this, don't worry about this now. You should just do this, or you should focus on this."

When Angelina was feeling unsure about the rate of her progress before preparing for preliminary exams, she shared that her peers who had experienced it before provided important validation and encouragement. She recounted her experience saying:

> There was a period of time where I felt like everyone was making progress except me. At that time, I think, discussing it with peers ... While I was preparing for the preliminary exam and reflecting back on everything I had done and feeling like it wasn't enough, even though I had put in so much effort, discussing it and seeing that maybe I had done more than I felt like I had done really helped, especially when I got to my meeting and they're like, "You've done a lot." I realize that my friend, that I was mainly complaining about it to and trying and bouncing ideas off of, was right. That validation and encouragement from my friend really helped me get over that hump. That was important.

Summer Bright revealed that one particular peer mentor was critical in helping her to navigate the environment of her new research lab: She stated:

> She's African American, and one thing she had said to me was, you have to know the right questions, and you have to be your own advocate… So, I really appreciate that person for being as candid as she could have been, to let me know, and when I did come to the lab, because it was a pretty small lab, she was very warm to me, and started really trying to get me reacquainted with this campus, trying to get me involved in other graduate organization in campus, just to get me out there. For me that was really, really helpful, because I was already going through my own emotional issues where you're in one lab, you go to another, you're feeling like oh, you're such a failure or whatever. Just to know that someone was there to like, "Hey, you know, don't worry about that. I got you. Okay, what do you need?"

The study participants also described how faculty and staff helped them to learn how to negotiate their multiple identities. James shared his experience here:

> I think seeing Black academics definitely gives some kind of idea of playbook, something closer to a playbook. There are ways that you negotiate with other people, and there's a certain freedom, because some ... I think as a Black person in general, there's a bit of vagueness about what is allowed, per se. What is allowed to escape certain stereotypes, what's allowed to just be seen as a regular person, and seeing [Director of ISSP 1] or seeing [the President] being whoever they are, it just gives ... The more examples you have, the more examples you have of

Black academics, Black people in academia just succeeding. So if I think about just their existence and just seeing them, and talking to them partly but just seeing them interact with the administration, interacting with other professors, that helps a great deal.

Michael also described the president and other Black administrators on campus saying:

... I can see a lot of how they conduct themselves. A lot of the time, they've gotten to the point where it seems like they can be themselves. They don't have to put on an act for anyone or anything. Being able to see that level of comfort, being comfortable in your skin is really helpful. It's like okay, so I don't have to be like my mentor. I don't have to be like the person who is, you know, my role model. While I'm supposed to look at them as a role model, I don't have to develop the same personality. It's really helpful to see those examples, and to see examples of people succeeding, and maintaining their identities.

Summer Bright also shared words of encouragement from female faculty and staff members who taught her how to navigate situations where she may feel intimidated. She shared:

…you might go into a room, you don't quite have the degrees that other people have but you know you have something valuable to say, and even though you're nervous as heck, sometimes you just have to project and just reinforce that you have something that they need to know. Just keep doing it and over time, you'll just get better. So for me, I think she was one person who really helped me to find

that voice, internal voice, to say, hey, you're Black, you're in a place where there's going to be a lot of people who don't look like you, but it's okay.

As a mother, Summer Bright also shared how a female URM mentor helped her to navigate not only her STEM, racial/ethnic, and graduate student identities, but also her identity as a mother. She said:

…I was really having a chaotic feeling inside my head, and she was one person who really was able to come alongside me, like, okay, so you're a mom. That's okay. We're going to get this done, and she really provided that support and that mentoring needed to balance mommyhood and pursuing a PhD, when the going was really tough. I feel like I've learned some really valuable lessons from that, that simply put, all of those people combined together is a really large force in why I'm still here.

In summary, the three sub-themes 1) Characteristics of Mentors, 2) Peers as Primary Mentors, and 3) Mentors as Playbooks for Success describe the role of mentors in helping URM graduate students in STEM negotiate multiple identities. The responses suggest that not only do the study participants identity mentors as individuals who provide various levels and types of support, but that peer mentors specifically are critical to helping students successfully matriculate through their graduate programs. Peer mentors not only provide instrumental support in helping students successfully complete milestones required in the graduate program, but provide psychosocial support through friendship and camaraderie. Finally, the findings indicate that both peer and faculty and staff mentors are key in helping study participants learn how to negotiate their identities.

4.8   Chapter Summary

This chapter included the purpose of the study, the research questions, and the findings of the study presented in four thematic areas: 1) *Understanding My Identities*, 2) *Intersection and Negotiation*, 3) *Institutional Support Mechanisms that Shape Perception of Campus Climate*, and 4) *Mentors as Institutional Agents*. The four themes addressed research questions three through six as research questions one and two were topical questions, and were addressed in chapter three. Each of the themes in this chapter characterized the study participants' experiences, interactions, and behaviors as they made meaning of and negotiated their STEM, racial/ethnic, and graduate student identities. The themes also described the role of campus climate and mentoring as the study participants negotiated their multiple identities. The theme, *Understanding My Identities* focused on how the study participants made meaning of their STEM and graduate student identities as well as described the isolating and independent nature of graduate study. The theme, *Intersection and Negotiation* described how study participants made meaning of their racial/ethnic identity through intersection with their STEM and graduate student identities. Additionally, this theme also highlighted how students negotiated their STEM and graduate student identities absent of race and additional identities separate from those explored in the study such as gender. The theme, *Institutional Support Mechanisms that Shape Perception of Campus Climate described* how involvement in programs targeted for URM graduate students in the STEM disciplines shaped the participants' perception of campus climate through providing activities that build community among URM graduate students and deliver both

instrumental and psychosocial support. Finally, *Mentors as Institutional Agents* described

how administrators, faculty and staff, and peers mentored the study participants and

helped them not only to complete programmatic milestones like preliminary exams, but

serve as examples to demonstrate how to successfully negotiate multiple identities in

various contexts.

CHAPTER 5. CONCLUSIONS

5.1   Chapter Overview

This chapter will present a summary of the conclusions for the study. First, the chapter will provide a review of the purpose of study as well as the research questions that guided the study. The chapter will then highlight the five major conclusions of the study which include: 1) Understanding STEM and Graduate Student Identity for URM Graduate Students in STEM, 2) Influence of Racial/Ethnic Identity for URM Graduate Students in STEM, 3) Role of Support Programs for URMs in STEM in Shaping Campus Climate, 4) Role of Peer and Faculty Mentoring, and 5) Negotiating STEM, Racial/Ethnic, and Graduate Student Identities. The chapter will conclude with implications for theory and practice as well as recommendations for future research.

5.2   Purpose of the Study

The purpose of this study was to explore the negotiation of STEM, racial/ethnic, and graduate student identities among URM graduate students pursuing STEM degrees at a predominantly white research institution. Further, this study sought to explore the role of mentoring and campus climate in the negotiation of STEM, racial/ethnic, and graduate student identities.

5.3   Research Questions

1. What are the student and faculty demographic characteristics in the STEM departments of the predominantly white research institution in this study?

2. What are the completion rates of the URM graduate students majoring in STEM disciplines at the predominantly white research institution in this study?

3. How do URM graduate students pursuing STEM degrees make meaning of their STEM, racial/ethnic, and graduate student identities?

4. How do URM graduate students pursuing STEM degrees negotiate their STEM, racial/ethnic, and graduate student identities?

5. What role does campus climate play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

6. What role does mentoring play in the negotiation of STEM, racial/ethnic, and graduate student identities for URM graduate students pursuing STEM degrees?

5.4   Conclusions of the Study

The following sections will present conclusions for the study. Five major conclusions are discussed below, along with how the conclusions relate to prior research on URM graduate students in STEM as well as how they contribute to the current literature. Additionally, the results will be linked to the theoretical perspectives that guided the study, Intersectionality and the Institutional Agents Framework.

5.4.1 Conclusion 1: Influence of Race/Ethnicity for URM Graduate Students in STEM

The findings from this study suggest that race/ethnicity was the single most influential factor not only in how the study participants behaved and interacted with URM and non-URM peers and faculty, but also how they were perceived and regarded by others. The findings suggest that some study participants experienced microaggressions, overt racism, and feelings of inadequacy all related to their racial/ethnic identity. Results also showed that participants often felt the need to represent their race in a positive manner by demonstrating socially acceptable behavior and feeling that they needed to "be the best" among their peers in an effort to avoid negative stereotypes about URM individuals, namely those who identify as African American and Hispanic. Finally, participants in this study often sought opportunities to link their racial/ethnic identity with their STEM and graduate student identities through research, recruitment, and engagement with URM individuals and communities.

According to the literature, social identities such as race/ethnicity, not only influence the development of academic identities, like STEM and graduate student identities, but also influence learning (Wortham, 2004). Researchers have also found that students tend to bring their racial/ethnic identities into academic environments (Fordham & Ogbu, 1987). Findings from this study suggest that URM graduate students in the STEM disciplines tend to gravitate toward other URM individuals in academic settings like classrooms, labs, and conferences in an effort to seek individuals who may share similar backgrounds, perspectives, and experiences. In essence, for participants in this study; engagement with other URM students and faculty provided a sense of comfort,

community, and inclusion in settings where they otherwise often felt marginalized. In fact, one participant stated explicitly that he felt more comfortable when engaging with other URM graduate students rather than with members of the White majority. Further, some participants sought opportunities to engage with individuals through languages like Spanish and Tagalog, which also enhanced sense of belonging in settings where members of similar racial/ethnic groups are often fewer in number. These experiences shed light on the literature that emphasizes sense of belonging as an important factor for URM students in the STEM disciplines that often find themselves marginalized (Hurtado & Carter, 1997; Strayhorn, 2013).

Throughout this study, participants indicated that they often altered their behavior in academic settings, particularly when there is little URM presence, to avoid perpetuating negative stereotypes such as laziness, aggression, or lack of academic ability. This finding is supported by previous literature on stereotype threat and impostor syndrome (Beasley & Fischer, 2011; Graham, 2013; Peteet, Montgomery, & Weekes, 2015). For example, one participant shared his reluctance to openly express dislike or disagreement in academic settings for fear of being perceived as hostile. This type of behavior is associated with stereotype threat, specifically with what Pinel (1999) described as stigma consciousness, whereby individuals may modify their behavior based on how much stereotype threat they perceive in their environment. Furthermore, multiple participants shared both the desire and the pressure to be the best among their peers to demonstrate their academic ability and prove their worth. This behavior aligns with findings on stereotype threat which has been found to enhance performance anxiety for African Americans and Hispanics in STEM (Beasley & Fischer, 2012). In addition to

stereotype threat, participants in this study also demonstrated that they suffer from impostor syndrome (Clance & Imes, 1978). For example, one participant shared her reluctance to raise her hand in class for fear of being perceived as academically inadequate. Another student also shared specific instances in lab meetings and classroom settings where he felt like he did not belong. According to Graham (2013), impostor syndrome can have demoralizing effects on minority doctoral students. In fact, it has been found to influence development and overall academic contributions (Reybold & Alamia, 2008). Finally, study participants discussed multiple instances where they were the victims of microaggressions in the form of subtle jokes and overt discriminatory remarks which have been found to enhance emotional and cognitive stress and potentially deplete resources for STEM success (Grossman & Proche, 2013).

In the seminal work that established science identity, Carlone and Johnson (2007) found that some URM women in science redefined their definition of what it meant to be a scientist and used science as a means to pursue altruistic ambitions. However, Tran (2011) found that URM graduate students in STEM not only utilize science as a vehicle to engage in altruistic interests, but also take it a step further and use science as an instrument to catalyze social change. The findings in this study revealed similar results indicating that participants not only felt a personal responsibility to recruit more URM students into the STEM disciplines, but also sought to conduct research projects and address research questions specifically focused on challenges in URM communities. Furthermore, the participants in this study were deliberate in their efforts to engage and participate in diversity initiatives within their specific disciplines. Therefore, it is logical to assume that for these study participants, utilizing STEM identity as a tool to fulfill

altruistic aims and foster social change eliminated or, at the very least, reduced the dissonance that occurs between STEM identity and racial/ethnic identity which often causes many high achieving URM students to leave the STEM disciplines (Cobb, 2004).

5.4.2   Conclusion 2: Role of Faculty and Peer Mentoring

For participants in this study, faculty and peer mentors were critical not only in helping students to negotiate their STEM, racial/ethnic, and graduate student identities, but also in providing the instrumental and psychosocial support necessary to help the participants succeed academically. While both faculty and peer mentors were cited as providing critical mentoring support to the study participants, faculty mentors were more likely to provide instrumental support in the form of academic and financial resources, which led to enhanced professional development. Conversely, peer mentors were associated with providing both instrumental and psychosocial support, which was determined to be influential in helping students to overcome academic and personal obstacles, and essentially, helping students to matriculate through their graduate programs.

The findings of this study suggest that the provision of instrumental and psychosocial support was critical to helping students navigate challenges such as changing research labs, managing the competitive culture of graduate study, and providing resources to enhance professional development. For example, one participant explicitly stated that she would not have reached doctoral candidacy without the support of mentors. Another student, the only participant who attended an HBCU for undergraduate study, suggested that mentoring was vital to helping her understand and

manage the competitive graduate school environment. These findings support existing literature which has found that effective mentoring is particularly important for URM students matriculating through graduate programs (Fedynich & Bain, 2011). These findings further support research which has demonstrated that mentoring is significantly and positively related to student persistence and graduation in STEM majors as it helps URM students navigate potential barriers related to pursuing graduate study at PWIs (Maton & Hrabowski, 2004). These findings further supports the work of Figueroa and Hurtado (2014) who found that mentoring and faculty support were critical to success in the graduate environment.

Findings from this study suggest that faculty mentors were key in helping provide instrumental support and guidance on developing research studies, writing manuscripts, and building a personal brand within an academic discipline. These findings are aligned with research which has found instrumental support from advisors to be significantly related to student productivity (Tenenbaum, Crosby, & Gliner, 2001). The findings also support literature that have found faculty members to be key in helping students to socialize students into graduate departments and the academic discipline (Hall & Burns, 2009). In this study, faculty mentors were the primary providers of instrumental support, which focuses on skill enhancement and aiding in the expansion of professional networks (Davidson & Foster-Johnson, 2001). Existing literature suggests that academic advisors do not necessarily serve as mentors (Johnson, 2016). However, findings from this study suggest that many participants do consider their advisor as a mentor. This is important as advisors have been found to be the most important contributors to socialization in the academic community (Nettles & Millett, 2006; Lovitts, 2001). Research has also found

that overall graduate experience has been positively associated with the receipt of psychosocial support from mentors (Tenenbaum, Crosby, & Gliner, 2001).

While mentoring from faculty was important, participants shared that mentorship provided by peers was the most influential for the study participants. In fact, one participant stated, "So it's definitely the support of a lot of students that have really helped me to where I am today." According to the findings, peer mentoring relationships were essential in helping students to successfully complete programmatic milestones such as preliminary exams, providing advice and guidance on coursework, and navigating departmental and university hierarchical structure. For example, one student shared an experience in which a peer mentor in her cohort lab group helped her to grade assignments for her teaching assistantship to ease her workload while preparing for preliminary exams. Other students shared similar experiences whereby peer mentors provided tips and strategies for taking preliminary exams. While these are only two examples, accounts of peer mentorship were salient across all study participants. These findings are consistent with the findings of Reddick and colleagues (2012) who found that not only is peer mentorship reciprocal in nature, but it also provides an opportunity for students to gain an enhanced understanding of their academic discipline by providing assistance to others. These findings also support research suggesting that peer mentors can also serve as an important advising alternative to faculty members (Kram & Isabella, 1985). In addition to instrumental support, findings from this study suggested that peer mentors were also critical in providing psychosocial support as well. One participant specifically cited the support of peers in helping her to cope with failing preliminary exams and subsequently providing encouragement and support in preparation for re-

taking the exam. Additionally, all participants identified peer mentors as friends. Therefore, it is a logical assumption that individuals identified as friends provided some level of psychological and social support as well. Taken together, the findings on peer mentorship align with the literature which suggests that peer mentors are critical to retaining students in STEM graduate programs since they not only provide support in helping students to overcome programmatic milestones, but also help students to overcome feelings of marginalization and loneliness (Brown, Cropps, Coy, Esters, & Knobloch, 2016).

The collective findings from this study substantiate the assertion that mentoring is an effective strategy to improve the retention of students where historical underrepresentation has occurred (Girves, Zepeda, & Gwathmey, 2005). While many studies have focused on mentoring support from advisors, this study suggests that peer mentoring is equally as important, if not more important than faculty mentoring as peers tend to be closer in proximity and the relationships tend to be reciprocal in nature and less hierarchical (Ensher, Thomas, & Murphy, 2001).

5.4.3   Conclusion 3: Institutional Support Programs and Shaping Campus Climate

Findings from this study suggest that institutional support programs, were critical to shaping the perception of campus climate among URM graduate students in the STEM disciplines. Due to the isolating nature of graduate study, institutional support programs like the [ISSP 1] and the [ISSP 2] were key in providing the study participants with an opportunity to become a member of an academic and social community consisting of URM graduate students and faculty which enhanced their sense of belonging. These

programs also provided a space where students cultivated friendships and mentoring

relationships, were shielded from stereotypes and negative racial experiences, and safely

learned to negotiate multiple identities.

Seymour and Hewitt (1997) found that individuals from URM communities tend

to be cooperative and community oriented in nature. Conversely, however, research has

demonstrated that the culture and climate of STEM disciplines and graduate school

environments typically reflect values of the White majority which tend to be competitive

and individualistic (Bonous-Hammarth, 2000; Seymour & Hewitt, 1997). A key finding

of this study suggests that institutional support programs that are specifically focused on

providing support for URM graduate students in the STEM disciplines are critical in

helping URM students to reconcile their natural dispositions toward family-like,

community environments with their STEM and graduate student identities, which tend to

be individualistic and independent in nature (Cobb, 2004; Lovitts, 2005). For example,

one participant highlighted the isolating nature of graduate school, but suggested that

engagement with the [ISSP 1] and [ISSP 2] helped to combat feelings of isolation and

even catalyzed her participation in other disciplinary student groups. Another student

who attended an HBCU suggested that without the presence of institutional support

programs at the study site, the environment was not as friendly. She also suggested that

institutional support programs feel more like "home," for her as opposed to her academic

department. This finding supports research which has demonstrated that positive

perceptions of campus climate may alleviate the negative racial culture that may exist in

STEM departments (Johnson, 2012). Findings from this study suggest that institutional

support programs provided an enhanced sense of belonging for the study participants. In

fact, one student specifically referred to the [ISSP 1] and the [ISSP 2] as a community not only where he holds membership, but also a place where he can get support from people with similar backgrounds. Finally, some participants referred to the institutional support programs as a "safe space" where they can think freely about how to negotiate their STEM, racial/ethnic, and graduate student identities. These findings align with research which has identified sense of belonging as an influential factor in the persistence of URM students in STEM who find themselves marginalized in collegiate environments (Hurtado & Carter, 1997; Strayhorn, 2012)

In Hurtado's (1994b) framework for campus racial climate, the institutional context of the university is the product of the intersection between structural diversity, psychological climate, behavioral dimension, and historical legacy of inclusion/exclusion at the university. Findings of this study suggest that institutional support programs contributed to a positive perception of structural diversity, psychological climate, and behavioral dimension for the study participants. Essentially, both the [ISSP 1] and [ISSP 2] cultivate supportive communities of URM graduate students and faculty members which help to combat feelings of isolation, ease racial/ethnic tensions, and provide opportunities for social interaction and campus involvement. Hence, the presence of institutional support programs for URM graduate students in STEM positively shape the institutional context of the university, and therefore, the positive perception of campus climate. These findings support the work of Espinosa (2011) who found the college environment and college experiences to be influential to STEM persistence.

5.4.4   Conclusion 4: Making Meaning of Academic Identities

Findings of this study suggest that URM graduate students in STEM understand and make meaning of their STEM and graduate student identities absent of their racial/ethnic identity. For example, when characterizing STEM and graduate student identities, the participants described tasks, responsibilities, and accomplishments that were deemed successful only when achieved independently such as passing preliminary exams and managing research projects. Therefore, it appears that while URM students tend to have cooperative and community-oriented dispositions, their experiences as graduate students in STEM have shaped their perception of what it means to be a successful graduate student and STEM scientist, which ultimately reflects the individualistic and competitive nature of STEM and graduate environments as socialized by the White majority (Seymour & Hewitt, 1997).

Researchers have found that URM students believe it is necessary to choose between a strong academic identity and a positive racial/ethnic identity (Nasir & Saxe, 2003). In this study, participants characterized STEM scientists as individuals who independently pursued their own research questions, published in peer-reviewed journals, received research grants, and who were acknowledged by their peers as experts. Essentially, they defined STEM scientists as individuals who were acknowledged by their peers for their independent disciplinary contributions. As a result, study participants acknowledged themselves as STEM scientists only when they too were recognized by their disciplinary peers for their independent disciplinary contributions. For example, one participant correlated her STEM identity to the successful submission of manuscripts,

receipt of research grants, and winning research competitions. This finding aligned with the Science Identity Framework which identifies performance, recognition, and competence as the three primary dimensions of science identity (Carlone & Johnson, 2007). Additionally, this finding supports Gee's (2000) definition of discourse identity whereby an individual is recognized through discourse and dialogue for an individual trait such as STEM expertise.

When describing graduate student identity, a salient finding among the study participants was the notion of being responsible for driving one's own progress through the stages of graduate study including completion of coursework, research, and preliminary exams. This finding is consistent with Lovitts' (2001) work on graduate study emphasizing the value and importance of independent accomplishments. Participants also linked their graduate student identity to managing multiple tasks such as serving as a teaching or research assistant, managing research projects, taking courses, attending meetings, and mentoring undergraduate students. It is also worth acknowledging that some participants associated graduate student identity with the hierarchy that exists at the university and within individual labs. The notion of hierarchy suggests that participants recognize their identity as a graduate student and its related duties as a position within the university structure (Gee, 2000). Most importantly, participants' understanding of graduate student identity confirms the assertion made earlier in this study that graduate student identity is an identity in its own right. Therefore, like other identities, graduate student identity has its own set of norms, expectations, and challenges.

Research suggests that URM students often feel the need to become 'raceless' in the classroom or mask their racial/ethnic identities in academic settings to achieve success (Davidson, 1996; Fordham & Ogbu, 1986). The collective findings on STEM and graduate student identities suggest that study participants have essentially removed race from the characterization of STEM and graduate student identity, and embraced the independent and individualistic nature of STEM and graduate programs.

5.4.5   Conclusion 5: Negotiating STEM, Racial/Ethnic, and Graduate Student Identities

As revealed in the findings of the study, the participants encountered difficulty with the notion of negotiating their STEM, racial/ethnic, and graduate student identities. It is notable, however, that although participants encountered difficulty, they suggested that peer and faculty mentors were exemplary demonstrations of how to negotiate STEM, racial/ethnic, and graduate student identities. In general, participants shared that instead of negotiating their STEM, racial/ethnic, and graduate student identities collectively, they often opted to emphasize the identity that they determined to be the most appropriate for the context or setting (Tran, 2011).

Similar to the findings of Tran (2000), participants in this study suggested that they consider their STEM, racial/ethnic, and graduate student identities separately to avoid thinking about the collective challenges and expectations associated with each individual identity. For example, when asked to describe the thoughts associated with negotiating his STEM, racial/ethnic, and graduate student identities, one participant described the process as "dark." Other participants suggested that considering the identities separately allowed them to compartmentalize and select the appropriate identity

for the appropriate context. This approach of considering identities separately and emphasizing a particular identity based on the setting is something that Brown (2004) calls "code-shifting" whereby students emphasize the identities that they deem most appropriate for the context. This approach is not ideal as it prevents participants from successfully merging their collective identities (Brown, 2004; Tran, 2000). Another approached utilized by one study participant was mentally detaching from racial/ethnic identity to eliminate any potential feelings of inferiority. While this strategy may seem effective, it is actually associated with stereotype threat whereby individuals disengage from the domain or identity in question to make the identity less central or less relevant to the interaction (Major, Spencer, Schmader, Wolfe, & Crocker, 1998). Finally, although participants in the study experienced difficulty in negotiating their own multiple identities, many participants cited peer, faculty, and administrative mentors, who were also URMs, as being exemplary demonstrations of how to negotiate multiple identities. This finding indicates that although participants encounter difficulty themselves, they do know what it looks like to successfully negotiate multiple identities in various contexts. This finding supports existing literature that mentors are important for identity development and learning how to negotiate the roles associated with being both a researcher and a student (Hall & Burns, 2009; Zhao, Golde, & McCormick, 2007).

5.5   Implications for Theory

Two theoretical perspectives, Intersectionality and Institutional Agents Framework, were utilized to inform the development of this study as well as interpret the results. Intersectionality suggests that multiple identities, like race/ethnicity and gender,

interact in ways that affect perceptions, experiences, and behaviors as well as how one is viewed by others (Crenshaw, 1989; Tennenbaum, 2015). Intersectionality theory further suggests that multiple identities are not separate, binary entities, but collectively create their own unique interplay of identity (Crenshaw, 1989). Institutional Agents Framework is a social capital framework that describes the means by which institutional agents can provide institutional support and resources that help to increase the social and cultural capital of marginalized individuals (Stanton-Salazar, 2011). Together, these theoretical frameworks helped to shape the overall design of the study as well as to interpret results, particularly as they related to negotiating STEM, racial/ethnic, and graduate student identities and mentoring.

5.5.1 Intersectionality

Though intersectionality was first used as a construct to explore the ways in which race and gender interact to shape the experiences of Black women, today, various disciplines have adopted it as a construct to explore the intersection of other social identities and other categories of difference. In this study, intersectionality was used to explore the interplay among STEM identity, racial/ethnic identity, and graduate student identity. The findings of this study suggested that participants experienced difficulty when attempting to negotiate their STEM, racial/ethnic, and graduate student identities, but rather engaged in code-switching whereby the participants compartmentalized and considered their identities separately and emphasized the most appropriate identity based on context (Brown, 2004). For example, when conducting research, study participants

indicated a tendency to emphasize their identity as a STEM scientist, whereas in meetings with advisors, participants tended to emphasize their identity as a graduate student.

Intersectionality posits that multiple identities come together to create a unique and complex interplay of identity (Crenshaw, 1989). The findings of this study revealed that the intersection of STEM, racial/ethnic, and graduate student identities does create a distinctive set of issues (Reynolds & Pope, 1991). For example, not only are students faced with the pressures and challenges associated with their URM racial/ethnic identity as discussed in conclusion one, but they are also confronted by the challenges and expectations of being a STEM scientist and graduate student as discussed in conclusion four. An additional level of challenge exists since the natural dispositions of the participants are in direct conflict with the climate, culture, and expectations associated with success in STEM and graduate study.

While gender identity was not considered in the negotiation of multiple identities for this study, some female participants expressed gender identity as a significant identity to consider in the negotiation of STEM, racial/ethnic, and graduate student identities. For example, one participant recounted an experience where she felt she was mistreated, however, she could not discern whether the treatment was due to her race/ethnicity, gender, or both. Additionally, two participants also expressed that they felt anxious when justifiably asserting themselves for fear of being stereotyped as angry Black women. Not only is this behavior evidence of stigma consciousness (Phinel, 1999), but these findings are not surprising as intersectionality was first constructed to explore the intersection of race and gender, specifically, the experiences of Black women (Crenshaw, 1989).

The findings in this study also substantiate the oppression and marginalization that can occur as a result of possessing both STEM and graduate student identities. For example, as a result of the power differential that exists between advisors and graduate students, some participants expressed difficulty or no desire at all to develop mentoring relationships with their advisors because their advisor also served as their supervisor. In essence, while not stated explicitly, it appears that participants didn't feel comfortable developing mentoring relationships with individuals who have the power or authority to negatively influence their matriculation. In addition to the power differential that exists between advisors and graduate students, participants also expressed feeling less knowledgeable and less capable in their role as a graduate student when interacting with an advisor or STEM scientist who possessed a doctorate degree. For example, many participants shared difficulty articulating themselves in the presence of their advisor for fear of being perceived as incapable. Additionally, one participant expressed feeling less welcomed and less respected when serving on a panel of judges for a research competition with other individuals who already obtained their doctorate degrees and were assistant and associate professors. Finally, participants also discussed the hierarchy that not only exists at the university overall, but within the graduate environment as well. This finding has two implications. First, while the students didn't express negative experiences as a result of the hierarchical structure, their acknowledgement of the hierarchy does indicate that the participants recognized the power, privilege, and limitations of their identity as a graduate student. Second, this finding suggests that within the graduate environment, there are certain levels of privilege and social status associated with the role of master's and doctoral student. Furthermore, the findings suggest that there is a

hierarchy and set of expectations and responsibilities associated with doctoral students who have passed their preliminary exams and those who have not. For example, participants discussed having increased responsibilities in the lab, increased expectations to mentor younger students, and increased flexibility to explore research independently after passing preliminary exams.

5.5.2   Institutional Agents Framework

Institutional Agents Framework was incorporated in the study to primarily explore how institutional support and resources provided by institutional agents, defined as mentors in the context of this study, ultimately increased the social and cultural capital of participants. Study findings suggest that the mentorship provided by peers, faculty, and administrators not only provided a wide spectrum of different types of support, but also served in multiple roles. For example, a salient finding across all participants was that the Directors of the [ISSP 1] and [ISSP 2] not only provided direct support by providing professional development resources, but also provided system developer support as they developed programs that helped the participants matriculate successfully through their graduate programs. Additionally, participants in the study suggested that their advisors not only provided guidance on coursework and research, but were also critical in coordinating participants' integration into disciplinary networks. This suggests that participants were engaged in multiplex and multi-stranded mentoring relationships, indicating that mentors played multiple roles in the lives of the students and provided support across multiple spectrums (Stanton-Salazar, 2011).

Across the corpus of data collected for the study, collective findings indicated that collectively, mentors provided direct support, integrative support, system developer support, and system linkage and networking support. Essentially, participants were provided with all four types of support outlined by the Institutional Agents Framework. Additionally, findings suggest that mentors served as resource agents, networking coaches, advisors, advocates, knowledge agents, cultural guides, integrative agents, program developers, recruiters, bridging agents, institutional brokers, and coordinators. The roles of lobbyist and political advocate were not discussed by the participants. However, since the role of lobbyist entails lobbying for organizational resources to be directed toward recruiting and supporting students, it is safe to assume that mentors fulfilled this role as well, since faculty members and directors of institutional support programs rely, to some degree, on university resources. The role of political advocate entails membership in a political action group, and was not discussed by the participants. Therefore, mentors essentially played 15 of the 16 total roles outlined by the Institutional Agents Framework. Therefore, the findings suggest that through the support of mentors, study participants were able to navigate the institutional structure, locate and secure appropriate resources for personal and professional development, and identify individuals to help them navigate disciplinary contexts and expand their networks. Hence, participants were able to secure the tangible and intangible resources available to enhance their social and cultural capital. Therefore, it can be inferred that mentoring provided participants with the guidance, support, resources, and opportunities necessary to help them negotiate STEM, racial/ethnic, and graduate student identities, or at the very least provided them with the appropriate experiences and level of exposure that would help

them develop tools and strategies to negotiate their STEM, racial/ethnic, and graduate student identities.

5.6   Implications for Practice

The first implication for practice is for universities, faculty, and staff, particularly those who work within the realm of STEM graduate education, to begin making deliberate efforts to engage in culturally relevant activities and practices that are not only valued by URM students, but also beneficial for all students. The findings from this study support existing literature that URM graduate students in STEM make meaning of their racial/ethnic identity by engaging in research and getting involved in programs that allow them to lean into their natural dispositions for cooperation and community. Additionally, research has demonstrated that URM students often seek to use science toward altruistic aims and for social change. Therefore, it is important for STEM graduate programs to begin utilizing cohort structures, particularly for URM students, which will enhance sense of belonging and decrease feelings of marginalization and isolation. Additionally, faculty advisors should foster an environment where collaborative efforts are valued, such as requiring cohort members to engage in collaborative research projects, and encouraging collaborative research efforts among other departments, perhaps even with Minority Serving Institutions. Other culturally relevant mechanisms may include linking research questions and projects to challenges that face URM communities.

The second implication for practice includes increasing the presence of URM faculty, staff, and graduate students in STEM departments. While this may seem simplistic, the reality is that Blacks and Hispanics continue to be underrepresented in the

STEM disciplines despite decades of research and millions of dollars invested in programs designed to increase the presence of URM students pursuing STEM degrees. Because isolation is one of the greatest challenges faced by graduate students, particularly for URMs, achieving critical mass is one of the strongest arguments for increasing diversity in education (Allen-Ramdial & Campbell, 2014). Additionally, many of the challenges confronted by the participants in this study, such as stereotype threat, impostor syndrome, microaggressions, and feelings of isolation can all be attributed to a lack of URM peers and faculty members (Graham, 2013; Museus, Palmer, Davis, & Maramba, 2011). Furthermore, the difficulty associated with negotiating STEM, racial/ethnic, and graduate student identities may be attributed to a lack of URM faculty role models and mentors who can both demonstrate and provide guidance on how to negotiate identities that have conflicting values. Increasing the presence of URM in STEM, however, cannot be approached simplistically. Therefore, the following is suggested: 1) develop and implement faculty and staff training and development focused on understanding the value systems and cultural backgrounds of URM populations, 2) engage in partnerships with Minority Serving Institutions to create a pipeline of graduate students pursuing STEM graduate degrees, 3) engage Minority Serving Institution scholars, faculty, and administrators on best practices for cultivating supportive academic environments at predominantly white research institutions, 4) develop professional development mechanisms for future faculty members on how to appropriately mentor and support URM graduate students, 5) and revise current tenure and promotion policies to include direct and tangible outcomes to increasing the presence of URMs in STEM departments such as recruiting, retaining, and graduating URM graduate students.

The third implication for practice includes enhancing capacity for peer mentorship. Findings from this study suggest that peer mentoring relationships were important and influential in helping students understand and make meaning of STEM, racial/ethnic, and graduate student identities both separately and collectively. It appears, however, that many of the relationships were cultivated through informal interactions. Therefore, the final implication includes developing formal peer mentoring programs that provide opportunities for one-on-one mentoring, group mentoring, or a combination of both as peer mentors are often closer in age, more accessible, and may be better equipped to provide guidance and advice as peers are likely to be in similar stages of the matriculation process. Formal peer mentoring programs may also include the inclusion of social and professional activities as a way develop relationships outside of professional or academic settings.

5.7   Recommendations for Future Research

This study is one of the few that has focused on the intersection of STEM, racial/ethnic, and graduate student identities among URM graduate students in the STEM disciplines. Further, this study is novel as it explored identity negotiation in conjunction with campus climate and mentoring. In sum, there is a significant opportunity for additional research to be pursued in this area. As an example, the following recommendations for future research are suggested.

1. This case study focused on one university with a strong reputation for supporting URM graduate students in STEM, producing the highest number of URM baccalaureate degree holders that go on to receive STEM

doctoral degrees, and enrolling a smaller, more diverse student body than most research universities. Future studies should be conducted at universities that mirror the less ideal, but typical environment for URM graduate students in STEM such as large predominantly white, research universities. These types of studies would allow researchers to explore how URM graduate students in STEM negotiate multiple identities in environments that have larger enrollments, have less URM representation in the graduate student body, and fewer resources and institutional support mechanisms specifically dedicated to supporting URM students which may influence the identity negotiation process.

2. Previous literature has suggested that students who attend Historically Black Colleges and Universities experience an enhanced sense of belonging, high levels of academic integration, more access to same race role models and peers, and a family-like, supportive environment, all which have been found to contribute positively to STEM persistence. As such, future studies should be conducted at HBCUs to explore how Black graduate students in STEM negotiate multiple identities in an environment established specifically for the academic and personal development of underrepresented populations. Studies of this nature would also provide an opportunity to compare and contrast how Black graduate students in STEM negotiate multiple identities at PWIs versus HBCUs.

3. This study was conducted with URM graduate students, students who are underrepresented in the STEM disciplines in comparison to their

percentage in the overall population. Future research should include an examination of how White and Asian students, populations who are not underrepresented in the STEM disciplines in comparison to the percentage in the overall population, negotiate their STEM, racial/ethnic, and graduate student identities. Further, as suggested in recommendation two, these studies should be conducted at HBCUs, and large predominantly white research universities. These studies would provide comparative insights into how URM and non-URM students may negotiate their STEM, racial/ethnic, and graduate student identities. These studies would also highlight how the culture and climate of different types of institutions influence identity negotiation for URM and non-URM students.

4. Though not a salient finding in this study, the results did indicate that female participants not only encountered negative experiences as a result of their collective racial/ethnic and gender identity, but also highlighted gender identity as an important and influential factor in negotiating their STEM, racial/ethnic, and graduate student identities. Therefore, future research should consider the role of gender in the negotiation of STEM, racial/ethnic, and graduate student identities. This type of research would help highlight similarities and differences in how male and female individuals negotiate their STEM, racial/ethnic, and graduate student identities. Gender-based studies would also provide an opportunity to explore gender-specific challenges and barriers to identity negotiation.

5. This study considered race/ethnicity as a single construct, however, at least half of the study participants were second generation immigrants to the United States. Further, of these participants, most discussed challenges associated with negotiating and reconciling their racial and ethnic identities. Hence, future studies should explore how second generation immigrants negotiate identity conflicts between their racial and ethnic identity. This research would provide insight into challenges that are specific to second generation immigrants who were born in the United States, but still possess strong ethnic ties to the culture and language of their native countries.

6. This study was a qualitative case study. Consideration for future studies should include a quantitative scale to measure factors like ethnic identity, campus climate, or perception of mentoring. Use of quantitative measures not only allows researchers to triangulate data using instruments that have been deemed reliable and valid, but also expands the use of quantitative instruments in addressing novel and innovative research questions. Moreover, use of mixed methods may provide researchers with a more holistic view of how students negotiate their STEM, racial/ethnic, and graduate student identities.

7. The participants in this study specifically identified Black faculty and administrators as being playbooks for success, in other words, as ideal examples of how to successfully negotiate multiple identities. However, this study also revealed that participants tend to code-switch their

identities instead of negotiating them collectively. Therefore, future studies should explore how administrators, faculty, and staff who work in STEM disciplines and/or hold a degree in STEM, negotiate their STEM and racial/ethnic identity in conjunction with their institutional identity (e.g., role as an administrator, faculty, or staff member). The perspectives of these individuals are important as they have matriculated through graduate study and may be able to provide valuable insight on best practices and strategies they used or learned while pursuing their graduate degrees. Additionally, the institutional identities of administrators, faculty, and staff likely possess their own sets of norms, challenges, and behaviors which, therefore, may require different identity negotiation strategies. Finally, studies exploring various institutional identities may also highlight specific kinds of academic and personal experiences that influence the dispositions necessary to successfully negotiate multiple identities.

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APPENDICES

Appendix A IRB Approval

PURDUE
UNIVERSITY

HUMAN RESEARCH PROTECTION PROGRAM
INSTITUTIONAL REVIEW BOARDS

To:	LEVON ESTERS AGAD
From:	JEANNIE DICLEMENTI, Chair Social Science IRB
Date:	03/30/2016
Committee Action:	**Amendment to Approved Protocol**
IRB Action Date	03/29/2016
IRB Protocol #	1601017019
Study Title	A Case Study Analysis of Minority Students¿ Negotiation of STEM, Racial/Ethnic, and Graduate Student Identities

Expiration Date

Following review by the Institutional Review Board (IRB), the above-referenced protocol has been approved. This approval permits you to recruit subjects up to the number indicated on the application form and to conduct the research as it is approved. The IRB-dated consent, assent, and/or information form(s) approved for this protocol are in the Attachments of this protocol through CoeusLite. Please make copies from these document(s) both for subjects to sign should they choose to enroll in your study and for subjects to keep for their records. Information forms should not be signed. Researchers should keep all consent/assent forms for a period no less than three (3) years following closure of the protocol.

Revisions/Amendments: If you wish to change any aspect of this study, please submit the requested changes to the IRB through the CoeusLite Online Submission System. IRB approval must be obtained before implementing any changes unless the change is to remove an immediate hazard to subjects in which case the IRB should be immediately informed following the change.

Continuing Review: It is the Principal Investigator's responsibility to obtain continuing review and approval for this protocol prior to the expiration date noted above. Please allow sufficient time for continued review and approval. No research activity of any sort may continue beyond the expiration date. Failure to receive approval for continuation before the expiration date will result in the approval's expiration on the expiration date. Data collected following the expiration date is unapproved research and cannot be used for research purposes including reporting or publishing as research data.

Unanticipated Problems/Adverse Events: Researchers must report unanticipated problems and/or adverse events to the IRB through the CoeusLite Online Submission System. If the problem/adverse event is serious, or is expected but occurs with unexpected severity or frequency, or the problem/event is unanticipated, it must be reported to the IRB within 48 hours of learning of the event and a detailed report submitted within five (5) business days. All other problems/events should be reported at the time of Continuing Review.

You are required to retain a copy of this letter for your records. We appreciate your commitment towards ensuring the ethical conduct of human subjects research and wish you luck with your study.

Appendix B Email Invitation to Participants

A Case Study Analysis of Minority Students' Negotiation
of STEM, Racial/Ethnic, and Graduate Student Identities
Principal Investigator: Levon Esters, Ph.D., Associate Professor
Co-Principal Investigator: Brittini R. Brown, Doctoral Student
Youth Development and Agricultural Education
Purdue University

Dear Student,

My name is Brittini Brown and I am doctoral student in the Department of Youth Development and Agricultural Education at Purdue University. I am conducting research for my doctoral dissertation and would like to invite you to participate in research study entitled, *"A Case Study Analysis of Minority Students' Negotiation of STEM, Racial/Ethnic, and Graduate Student Identities."*

The purpose of this study is to explore how URM graduate students pursuing advanced post-secondary STEM degrees at predominantly white research institutions negotiate their STEM, racial/ethnic, and graduate student identities and how mentoring and campus climate influence the negotiation of those identities. As a URM graduate student pursuing a STEM graduate degree, you are in an ideal position to provide us with valuable insight about your experiences. Specifically, I am looking for full-time/domestic graduate students who attend the University of Maryland Baltimore County, who are majoring in a STEM discipline, have been in their graduate program at least one year, and identify as African-American, Hispanic, Native American, or Native Hawaiian/Pacific Islander.

Should you chose to accept my invitation, you will be asked to participate in two 60-90 minute interviews on the campus of the University of Maryland Baltimore County between March 21-April 1, 2016. The setting and attire for the interview is informal. Your responses will be kept confidential. Each participant will be assigned a pseudonym to help ensure that personal identifiers are not revealed during the analysis and write-up of findings. Furthermore, the transcripts will be kept in a secure location at Purdue University until the study is complete.

Each participant will receive compensation up to $20.00 cash for participating in the study. Also, light refreshments will be provided during each interview session. Your participation will be a valuable contribution to my research and could provide a better understanding of the role of mentoring and campus climate on the persistence of URM graduate students pursuing STEM degrees. Participation in this study is voluntary and all participants must be 18 years or older to participate. If you are willing to participate, please RSVP by contacting brown913@purdue.edu by Friday, April 11, 2016 and I will provide you with options for the date/time of your first interview as well as the location.

Thank you so much for your consideration and I look forward to hearing from you.

Sincerely,

Brittini Brown

Appendix C Participant Consent Form

RESEARCH PARTICIPANT CONSENT FORM
A Case Study Analysis of Minority Students' Negotiation
of STEM, Racial/Ethnic, and Graduate Student Identities
Principal Investigator: Levon Esters, Ph.D., Associate Professor
Co-Principal Investigator: Brittini R. Brown, Doctoral Student
Youth Development and Agricultural Education
Purdue University

What is the purpose of the study?
The purpose of this study is to explore how URM graduate students pursuing advanced post-secondary STEM degrees at predominantly white research institutions negotiate their STEM, racial/ethnic, and graduate student identities and how mentoring and campus climate influence the negotiation of those identities. You are invited to participate in this study because you represent an important group of students pursuing advanced post-secondary degrees in the STEM disciplines. I hope to enroll 7-10 total participants in this study.

What will I do if I choose to be in this study?
You are to participate in two face-to-face interviews on the campus of The University of Maryland Baltimore County. Each interview will last for approximately 60-90 minutes. Light refreshments will be provided. Each participant will also receive compensation in the amount of $20.00 cash at the beginning of the second interview of the two-interview series.

How long will I be in the study?
Two 60-90 minute interviews over the span of two weeks.

What are the possible risks or discomforts?
Breach of confidentiality is a potential risk, please see the "Confidentiality" portion of the consent form to learn about the safeguards used to minimize this risk.
Additional discomforts may include being asked questions that make you feel uncomfortable.

Are there any potential benefits?
There are no direct benefits to the participants in this research study. However, you may receive indirect benefits from participation in these interviews. Additionally, your insight may inform research focused on how URM students pursuing STEM degrees negotiate multiple identities and how campus climate and mentoring may influence that process.

What happens if I become injured or ill because I took part in this study?
If you feel you have been injured due to participation in this study, please contact Levon Esters at lesters@purdue.edu or 765-494-8423. Purdue University will not provide medical treatment or financial compensation if you are injured or become ill as a result of participating in this research project. This does not waive any of your legal rights nor release any claim you might have based on negligence.

Will information about me and my participation be kept confidential?
The transcripts will be kept in a secure location at Purdue University and destroyed once the project is complete. The principal investigator and co-principal investigators will have access to the data. The project's research records may also be reviewed by departments at Purdue University responsible for regulatory and research oversight.

What are my rights if I take part in this study?
Your participation in this study is voluntary. You may choose not to participate or, if you agree to participate, you can withdraw your participation at any time without penalty or loss of benefits to which you are otherwise entitled.

Who can I contact if I have questions about the study?
If you have any questions about this research project, you can contact Dr. Levon Esters at 765-494-8423 or lesters@purdue.edu. If you have questions about your rights while taking part in the study or have concerns about the treatment of research participants, please call the Human Research Protection Program at (765) 494-5942, email (irb@purdue.edu)or write to:
> Human Research Protection Program - Purdue University
> Ernest C. Young Hall, Room 1032
> 155 S. Grant St.,
> West Lafayette, IN 47907-2114

Documentation of Informed Consent

I have had the opportunity to read this consent form and have the research study explained. I have had the opportunity to ask questions about the research study, and my questions have been answered. I am prepared to participate in the research study described above. I will be offered a copy of this consent form after I sign it.

_____   _____
       Participant's Signature   Date

_____
       Participant's Name

_____   _____
       Researcher's Signature   Date

- The participant must sign and date the consent form. The only exception is if the study is granted a waiver of signed consent.
- The researcher's signature, above, refers to the research team member who has obtained the participant's consent. The researcher's signature indicates s/he has explained the

research to the participant (or the legally authorized representative when IRB approved) and has answered any of the participant's questions

Appendix D Demographic Questionnaire

**A Case Study Analysis of Minority Students' Negotiation
of STEM, Racial/Ethnic, and Graduate Student Identities**
Principal Investigator: Levon Esters, Ph.D., Associate Professor
Co-Principal Investigator: Brittini R. Brown, Doctoral Student
Youth Development and Agricultural Education
Purdue University

Student Information Form

All responses will be kept confidential, and your identity will remain private. Your responses to these questions are optional, but will be extremely helpful in our research. Thank you!

1. Name:_____

2. Email Address:_____

3. Pseudonym:_____

4. Sex (*Please check one*):   Male _____   Female_____

5. Age: ____

6. How do you identify racially/ethnically (*Please check all that apply*)

   ____Native American

   ____ Native Hawaiian/Pacific Islander

   ____Asian

   ____African-American/Black

   ____Hispanic/Latino/Chicano

   ____White/Caucasian

   ____Other

7. What is your classification?

   ____ Master's Student

   ____ Doctoral Student

8. What graduate degree are you currently pursuing (Major)?

   _____

9. When did you start your graduate program? (MM/YYYY): _____/_____

10. When do you expect to complete your degree? (MM/YYYY): _____/_____

11. From what institution did you receive your bachelor's degree?

    _____

    a. Major: _____
    b. Graduation Year: _____

12. Is your bachelor's degree from a Historically Black College or University, Hispanic-Serving Institution, Tribal College, or other minority-serving institution?

    Yes _____   No _____   Don't Know ____

13. From what institution did you receive your master's degree?

    _____

    a. Major:_____
    b. Graduation Year: _____

Appendix E Interview 1 Protocol

Interview One: Life History and Experience

Welcoming Comments

Thank you for agreeing to participate in my study.

My name is Brittini Brown and I am a doctoral candidate at Purdue University in the Department of Youth Development and Agricultural Education. I went to undergrad at a small HBCU, The University of Arkansas at Pine Bluff and received my master's at Iowa State University. (**Will describe pathway to the doctoral program**).

The purpose of this study is to explore how URM graduate students pursuing advanced post-secondary STEM degrees at predominantly white research institutions negotiate their STEM, racial/ethnic, and graduate student identities and how mentoring and campus climate influence the negotiation of those identities. You were invited to participate in this study because you represent an important group of students pursuing advanced post-secondary degrees in the STEM disciplines and I am interested in how you negotiate your multiple identities at the University of Maryland Baltimore County, a university that has been nationally recognized for producing URM students in the STEM disciplines and producing the largest number of African American students that go on to pursue doctoral degrees in the STEM disciplines.

For the next hour or so, I will ask you a series of questions about your own personal experience as racial/ethnic minority pursuing a graduate degree in a STEM discipline. Please feel free to share whatever you wish. However, if you prefer not to respond to a specific question, please say, "I'd prefer not to answer that question." Additionally, you may excuse yourself from the interview at any time.

I also ask for your permission to audio record the interview and to take notes during our discussion. In order to protect your real name and identification, I will use the pseudonym that you selected on your participant questionnaire when I review the transcription. Finally, I ask that you keep our discussion confidential. **Please note:** We cannot guarantee complete confidentiality as stated in the Participant Consent Form.

Are there any questions before we start?

Background
1. Can you please tell me your name, your program of study, the degree you are pursuing, and how far along are you in your graduate program. Also, similar to

the way I shared my story in the beginning, can you tell me your path to becoming a graduate student at UMBC?

Establishing identities:
2. How do you identify yourself racially and/or ethnically?
3. Do you consider yourself a scientist and why?
4. In addition to being <insert race/ethnicity identified above> and a scientist, you are also a graduate student, can you talk about your experience as a graduate student in terms of where you are positioned in the university? For example, the university expects faculty members to teach, conduct research, serve on committees, etc. Would you say that the university has expectations of graduate students as well? If so, what are some of those expectations?

Campus Racial Climate
5. UMBC is a unique university, it is a predominantly white university situated in an urban city with a majority minority population. It also has a larger minority student enrollment that many other PWI universities. Describe what is it like to be an underrepresented minority student on this campus?
    a. Overall, can you describe the racial climate on this campus?
6. How do you think your race/ethnicity plays a role in how you interact with other students, faculty, staff, and administration on this campus?
7. Research has indicated that sometimes URM students feel isolated and unwelcome on PWI campuses. Researchers have also found that sometimes URM students feel that they have to prove themselves academically more than their majority peers? Have you ever had an experience like that, would you mind telling me about it?

Mentoring
8. In this study, a faculty mentor is defined as an advisor, major professor, or other faculty member that provides students' with social and emotional support as well as career development opportunities. Using that definition, can you tell me a little bit about your faculty mentor and how s/he became your mentor?
9. Can you describe your relationship with your mentor?
10. Can you discuss other mentoring relationships that you may have with other faculty members or students?

Appendix F Interview 2 Protocol

Interview Two: Reflection and Meaning

Welcoming Comments

Thanks so much for returning for your second and final interview for my study.

As you may recall, the purpose of this study is to explore how URM graduate students pursuing advanced post-secondary STEM degrees at predominantly white research institutions negotiate their STEM, racial/ethnic, and graduate student identities and how mentoring and campus climate influence the negotiation of those identities.

During the last interview, we discussed your path to UMBC, your experiences with mentors, and your perception of the campus climate. We also touched a bit on your racial/ethnic identity, your identity as a scientist, and a graduate student. Today, we will delve a bit deeper into what it means to negotiate all three of these identities.

Similar to the last interview, please feel free to share whatever information or experiences that you wish. However, if you prefer not to respond to a specific question, please say, "I'd prefer not to answer that question." Additionally, you may excuse yourself from the interview at any time.

I also ask for your permission to audio record the interview and to take notes during our discussion. In order to protect your real name and identification, I will use the pseudonym that you selected on your participant questionnaire when I review the transcription. Finally, I ask that you keep our discussion confidential. **Please note:** We cannot guarantee complete confidentiality as stated in the Participant Consent Form.

Are there any questions before we start?

Intersection between racial/ethnic and STEM identity:
1. During the last interview, you told me that you identified as <insert identified race/ethnicity here>, what does that mean to you?
2. Researchers have found that sometimes students of color leave the STEM disciplines because the curriculum lacks cultural relevance. Although there is a lack of color in STEM curriculum, can you talk about why you decided to pursue a STEM degree and the factors that have helped you to stay the course?

Intersection between graduate student and STEM identity:
3. By definition, a student is someone who is still learning. However, graduate students in all disciplines, including STEM, are also expected to teach courses, present at professional conferences, conduct independent research. How do you manage or handle both identities as scientist and student?

      a. Can you talk about any experiences that you may have had that influence how you manage both identities?

The intersection of racial/ethnic, STEM, and graduate student identity:

4. Some researchers have suggested that race/ethnicity plays a role in how people develop their other identities. For example, for me, being an African American has largely influenced my research interests, the communities that I hope to serve with my research, and how I go about conducting research. How has your race/ethnicity influenced you as a scientist and a graduate student?

5. Have you ever felt like you had to mask one of your identities to better fit in within a group? For example, have you ever felt like you had to downplay your racial/ethnic identity when you're among other graduate students or scientists? Or have you ever felt like you had to downplay your role as a graduate student when talking among faculty members?

      a. How did this experience make you feel?

6. We have discussed your race/ethnicity, your role as a graduate student, and how you came to identify yourself as a scientist. Can you describe what it's like to juggle being a URM, a graduate student, and a STEM scientist?

7. During the last interview we talked about your faculty and peer mentors, can you talk about how their mentorship has influenced your ability to manage your racial/ethnic, STEM, and graduate student identities?

8. We've also talked about the campus climate of UMBC, can you explain how the climate of the university has influenced your ability to managed your racial/ethnic, STEM, and graduate student identities.

VITA

VITA

Brittini Brown is a proud native of Augusta, Arkansas. She holds a B.S. in Regulatory Science from the University of Arkansas at Pine Bluff and a M.S. in Industrial and Agricultural Technology from Iowa State University. Prior to attending Purdue University, Brittini served as the Interim Director of the USDA/1890 National Initiative as well as an evaluation and assessment professional for the U.S. Department of Agriculture.

Brittini began her doctoral studies at Purdue University in 2013. Since that time she has served as the Coordinator of HBCU Outreach for Mentoring@Purdue as well as the Coordinator for Strategic Planning, Partnership, and Development. Brittini is also Center Affiliate for the Penn Center for Minority Serving Institutions at the University of Pennsylvania. Brittini's research interests include human capacity development of women and URMs in STEM, mentoring, and higher education policy. She has published opinion pieces in higher education media such as Diverse Issues in Higher Education and MSIs Unplugged. She has also presented her research at the American Association for Educational Research, the National Conference on Race and Ethnicity, and the American Association of Blacks in Higher Education.

Brittini will be working at the University of Maryland Baltimore County as the Director of Student Affairs Assessment and Strategic Initiatives.