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Lift Ev'ry Voice: Using Q Methodology to Understand the Shared Perspectives of African American Undergraduate Students Regarding Strategies that Predominantly White Institutions Can Use to Support their Persistence in STEM

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Lift Ev'ry Voice: Using Q Methodology to Understand the Shared Perspectives of African American Undergraduate Students Regarding Strategies that Predominantly White Institutions Can Use to Support their Persistence in STEM.

By

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Dedication

I dedicate this dissertation to my mother, Edna Washington, and my late father, Louis Washington. Thank you for always being the shoulders that I stood upon. I would not have made it this far in life without your love and support. I would also like to thank my twin sister, Dione Washington for putting up with me all of these years. You have been my rock and the person I go to when faced with the storms of life. It has truly been an honor to take this life journey with you, and I cannot wait to see what happens next. To my older brother Louis Washington, you are an awesome big brother. Thanks for always being there when I needed you. And, lastly to my younger brother, Andre Washington, thanks for heckling me about my dissertation until I finally finished. I know that we banter a lot, but the truth is that you have been there for me more times than I can count, and I hope that I have done the same for you. Thanks to my family for pushing me to finish my doctoral studies. I could not have asked for a greater support system.

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Abstract

In this study the researcher used Q methodology to understand the shared perspectives of African American undergraduate students attending predominantly White institutions regarding strategies and supports that would help them persist in their STEM majors. Q methodology involved two phases. In phase 1, the researcher recruited 13 participants (n =10, female; n = 3, male) to respond to an open-ended questionnaire using the following directions: "List and briefly describe up to 8 strategies that predominantly White institutions can use to support African American undergraduate students' persistence in STEM." There were 57 opinion statements generated from this questionnaire along with 50 statements from the professional literature and 6 statements from social media sources online. The researcher then reduced the opinion statements to a representative Q sample that consisted of 43 statements by eliminating repeating statements, combining similar statements, and discarding statements that were impertinent to the initial prompt. In phase 2, the researcher recruited a P set of 30 participants (n = 20, female; n = 10, male) to perform a Q sort of the opinion statements comprising the Q sample. Five factors were identified as representing the most widespread views of the majority of the participants. The collective perspectives of African American students in Factor 1 revealed a need to be supported by the institution in order to succeed academically, Factor 2 revealed a need for diversity and inclusion for everyone, Factor 3 revealed a need for social interactions with other African Americans, Factor 4 expressed a need for support with dealing with issues around science and math self-efficacy, and Factor 5 showed a need for support from the institution with achievement of goals by removing barriers produced by stereotype threat. Results show that institutions should consider providing various layers of support for African American students in STEM including STEM advisors, STEM learning communities, African American social groups, and supportive faculty and staff.

Chapter 1: Introduction

The demographic landscape of America is changing. U.S. Census Bureau (2008) data suggests that by 2042, racial minority groups will make up the majority of the population (Craig & Richeson, 2014). As the country goes through this "majority-minority shift," Americans must continually compete with the global market for jobs. In a world where technological advancement rapidly changes the job market, Americans must major in STEM fields in order to meet the demands of a high-tech society. However, African Americans and women continue to experience barriers to achievement. According to McGee (2018), the majority of college students in STEM are "White, male, and middle-class." Black students are also more likely than other racial groups to carry at least $30,000 of debt after obtaining a baccalaureate degree in science and engineering (McGee, 2018, p. 1). In 2011, African Americans made up 11% of the workforce, but 6% of STEM workers (U.S. Department Of Education, 2016). Also, according to McGee (2018), in 2015 there were "6.4 million workers employed in science and engineering occupations, and 67% of them were White. White employees who are 21 and older represented 66% of the working population (McGee, 2018). Hispanics accounted for 6% of employees in science and engineering occupations, but the working age population was 15% (McGee, 2018). Blacks accounted for 5% of science and engineering employment although they now make up 12% of the U.S workforce" (McGee, 2018, p. 2).

The shifting American demographic will make it impossible for the system to sustain itself with a predominantly White, male workforce (Strayhorn, 2015). Institutions must broaden their scope to recruit and retain racial minorities and female students in STEM majors (Strayhorn, 2015). However, the amount of African American students earning degrees in science and engineering has stayed stagnant since 2000 (McGee, 2018). African Americans are under-represented in every area of STEM (Strayhorn, 2015). According to the National Science Board

2012 Science and Engineering Indicator's Report, African American students are less likely to complete a STEM degree when compared to their non-Black peers (Strayhorn, 2015). For example, in 2009 approximately 488,380 U.S. students earned a STEM related degree, however, White students (men and women) accounted for 69% of the undergraduate degrees in engineering and 65% of degrees in science (Strayhorn, 2015, p. 46). Black students accounted for 4.7% of engineering and 9.2% of science undergraduate degrees (Strayhorn, 2015, p. 46).

Persistence in STEM is also a problem. While 33% of all undergraduate students indicate a desire to pursue STEM majors, half of them switch out into other fields (Strayhorn, 2010, p. 85). For African American males, the situation is worse. One third of African American male students will drop out of college before obtaining a degree (Strayhorn, 2015). Current research suggests that the issue may reside with the institutional structure of colleges and universities (Gasiewski, Eagan, Garcia, Hurtado, & Change, 2011; Espinosa, 2011). Introductory STEM courses are considered "gate keeper" or "weed out" courses. Gasiewski et. al (2011) used quantitative survey data taken from 2,873 students within 73 introductory science, technology, engineering, and mathematics (STEM) courses. They found that students tended to be more engaged when the instructor was open to questions, and made students feel that it was okay to ask for help (Gasiewski, Eagan, Garcia, Hurtado, & Chang, 2011). However, the culture of science and "weed out" courses sends the message that only a fraction of entering students will successfully complete the course.

When placed in racially isolating environments like in predominantly White institutions, African American students taking "weed out" STEM courses may be all that is needed to trigger feelings of not being "good enough" making it difficult to persist in STEM (Gasiewski, Eagan, Garcia, Hurtado, & Chang, 2011). African American students taking challenging STEM courses

at predominantly White institutions where there is no community, appreciation for diversity, and lack of support may experience the institution as hostile (Bourke, 2010). Increasing diversity on college campuses involves much more than admission of diverse student populations. It is important for administration, faculty, and staff to understand the roles they play in creating the culture of the institution. Minority students may feel alienated in predominantly White institutions if the campus culture and climate only reflect the values and ideals of the dominant group (Bourke, 2016). Bourke (2010) also said that, "Black students routinely have to deal with stereotypes assigned to their identity category on campus, and the associated risk of internalization of stereotypes" (Bourke, 2010, p. 127). Also, because African American student populations tend to be small in predominantly White institutions, Black students may have difficulty finding peers of their own racial/ethnic group (Bourke, 2010, p. 127). Faculty, staff, and students that belong to institutions "steeped in tradition" may not realize that these celebrated traditions may be viewed as associations with "Whiteness" by minorities (Bourke, 2010, p. 128).

According to Bourke (2016), racial diversity and racial climate are affected by five institutional practices: compositional diversity, historical legacy of inclusion or exclusion, psychological climate, behavioral climate, and organizational/structural elements (Bourke, 2016, p. 15). Compositional diversity involves the racial makeup of the student population. It is important to understand the racial history of the institution, and how it affects the current racial climate. The psychological climate relates to non-verbal messaging students of color receive, which involves perceptions of racial discrimination, and the institutions response to race related issues. The behavioral climate involves the nature of the interactions between students of different cultural and ethnic backgrounds. The organizational/structural elements of an institution

include diversity related and non-diversity related initiatives that include admission procedures and practices, curriculum, and the day-to-day operations of the institution (Bourke, 2016, p. 15). It is important to note that in predominantly White institutions, White students may perceive the campus as open and welcoming, but students of color may experience the same environment differently (Bourke, 2016, p. 17). Minority students are always aware of the dominant culture, especially because the world of the dominant culture is presented as the norm (Bourke, 2016, p. 16). Because of this, African Americans students that come from segregated neighborhoods may experience a culture shock on a predominantly White campus. All of these factors become race-related stressors that have consistently been associated with worse academic performance, increase attrition, high dropout rates, and increases in incidences of protest among African American students (Shahid, Nelson, & Cardemil, 2018, p. 3).

There are many factors that affect African American undergraduate students' academic performance and ability to persist in STEM courses. Q Methodology was used to understand the strategies that predominantly White institutions could use to help students persist in STEM.

Research Question

What are the shared perspectives of African American students regarding strategies that predominantly White institutions can use to help African American students persist in STEM majors?

Conceptual Framework

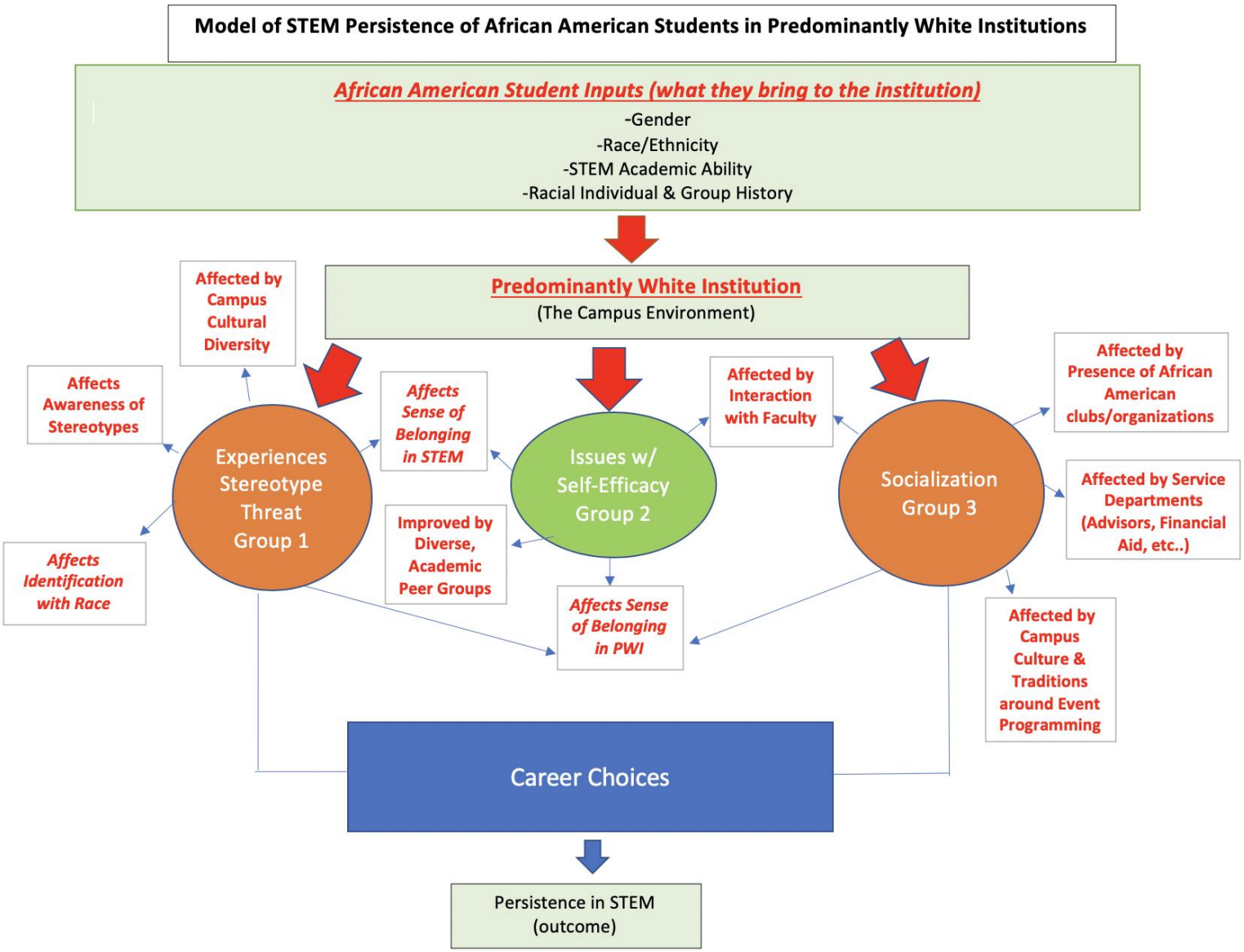


Figure 1: Model of STEM Persistence of African American Students in PWIs

In this study, Q methodology was used to examine the shared perspectives of African American students taking STEM courses at predominantly White institutions. Students were asked to identify strategies that these institutions could use to support their persistence in STEM. After extensive review of the professional literature, the researcher created the model (Figure 1) to identify all of the elements that contribute to African American students' persistence in STEM. The researcher applied Stereotype Threat Theory (Steele C. M., 1997) and Social

Cognitive Career Theory (Lent & Brown, 2017) to understand the factors that determine African American students' career choices when choosing whether or not to major in STEM. Several themes emerged from the literature. Firstly, STEM persistence is affected by personal inputs that African American students bring with them when they come to the institution (Tolliver & Miller, 2018; Shahid, Nelson & Cardemil, 2018; Belser, Shillingford, Daire, Prescod & Dagley, 2018). These inputs include their race, gender, STEM academic ability, and individual and group histories. These personal inputs will shape how African American students perceive their experiences on campus. Secondly, students that identify heavily with their race or gender may report feeling effects from stereotype threat if their race or gender is not heavily represented in the STEM classroom or around campus (Meador, 2018; Brown, Margram, Sun, Cross & Raab, 2017; Cadret, Hartung, Subich & Weigold, 2016). In Figure 1, the researcher used the professional literature to suggest that African American students experiencing stereotype threat will have issues with racial identification and sense of belonging in STEM. These students will constantly be aware of stereotypes about their race and have a need to create a culturally diverse campus. Students who feel that others may not perceive them as being competent or feel the need to "represent" for their race may also have issues with self-efficacy (Hall, Nishina & Lewis, 2017; Charleston & Leon, 2016; Dagley, Georgiopoulos, Reece & Young, 2016). The professional research revealed that African American students experiencing issues with self-efficacy will be affected by the interactions they have with faculty and peers. They will also have issues with belonging in the institution and in their STEM major. Lastly, African American students who need social interaction may feel isolated on campus if the PWI lacks institutional supports, diverse networking opportunities, mentorship opportunities from faculty and peers, and

diverse clubs and organizations (Love, 2008; Thelamour, Mwangi & Ezeofor, 2019; Greyerbiehl & Mitchell, 2014).

Overall, STEM persistence in a predominantly White institution is shaped by what African American students bring to the institution (personal inputs), which may cause them to experience stereotype threat, issues with self-efficacy, and/or develop a need for strong positive social interactions in order to persist in STEM. All these interactions only become salient when placed in the context of a predominantly White institution as the environment. This will determine whether a student decides to pursue STEM as a career choice.

Purpose of Research

The purpose of this study was to understand the shared perspectives of African American undergraduate students attending predominantly White institutions regarding strategies and supports that will help them persist in STEM majors.

Significance of the Research

African Americans are substantially marginalized and underrepresented, therefore little research has been done to examine issues from their perspective. Most research has focused on African American students as a population in most cases or as a subset of the minority population. Even then, results are analyzed primarily in a quantitative way from the viewpoint of the researcher. Q-methodology was chosen as the technique because it draws upon quantitative and qualitative methods designed to allow the researcher the ability to examine the perspectives of African American students attending predominantly White institutions.

Chapter 1 Summary

Chapter 1 provided an overview of a study that used Q methodology to understand the shared perspectives of African American STEM majors attending predominantly White institutions. In this chapter, the researcher introduced a model of STEM persistence of African

American students and analyzed the elements that based on literature contribute to persistence and subsequent degree attainment. The purpose of the research and significance of the study are also discussed.

Chapter 2 Summary

In chapter 2, the researcher explores the professional literature that contributed to the conceptual framework model and discusses how Q methodology could be an extension to current research. The researcher also looks at stereotype threat and self-efficacy issues that African Americans face from a historical context.

Chapter 3 Summary

In chapter 3, the researcher explains the methodology used in this study. This chapter also explained the two phases of Q methodology and methods for data collection. Participant demographics are also discussed.

Chapter 4 Summary

In chapter 4, the researcher discusses the results of the study. This chapter explores the process used to determine how many factors to extract using Humphrey's Rule, the scree plot, and a variety of other techniques. The researcher also discusses the collective perspectives generated from each factor.

Chapter 5 Summary

In chapter 5, the researcher compares each factor and discusses patterns and themes that emerged from the data. The researcher explores implications for institutions and discusses limitations and delimitations of this study.

Operational Definitions:

Stereotype Threat- the threat that others' judgements or their own actions will negatively stereotype them in a domain (Steele, 1997).

Implicit Bias- attitudes or stereotypes that affect our understanding, actions, and decision in an unconscious manner (Staats, 2016).

Predominantly White Institution (PWI)- institutions of higher learning in which Whites account for 50% or greater of the student population (Lomotey, 2020).

Persistence- the continual pursuit of the completion of a college degree (Astin, 1984; Tinto, 1987).

Self-Efficacy- an individual's belief in their innate ability (Charleston & Leon, 2016).

Chapter 2: Literature Review

The demographic college and university landscapes are changing. People of color now represent the largest group entering college (Brothers & Knox, 2013). Despite this fact, African American students are leaving the college pipeline at equally alarming rates causing institutional graduation rates for African Americans to stay stagnant (Brothers & Knox, 2013). Education is one of the most important tools that African Americans can use to achieve social mobility in America (Sinanan, 2016). However, African Americans experience many issues on college campuses that range from microaggressions (Sinanan, 2016) to lack of institutional support (Tolliver & Miller, 2018). In the article titled, *Experiences of Black Students in Multiple Cultural Spaces at a Predominantly White Institution*, Bourke (2010) explained that the bulk of literature that examines diversity in institutions focuses on three main areas: structural diversity (demographics and socioeconomic status of the campus population), diversity related initiatives (race conscious curriculum, multicultural student centers and organizations), and diverse interactions (social dynamics that occur between individuals and groups on campus). These were also the themes that emerged from the literature relating to strategies predominantly White institutions could implement that would support African American student's persistence in STEM majors.

The researcher designed a model for African American STEM persistence based on the themes that emerged from the literature (Figure 1). The model begins with personal inputs, which are the variables that African American students contribute to the predominantly White institution (the campus environment). African American students' personal inputs are their race/ethnicity, gender, STEM academic ability, and racial individual and group histories. These personal inputs can affect the way African American students perceive their experiences when faced with various social and academic situations on campus. The model goes further to depict

how these personal inputs may affect an African American student's experience on a predominantly White campus. They may experience stereotype threat, have issues with math and science self-efficacy, and/or need positive strong interactions with others on campus in other to persist in STEM. Based on the literature, these interactions shape the career choices that African American students make, which will cause them to persist or not persist in STEM.

The literature review portion of this dissertation research delved deeper into how African American students' personal inputs shape their experiences at predominantly White institutions, and how the three groups that African American students fall in (stereotype threat, self-efficacy, and socialization), interact with these personal inputs to affect a student's career choices that lead to the outcome, persist or not persist in STEM. The researcher discussed racial group history (personal input) only in relation to the three groups because each group connects to a different aspect of racial history for African Americans.

African American Student Inputs

Race. Race is a social construct that was defined by the ability to separate individuals into groups based on phenotypic characteristics (Sinanan, 2016). However, according to Sinanan (2016), thinking of race as a social construct ignores the fact that race has been used to create barriers to limit social mobility, physical mobility in terms of travelling from one location to another safely like in the Jim Crow era, and participation in the larger predominantly White American society. So, although race is more of a cultural, not genetic association, it is still much more than "skin deep."

Bonilla-Silva (2015) described a racialized society as one that operates on dominant racist ideology that fulfills five social functions: (1) account for the existence of racial inequality; (2) providing basic rules on engagement in interracial interactions; (3) furnishing the basis for actors' racial subjectivity; (4) shaping and influencing the views of dominated actors; and (5) by

claiming universality, hiding the fact of racial domination or racial order that benefits a racial group (Bonilla-Silva, 2015).

African Americans are some of the most genetically diverse groups in the world (Collier Jackson, 1993). This is due to the way race is defined in America based on phenotypic, not genotypic traits. As a result, individuals who do not define themselves as African Americans may be labeled that way based on physical characteristics. The consequence of an individual's racial label in a racialized society can impact socioeconomic status, educational opportunities, and influence the way society responds, such as feeling afraid (Bonilla-Silva, 2015). African American's genetic variation is not only a product of African ancestry, but of "gene flow with non-African groups, such as, Native Americans and Europeans" (Collier Jackson, 1993). However, racial segregation and discrimination throughout American history forced African Americans to live in similar areas, developing community and culture (Anderson, 1988). America's racialized society also created White Americans, who were originally individuals from all over Europe with individualized cultures, traditions, and norms (Anderson, 1988). When considering strategies to support African American student's persistence in STEM, it is important to understand that a person may be labeled African American, but not self-identify that way.

It is also important to note that African American students come from different classes and socioeconomic backgrounds, so they are certainly not a monolith. Take for instance a study that Waldoff, Wiggings, and Washington (2011), conducted to examine the adjustment differences between in-state Black students who were familiar with predominantly White environments and out of state Black students from segregated communities. This example demonstrates how individual history (personal input), shapes the way African American students

as individuals experience their campus environment. The study was conducted at a rural predominantly White institution (Waldoff, Wiggins, & Washington, 2011). The researchers used qualitative methods in order to preserve participant's narratives and language (Waldoff, Wiggins, & Washington, 2011, p. 1055). The researchers also described the research setting which was Morgantown, West Virginia as a large predominantly White institution with an undergraduate population of approximately 21,720 students (Waldoff, Wiggins, & Washington, 2011, p. 1055). African American students comprised 3% of the student body (Waldoff, Wiggins, & Washington, 2011). Based on this gross underrepresentation of African American students, Waldoff et. al (2011) noted that African American students are "often at heightened risk of discontinuing their education."

The researchers conducted three focus groups with a total of 19 participants (in state and out of state students) (Waldoff, Wiggins, & Washington, 2011). Researchers asked participants to identify some of the differences they see in in-state versus out of state African American students. Participants said that in state students seemed more adjusted to the predominantly White institution. Waldoff et. al (2011) quoted the words of one student as saying, "In-state students have an easier time connecting and having White friends' cause this is their home. This is really all they've known. They're used to being one of five Black people in a school or town. We're not. It's different for us."

When looking at strategies that institutions could use to help support African American students' persistence in STEM, it is very important to take race and individual history into account. Some African American students are well adjusted to predominantly White educational settings, and thus may not require interventions that focus on race. However, African American students who come from predominantly black neighborhoods may require interventions.

Race and Gender. Being an African American student attempting to navigate through the academic environment can be challenging. However, the intersection of race and gender creates additional challenges. Current research suggests that while the racial experiences of African American men and women are similar in a lot of ways, there exists simultaneously stark differences. According to Espinosa (2011) there is limited research available that addresses the intersection of gender and race/ethnicity in STEM fields. However, some studies have been conducted on the matter (Espinosa, 2011; Borum & Walker, 2012; Byars-Winston & Rogers, 2019).

Shahid, Nelson & Cardemil (2018) conducted a study using hierarchical multiple regression to examine the coping mechanisms that Black women use to combat stressors in predominantly White institutions. The study used (n = 129) Black undergraduate women attending a PWI in the Mid-Atlantic and Northeast region of the United States (Shahid, Nelson, & Cardemil, 2018). Results indicated that campus racial tension was a significant predictor of stress for African American women attending predominantly White institutions $\beta = .48$, $t(125) = 6.17$, $p < .001$.

Research has shown that African American women may view predominantly White institutions as isolating and hostile (Booker, 2016). Cohen (2007) found that Black students who "experience belonging uncertainty had high levels of stress and dissatisfaction, which was strongly associated with lower GPAs and decreased motivation when compared to students who were more socially integrated" (Booker, 2016, p. 6). According to Booker (2016), "African American first year college students attending PWIs had significantly lower grades than those enrolled at historically Black colleges and universities (HBCUs)" (Booker, 2016, p. 6)

Research indicates that African American women experience many issues that relate to stereotype threat and self-efficacy, which will be discussed later. Booker (2016) conducted a qualitative study using focus groups and individual interviews to look at the perceptions of African American women attending PWIs in terms of classroom dynamics and peer interactions. Participants included six African American upper-class female undergraduate students (Booker, 2016). Booker (2016) found that African American women's decisions to persist at PWIs were based on "faculty being accessible, approachable, and providing authentic instruction." Booker quoted a student as saying, "Her professor's class was challenging but she was just really into us as a class…not just as students but also outside of school. I remember I told her a story about my niece, and she followed up" (Booker, 2016, p. 222).

The women also described challenges with microaggressions from instructors and students and feeling the need to "represent their race." (Booker, 2016, p. 218). Shahid et al. (2018) described African American women as being challenged by racial and gender stereotypes in predominantly White institutions. Shahid et al. (2018) cited a study done in which Donovan (2011) reported the views of 109 White college students as it relates to Black women. According to Shahid et al. (2018), participants reported viewing Black women as, "loud, tough, strong, angry, and domineering." Shahid et al. continued by saying that participants also described Black women as "talkative, insensitive, and less educated as compared to White women." Shahid et al. (2011) further noted the contrasts in experiences of Black women in PWIs when compared to Black women attending HBCUs. According to Shahid et al. (2011), "researchers have found that African American women at HBCUs had higher levels of cultural congruity, life satisfaction, and academic competence than those who attended PWIs."

African American men in predominantly White institutions based on current literature seem to have issues surrounding self-efficacy and social dynamics, which will be discussed later. One third of all black men entering college will drop out before obtaining a degree (Strayhorn, 2015). Also, African American women attending college outnumbers African American men 2 to 1 (Strayhorn, 2015). Some research has examined how African American men struggle with adjusting to PWIs in comparison to African American women (Chavous, Harris, Rivas, Helaire, & Green, 2004). While African American women report experiencing racial discrimination and inequity at PWIs, which caused them to become more vocal and independent, African American men were encouraged to conform (Chavous, Harris, Rivas, Helaire, & Green, 2004). So, according to Chavous et al. (2004), PWIs allowed for expressions of assertiveness in African American women, but not in men.

This creates a stark difference in the way African American women and men view PWI environments. While African American women expressed more of a sense of not belonging on campus than African American men (Chavous, Harris, Rivas, Helaire, & Green, 2004). African American men were more ethnically fit which correlated highly to their academic outcomes (Chavous, Harris, Rivas, Helaire, & Green, 2004). Chavous et al. (2004) stressed the importance for PWIs to be an ethnic fit or nonthreatening to the cultural background of African American men in order to assist with their adjustment. Other research studies suggest that unwelcoming PWI environments can be particularly damaging to African American men (Chavous, Harris, Rivas, Helaire, & Green, 2004). In these environments, African American men can experience elevated levels of stress and anxiety, which can cause them to question their academic competence and intellectual ability (Chavous, Harris, Rivas, Helaire, & Green, 2004).

Academic Ability. When examining the personal inputs that African American students bring into the institution, academic ability is one of the most important. Although African American males express a desire to become scientists or engineers, less than 10% of Black males entering college will major in STEM (Strayhorn, 2015). Also, less than 3% of African American male STEM majors will be in math or computer science (Strayhorn, 2015). Maple and Stage (1991) analyzed data from high school and beyond, and found four predictors for determining the likelihood that an African American male will major in STEM (Strayhorn, 2015). Results indicated that, " parent's education, math attitudes, confidence in one's abilities (self-efficacy), and prior math and science learning experiences" predicted STEM persistence (Strayhorn, 2015).

Espinosa (2011) found that women of color who persisted in STEM were frequently engaged in discourse with peers, were heavily involved in STEM related clubs and organizations, and were generally active in undergraduate research. These students also attended institutions with robust STEM communities (Espinosa, 2011). In the article titled, "*Pipelines and Pathways: Women of Color in Undergraduate STEM Majors and College Experiences That Contribute to Persistence*," Espinosa (2011) discussed the importance of educators creating clear pathways for women of color that would encourage them to persist in STEM majors. Espinosa (2011) continued by saying that the current educational system has failed to prepare students for STEM, which has resulted in "historically underrepresented groups," including people of color, and especially women of color.

Determinants of STEM Persistence

The professional literature outlined African American students experiencing issues with STEM persistence as falling into one or more of the following groups: stereotype threat, self-efficacy, and/or social dynamics. This section addressed current research that explored how each

group affects STEM persistence, then discussed relevant research regarding strategies that PWIs could use to combat negative effects from each group. Next, the researcher examined the historical context that shaped each group and the level of influence that each group has on society and the individuals affected.

Group 1: Stereotype threat effects. Johnson-Ahorlu (2013) conducted a study to determine what factors impact graduation and retention rates of diverse student populations. The researcher sampled 94 African American, Asian American, Latina/o, Native American, and White undergraduates from seven postsecondary institutions (five four-year institutions and two two-year institutions) (Johnson-Ahorlu, 2013, p. 384). The project used a mixed method approach that incorporated the use of surveys and racially homogenous focus groups (six members of each of the aforementioned racial groups) (Johnson-Ahorlu, 2013). The purpose of the focus groups was to explore how students perceived their academic experiences when viewed through the lens of their racial identity (Johnson-Ahorlu, 2013). Of all the groups, African American students were the only group to identify stereotypes and stereotype threat as barriers to their academic success (Johnson-Ahorlu, 2013). Johnson-Ahorlu (2013) summarized findings with the following statement, "In this study, students voiced that stereotypes and the threat of fulfilling them is a major obstacle in their academic lives. This indicates that racial thoughts and attitudes towards African Americans are a significant problem that must be addressed at postsecondary institutions" (Johnson-Ahorlu, 2013). In this dissertation, the researcher used Q-methodology as a means of giving African American undergraduate students a voice to suggest strategies that institutions could use to support them in persisting through STEM. The results of the Q sort were used to determine if stereotype threat was a significant factor that impacted their persistence.

In the article titled, "*A Threat in the Air*," Steele (1997) examined how stereotypes of African Americans and women affected their performance in various academic arenas. Steele (1997) suggested that the low academic performance observed in African American students when compared to White students could partially be due to stereotypes of African Americans being made salient in national debates and dialogue. Making these stereotypes salient creates a "threat in the air" causing members of the targeted group to internalize the stereotype (Steele C. M., 1997, p. 617).

Stereotype threat operates under the General Theory of Domain Identification. This theory states that someone will experience stereotype threat if the individual identifies with the domain under threat, and/or if the group, in which the targeted individual belongs, experiences stigmatization regarding that domain. According to Steele (1997), the General Theory of Domain Identification assumes, "that sustained school success requires identification with school and its subdomains; that societal pressures on these groups can frustrate this identification; and that in school domains where these groups are negatively stereotyped, those who have become domain identified face the further barrier of stereotype threat, the threat that others' judgements or their own actions will negatively stereotype them in the domain" (p. 613). Stereotype threat is believed to primarily affect the vanguard of a domain because it operates under the assumption that those individuals' self-esteem and identity are linked to their performance in the domain. If a person is aware of a negative stereotype about their group, such as African Americans in the domain of academic performance, research indicates that making the stereotype salient hinders performance. It is important to note that stereotype threat is not the only factor that may hinder performance of African American students. Societal structures such as low socioeconomic status, segregation by neighborhood, lack of educational resources and role models also affect

performance. Stereotype threat is another factor that can further suppress the performance of African American students who have managed to survive the other factors and demonstrate strong academic ability.

Steele (1997) identified two ways that stereotype threat can be triggered and persist in social situations. First, if the individual experiences the threat while performing a domain related activity (Steele C. M., 1997). Steele (1997) suggested that the emotional reaction to the threat is enough to suppress performance. Second, if the threat is chronic and persistent, such as the stereotype about African Americans' low scholastic aptitude. Steele (1997) said that over time these stereotypes will become internalized and cause individuals to "disidentify" with the domain. Steele (1997) defined disidentification as, "a reconceptualization of the self and of one's values so as to remove the domain in relation to the self" (Steele C. M., 1997, p. 614). Steele (1997) described disidentification as a method that a person might use to protect themselves from the adverse emotional implication that may arise when one becomes invested in a domain for which they are negatively stereotyped. Disidentification can further result in a lack of motivation in a domain that an individual would have otherwise performed well in (Steele C. M., 1997, p. 614). Steele (1997) further suggested that focus should be on removing the threat versus changing the internal psychology of the individual (Steele C. M., 1997, p. 614).

Studies on stereotype threat. According to Steele (1997), several general features of stereotype threat exist. First, stereotype threat is a general threat that is not linked to the psychology of the stigmatized group (Steele C. M., 1997, p. 617). Stereotype threat can exist in any context and affect anyone who belongs to a group in which a negative stereotype persists, such as gender, race, age, or sexual orientation related stereotypes. The emotional implication arises when individuals fear that their behavior may reinforce the stereotype about their group.

Second, the mechanism for stereotype threat depends on if the threat on the group affects the individuals' identity as well. Steele (1997) suggested that what turns stereotype threat on and off is determined by its relevance for an individual to interpret the threat as applying to themselves, or their behavior when in a social setting mixed with stereotype threatened and non-stereotype threatened members. Third, the type and degree of stereotype threat differs from group to group. Steele (1997) suggested that the type of stereotypes and the degree to which the stereotype exists differs because of varying situations in which different stereotypes can be applied. Fourth, an individual does not need to believe the stereotype to be affected by it. The person must simply be aware of the existence of the stereotype. And fifth, putting forth the effort necessary to overcome a negative stereotype can be challenging. Also, the targeted individual may feel the need to have to disprove the stereotype in different situations. Steele (1997) stressed that stereotype threat creates yet another barrier to a student's academic success and identity. In societies where historical patterns of oppression exist, the persistence of negative stereotypes about historically oppressed groups have the potential to impact the mental psychology of the targeted individuals. Steele (1997) suggested that prolonged exposure to negative stereotypes can cause members to internalize them and develop a sense of inadequacy when operating in the stereotyped domain, thus making the stereotype real and true for them (p. 617). This is what makes stereotyping groups so detrimental.

Several research studies have been conducted to understand the connection between stereotype threat and performance. A study done by McFarland, Lev-Arey, and Ziegert (2003), used two hundred and forty-one undergraduate students (n = 191 white, n= 50 black), to determine whether stereotype threat exists in a motivational context that takes into account racial identity and domain identity (McFarland, Lev-Arey, & Zeigert, 2003, p. 181). Participants were

administered a cognitive ability test that consisted of 27 difficult multiple-choice questions. On average, students answered 33% of the questions correctly (McFarland, Lev-Arey, & Zeigert, 2003, p. 190). Participants were also assessed using a domain identity scale, and a pre-and-post racial identity scale was used for those individuals in the threat condition. Results showed that Whites who were identified with the domain (cognitive ability) performed better on the cognitive ability test than those who did not (McFarland, Lev-Arey, & Zeigert, 2003, p. 193). The results also did not show a relationship between domain identity and test performance for Blacks. The experimenters subsequently examined how racial identity relates to stereotype threat and test performance. Results revealed that Black individuals with a strong racial identity performed significantly worse in the stereotype threat condition (McFarland, Lev-Arey, & Zeigert, 2003, p. 194). Black participants who dis-identified themselves from their race during the course of the testing session performed better than those who strongly identified with their race (McFarland, Lev-Arey, & Zeigert, 2003, p. 194). Steele (1997) described dis-identification as an individual's ability to dissociate from a domain or a group as a means of protecting themselves from a negative outcome.

Fogliati and Bussey (2013) conducted a study using 80 participants (women n = 54, men n= 26) to determine if negative gender stereotypes concerning low math ability among women impacted the female subjects' level of motivation, self-esteem, and willingness to attend free math tutorials. The experiment involved two to six participant groups seated at separate computers. The participants were asked to take a 30 multiple-choice Graduate Record Examination (GRE) test. Prior to testing, participants in the no stereotype threat condition were told that "studies have provided evidence that males and females generally perform equally well on this test" (Fogliati & Bussey, 2013, p. 315). Participants in the stereotype threat condition

were told, "studies have provided evidence that males generally perform better than females on this test" (Fogliati & Bussey, 2013, p. 315). Results from the mathematics test reveal that women performed better in the no stereotype condition (M = 10.00, SD = 4.15), than women in the stereotype condition (M = 7.43, SD = 3.52), t(77) = 2.31, p = .02).

After participants completed the mathematics test, researchers gave participants false results to determine if negative performance feedback would affect the self-esteem of participants in the stereotype condition. Researchers did not observe a statistically significant difference in self-esteem of women in the negative feedback condition (M = 5.49, SD = 0.67), and women in the positive feedback condition (M = 5.35, SD= 0.74), t(72) = -0.69, p = .49). Fogliati and Bussey (2013), suggested that the negative female mathematics stereotype acts a buffer for self-esteem in women. Men who received negative feedback reported significantly lower self-esteem (M = 4.83, SD = 0.67), than men with positive feedback (M = 5.50, SD 0.79) t(72) = 2.52, p = .01, which suggests that men identify strongly with mathematics, and are thus adversely affected by negative results (Fogliati & Bussey, 2013, p. 316). Lastly, results showed that women in the stereotype threat condition who received negative feedback were less likely to attend tutoring session (M = 2.56, SD = 1.07) than women in the no stereotype condition (M = 4.00, SD = 2.05), t(62) = 2.04, p =.05 (Fogliati & Bussey, 2013, p. 316). Men in both negative and positive feedback conditions and women in the stereotype condition who received positive feedback, were not adversely impacted and thus results indicated no effect on the likelihood of attending tutoring sessions (Fogliati & Bussey, 2013, p. 316).

Stereotype threat has also been shown to affect cognitive load. Forbes and Schmader (2010) conducted several experiments to study the effects of attitude and stereotypes on motivation and cognitive capacity. In study 1, the experimenters focused on retraining women (n

= 58) to have a positive attitude about math. Participants were randomly assigned to a "like math" or "dislike math" training condition (Forbes & Schmader, 2010, p. 742). The participants viewed words on a screen and categorized them as a word they liked or did not like. Later, they were asked to categorize each word as related to math or language. The researchers trained participants in the "like math" group to associate positive feelings with math by using a response mapping technique designed to associate the "I like" option with "Math" (Forbes & Schmader, 2010, p. 743). Results indicated that women trained to like math spent more time working on math problems (M = 325.84 sec, SD = 101.84) than language problems (M = 81.89 sec, SD = 101.84). Also, women trained to like math problems spent more time working on problems than women trained to dislike math, $t(56) = -2.23$, $p < .03$, $d = 0.59$ (Forbes & Schmader, 2010, p. 744). Forbes and Schmader (2010) suggest that retraining math attitudes affects women's motivation for choosing to work on math.

In study 2, 143 participants (women n = 63 and men n = 80) were studied to test the effects of attitude retraining specifically on the motivation of women in stereotype threat situations. Groups were assigned to one of three conditions, like math/stereotype threat, like math/stereotype neutral, or dislike math/stereotype neutral. (Forbes & Schmader, 2010, p. 745). Participants completed the attitude retraining task first, then one day later, they returned to complete a math motivation measure in mixed gender groups in the stereotype threat or neutral condition (Forbes & Schmader, 2010, p. 745). Women in the stereotype threat condition took a math and verbal assessment under the assumption that the test measured natural intellectual ability (Forbes & Schmader, 2010, p. 745). The experimenters also placed those female participants in proximity to male participants, and asked them to mark their gender on a demographic questionnaire to trigger the stereotype threat condition (Forbes & Schmader, 2010,

p. 745). Women in the neutral condition were told that they would complete a problem-solving task that examines their strategy preferences (Forbes & Schmader, 2010, p. 745). They were also seated in places that did not allow them to see male participants. Results indicated that women trained to have positive math attitudes in the stereotype threat condition were more motivated and spent more time on the assessment than the male participants $F(1,137) = 6.98$, $p < .01$, eta2 = .05 (Forbes & Schmader, 2010, p. 745). Same was true for women in the positive, $F(1, 137) = 1.98$, $p = .05$, eta2 =.04 and negative, $F(1, 137)= 3.09$, $p < .01$, eta2 = .09 neutral conditions.

In Study 3, Forbes and Schmader (2010) examined if retraining attitudes of women (n =120) to like math, coupled with associating women with being good in math could prevent cognitive impairments in stereotype threat situations and improve working memory. Participants were divided into counter stereotype retraining and stereotype reinforcing groups. Participants in the counter stereotype retraining group completed an assessment on a computer that had the labels "Women are good at" and "Math" in the top left hand corner of the screen in order to associate women with being good at math (Forbes & Schmader, 2010, p. 746). Participants in the stereotype reinforcing group were seated at a computer with labels that read, "Men are good at" and "Math" in the right-hand corner of the screen (Forbes & Schmader, 2010, p. 746). Results indicated that women trained to associate women with being good at math ($M = 33.22$) had higher working memory scores than did women trained to associate men with being good at math ($M = 27.34$) $F(1, 116) = 4.62$, $p < .04$, eta2 = .04 (Forbes & Schmader, 2010, p. 747).

Grand (2017) conducted a study to examine if negative stereotypes impair knowledge acquisition and learning in women. Since the study focused on women, the experimenters decided to use an over-representative sample of female undergraduate participants (n = 145, female; n = 53, male) (Grand, 2017, p. 119). These participants were recruited from introductory

and upper-level psychology courses (Grand, 2017, p. 119). Experiments used mathematical/analytical reasoning as the ability domain to induce the stereotype threat condition for women (Grand, 2017, p. 119). This was a double-blind study that placed participants in the stereotype threat or control condition. Participants in the stereotype threat condition were given instructions on their computer screen, and audibly through headphones that explained that the purpose of the study was to examine possible reasons why women tend to perform poorly in relation to men on tasks that involve mathematical or analytical tasks (Grand, 2017, p. 120). Results indicated that participants in the control condition (M = 2.88 [95% credibility interval = 2.75, 3.03], SD = .51) reported perceiving less stereotype threat than participants in the stereotype threat condition (M = 3.29, [3.15, 3.42], SD = .50), and a difference that reflects a moderate to large effect size (d = -.79) (Grand, 2017, p. 123). Participants were tested over a period of three days to test knowledge acquisition over time in the stereotype threat condition. Experimenters noted that women in the stereotype threat condition achieved equivalent levels of declarative knowledge by the end of day 1, however the rate of acquisition of knowledge was slower in women in the stereotype threat condition (Grand, 2017, p. 123). The probability of increasing in declarative knowledge increased by 62% for women in the control condition compared to 56% for women in the stereotype threat condition over the course of three days (Grand, 2017, p. 123).

Stereotype threat affects African American students. Mayer and Hanges (2003), conducted a study to measure performance of 60 African American and 90 White undergraduate students using the Raven Advanced Progressive Matrices, also known as Raven APM. The researchers wanted to determine if two types of stereotype threat relationships existed, stereotype threat specific, a threat that results from the testing situation, and stereotype threat general, a

more global sense of threat that individuals carry into a multitude of social situations. Students were placed into two groups based on the presence or absence of the stereotype threat condition. Students were told that the Raven APM either measured intelligence or perceptual ability (Mayer & Hanges, 2003, p. 214). The researchers were very careful not to describe the assessment as a measure of race and intelligence because they did not want to trigger the stereotype threat condition, but rather mimic a more natural environment, such as a work environment, to see if stereotype threat still occurs. The researchers also wanted to determine the mechanism that allows stereotype threat to occur. They measured four mediator variables which were anxiety, evaluation apprehension, self-efficacy, and cognitive interference (Mayer & Hanges, 2003, p. 215).

The researchers noted that only two mediator variables had an impact on the results in any meaningful way. Stereotype threat-specific only showed a significant positive correlation with evaluation apprehension (Mayer & Hanges, 2003, p. 220). Stereotype threat-specific did not affect any other variable. Also, self-efficacy was the only variable that showed a direct relationship to the test score, and stereotype threat-general was found to positively relate to anxiety. The results also showed that African Americans ($M = 3.57$, $SD = .90$) reported more stereotype threat general than Whites ($M = 2.09$, $SD = .75$), $t(150) = -10.98$, $p < .001$. They also observed a larger difference in stereotype threat-specific related to the diagnostic test results between Blacks ($M = 2.52$) and Whites ($M = 1.56$) who were told the assessment measured intelligence, versus those who were told the assessment measured perceptual ability ($M = 2.23$, African Americans; $M = 1.76$, Whites) (Mayer & Hanges, 2003, p. 218). Overall, the researchers suggested that stereotype threat that comes from the test (stereotype threat-specific), negatively

impacts the test score, but not as much as general stereotype threat or the way people believe society perceives them as being a member of a certain group (Mayer & Hanges, 2003, p. 219).

Marx and Goff (2005) discovered that when a Black experimenter administered a test to Black participants, performance did not decrease despite being in a stereotype threat condition. This study was significant because it went beyond the testing situation, and examined how the social situation, like racial makeup of the testing group or race of a competent in-group test administrator, could delegitimize a negative stereotype. The experiment included Black (n = 32) and White (n = 27) Harvard undergraduates. The undergraduates were met by either a Black or White experimenter who explained that they would be taking a challenging verbal test that they created (Marx & Goff, 2005, p. 648). The experimenter also indicated that they would provide feedback to the participants at the end of the experiment, however no feedback was given. This was a part of the experimental design to reinforce the competence of the experimenter. Participants also completed a study feedback form where they were asked to indicate the race of the experimenter. Only the participants that accurately identified the race of the experimenter were included in the study. Result indicated that Black participants who were given the verbal test by a White experimenter performed worse than in any other condition (Marx & Goff, 2005, p. 650). Also, there was a marginal interaction between race of the participant and race of the experimenter $F(1, 45) = 3.60$, $p = .064$, $\eta = .27$) (Marx & Goff, 2005, p. 650). Black and White participants who took the verbal test administered by a Black experimenter showed no real difference in test scores (Marx & Goff, 2005, p. 651). However, Black participants who were given the test by a Black experimenter ($M = 12.08$, $SD = 2.73$) outscored Black participants who were given the test by a White experimenter ($M = 9.80$, $SD = 3.31$), $F(1,45) = 4.98$, $p < .05$, $\eta = .32$) (Marx & Goff, 2005, p. 651). White participants' scores did not significantly differ when

tested by a White experimenter (M = 13.16, SD = 3.01) and Black experimenter (M = 12.39, SD = 4.33), F(1, 45) = 0.39, p = .54, η = .09 (Marx & Goff, 2005, p. 651). Marx and Goff (2005) argued for the presence of the stereotype threat by stating that Black participants (M = 9.80, SD 3.31) scored worse than White participants (M = 13.16, SD = 3.01) when the test was administered by a White experimenter F(1, 45) = 10.07, p < .01, η = .43 when compared to Black participants (M = 12.08, SD = 2.73) whose test scores were not significantly different from White participants (M = 12.39, SD = 4.33) when the test was administered by a Black experimenter F(1, 45) = .07, p = .79, η = .04 (Marx & Goff, 2005, p. 651).

Reducing stereotype threat. Further research has focused on reducing stereotype threat effects. Martens, Johns, Greenberg, and Schimel (2006), conducted a study to determine if self-affirmation reduces stereotype threat effects on women's performance on a difficult math test. The experimenters conducted two studies. The first study had 147 participants (n= 77, female; n= 70, male) in introductory psychology students (Martens, Johns, Greenberg, & Schimel, 2006, p. 237). Female participants were placed in one of three groups, control, stereotype threat, or stereotype threat/affirmation condition. Male participants were however placed in one of two conditions; control or stereotype threat. Results showed that women in the stereotype threat condition (M = 3.60) performed worse than women in the no stereotype threat control condition (M =5.70), p = .05, and men in the stereotype threat condition (M = 8.31), p <.01 (Martens, Johns, Greenberg, & Schimel, 2006, p. 239). Also, no statistically significant difference was observed between men in the stereotype threat condition (M = 8.31) and men in the non-threat control condition (M = 8.09), p >0.8. Results also indicated that women who affirm positive attributes about themselves (M = 6.42) performed better than women in the control/non-diagnostic condition (M = 3.60), p <.01 (Martens, Johns, Greenberg, & Schimel, 2006, p. 239).

Study 2 was designed to determine if self-affirmation impacts male performance when given a spatial rotation assessment. The experimenters wanted to know if the increase in female performance was due to a general boost in performance or reduce effects of stereotype threat. This study included 105 participants (n = 53 male, n = 52 female). The participants were explicitly told that women generally perform worse than men on the spatial rotation test, and that the test would be challenging (Martens, Johns, Greenberg, & Schimel, 2006, p. 240). In this study both men and women were placed in a stereotype threat/affirmation condition. Results showed again that women in the stereotype threat condition who affirm got more questions correct (M = 13.44) than women who did not (M = 10.05), $t(70) = 2.19$, $p < .05$ (Martens, Johns, Greenberg, & Schimel, 2006, p. 240). The test did not show an increase in performance of men (M = 13.13 stereotype threat w/o affirmation), (M = 14.24 stereotype threat with affirmation), $t(70) = .67$, $p > .5$ (Martens, Johns, Greenberg, & Schimel, 2006, p. 241).

Shapiro, Williams, and Hambarchyan (2012) sought to reduce stereotype threat by introducing a multi-threat framework that organizes stereotype type threat into two categories; group-as-target stereotype threats, and self-as target stereotype threats. They suggested that interventions will only be effective when they address the specific type of stereotype threat experienced by individuals, consequently one form of intervention cannot be used to reduce stereotype threat across a wide range of situation (Shapiro, Williams, & Hambarchyan, p. 277). The Multi-Threat Framework identified six qualitatively distinct stereotype threats that emerged from the intersection of two dimensions-the target of the threat or who the actions will reflect on, which consists of the racial or gender group, and the source of the threat being who can judge the actions (the self, out-group, or in-group) (Shapiro, Williams, & Hambarchyan, p. 278).

Shapiro et. al. (2012) focused on one dimension of the Multi-Threat Framework, which was the target of the stereotype threat (group or self). Shapiro et. al (2012), designed four experiments to test the theory that self-affirmation interventions reduce group as target stereotype threats (experiments 1 and 2), and role model interventions reduce self-as-target stereotype threats (experiments 3 and 4). In Experiment 1, the researchers exposed Black students to a self-as-target or group-as-target stereotype threat in a situation that involved either a role model intervention or control. After exposure, participants subsequently completed a GRE like assessment that included verbal and quantitative multiple- choice questions. Results showed no difference in the self-as-target with a role model intervention and control. However, results indicated that individuals exposed to the group-as-target stereotype threat condition performed better when placed in a role model intervention condition (M = 12.88, SD = 2.92) than participants in the self-as-target stereotype threat condition (M = 7.87, SD = 2.95), F (1,61) = 19.90, p <.001, η^2 = .25 (Shapiro, Williams, & Hambarchyan, p. 280).

Experiment 2 was designed to see if the role model intervention protects against other stereotype threat related areas like career choices or college majors. In this experiment, Shapiro et. al (2012) wanted to explore the impact that group-as-target stereotype threats have on women's decisions to choose STEM majors and careers. Results showed that women were less likely to choose a STEM major when exposed to a self-as-target stereotype threat when using the role model intervention. However, women exposed to a group-as target-stereotype threat and role model intervention reported more interest in pursuing a STEM major (M = 2.79, SD = 1.29) compared with the self-as-target stereotype threat condition (M = 1.93. SD = 1.28), F(1, 45) = 4.16, p =.05, η^2 = .08 (Shapiro, Williams, & Hambarchyan, p. 282).

Experiments 3 and 4 were designed to explore the self-as-target stereotype threat condition with the self-affirmation intervention. In experiment 3, Black student participants were placed in a stereotype threat condition (group-as-target or self-as-target) and exposed to the self-affirmation intervention or control. After the intervention, participants completed a GRE-like assessment that included verbal and quantitative questions. Results showed that participants exposed to the self as target stereotype threat performed better on the GRE-like assessment when given the self-affirmation intervention ($M = 11.27$, $SD = 3.69$) when compared to participants in the group-as-target stereotype threat condition ($M = 7.00$, $SD = 2.78$), $F(1, 33) = 11.65$, $p = .002$, $\eta^2 = .26$ (Shapiro, Williams, & Hambarchyan, p. 283). Experiment 4 yielded similar results when women's performance was measured against a quantitative GRE-like exam. Results indicated that self-affirmation interventions were effective at protecting women against self-as-target stereotype threats ($M = 9.31$, $SD = 3.24$), thus they performed better when compared to participants in the group-as-target stereotype threat condition ($M= 6.86$, $SD = 2.38$), $F(1,57) = 5.55$, $p =.02$, $\eta^2 = .09$ (Shapiro, Williams, & Hambarchyan, p. 284). Although many studies continue to yield varying results, the multi-threat framework brings another level of complexity to stereotype threat theory and may begin to shed some light on why results in previous experiments have been inconsistent when researchers used a single intervention to combat various forms of stereotype threat.

Aronson, Fried, & Good (2002) conducted an experiment to determine if reshaping the view of intelligence as malleable rather than fixed would change the way African Americans under stereotype threat view their own intelligence, thus reducing stereotype threat in intelligence related domains. Seventy-nine ($n = 42$ Black and $n = 37$ White) Stanford undergraduates participated in the study (Aronson, Fried, & Good, 2002, p. 117). Participants

were randomly assigned to one of three groups; malleable pen pal condition, control pen pal condition, non-pen pal condition. The group in the malleable pen pal condition (experimental group) were asked to respond to letters from "at risk" middle school students. The middle school students were described as coming from impoverished communities, and would benefit from encouragement from an elder (Aronson, Fried, & Good, 2002, p. 117). Participants were told to use themselves as the example to show the middle school students that successful college students were once like them (Aronson, Fried, & Good, 2002, p. 117). The experimenters also asked participants to include pictures of themselves with the letter. When writing the letter, participants were told to explain intelligence as something that is malleable, changes over time, and increases with knowledge. In the control pen pal condition, all factors were the same, except participants did not explain intelligence as being malleable, but rather that people have different natural abilities. Participants in the control group were told to encourage the middle school students to discover the areas where they are naturally gifted (Aronson, Fried, & Good, 2002, p. 118). The no pen pal group did not participate in the study. Experimenters measured the short term and long-term effects of the study. Participants in the malleable pen pal group reported viewing intelligence as more malleable ($M = 4.92$) than those in the pen pal control group ($M = 4.24$), $t(73) = 2.07$, $p < .05$ (Aronson, Fried, & Good, 2002, p. 119). Also, there was no significant difference between the pen pal control group ($M = 4.24$) and the no pen pal group ($M = 3.93$) (Aronson, Fried, & Good, 2002, p. 119). Further research showed that the intervention caused a long-term change in the malleable group participants' views of intelligence.

Conclusively, there is overwhelming evidence to support the existence of stereotype threat. However, many studies are conducted in controlled experimental conditions that measure stereotype threat in an objective and quantifiable way. These studies indicate the presence of a

stereotype threat condition but lack the qualitative elements that would assist in understanding the perception of the individuals experiencing the threat. Without a clear understanding of participant perspectives, the researcher can only draw conclusion from numerical data. Q methodology can augment this research by helping to reveal the perspectives of individuals that experience the stereotype threat conditions.

Strategies that PWIs can use to reduce stereotype threat. Understanding stereotype threat and the mechanisms by which it operates is important to helping African American students persist in STEM majors. In the article titled, *Reducing Stereotype Threat in the Science and Mathematics Classroom: An Overview of Research, Best Practices, and Intervention Strategies,* Sparks (2016) describes the layers of stereotype threat research by citing the research of Toni Schmader who organizes it into three categories, " identifying the extent of the phenomenon, looking at who experiences the effect and its mechanisms, and translating these results into interventions (Sparks, 2016, p. 7). Sparks (2016) discusses several interventions that can be implemented in the science and mathematics classroom by teachers who educate minority students, specifically African Americans. These strategies include:

1. Teach African American students in science and mathematics that intelligence is fluid and can be expanded (Steel, 1997; Aronson et al., 2002). Students who view intelligence as fixed tend to disidentify with academics after receiving negative feedback (Sparks, 2016).
2. Encourage values affirmation and affirmation of self (Martens et. al, 2006; Shapiro et. al, 2012, Sparks, 2016). Several studies show how self-affirmations are important to overcome negative views of oneself. When African American students affirm

themselves through writing positively about their characteristics and abilities, they can overcome stereotype threats to their science and math skills (Sparks, 2016).

3. Teach African American students about stereotype threat (Sparks, 2016). Allow students to discuss stereotype threat openly in a class setting and remove its power by removing the salience of race and gender (Sparks, 2016).
4. Give feedback that is mindful of stereotype threat effects (Sparks, 2016). It is important for teachers to give constructive feedback that also reaffirms the ability of their African American students to complete the task. So, communicate high standards and confidence in the student's ability to attain them (Sparks, 2016).
5. Expose the student to positive role models (Marx & Goff, 2005; Sparks 2016). Exposing students to role models that are the same race and gender builds the student's confidence in their own abilities. If African American students can see themselves in a teacher or tutor within a difficult course or subject, it helps them to believe that they could also be successful in that course or subject (Sparks, 2016).
6. Reframe tasks to make them less threatening (Sparks, 2016). Tell African American students that it is okay to be anxious before a test (Sparks, 2016).

Stereotype threat through a historical context. Several scholars have studied how stereotypes and racially oppressive assumptions adversely affect the way that African Americans view their racial identity (Ogbu, 1986; Steele, 1997; Moody, 2004; Harper, 2006; Banks and Horenstein, 2012). Other researchers explore the role of capitalism as a mechanism for building social structures that negatively affect the psychology of African Americans (Mocombe, 2011; Buck, 2017). In order to understand the roles that stereotypes play in shaping societal views of African Americans, we must first examine the role that stereotypes and implicit bias play in

promoting the cyclical nature of racism in America. If we can understand the pervasive nature of racism and how it stains every aspect of our society, then we can understand the difficulty African Americans face when trying to escape these stereotypes.

Gallagher (2003) argued that embracing the colorblind perspective reinforces Whites' belief that being white or black or brown has no bearing on an individual's or group's relative place in the socio-economic hierarchy. Drawing from interviews and focus groups with White Americans, Gallagher (2003) also argued that colorblind depictions of U.S. race relations serve to maintain white privilege while simultaneously negating racial inequality. Williams (2012) called it an unintentional form of bias that is just as damaging as overt racism.

Williams (2012) also argued that structural inequality is another form of bias, which describes the degree to which social groups, such as; racial groups differ in income, health, and wealth (p.42). Williams (2012) used critical race theory to suggest that racism, in all of it forms (structural, institutional, unintentional, and unconscious), is pervasive, and here to stay (Williams, 2012, p. 43). He also addressed the cyclical nature of institutional racism by saying that, "Institutions and social structures preserve and maintain, by way of policies and practices, behaviors and environments that support the status quo and consequently the subordination or marginalization of racial groups" (Williams, 2012, p. 43).

Take the historical stereotypes that have linked African Americans to criminality as an example of the cyclical nature of institutional racism that despite achieving progress, moves in a different direction in order to maintain the status quo. This is depicted in society's evolution from a forced free labor system during slavery to Jim Crow segregation and present day forced free labor systems that thrive on the mass incarceration of African Americans.

The Reconstruction era (1865-1877) brought with it hope for independence and freedom for ex-slaves to determine their own destiny. The White ruling elite, planter class, however, looked at Reconstruction as an end to the southern way of life. One-third of Black laborers left the labor force after emancipation. (Foner, 2014, p. 139). Women left the fields to become care takers in the home caring for their own children and tending their own gardens. Planters found it difficult to force blacks to work in pre-Civil War conditions. The lack of labor was not the only thing that threatened the southern way of life. The Civil War left many once wealthy Confederate planters struggling to rebuild their lives after losing their life savings in Confederate bonds and their slaves (Foner, 2014). The plight of many once wealthy southerners is clearly depicted in Eric Foner's (2014) book titled, *Reconstruction- America's Unfinished Revolution*. In the book, he includes a Maryland Unionist's description of a planter class family as being a "once very wealthy" family that was now reduced to a state worse than poverty (Foner, 2014, p. 128). The family drowning in debt and without servants found themselves having to take care of everyday responsibilities such as milking cows, harnessing their own carriages, and shining their own shoes.

Many hoped that the government would compensate them for the loss of their slaves, or that the Supreme Court would overturn the Emancipation Proclamation (Foner, 2014). Many planters saw ex-slaves as children still needing a master. While Blacks sought autonomy and freedom, planters sought to rule over them, seeing Blacks as an inferior race needing guidance, not equality. This impeded Whites from accepting emancipation and seeing Blacks as capable of surviving independently. It also prevented Whites from accepting a free labor market, where Blacks had the right to decide where and when they should work. Many planters felt that their ex-slaves were ungrateful when they asked for better working conditions, higher wages, or

expressed the desire to leave. Ex-slaves that stayed on the plantation were forced to pay for the clothes on their backs, food, housing, and their garden plots. (Foner, 2014). These instances can be summed up by a Missouri freedman who said, "I do know some of dem old slave owners to be nice enough to start der slaves off in freedom wid somethin' to live on…but dey wasn't in droves, I tell you" (Foner, 2014, p. 131).

The Hayes-Tilden Compromise of 1877 was an informal agreement between the southerners and Republicans that promised the presidency to Rutherford B. Hayes if he agreed to remove the federal troops from the South. This move allowed the planter class to re-establish their hold on the economy, and thus ushered in the era of Jim Crow segregation (1877-1950). As Southern whites regained control of the government, the Freedmen's Bureau officials had difficulty providing legal protection for ex-slaves (Harrison, 2007, p. 207). Blacks were forced to work as laborers on the same land, in some cases, where they were once enslaved. At the end of the war, the planter class also sought to restore the economy by instituting a coercive labor system that closely resembled the prewar South where the overseer became the "manager" or "agent" (Anderson, 1988, p. 21). The Freedmen's Bureau also did very little to prevent former slaves from becoming victims to contractual labor obligations that forced them to remain and work on plantations for low wages. Enticement laws, passed by ten southern states from 1865 to 1867, prevented blacks from seeking employment on another plantation. (Anderson, 1988, p. 25). These laws established proprietary claims on the laborer making it illegal for them to be hired or enter another contractual agreement with a different employer.

Although the 13th amendment abolished legal slavery, the institution itself was maintained through vagrancy laws, passed by all Confederate states except Tennessee and Arkansas (Anderson, 1988, p. 25). These laws made it illegal for Blacks to be unemployed

(Anderson, 1988, p. 25). Also known as "Black Codes," these laws not only restricted the freedom of ex-slaves to control their own labor decisions, but they worked as tools that linked African Americans to criminality and stereotype threat. "Vagrancy became the primary all-purpose crime for re-enslaving black men, along with other trumped-up charges that required either payment of an often impossibly large fine or slavery until the fine was paid off " (Buck, 2017, p. 178). Former slaves were forced to sign annual labor contracts; failing to do so resulted in eviction from the plantation, and enforcement of vagrancy laws (Harrison, 2007, p. 207). If a black person was found to be unemployed, they were jailed and forced to work on a chain-gang or return to the original employer or any employer who posted their bond. Chain-gangs were established as a way to maintain free labor systems through continued exploitation of ex-slave convicts. Industrialist or mine-owners purchased convict leases, which continued the purchase of Blacks. Poor Whites who were convicted, on the other hand, were rarely leased (Buck, 2017, p. 179). In many ways the treatment of ex-slaves during the vagrancy law policing era of Jim Crow mirrors the treatment that African Americans currently experience during this modern era of stop and frisk policing. So, it appears that the more things change, the more they stay the same.

Buck (2017) established a similar correlation in the article titled, *The strange birth and continuing life of the US as a slaving republic: Race, unfree labor and the state*. In this article, Buck (2017) depicted convict labor as a source of profit (Buck, 2017, p. 181). Federal and state prisons had convicts producing goods such as sunglasses, furniture, and a variety of other items (Buck, 2017, p. 181). Private corporations also benefitted from this system that Buck (2017) called "prison slavery." Boeing, for instance, paid employees $30 per hour, but laid off workers to employ prisoners at $7 per hour (Buck, 2017, p. 180). The state system then took the money from the prisoners to pay for room and board (Buck, 2017, p. 180).

Cooper et. al (2016) explored how major non-profit organizations, like the American Legislative Exchange Council (ALEC), worked with politicians since the 1980s to establish policies that privatized the prison system and generated profits for corporations. Cooper et. al (2016) cited from 800 model bills that revealed ALEC's involvement in "corporate profit making from the industrial prison complex" (Cooper, Heldman, Ackerman, & Farrar-Meyers, 2016, p. 380). Cooper et. al (2016) suggested that ALEC sought to expand the prison industry in three ways, "promote greater use of prison goods and services, promote greater use of prison labor, and increase the size of the prison population" (Cooper, Heldman, Ackerman, & Farrar-Meyers, 2016, p. 380). This objective was also reflected in the legislation of the time, which was heavily influenced by corporations operating through ALEC and other special interest groups. These included the Broken Window policy and the War on Drugs of the early 80s and 90s that devastated communities of color (Cooper, Heldman, Ackerman, & Farrar-Meyers, 2016).

Systemic racism in America is imbedded in society and shapes the way African Americans are viewed and subsequently treated. The cyclical nature of racism allows for society to evolve and progress all while maintaining its racist institutions (Buck, 2017). These institutions shape society in terms of its media and culture, which influences how African Americans are depicted in news and movies. Because African Americans are such a small percentage of the American population, the depictions of them in news and other forms of media are often the only information large segments of the American population receive. This places an undue burden on the shoulders of African Americans in every aspect of society to constantly overcome stereotypes. Thus, if African American students are cognizant of negative stereotypes that exist about their academic performance, then it is impossible to study academic performance alone without considering the impact of stereotype threat. It would also be important to

understand if stereotype threat pushes African American undergraduate students away from pursuing STEM degrees. In this study, we used Q methodology to give African American undergraduate students a voice in helping to understand if stereotype threat currently affects them, their college experience at a PWI, and their decision to persist in STEM.

Group 2: Issues with self-efficacy. There is empirical evidence to suggest that self-efficacy is a "central factor" that determines successful outcomes for African American students in academic and career development (Charleston & Leon, 2016; Hall, Nishina, & Lewis, 2017). Stout et al. (2011) found that women who engaged with female STEM experts increased their identification with women and STEM (Charleston & Leon, 2016). Charleston & Leon (2016) also suggests that men and women are shown to draw upon different aspects of self-efficacy. They used research from Zeldin et al. (2001) to suggest that women draw upon vicarious learning and men use mastery experiences in order to persist in STEM courses (Charleston & Leon, 2016). Charleston & Leon (2016) also referenced the work of Hackett and Betz (1981) to suggest that students who have strong math self-efficacy were more likely to choose science-based majors. Other studies found that, "high school mathematics preparation, past math achievement and gender, as well as gender role socialization, all influenced mathematics self-efficacy" (Charleston & Leon, 2016).

Current research seeks to study the relationship that cognitive person variables, such as self-efficacy have on goals and career outcome, also called social cognitive variables (Hall, Nishina, & Lewis, 2017). This connection forms the basis of Social Cognitive Career Theory (Hall, Nishina, & Lewis, 2017). Bandura's (1986) Social Cognitive Career Theory (SCCT) looks at the environmental and behavioral variables that affects a person's career choices (Charleston & Leon, 2016). Charleston & Leon (2016) described SCCT as a theoretical model "that predicts

that one's self-efficacy (beliefs about personal capabilities) promotes favorable outcome expectations (beliefs about the outcomes of one's actions) (Charleston & Leon, 2016, p. 154).

Charleston & Leon (2016) used Bandura's (1986) Social Cognitive Career Theory to explain the social cognitive factors that affect self-efficacy in African American students. These were performance accomplishments, vicarious experiences, encouragement from others, and physiological or emotional anxiety (Charleston & Leon, 2016, p. 154). Belser et al. (2018) suggested that career interventions have the greatest impact on undergraduate students, which results in 90% of them displaying increases in self-efficacy and completing their majors.

Studies on self-efficacy. Hall, Nishina, & Lewis (2017) conducted a study to examine how two social factors, ethnic discrimination (negative barrier) and friendship group diversity (positive support) affects academic self-efficacy of minority college students and their intent to major in STEM-related fields. Two cohorts of incoming minority students were studied (n = 1307 and n = 1701) (Hall, Nishina, & Lewis, 2017). Cohort 1 was given a survey that had STEM related items on there that related to science and math efficacy while Cohort 2 received a more general self-efficacy measure. (Hall, Nishina, & Lewis, 2017). The type of efficacy measure was adapted from the Adolescent Discrimination Distress Index subscale of educational discrimination (Hall, Nishina, & Lewis, 2017) . The efficacy measure differed between cohorts with one measuring ethnic discrimination and the other measuring group diversity to see the association with academic efficacy (Hall, Nishina, & Lewis, 2017).

The results of the study showed that in Cohort 1, 55% of students reported a desire to major in STEM (Hall, Nishina, & Lewis, 2017). The percentage of students in Cohort 1 pursing stem were 60% Asian, 3% African American, 24% Latino/a, and 13% Mult-ethnic (63% of participants were women) (Hall, Nishina, & Lewis, 2017). Chi square analysis showed that no

significant difference existed between the ethnic groups and STEM major type $\chi 2$ (9) = 6.27, p = 0.71 (Hall, Nishina, & Lewis, 2017). Cohort 2 had 55% of students reporting a desire to pursue a STEM related major (Hall, Nishina, & Lewis, 2017). This included 32% biological/life science, 17% engineering, 3% mathematics, and 3% other physical sciences (Hall, Nishina, & Lewis, 2017). Students were 54% Asian, 3% African American, 29% Latino/a, and 14% Multiethnic (62% of the participants were women) (Hall, Nishina, & Lewis, 2017). Chi square analysis again showed that no significant difference existed between the ethnic groups and STEM major type $\chi 2$ (9) = 9.69, p = 0.37 (Hall, Nishina, & Lewis, 2017). Further results showed that there were significantly more ethnic minority students declaring STEM related majors in Cohort 2 than in Cohort 1 $\chi 2$ (1) = 20.21, $p < 0.001$ (Hall, Nishina, & Lewis, 2017).

Further results indicated that ethnic discrimination was negatively associated with self-efficacy for math and science, but unrelated to intent to major in STEM (Hall, Nishina, & Lewis, 2017). Friendship group diversity was positively associated with both self-efficacy and likelihood of majoring in a STEM field (Hall, Nishina, & Lewis, 2017). Hall et al. (2017) also noted that friendship group diversity emerged as a buffer of ethnic discrimination on intent to major in STEM, but not for self-efficacy (Hall, Nishina, & Lewis, 2017). Consequently, the researchers suggested that, "ethnic discrimination was associated with decreased likelihood of majoring in STEM, but only for students with less diverse friendship groups" (Hall, Nishina, & Lewis, 2017, p. 81).

Estrada, Hernandez, & Schultz (2018) conducted a study to longitudinally examine the integration of URMs (underrepresented minorities) into the STEM community by using structural equation modeling (SEM). Using growth curve analysis, the researchers wanted to measure the development of key variables (science efficacy, identity, and values) (Estrada,

Hernandez, & Schultz, 2018). Estrada, Hernandez & Schultz (2018) had two basic research questions: "Does research experience and mentorship contribute toward integrating undergraduates in STEM fields, and Do URM undergraduate students; science self-efficacy, identity, and values (measures of student integration into the scientific community) positively relate to persistence in STEM career pathways up to 4 years later? (Estrada, Hernandez, & Schultz, 2018).

The study was conducted with 1420 minority science students (undergraduate and graduate) from 50 universities across the United States (Estrada, Hernandez, & Schultz, 2018). Results indicated that the quality of mentorship had small positive effects on science efficacy growth so that 1 standard deviation (SD) increase in the quality of mentorship resulted in 0.31standard deviation (SD) growth in science efficacy (Estrada, Hernandez, & Schultz, 2018, p. 7). The researchers also found that the quality of mentorship and research experiences had small positive effects on science identity and science community values (Estrada, Hernandez, & Schultz, 2018). Further, the researchers found that higher levels of science identity increased the probability that students will pursue science as a career choice (Estrada, Hernandez, & Schultz, 2018).

While stereotype threat studies are primarily quantitative in nature, self-efficacy studies are overwhelmingly qualitative using survey data and interviews to understand the perspectives of individual participants. Q methodology, on the other hand, would add an additional layer to these studies by introducing a collective perspective that would provide the researcher with a wider range of information.

Strategies that PWIs can use to combat issues with self-efficacy. Predominantly White institutions (PWIs) looking to encourage STEM persistence of African American students facing

issues related to self-efficacy must understand how faculty and staff influence the way these students see themselves and their fit with the institution. According to Charleston and Leon (2016), teachers, mentors, advisors, and peers can deeply influence an African American student's science self-efficacy. Charleston and Leon (2016) suggested that institutions should create interventions designed to re-establish self-efficacy at each level of an African American student's academic career (undergraduate, masters, and doctoral degree). The researchers said that, "African American students must be continuously exposed to the behaviors that contribute to the development and modification of efficacy beliefs" (Charleston & Leon, 2016, p. 163). This includes increase exposure through research, access to equipment, group work with peers, and verbal encouragement and mentorship from faculty (Charleston & Leon, 2016). This involves creating more vicarious learning experiences for African American students (Charleston & Leon, 2016).

Booker (2016) found that African American women persist in PWIs when faculty are accessible, approachable, and provide authentic instruction. African American women suffering with issues around self-efficacy may feel that they do not belong in the STEM classroom or at the PWI. African American women at PWIs may feel invisible in hostile campus environments, experience emotional pain, and isolation (Shahid, Nelson, & Cardemil, 2018). Because of this, faculty may need to create a safe space that allows African American women to engage and participate fully when in the classroom (Booker, 2016). Outside of the classroom, PWIs should also provide opportunities for African American women to participate in learning communities in order to combat the sense of not belonging (Dagley, Georgiopoulos, Reece, & Young, 2015).

According to Williamson (2010), literature suggests that African American males majoring in STEM must have academic integration, institutional support, personal qualities and

academic skills in order to persist in college and earn a degree. Williamson (2010) suggested that African American male students suffering with self-efficacy issues need a campus climate that overtly supports a multicultural environment in and out of the classroom, so that every student feels like they belong. This may involve changing the campus climate to encourage cultural heterogeneity (Williamson, 2010). For African American male undergraduates in STEM, Williamson (2010) found that the academic climate may be a better predictor of success. The academic climate involved the way students perceive their academic experiences, interactions with faculty, if peers perceived them to be "serious students," and whether they received any academic mentorship. This is especially important for African American male students who, according to Chavous et al (2004) are often forced to conform to fit within the college environment. Tolliver and Miller (2018) identified similar factors that affected African American male students' persistence. These were mentorship, socialization, on campus supports, and family and community expectations. In their study, Tolliver and Miller (2018) cited a student describing his first year at college. The student said, "I fumbled around campus and didn't get it. Then I had a professor who talked to me after class, and then we kept talking after class. He took me under his wing, and it helped me get grounded on campus." Tolliver and Miller (2018), also cited students describing the importance of on-campus supports. The researchers said, "one participant described how his school's multi-cultural center was a space that allowed him to meet other students and faculty that shared his worldview and sense of underrepresentation on campus" (Tolliver & Miller, 2018, p. 306).

Issues with self-efficacy viewed through a historical context. Issues with self-efficacy for African Americans are rooted in the history of scientific racism. While it is natural for human beings to compartmentalize information into groups by defining, quantifying, and categorizing

abstract concepts, early anthropological research used anatomical features i.e. skull sizes, physical appearance i.e. athleticism, and musical inclinations of African Americans as a basis to support racist ideologists that maintained racist social systems (Gould, 1996). This was based on the premise that African Americans were genetically/intellectually inferior (Gould, 1996).

Johnson-Ahorlu (2013) recorded responses from African American students in STEM courses when asked what they perceived the barriers were to their academic achievement (Johnson-Ahorlu, 2013, p. 386). All focus group participants said they felt racial stereotypes around African American intellectual inferiority were pervasive in their institution (Johnson-Ahorlu, 2013, p. 388). They also believed the treatment they received from their professors and other students may be influenced by these stereotypes. Johnson-Ahorlu (2013) gave voice to those students by including their comments verbatim in her study. One student reflected on an experience walking in late to a calculus class. The student said he was taken aback when the professor said, "You know this is calculus 3 right?" (Johnson-Ahorlu, 2013, p. 387). The student felt that the professor must have been surprised to see an African American student in the class. Other students described feeling like faculty watch them closely to see if they have the ability to persist in the class and handle the difficult workload. A student stated, "I feel like everyone's just looking at me to see if I'm doing the work, you know…if I'm smart enough" (Johnson-Ahorlu, 2013, p. 387). Some students felt stereotypes around African American intellectual ability affected the perception of them by their peers. Students felt that classmates may be hesitant to share notes with them or work in groups believing that African American students will not carry their weight (Johnson-Ahorlu, 2013, p. 388). One student noted coming in late to a biology class and asking a Caucasian classmate to see her notes (Johnson-Ahorlu, 2013, p. 388). The student

described her classmate's look like, "No, I'm not helping you at all" and feeling that it was because of her race (Johnson-Ahorlu, 2013, p. 388).

Whether these situations are real or simply the perception of these students, it is important to note that African American students experience personal challenges that expand far beyond the boundaries of normal coursework. Johnson-Ahorlu (2013) summarized this sentiment perfectly with this statement from an African American student, "I feel like I have to represent to the very best of my ability to show that Black people can learn, Black people are here to study and better themselves, otherwise if I put forth a bad example, they're all going to judge Black people to be this way" (Johnson-Ahorlu, 2013, p. 388).

In the White Architects of Black Education, Watkins (2001) described how proponents of the concept of Black inferiority used scientific racism to justify slavery and post-civil war labor systems. Watkins (2001) said, "The naked and brutal exploitation of people of color provided context for 'color coding' and classifying. If 'proof' could demonstrate that nature rendered Whites superior, a ready-made explanation for social hierarchy could be established" (Watkins, 2001, p. 24).

The classification of races based on phylogenetic traits was a practice used by some of the earliest biologist. Carolus Linnaeus, also known as the father of taxonomy, sought to organize humans into racial categories. He used skin color and other personal characteristics for his typology (Watkins, 2001). In his essay titled, *Systema Naturae*, Linnaeus divided people into racial colors (Yellow, Black, White, Red), and described Blacks as being lazy and careless (Watkins, 2001, p. 27). The scientists that followed would continue this trend such as zoologist Ernst Haeckel who placed Blacks on the evolutionary tree with primates in his 1874 book titled, Anthropogenie (Watkins, 2001, p. 27). In addition, Johann Friedrich Blumenbach, a physiologist

who introduced the term Caucasian patterned after the beautiful slopes of Mount Caucasus, and "oran-outangs" for Blacks placing them in the realm of monkeys and chimpanzees (Watkins, 2001, p. 27).

Some of the earliest American anthropologists' studies and writings were shaped by these ideas. Samuel Morton, a Philadelphia physician, collection of one thousand human skulls would form the basis of scientific racism (Fabian, 2010). Morton measured the sizes of human skulls using mustard seeds initially, and then moved on to using lead shot. He created a system of ranking races based on cranium sizes with Caucasians having the largest skulls, and Blacks with the smallest (Gould, 1996, p. 82). Gould (1996) describes Morton as being "self-deluded" to the point where his prejudices were revealed in skulls and bones (Gould, 1996, p. 88). When Gould (1996) re-analyzed Morton's work, he found no statistically significant difference in skull sizes between races when controlling variables like the amount of male and female skulls used because skull size correlates to body size.

Gould (1996) also re-analyzed the work of Paul Broca who designed a system of ranking brain sizes that was patterned after Samuel Morton's work. Gould (1996) claimed that Broca made the mistake of failing to be scientifically objective when measuring samples, which caused his findings on brain sizes to be skewed in favor of Caucasians. While the data itself that Broca presented was reliable, it was gathered selectively and then manipulated unconsciously to reveal results that matched Broca's pre-determined conclusions of White superiority and Black inferiority (Gould, 1996, p. 117). Gould (1996) said, "By this route, the conclusions achieved not only had the blessing of science, but the prestige of numbers". For example, Broca failed to control for brain sizes of individuals with degenerative diseases, and those of elderly people in

his samples of "inferior races." These are both factors known to decrease brain size (Gould, 1996).

When measuring brain sizes, Broca made another mistake. He not only linked brain size to intelligence, but also claimed that small brains only belonged to less intelligent inferior races. During this time E. A. Spitzka, another scientist, asked white men of great genius to donate their brains to science upon their death. Many complied, and while some men were discovered to have larger than average brains, some men of genius like, Walt Whitman, Franz Josef Gall, the founder of phrenology, and Karl Friedrich Gauss, a great mathematician had small to average brains sizes (Gould, 1996, p. 125). When confronted with this data, Spitzka claimed that it was not the brain size itself that made a person intelligent, but rather the folds in the brain.

Louis Agassiz was a Harvard naturalist, expert in paleontological ichthyology, and prominent contributor to the school of anthropology (Baker, 2007, p. 78). He left a legacy of statues, schools, and museums that bear his name, as well as, the students that studied under his tutelage at Harvard University (Baker, 2007, p. 79). In a letter to his mother, Agassiz describes the Black male waiters in his hotel as "degraded" and of a "degenerate race" (Gould, 1996, p. 75). He further wrote, "In seeing their Black faces with their thick lips and grimacing teeth, the wool on their head, their bent knees, their elongated hands, their large curved nails, and especially the livid color of the palm of their hands, I could not take my eyes off their face in order to tell them to stay far away (Gould, 1996, p. 76).

Physician Josiah Nott, who was raised in Alabama, and trained by Samuel Morton, contributed to the original American School of Anthropology by promoting the idea that Blacks were a separate species in the 1840s (Baker, 2007). He was proslavery, and wrote numerous

publications advancing the idea that Negroes were like children needing discipline, guidance, and direction from the parental care of a master (Baker, 2007).

The Dred Scott v. Sanford (1857) decision demonstrated how science can influence policy and law. Chief Justice Roger B. Taney authored the majority opinion in the Dred Scott case. Although the focus of the opinion should have been on the right of a manumitted slave to sue across state lines in federal court, Justice Taney further decreed that African Americans had no right to citizenship under the U.S Constitution (Baker, 2007, p. 78). He justified his claims by arguing that African Americans were low ranking in the "scale of created beings" (Baker, 2007, p. 78).

Modern research has moved away from examining physical differences between races, to IQ tests and other standardized assessments. Herrnstein and Murray's book, *The Bell Curve* ushered in a modern era of scientific racism by attempting to correlate general intelligence, known as the g factor, to successful life outcomes. In *The Bell Curve*, Herrnstein and Murray (1994) defined intelligence as stable, genetic, and measurable through the use of an IQ test. Although, this conversation of Black genetic inferiority was new for the modern times, the use of IQ testing to develop a basis for discrimination was not a new concept in America. Gould (1996) described the hereditary theory of IQ as a home-grown American concept. The idea of purifying society and reducing "feeble-mindedness" became very popular in twentieth century America, which turned into what is known as the Eugenics Movement (1890-1940). During this time, immigrants were heavily discriminated against. Works of literature during this time consisted of early twentieth century sociologist Edward A. Ross who wrote, *The Old World in the New* in 1914 (Watkins, 2001). In his book, Ross described Mediterranean Europeans as "servile," "wife beaters," "criminals," and "alcoholics" (Watkins, 2001, p. 37).

In the Bell Curve, Herrnstein and Murray drew conclusions based on a plethora of assumptions. First, they assumed that race is a biological construct. While it is beneficial to categorize people by race for medical purposes, such as, racial groups with high risk for diabetes, or genetic predisposition to illnesses, such as sickle-cell anemia, consequentially race is not genetic. For example, children do not get a white gene or black gene from their parents. The genetics of skin color is much more complex.

Mutations introduce new genetic variation into a population. For example, sickle cell anemia disease is a recessive trait that evolved as a mutation from exposure to plasmodium, the virus that causes malaria. Although, sickle-cell anemia has been commonly associated with black people, the Middle East, southern Europe, and South Asia were all regions affected by malaria, thus these populations also evolved genetic variations in response to this disease. Overall, genetic diversity in Homo sapiens is about 0.01%, and these differences are due to evolutionary adaptations to different geographic environments.

Herrnstein and Murray (1994) also made the claim that general intelligence (g factor) was the reason why IQ scores differed between races. They argued that there is a correlation between g or IQ, and that individuals with low IQs are more likely to be in poverty, drop out of school, be unemployed or out of the labor force on welfare (Heckman, 1995, p. 1097). Herrnstein and Murray (1994) equated IQ to skill with high IQ individuals being better suited genetically for high skilled jobs. Furthermore, because IQ was genetic and predictive of societal outcomes, social programs would not be effective.

According to Heckman (1995), Herrnstein and Murray claimed that g had three essential characteristics (a) it explained correlations among test scores (b) it explained differences in achievement of individuals, and (c) it was an immutable characteristic (Heckman, 1995, p.

1104). Heckman (1995) used the Flynn effect to make the case that g could be affected by the environment. Based on the Flynn effect, IQ scores and other standardized test scores have been increasing over time. "The fact that IQ scores rise with age, and since g was achievement test loaded and schooling was likely to raise performance on achievement tests, there was likely to be a strong relationship between g and education" (Heckman, 1995, p. 1109).

In the article, *How Heritability Misleads about Race*, Block (1995) argued with Herrenstein et. al claim that heritability in IQ is 60% for Whites, therefore the differences between Whites and Blacks in IQ must be genetic. Heritability is defined as a ratio of genetic variation to total variation. Heritability is a comparison of variation due to genetics versus the environment. Block (1995) made the point that groups can have high heritability, but it not be genetically determined. An example he used was women wearing earrings. When only women wore earrings, the heritability of wearing earrings was high because it was determined by XX and XY sex chromosomes (Heckman, 1995, p. 104). This high heritability was linked to genetics, despite not being genetically determined. Heckman (1995) further claimed that IQ was another example of something that has high heritability but is not genetically determined. IQ was very reactive to environmental changes. White Americans share commonalities in their culture that explains the high heritability. An African American child cannot move between environments, like low socioeconomic status to high SES without bringing part of their environment (their race) with them. For this reason, heritability between races is difficult to study.

Heckman (1995) also used a corn plant example to explain how the environment affects heritability. He described measuring the height of corn plants placed in a nutrient rich environment to those placed in a nutrient poor environment. Although the same plant was used,

the corn plants growing in the nutrient poor environment may have the genetics to grow tall, but they will not grow to reach the heights of corn plants in the nutrient rich environment. In this example, heritability is 100% within each corn plant group. However, the differences between the two groups is entirely environmental, thus no conclusions can be draw when comparing the two corn plants groups to each other. (Heckman, 1995, p. 111). The same is true when examining racial groups living in segregated neighborhoods because you cannot discount the fact that Blacks have been environmentally disadvantaged in a way that has been shown to count (Heckman, 1995, p. 112).

What all these forms of research have in common is that they seek to view the individual objectively and in a quantifiable way. This type of reductionist science draws conclusions from the viewpoint of the researcher and cares little for the perspective of the individuals in the study. Q methodology works in contrast to reductionism because it seeks to give a voice to the research participants and understand the phenomena through the lens of the individual.

Group 3: Effects of social interactions on African American students. The social interactions that African American students have with faculty, staff, peers, and other elements of the campus will inevitably impact their ability to persist at predominantly White institutions. These social interactions are shaped by campus climate, absence or presence of diverse social organizations, and interactions that take place in the classroom with faculty and peers. The purpose of this section was to explore how these social dynamics affect African American students, and to look at strategies that predominantly White institutions can use to help these students persist.

Relevant studies and strategies that PWIs can use to assist African American students. Love (2008) suggested that social barriers within the campus climate and lack of faculty

relationships contributed to increased attrition rates among African American students. In this study (n = 90) African American students were asked to complete the Culture Attitude and Climate (CACS) survey (Love, 2008). Results indicated that campus climates that lack diversity in programming are perceived as alienating to African American students (Love, 2008). PWIs that do not promote inclusive networking activities or fail to provide access to campus networks will experience increase attrition from African American students (Love, 2008). Results of the study also showed that positive relationships with faculty were essential to the success of African American students at PWIs (Love, 2008). Love (2008) cited a study from Guiffrida (2005) that suggested that positive faculty relationships increased student satisfaction, academic achievement, and retention (Love, 2008, p. 44).

Thelamour, Mwangi, and Ezeofor (2019) found that same-ethnic peers can help to affirm racial identity for African American students experiencing stereotype threat effects, loneliness, or isolation at PWIs. The study included (N = 345) sample of African, Caribbean, and African American college students (Thelamour, Mwangi, & Ezeofor, 2019). The majority of participants attended 4-year PWIs (n = 322, 91.7%), Nineteen participants attended Historically Black Colleges and Universities (HBCU: 5.4%), and the remaining participants attended community college (n = 8, 2.3%) or vocational or technical school (n = 2, 6%) (Thelamour, Mwangi, & Ezeofor, 2019, p. 4). Participants completed surveys that asked questions about campus connectedness, racial identity, and friendship. Results indicated that students with strong racial identities tended to feel less connected to the campus (b = -.456, p = .003), but this was only significant for African American students. The researchers also interviewed participants, and noted an African American student explaining that when racial identity is salient, they felt marginalized at their PWI (Thelamour, Mwangi, & Ezeofor, 2019). A student named Monica

was cited as saying, "I feel other than because of my experience here. I isolated myself on purpose from those around me because I do not have that much interest in assimilating here. I'm happy with who I am and what I look like, and who my friends are, I do not plan on deviating from that" (Thelamour, Mwangi, & Ezeofor, 2019, p. 6). Another African American student named Monica was quoted describing her decision to live in a residence hall where many women of color live (Thelamour, Mwangi, & Ezeofor, 2019). She said, "I'm probably going to be here (in the women of color residence hall) my whole time [in college], because I get very aggressive and angry when [White] people do things, and it would take one microaggression for me to get kicked out of college" (Thelamour, Mwangi, & Ezeofor, 2019, p. 6). Overall, the research showed that African American students who identified strongly with their race felt less connected with the institution (Thelamour, Mwangi, & Ezeofor, 2019). However, same-ethnic friendships on PWI campuses may create the connectedness that the institution cannot provide. (Thelamour, Mwangi, & Ezeofor, 2019).

Several studies have shown that diverse student organizations are vitally important to helping African American students persist at PWIs (Patton, Bridges, & Flowers, 2011; Greyerbiehl & Mitchell, 2014). These studies have shown that Greek affiliation enhances African American student engagement in terms of interactions with peers and faculty (Patton, Bridges, & Flowers, 2011). Patton, Bridges, and Flowers (2011) described student engagement as effective educational practices along with policies and practices tied to cultural institutional elements that create viable student activity. The researchers suggested that increases in student engagement will reflect in positive educational outcomes for African American students (Patton, Bridges, & Flowers, 2011). Eakins & Eakins (2017), suggested that students who are academically and socially integrated will form positive attitudes about their institution. Because

African American students often feel invisible at PWIs, Eakins & Eakins (2017) suggested that advisors host events specifically for African American students as part of their new student orientation. This would give African American students the opportunity to meet peers, faculty and staff, and create allies on campus (Eakins & Eakins, 2017). Eakins & Eakins (2017) also discussed the importance of creating cohort advisors to work with African Americans students as they persist through college. They also discussed the importance of developing peer mentorship programs (Eakins & Eakins, 2017).

Like the self-efficacy studies, the studies that focus on socialization are highly qualitative and use survey data primarily. Introducing a collective perspective that allows the voice of the participants to emerge from the data would offer a significant addition to this research. Q-methodology is a research tool that would allow the researcher to extract the collective voice of the participants. This would provide a wider range of information revealing deep perceptual diversity. Overall, data generated through Q-methodology can reveal more complex and diverse views than survey or experimental data.

Chapter 2 Summary

This chapter was a literature review of current research. The research was organized by the conceptual framework based on a model created by the researcher. This model outlined all the elements that contribute to African American STEM persistence in predominantly White institutions. In this chapter, the researcher addressed the inputs that African American students bring into the institution, such as, gender, race, STEM ability, and group history that shape their experiences. The researcher then organized current research into three major groups, research that addresses self-efficacy, stereotype threat, and socialization. In this chapter, the researcher also examined the research tools used in these studies, which were primarily experimental for

stereotype threat studies, and survey and interview tools for self-efficacy and socialization studies. The researcher subsequently made a case for using Q-methodology as a means of providing a wider range of diverse perspectives.

Chapter 3 Summary

In chapter 3, the researcher describes Q-methodology theory and practice. The purpose and uses for Q-methodology in this study are also discussed. The researcher connects Q-methodology to the conceptual framework presented in the literature review. The data collection process and participant demographics are also discussed.

Chapter 4 Summary

In chapter 4, the researcher analyzes the results generated from the study. The process for factor extraction was also discussed along with a description of each factor. The researcher also named each factor and linked them to the groups (stereotype threat, self-efficacy, and socialization) presented in the literature review.

Chapter 5 Summary

In chapter 5, the researcher summarizes and connects the findings to the professional literature. The researcher made comparisons between factors and looked at the collective perspectives that emerged across all factors. Implications for institutions, limitations and delimitations of the study were also addressed.

Chapter 3: Procedures and Methods

Q-Methodology Overview

The conceptual framework model outlined in the literature review section of Chapter 2 depicted how African American students' persistence in STEM in a PWI can be affected by a multitude of variables. These included race, gender, STEM ability, individual/family background, and racial background. These personal inputs subsequently affect the perception African American students have regarding their experiences on campus. These students may experience stereotype threat, have issues with self-efficacy, and/or issues with socialization along with many other issues. The researcher chose to use Q-methodology as a means to understand the shared perspectives that African American students have about these issues. In chapter 2, the researcher also discussed what it meant to be labeled African American, and how this term covered a diverse group of people. African Americans have diverse backgrounds, come from diverse communities and thus have diverse perspectives. Q-methodology is an excellent research tool to use when attempting to capture all of the different perspectives of a group. Q-methodology also gives a voice to the participants, which is especially important for African Americans who have been historically marginalized.

In the article titled, *A Match Made in Heaven: A Marginalized Methodology for Studying the Marginalized*, Brown (2006) discusses what it means to be marginalized. In this article, Brown describes marginalization as being ignored or devalued resulting in individuals and marginalized populations inadvertently becoming subject to consequences such as powerlessness, ignorance, poverty, illness, and other manifestations of devaluation (Brown, 2006). This type of devaluing has further consequences because it causes individuals in power to make assumptions about marginalized groups without involving them in the discussion.

Brown (2006) used the statues of Easter Island to illustrate this phenomenon. The statues were, "huge sculptures, some of them seven stories tall and weighing 30 tons or more" (Brown,

2006, p. 362). The structures faced the Pacific Ocean in several locations along the perimeter of the island. The visitors to the island were puzzled at how these structures were arranged in these upright positions. They assumed that the architects of these structures were primitive and did not possess the kind of tools that would allow them to lift and move the structures. Brown (2006) even noted that some authors, such as, Von Daniken claimed that aliens must have created the structures and placed them on the island (Brown, 2006, p. 362). It was not until archaeologist Thor Heyerdahl (1958) asked the natives of the island about the origin and placement of the stone structures that scientist finally understood how they got to be in those upright positions around the perimeter of the island (Brown, 2006). It turned out not to be an act of an alien species, but a feat accomplished by a dozen men, several wooden poles, and boulders to set the statues upright. Poles were placed underneath the statue, then stones and small boulders placed under the statue daily until it was finally in the upright position (Brown, 2006). This story is pertinent to remind researchers that the "voice" of the participant is a pertinent and often critical part of data collection. Q-methodology is a technique that when used effectively by researchers, can capture those voices.

A benefit of Q-methodology is that it allows the researcher to see things from the perspective of the subjects. It gives individuals a voice to tell their own stories, which allows researchers to see subjects as individuals instead of populations. The purpose of this study was to understand the shared perspectives that African American undergraduate students in STEM majors have as it relates to strategies that predominantly White institutions can adopt to support their persistence in STEM. Currently, African American students face many obstacles when it comes to persisting in STEM fields. African Americans also make up a miniscule percentage of doctorate degrees in STEM majors.

It is important for institutions to understand the reasons why African American students have difficulty with persisting in STEM majors. There has been a wealth of research concerning why African American students struggle academically (Steele, 1997; Harper, 2006; Sankofa, Hurley, Allen, & Boykin, 2005; Archer-Banks & Behar-Horenstein), and further research exploring how being a minority at a predominantly White institution may affect African American students' perceptions of themselves (Bourke, 2010; Leath & Chavous, 2017). There also exists research that examines the Black experience and documents the discrimination that African Americans endure (Bowleg, et al., 2016). New research focuses on microaggressions, which are subtle, interpersonal manifestations of racial discrimination (Bowleg, et al., 2016, p. 177). Several studies cite a wealth of research to claim that racial discrimination is frequent and can result in negative health consequences for African Americans (Bowleg et al., 2016; Blascovich, Spencer, Quinn, & Steele, 2001; Kwate & Goodman, 2015). Other researchers have focused on how race related stressors cause psychological distress and academic distress on African American students that impact their overall GPA (Nevill, Heppner, & Peter JI., 2004). However, because African Americans are substantially marginalized and underrepresented, little research has been done to examine issues from their perspective. Most research has focused on African American students as a population in most cases or as a subset of the minority population. In this sense, Q-methodology was chosen as the technique because it allowed the researcher to examine the perspectives of African American students experiencing issues that may be affecting them adversely. Q-methodology is unique because it maintains the link between the data and the individual that it relates to by measuring absolute scores instead of standardized scores. This allows for individual differences to emerge from the data instead of standardized values that show relative positions in relation to the whole population.

Q methodology epistemology. Q methodology was created by William Stephenson as an adaptation of Spearman's traditional method of factor analysis (Watts & Stenner, 2012). Q – methodology is different from traditional R methodological techniques because items are measured relatively by individual versus the population (Watts & Stenner, 2012). This technique allows for factor analysis to produce correlations based on individuals, not variables. The people become the variables and traits and abilities are treated as the sample or population (Watts & Stenner, 2012, p. 12). It is important to know that while Q methodology has its roots in R methodology, it is a technique wholly unto itself. R methodology consists of data with various units that have been standardized to explain relative characteristics of a population. This data cannot simply be inverted to relate to individuals. One reason is that Q methodological factor analysis does not require the same measuring units for all persons', but requires that the unit be the same for an attribute (Watts & Stenner, 2012, p. 13). In this sense, the Q methodological data is obtained, "when a population or sample of tests (or other items) are measured or scaled relatively by a collection of individuals." (Watts & Stenner, 2012, p. 15).

In Q methodology, scores must still be standardized by row in the same way R methodology must be standardized by columns. In this sense, Q methodology is R methodology, inverted. However, in R methodology, standardization of scores by column was relevant to the entire population of scores for a single variable. In Q methodology where the individuals are the variables, the standardization of scores by row are relevant to the entire population of scores for an individual (Watts & Stenner, 2012). This ensures that every single score in a Q methodological data matrix is made in relation to the person. This is made possible by using a frequency distribution known as the Q sort, which delimits the ways in which participants can categorize aspects of their perceptions.

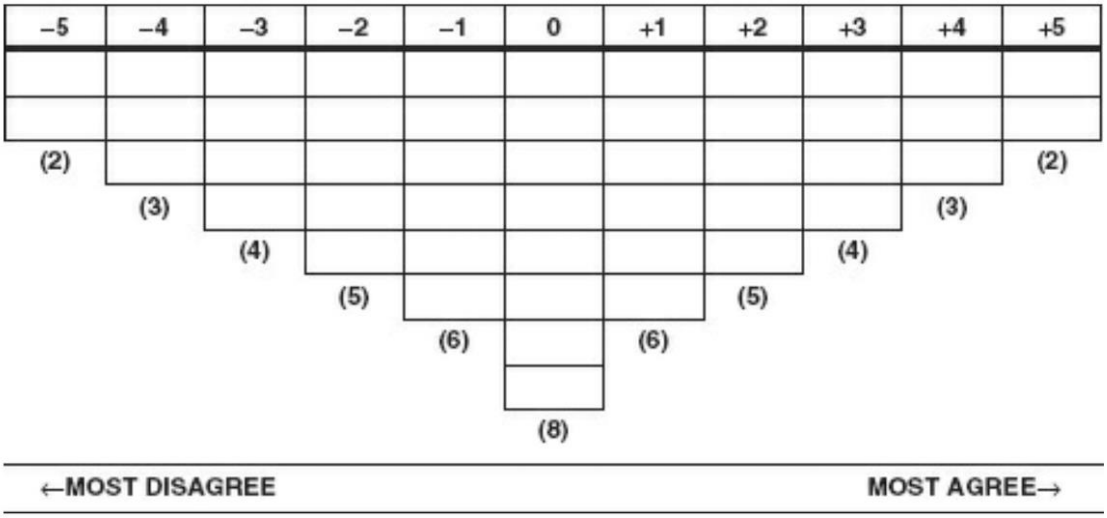


Figure 2: Example of a frequency distribution or Q sort. Reprinted [or adapted] from Doing Q Methodological Research (pg. 17) by Authors S. Watts & P. Stenner, 2012, Thousand Oaks: Sage Publications Inc.

The shape of the Q sort would ideally be normally distributed. Stephenson (1939) believed that the trait measurement for a single individual should behave the same way as a measure of population in relation to a trait of measure. The forced distribution and collection of Q sorts are based on the conceptual principles of Communication Theory. However, the Q sort grid is conventionally shaped to resemble a quasi-normal distribution. Although there are no specific guidelines for the "kurtosis" of the distribution of spaces under which sorters can place the Q sample items, Brown (2006) recommended that a topic where one suspects there to be less of range of viewpoints might benefit from a more leptokurtic distribution, while topics that are believed to contain a larger range of viewpoints might benefit from a more platykurtic distribution. In the end, it is more of an art than a science and the specific shape of the Q sort grid likely has little, if any, statistical significance.

Advantages of Q methodology. The purpose of this study was to understand the perspectives of African American students concerning the most effective strategies that

predominantly White institutions could use to support their persistence in STEM. There are several advantages to using Q methodology as the technique to understand participant perspectives. The final form of data collection involved participation in a Q sort, which is a means of capturing subjectivity (Watts & Stenner, 2012). It is important to understand that the physical act of sorting is a manifestation of an individual's perspective. This allows for experimentation to be conducted from a first-person viewpoint through reliable and scientific means. The participant's viewpoint is revealed through the Q-set items under controlled experimental conditions (Watts & Stenner, 2012). This information captured by the Q-sort represents the participant's own point of view. This was the way Stephenson defined operant subjectivity (Watts & Stenner, 2012). Operant subjectivity was defined by Watts and Stenner (2012) as the sum of behavioral activity that constituted a person's current point of view. Watts and Stenner (2012) also suggested that Stephenson used the concept operant subjectivity as a way to remove Q methodology from its association with the mind and consciousness, but rather as a reliable scientific tool that adheres to the scientific method. Understanding Q methodology allows the participant's first-person perspectives to be studied and accepted as high quality, scientific data that informs our decisions much like objective third person science does currently. In this case, by studying African American perspectives, Q methodology allows for subjective viewpoints to be analyzed scientifically with minimal influence from the researcher.

This is an advantage of Q methodology because it gives the participants a voice in the research. The participant will use a Q set, which is a defined number of statements about the topic at hand, to sort by ascribing a level of importance to each item. This allows the participants to find meaning and assign value to the statements that tie closely to their perspective (Watts & Stenner, 2012).

Procedures of a Q-methodology study. Manasia et al. (2018) outlines Q methodology in the following steps:

1. The concourse of communication is sampled, collected and compiled.
2. A Q sample of statements is developed from the concourse.
3. Participants are selected to sort the items in the Q sample. These participants are referred to as the P set, in the parlance of Q methodology.
4. Participants in this P set perform Q sorts of the items in the Q sample according to their subjective judgments following a condition of instruction. The researcher also collects qualitative data from participants regarding their decision-making while sorting.
5. The Q sort data are analyzed statistically, first by identifying correlations among the Q sorts, then factor analyzing these correlations, and then rotating and extracting factors.
6. These resultant factors, representing perspectives shared by groups of participants, are then described and interpretation.

Step 1: Concourse development. A concourse is most often written statements but could also be images. In this study, the researcher used words to develop the concourse. A core principle of Q methodology is subjective communicability (Manasia & Macovei, 2018). Watts and Stenner (2012) described communicability as an observable domain of self-referent statements and opinions. It represents a wide array of statements that can cover any context or situation (Watts & Stenner, 2012). According to Watts and Stenner (2012), the concourse represents a "universe of statements." Regarding this study, the concourse represents a "universe" of ways African American students would think about effective strategies that predominantly White institutions could use to help them persist in STEM majors. These perspectives may be shaped by relevant literature concerning the topic. The statements of a concourse are common knowledge and

represents the single most significant contribution to subjective science (Watts & Stenner, 2012, p. 33). The concourse involves the full volume of discussion around the topic. It includes an individual's perceptions, opinions, beliefs, thoughts, emotions and other forms of expression (Manasia & Macovei, 2018, p. 86).

In order to develop the communication concourse for this study, the researcher drew statements from three different sources. The main source was from subjective responses that participants produced in response to an open-ended questionnaire with the following directions: "List and briefly describe up to eight strategies that predominantly White institutions can use to support African American undergraduate student's persistence in STEM" (see Appendix A). In addition to these directions, the researcher also collected background and demographic information including sex/gender, race/ethnicity, age, educational level, major, current credits towards baccalaureate degree, and a question asking if the participant was a first-generation college student.

The concourse development questionnaire was distributed and administered through Qualtrics for online participants and printed for face to face interactions with participants. The researcher recruited participants through several online resources including LinkedIn and Facebook, as well as live face to face recruitment on campus at University of North Florida (UNF), a predominantly White institution with 16, 958 students (UNF, n.d.). Of that number of students currently enrolled at UNF, 9.5% (n = 1,614) were Black or African American, and 65.2% (n = 11, 056) were White. The researcher also recruited family and friends who fit the research criteria. Thirteen participants contributed to the concourse development. 77% (n = 10) were female, and 23% (n = 3) were male. The age of most participants ranged from 18-24, one participant was 33, and one was 54 years old. All participants reported their enrollment status as

full time with the exception of two participants who were part time, one participant was a graduate student at the time of the study, but was an undergraduate STEM major attending a predominantly White institution, and another participant had recently dropped out of school, but was an undergraduate STEM major attending a predominantly White institution. All participants reported their race as African American with the exception of two participants who identified as Haitian American. The current educational level of the participants included four participants who were pre-associates degree level, three were associates degree level, one professional trade or apprenticeship, three bachelor's degree level, one Ph.D. or Ed.D., and one person described their educational level as other. All participants listed the amount of credits they were away from completing a baccalaureate degree with the exception of the student in graduate school and the student who recently dropped out of school. Also, one student was unsure of the amount of credits they needed to complete the baccalaureate degree.

When asked if they were an undergraduate student pursuing a STEM degree, 92.31% (n =12) said yes, and 7.69% (n =1) said no. When asked about their major, 20% (n =3) were Biology majors, 15% (n = 2) were Health Science majors, 15% (n = 2) were Engineering majors, 8% (n = 1) were Nursing, 8% (n = 1) were Chemistry, and 13% (n= 4) were no response. Participants were subsequently asked if they were first generation to go college. 53.85% (n = 7) participants said yes, and 46.15% (n = 6) participants said no.

The collection of 57 opinion statements provided by participants during the concourse development phase was then combined with 50 other opinion statements collected by the researcher from three bins of professional literature. This included literature relevant to persistence of African American students in STEM, literature on persistence of students in general, and literature that focused specifically on all students, not just African Americans, in

STEM. These statements from the literature were collected as direct responses to the prompt and included in the concourse. Finally, the researcher collected six statements from social media sources online that were relevant to this topic. Concourse development stopped when saturation was reached, or no new information could be obtained from the communication concourse. The researcher then reduced the 113 opinion statements to a representative Q sample.

Step 2: Q sample developed from the communication concourse. The Q sample represents a small portion of the "universe" that is pulled from the concourse. The Q sample uses a clearly defined sampling procedure in order to reduce the communication concourse (Manasia & Macovei, 2018). This reduction process involved eliminating repeating statements, combining similar statements, and discarding statements impertinent to the initial prompt (See Appendix B). This resulted in 43 opinion statements making up the Q sample.

Step 3: Recruit individuals to make up the P set. The P set includes individuals who will do the sorting of the Q sample (Manasia & Macovei, 2018). The participants will sort the items according to the measure in which they viewed a statement as being most helpful (+4) to least helpful (-4) regarding strategies that predominantly White institutions could use to increase African American STEM persistence. (Manasia & Macovei, 2018). Thirty students were recruited to form the P set (n = 10, male; n= 20, female). Among these students, 83% (n= 25) students classified themselves as African American, 3% (n = 1) Caribbean Island/Jamaican and Black student, 7% (n =2) bi-racial, which included one student who classified as African American and Arab American, and another who classified as African American and Caucasian, and 7% (n =2) students who classified themselves as African. 80% (n = 24) of participants fell into the18-25 age range, 10% (n=3) ages 26-30, and 10% (n = 3) were over 30 years old. In regard to the majors of students in the P set, 27% (n = 8) of the students recruited were nursing

majors, 17% (n = 5) were health science majors, 13% (n = 4) were computer science majors, 10% (n = 3) were biology majors, and 10% (n =3) were engineering majors. The final 23% of majors included histology, dental hygiene, occupational therapy, surgical technology, and physical therapy with one student majoring in each discipline. 83% (n =25) of students were full time, 13% (n = 4), were part time, and 3% (n =1) represented one post-graduate who majored in biology as an undergraduate student at a predominantly White institution. 53% (n =16) of the students in the P set were not first generation in college, and 47% (n =14) were first generation.

These participants were recruited through face to face interactions on campus at a Southern university or college, and others were recruited through personal affiliations. Participants could perform the Q sort after they read the instructions outlined in the Q sort prompt (See Appendix C).

Step 4: Participants in the P set perform the Q sort: Participant Q sorts are what the researcher used to gain access to the subjective meaning that participants associate with each item. In this step, the participants in the P set performed a Q sort of the opinion statements that comprised the Q sample. First, the participants were invited to sort the Q sample statements into three piles: one for statements that they viewed as being most helpful, one for statements that were viewed as being least helpful, and a pile for items that fell somewhere in the middle or those items for which they were unsure. After this initial sorting, participants were asked to make finer distinctions reflecting their perspectives by placing the Q sample statements within a symmetrical sorting and resembling a semi-normal distribution. Within this sorting grid was one space for each statement. Participants were prompted to sort the Q sample statements with the prompt (called the condition of instruction): "What best represents your perspective regarding strategies that predominantly White institutions can use to support African American

undergraduate students' STEM persistence?" The column of this distribution ranged from -4 to +4 with the anchor statements "Most helpful strategy" (-4) to "Least helpful strategy" (+4). Finally, each participant was asked questions related to the decisions they made while performing the Q sorts. Specifically, participants were asked to elaborate on why they chose the three statements that were the most helpful and least helpful strategies that PWIs could use to support African American STEM persistence. These were referred to as the post-sort questions. As with the concourse development questionnaire, each response was anonymous as no personally identifiable information was collected. The Q sort process was facilitated and administered face to face with students using precut and laminated statement cards (See Appendix D).

Step 5: Q sort data is analyzed statistically. After the researcher collected the participant Q sorts, step 5 started with the Q sort being entered into a specialized Q Methodology software package called PQ Method (Schmolck, 2008). After the sorts were loaded, the researcher used PQ Method to determine the correlations among the individual sorts (see Table 1). These correlations were then factor analyzed using Principal Component Analysis (PCA). Principal Component Analysis is a dimension reduction technique that allows for the extraction of factors (McKeown & Thomas, 2013). PCA was the preferred factor extraction method over the centroid method because of its computational ease and mathematically precise factoring system (McKeown & Thomas, 2013). The extracted factors were then rotated using Varimax rotation in order to create more separation revealing distinct factors, or composite perspectives shared by individual sorters. These factors were then represented by factor arrays which resembled individual Q sorts.

Step 6: Analyze the resultant factors. The researcher proceeded to step 6 by examining and making meaning of the composition of the factor arrays in order to generate an understanding of the perspectives they represented. In addition to the factor arrays, the researcher used post-sort responses and demographic and background information affiliated with participants' sorts who loaded significantly on the resultant factors. This information was explained thoroughly in chapter 4.

Researcher Positionality Statement

As the researcher, I understand that my interest in this topic of African American STEM persistence is shaped by own experiences as an African American undergraduate STEM major attending a predominantly White institution. I was especially interested in this research because of my own experience and how I struggled to make sense of it. As a young African American woman attending a PWI, I often battled with the duality of having some of the most enlightening intellectual experiences mixed with some of the greatest moments of internal strife. Most of my internal conflict was caused by my feelings of being judged by everyone around me because of my race. I wondered if my professors looked at me differently and how I was being perceived by my peers. I joined the African American Student Union on my campus as a way of connecting with others to feel less alone.

If I were an undergraduate African American student participating in this study today, I would have probably loaded on a factor that reflected the perspective of someone wanting to increase the African American presence on campus, and create spaces for people who look like me to socialize, support, and encourage each other. However, I have experienced a lot of life since then, which has not only shaped my worldview, but was reflected in my own Q-sort. I felt it was important for me, as the researcher, to participate in this study and get an understanding of

my current perspective around this topic. It was important for me to understand how my own subjective experiences could impact my initial glance at the other factors. Knowing this helped me interpret the data as objectively as possible. In chapter 4, I will reveal the factor that I loaded on.

Chapter 3 Summary

In chapter 3, the researcher discussed the method of analysis and data collection. First the researcher recruited participants to complete a questionnaire administered through Qualtrics or through face to face interactions. The researcher combined responses from the questionnaire along with research gathered from the literature and online to create a communication concourse. Then, the researcher generated a Q sample from the concourse and recruited more students, the P set, to participate in a Q sort. This chapter also discussed demographics of the sample populations and detailed the methodology.

Chapter 4 Summary

In chapter 4, the researcher examines the factor arrays to understand the collective perspective across each factor. The researcher then extensively describes the characteristics of each factor along with the individuals that comprise each factor. The researcher also named each factor and linked them to the groups (stereotype threat, self-efficacy, and socialization) presented in the literature review.

Chapter 5 Summary

In chapter 5, the researcher summarizes and connects the findings to the professional literature. The researcher makes comparisons between factors and looks at the collective perspectives that emerged across all factors. Implications for institutions, limitations and delimitations of the study are also addressed.

Chapter 4: Results

In this chapter, the researcher discussed documentation of statistical procedures and performed a systematic qualitative analysis of the factor arrays. The researcher then created a description of each factor by analyzing the results from the factor arrays and extracting the statements from each factor that represented collective perspectives described as "most helpful" and "least helpful" to supporting African American undergraduate STEM persistence. This information was then compared to the participant responses provide in their Q sorts.

Statistical Procedure

Statistical procedures for a Q-methodology study include three main processes: 1) the correlation of Q sorts, 2) factor analysis of those correlations, and 3) factor rotation and extraction. Once results were collected, the researcher analyzed the Q sorts using a software packaged called PQMethod (Schmolck, 2008). According to McKeown & Thomas (2013), factor analysis in a Q-methodological study is fundamental because it provides a statistical means for participants to group themselves based on their responses. The factoring process begins once a correlation matrix is computed (McKeown & Thomas, 2013). The data was analyzed using the following procedure:

1. Use a correlation matrix to analyze the relationship between individual Q sorts (see Table 1).
2. Use principal component analysis to factor analyze the correlations and extract the appropriate number of factors (see Table 2)
3. Use varimax rotation to maximize the distinction between extracted factors (see Table 4)

The correlation matrix is an intermediate procedure that is used to indicate the extent to which individual Q sorts are similar or dissimilar to the composite factor array (McKeown &

Thomas, 2013). According to Watts and Stenner (2012), the correlation matrix is used in Q methodology to measure the nature and extent of the relationship between any two Q sorts and identify similarities. Table 1 shows the correlation matrix for this study. When looking at correlation(r), it is important to know that r = 1 represents a prefect correlation, r = 0 means no correlation, and r = -1 represents a perfect negative correlation. In the correlation matrix for this study, the correlations between two Q sorts were low to moderate. The highest correlation in this data were between Q sort 10 and 11 (r = .50), 2 and 14 (r =.50), and 19 and 23 (r = .51). These moderate correlation values indicate that the individuals in each Q sort pair arranged the Q sorts in similar configurations. PQMethod was used to create the correlation matrix (McKeown & Thomas, 2013).

Factor Analysis and Factor Extraction. The researcher used PQ Method with principal component analysis (PCA) as a data reduction method that is achieved by grouping similar Q sorts into factors, then extracting those factors (Watts & Stenner, 2012). The process of extraction involved identifying distinct regularities in the patterns that existed between Q sort configurations (Watts & Stenner, 2012, p. 100). Essentially, PQMethod software extracted Q sorts, organized them into factors, and measured the common variance (Watts & Stenner, 2012). After this process was complete, the PQ Method software gave an output that measured the extent to which each Q sort exemplified the factor pattern, called a factor loading (Watts & Stenner, 2012). These un-rotated factor loadings were also correlation coefficients that represented the degree that each Q sort had in common with that factor (See Table 2). The variance in table 2 indicated that Factor 1 contributed to the greatest amount of shared variance (r^2 = 16%) in the data, thus the Q sorts, as a group, had the most in common with the viewpoints exemplified by Factor 1. Factors 2-8 have r^2 values of 10%, 8%, 8%, 7%, 6%, 5%, and 5%

respectively. Looking at the un-rotated factor loadings for individual Q sorts in table 2, we can see that Q sort 10 had the greatest factor loading (r = .6992) with factor 1 accounting for 49% (r^2 = .6992 x .6992) of the variance that exists in that Q sort. The second highest loading for factor 1 was Q sort 11 that had (r = .6245), which accounts for 39% of the variance that exists in that Q sort. Overall, Q sorts 9, 10, 11, 15, 19, 23, 25, and 26 connected the most strongly to the viewpoints represented by Factor 1. The same aforementioned analysis was used when examining Factors 2-8.

The eigenvalues and variances can be used together to describe the level of strength and explanatory power for each factor (Watts & Stenner, 2012). Table 2 shows that Factor 1 accounted for 16% of the common variance present in this study and had the greatest eigenvalue (EV = 4.8409). Factor 2 accounted for 10% of the common variance present in the study with the second highest eigenvalue of 3.0031. The researcher examined subsequent %variance and eigenvalues for Factors 3-8 to determine which to extract. Factors that have high eigenvalues and variances should be extracted.

Factor Extraction. When determining how many factors to extract, there are a variety of methods that can be used. The Kaiser-Guttman criterion uses eigenvalues to determine how many factors to extract because eigenvalues represent the statistical strength and explanatory power of each factor (Watts & Stenner, 2012). This criterion suggests that only factors with eigenvalues greater than 1 should be extracted. Based on this logic, all 8 un-rotated factors would qualify for extraction because all of the eigenvalues were greater than 1.00. According to Watts and Stenner (2012), using the Kaiser-Guttman criterion to determine how many factors to extract is accepted by the factor analytic community, however, it often results in a large number of

factors being extracted (Watts & Stenner, 2012). This could lead to the extraction of superfluous and meaningless data (Watts & Stenner, 2012).

Another method used to determine how many factors to extract involves setting a mathematical definition for what qualifies as a significant factor load. Based on this criterion, a factor that has two or more significant factor loadings will qualify for extraction (Watts & Stenner, 2012). Before examining the factor loadings, the significance level must be defined using the following equation:

$$Signficant\ Factor\ Loading = 2.58\ x\ \left(\frac{1}{\sqrt{no.\ of\ items\ in\ Qset}}\right) = .393$$

Based on this formula, factor loadings that have values 0.393 or greater on two or more Q sorts within a single factor are considered significant. The un-rotated factor matrix in table 2 indicates that factor 1 has 10 significant factor loadings ($Qsort_1$ = 0.4916, $Qsort_2$ = 0.4984, $Qsort_5$ = 0.4176, $Qsort_9$ = 0.5744, $Qsort_{10}$ = 0.6992, $Qsort_{11}$ = 0.6245). Using this method, Factors 1, 2, 3, 4, 5, 7 & 8 had two or more significant factor loadings (≥ 0.393), while Factor 6 did not. So, if 6 factors could not be extracted, then 7 or 8 could not as well because factor 6 would be included. Thus, only 5 factors could be extracted using this method.

According to Watts and Stenner (2012), a scree plot can also be used to determine how many factors to extract, see Table 3. A scree plot is a graph that has eigenvalues plotted on the y-axis and factors on the x-axis. The number of factors to extract is determined by the point in the line that changes slope. According to the scree plot, the slope changes between the third and fourth factors, so this plot suggests that three factors should be extracted.

Humphrey's rule can also be used to determine how many factors to extract by using the standard error ($\frac{1}{\sqrt{no.of\ items\ in\ Q\ set}}$). After calculating the standard error multiply by 2.

$$Humphrey's\ Rule:$$

$$Standard\ Error = \left(\frac{1}{\sqrt{43}}\right) = .15249 * 2 = .30$$

So, 0.30 is twice the standard error. Next, take the cross product of the two highest factor loadings (ignoring the sign) on each factor. If the cross product exceeds twice the standard error, then it is significant and should be extracted. Using Humphrey's rule, the researcher calculated the cross product of the two highest factor loadings for Factor 5 to determine if five factors should be extracted. The cross product was 0.5002 * 0.6069 = 0.30, which is very close but does not exceed 0.30. Based on this method, the researcher could barely extract five factors.

Although these different methods give the researcher an idea of how many factors to extract, it is always best to continue extraction until no new information can be gained by adding additional factors. With this logic in mind, the researcher decided to extract 5 factors. Next, the researcher used table 4: Extracted Five Factor Matrix to organize the individual Q sorts into one of the five factors, and table 5: Factor Arrays to re-create the Factor Q sort needed to reveal the perspectives of the group of individuals loading on each factor. These perspectives were outlined as factor descriptions. The researcher also used varimax rotation in order to maximize the purity of saturation of as many Q sorts as possible on the extracted factors (McKeown & Thomas, 2013).

Factor Descriptions

Factor 1. Factor 1 accounted for 13% of the explained variance in the data with eight participants (n = 5, female; n = 3, male) loading on this factor. Seven of the participants were in the 19-25 age range, and one participant was 35 years old. The racial makeup of this group consisted of six participants who identified as African American, one African American/Arab American, and one African American/Bi-racial American. Seven participants classified their

current enrollment as full-time and one was part time. Three of the participants were first generation college students and five were not. In terms of STEM majors, two participants were nursing majors, one surgical technology, one dental hygiene, one mechanical engineering, one histology, one cardiovascular technology, and one biomedical science. Regarding current educational level, seven participants were working on an associate or other 2-year degree and one was working towards a bachelor's degree.

The collective viewpoints characterized by Factor 1 circled around the institution as a functional entity designed to support African American students by removing potential impediments, social, academic, and financial that may adversely impact their academic achievement. Viewpoints were focused more on creating a safe, encouraging, and supportive learning environment. These collective perspectives were not focused on the social aspects of the institution unless those social dynamics supported them academically.

Q sample statements that were viewed as "most helpful" to African American students' STEM persistence involved three aspects of support. These statements were denoted as +4 or +3 in the factor array. The first involved helping to remove social, cognitive, and academic roadblocks that may impede academic performance. Some statements that scored high in Factor 1 involved faculty helping African American students develop faith in their abilities. For example, statement 26 ("Help African American students to see themselves in STEM fields by teaching them about the contributions of accomplished African Americans in STEM") and statement 25 ("Encourage African American students to affirm themselves and their ability to succeed in STEM coursework, particularly within a broader university culture that may not be as affirming") demonstrates the collective perspective that faculty play a much larger role in an African American student's academic experience. Statement 4 ("Employ faculty who build

relationships with students by being approachable, relatable, engaging and connected inside and outside of the classroom") was denoted by +2 in the factor array. These opinion statements demonstrated a collective perspective that African American students' persistence in STEM could be augmented by having positive social interactions with faculty.

The second type of support that scored high denoted by +4 or +3 demonstrated a collective perspective that African American students need the institution and faculty to remove social/racial impediments that may affect them academically. Statement 43 ("Intervene when there is evidence of faculty bias, conscious or unconscious, racism and prejudice"), Statement 30 ("Working to create and sustain a campus environment that is inviting to everyone including African American students") demonstrates this viewpoint. Other statements denoted by +2 like statement 20 ("Convey the idea that diversity and inclusion matter") and statement 42 ("Ensure that anti-racist policies are widely known and supported by the institution") also support the perspective that African American students need the institution and faculty to monitor racial and discriminatory practices in order to help them persist in STEM. This viewpoint was further supported by statement 13 ("Build awareness among faculty and staff of the perceptions many African American students hold that they must work harder than other students to be viewed equally, and the emotional, physical toll that doing so can have"). This statement indicated the collective perspective that African American students want faculty who can empathize with them and the struggles they face, and support them through it.

The third type of support that emerged from the factor array was the need for financial assistance. This was best reflected in Q statements that scored high +4 or +3 as being "most helpful" to African American students like statement 34 ("Finding ways to support students

through scholarships and grants in order to reduce the financial strain") and statement 41 ("Invest in corporate internships for African American students").

Q sort number 23 most embodied the viewpoints of Factor 1. This Q sort had a factor loading of 0.8045. The individual who represented this Q sort was a 25-year old African American/Arab American male majoring in surgical technology. Statements 30 ("Working to create and sustain a campus environment that is inviting to everyone including African American students"), 34 ("Finding ways to support students through scholarships and grants in order to reduce the financial strain"), and 4 ("Employ faculty who build relationships with students by being approachable, relatable, engaging and connected inside and outside of the classroom") were all described as being the most helpful (+4) in the student's Q sort. The student chose statement 30 ("Working to create and sustain a campus environment that is inviting to everyone including African American students") because he felt that creating and sustaining an inviting campus environment would allow students to, "focus on their education versus being uncomfortable." This supported the viewpoints characterized by Factor 1 that the institution should remove barriers that prevent students from achieving academic goals. This statement was further supported by the student's response to choosing statement 4 ("Employ faculty who build relationships with students by being approachable, relatable, engaging and connected inside and outside of the classroom"). The student said that having a school with faculty who are approachable and relatable will make the student more "comfortable and able to focus all of their attention on the material instead of holding back from asking questions." The student was also concerned about financial stress creating barriers for students to achieve academic goals. He chose statement 34 ("Finding ways to support students through scholarships and grants in order

to reduce the financial strain") saying that removing financial stress would, "motivate the students to push further and allow them to succeed without the financial strain."

The collective perspectives in Factor 1 demonstrated a lack of concern with the social aspects of the institutions as these statements were found to be the least helpful and denoted -4 or -3. Statements like 31 ("More diversity in social clubs including Greek organizations") were viewed as being the least pertinent to helping African American students persist in STEM. Also, statement 22 ("Support students' sense of connection to the campus), statement 33 ("Create and maintain a campus responsive to African American culture, music, and food") demonstrate a collective viewpoint that socialization in all context along with a culturally inclusive campus is unimportant. This viewpoint also extended to social meetings with peers like in statement 2 ("Promote engagement with other students from underrepresented groups") and faculty as seen in statement 3 ("promote and use multicultural center spaces for students to meet with faculty, staff and other students to share worldviews") and statement 37 ("Have an orientation that introduces the whole department to new majors so that African American students get to know the faculty and staff and vice versa"). Also, statement 10 ("Create forums for diverse groups on campus to discuss issues of race including micro-aggressions") was also denoted as being least helpful (-3).

Q sort number 23 most embodied the viewpoints of Factor 1. This individual described statement 33 ("Create and maintain a campus responsive to African American culture, music and food") as not necessary for helping African American students. He said that, "everyone is so diverse with different tastes, so culturally responsive food may not be helpful." Also, he felt that Greek organizations and social clubs, "don't have a huge impact on the actual education process and degrees."

Factor 1 summary. The perspective represented by this factor depicted African American STEM majors as needing academic and financial supports in order to successfully persist in STEM. This perspective demonstrated the responsibility of faculty to remove roadblocks that may affect African American students' academically. This included racial impediments along with the student's own lack in self-confidence. The collective perspective depicted social aspects of the institution as not being helpful to African American students' persistence in STEM. These included Greek organizations and social forums. Even non-academically related social interactions with faculty were viewed as unimportant. Based on this information, Factor 1 was defined by the view that the role of the institution and faculty was to support African American students academically and remove barriers to achievement. The researcher used the professional literature to suggest that students who share this perspective may have some issues with self-efficacy and socialization. These students would need to be affirmed and encouraged by faculty (Charleston & Leon, 2016). They would also benefit from having academically focused positive social interactions with faculty (Love, 2008).

Factor 2. Factor 2 accounted for 10% of the explained variance in the data with four participants (n= 0, male; n= 4, female) loading on this factor. The ages of participants were as follows: one participant was 19, two were 21, and one participant was 38. All four participants identified as African American. Three were full time, and the fourth participant, the 38-year old was a working STEM professional with a graduate degree. However, she had also been an undergraduate STEM major attending a predominantly White institution. Two of the participants were working towards an associate degree, one towards a bachelor's degree, and the fourth participant had a graduate degree. Two of the participants were majoring in health sciences, one

in nursing, and one was working as a professional pharmacist with a Pharm.D. Only one participant was first generation in college.

The collective viewpoints of Factor 2 centered around valuing diversity and inclusion for everyone, not just African Americans. Like the other factors, the collective viewpoint in factor 2 showed that financial assistance was integral to African American students persisting in STEM. Take for instance statement 34 ("Finding ways to support students through scholarships and grants in order to reduce the financial strain") scored +4 as something that would be most helpful to students. Some elements of financial support were present in the collective perspectives across all five factors.

Aside from financial assistance, other perspectives representing this factor focused primarily on diversity. Statements that scored a +4 on the factor array like 21("Increase overall diversity on campus") and +2 like statement 20 ("Convey the idea that diversity and inclusion matter") demonstrate the perspective that creating a diverse and culturally enriching environment is helpful to everyone. Statement 30 ("Working to create and sustain a campus environment that is inviting to everyone including African American students scored +3 on the factor array, which further supports this perspective.

The collective perspective of Factor 2 was that the institution should value each student and what they bring to the institution including their cultural background. Statements denoted with +2 as being "helpful" were 23 ("Value student's individuality") and statement 11 ("Hiring and preparing faculty who have culturally responsive views of teaching and learning"). These statement rankings demonstrate the importance of valuing everyone, not just African Americans. Statement 43 ("intervene when there is evidence of faculty bias, conscious or unconscious, racism, and prejudice") and statement 42 ("Ensure that anti-racist policies are widely known and

supported by the institution") reinforce the perspective that students need the institution to create a safe, culturally responsive and welcoming campus climate for all students by intervening when there is evidence of racial bias or prejudice

Statements that scored +3 as being "very helpful" like statement 5 ("Have professors who are enthusiastic about the content, vary their instructional approaches, use "real world" examples to help students grasp concepts") and 7 ("Encourage critical thinking by having faculty who challenge students to think and question, not simply regurgitate information") demonstrate the view that faculty should look beyond race and challenge students to think intellectually as these statements scored +3 in the factor array.

Q sort 2, 8, and 14 embodied the viewpoints of Factor 2 the strongest. Q sort 2, a 19-year-old African American woman majoring in health sciences had a factor loading of 0.7322. She identified with statement 21 ("Increase overall diversity on campus") the strongest (+4). She acknowledged her institution for their efforts to increase diversity on her campus. Q sort 8, a 38-year-old African American woman currently working as a professional pharmacist, was an undergraduate STEM major at a predominantly White institution. She also identified strongly with statement 21, and had a factor loading of 0.6750. She said that, "ignorance and narrowmindedness are created when people are in a bubble, so increasing diversity can help shape perspectives and fix issues in society."

The collective views representing Factor 2 regarding statements that were "least helpful" focused on African American students receiving special treatment. For example: Statement 29 ("Connect African American students early with advisors who will assist them as they progress through their STEM major) was viewed as being most helpful with a +4 on the factor array, however, statement 16 ("Provide access to counselors, Black or otherwise, who are trained to use

culture specific interventions to effectively counsel African American students") was view as being less helpful with a -3 on the factor array. This could be due to the perspective that all students should have access to an advisor, but African American students should not receive special treatment through counseling. This viewpoint seemed to also be depicted in statements that related to faculty. For instance, the statements that were denoted as "least helpful" to African American students were statement 6 ("Faculty create and provide spaces in which African American students can share their knowledge without feeling judged") and statement 26 ("Help African American students to see themselves in STEM fields by teaching them about the contributions of accomplished African Americans in STEM").

Statements like 8 ("Train faculty so they do not, even inadvertently, structure learning experiences in which students are put in a position to feel they must be the spokesperson for all African Americans") and statement 12 ("Educate all students about persisting negative racial stereotypes toward African American students") were denoted with -4 or -3 as being "least helpful" to African American students. This depicted a collective perspective that African American students should be treated the same as other students and should not have a spotlight placed on them.

Q sort 8, an African American, 38 year old female summed this view point up perfectly by saying that she felt statement 16 ("Provide access to counselors, Black or otherwise, who are trained to use culture specific interventions to effectively counsel African American students") was least helpful (-4). She said that, "something should not be created for African American students because that is not how life works. They have to work in the current environment because that is how society is structured." Q sort 14, an African American 21-year-old female with a factor loading of 0.7188 disagreed with statement 28 ("The college, department, or

program clearly communicate that all students have met all requirements to be STEM majors i.e. no students have been admitted under lowered standards"). She said that statement 28 is "not important for others to know," and that it feels like African American students are being "called out."

Factor 2 summary. Overall, the collective perspective represented by factor 2 indicated a desire for the institution to value diversity and treat everyone fairly. The view was that African American students should not receive special treatment and do not require special accommodations. There also seemed to be a view that special treatment may result in African American students having a spotlight placed on them, which could adversely affect their STEM persistence. Based on this information, Factor 2 was defined as a perspective that values diversity for everyone, not just African Americans.

Factor 3. Factor 3 accounted for 8% of the explained variance with four participants (n = 0, male; n = 4, female) loading on this factor. Two participants were 20 years-old, one was 21, and the final participant was 27. All participants identified as African American. All participants were enrolled full time with one participant majoring in computer science, one in occupational therapy, one in nursing, and one in health sciences. Three of the participants were working towards completion of an associate degree, and one was working on a bachelor's degree. Two participants were first-generation in college.

The collective perspective of Factor 3 focused on the socialization of African American students with peers of the same race. Statements that scored high in this factor were denoted with +3 or +4 meaning "most helpful" to African American students' persistence in STEM. For example, Statement 8 ("Train faculty so they do not, even inadvertently, structure learning experiences in which students are put in a position to feel they must be the spokesperson for all

African Americans") demonstrated the perspective that institutions need large enough African American student populations, so that individuals do not feel the need to "represent" for their race. This view was further supported by a +3 score on statement 35 ("Increase the number of African American students, faculty, and staff on campus").

Other statements represented a collective perspective that demonstrated a lack of confidence in the faculty and the institution's ability to create diversity and inclusion. Statement 42 ("Ensure that anti-racist policies are widely known and supported by the institution), denoted with a +2 in the factor array, depicted the perspective that African American students did not want to be stereotyped or negatively impacted by racism or prejudice. However, statement 32 ("Creating opportunities for African American STEM students to come together for dialogue, support and encouragement; including conversations around the broader inaccurate stereotypes about their academic underperformance") suggested that African American students wanted to create spaces for themselves through their interactions with each other. This could reflect a perspective that African American students could provide a support system for their same race peers.

This perspective was also reflected in scores +3 or +4 in the factor array regarding the role of faculty that would be "most helpful" to African American students. Statement 5 ("Have professors who are enthusiastic about the content, vary their instructional approaches and use "real world" examples to help students grasp concepts") suggested that African American students needed highly competent faculty in the classroom, but did not require other types of faculty support.

The lack of confidence in the institution to create a diverse and inclusive environment was further reflected in statements regarded as "least helpful" to African American students.

These included statements like 22 ("Support students' sense of connection to the campus), which received a -4 in the factor array indicating a perspective that African American students did not need support or encouragement from their institution and faculty. This viewpoint was further supported by statement 6 ("Faculty create and provide spaces in which African American students can share their knowledge without feeling judged") and statement 43 (Intervene when there is evidence of faculty bias conscious or unconscious racism, and prejudice"), which were denoted by -4 and -3 respectively. Statement 3 ("Promote and use multicultural center spaces for students to meet with faculty, staff and other students to share worldviews") and statement 23 ("Value student's individuality") were also noted as being least helpful to African American students (-3 or -4) further supporting the view that these students did not require support from faculty outside of instruction.

Q sort 30 represented the viewpoint of this factor very well. With a factor loading of 0.5228, the individual representing Q sort 30 was a 27-year old African American female nursing major. She described her current program as an environment where African American students perform poorly and do not "make it out each semester." For this reason, she strongly agreed (+4) with statement 32 ("Creating opportunities for African American STEM students to come together for dialogue, support and encouragement; including conversations around the broader inaccurate stereotypes about their academic underperformance"). She also strongly agreed (+4) with statement 36 ("Visibly and actively support Black student organizations on campus and in the community as these groups are vital components of the support network for minority students"). She believed that, "when African Americans can see others like them supporting one another, it gives them a sense of belonging and in return [they can] perform better academically." This student also did not believe that statement 22 ("Support students' sense of connection to the

campus") was important and gave it a -4 in her Q sort. She felt that it was more important to "learn the material" rather than "feel a connection." She also strongly disagreed with statement 23 ("Value student's individuality") by saying that it was "not important enough as supporting African Americans [as a group]."

Q sort 5 was an African American 20-year old female majoring in computer information science. She had a factor loading of 0.5846. She strongly agreed (+4) with statement 32 ("Creating opportunities for African American STEM students to come together for dialogue, support and encouragement; including conversations around the broader inaccurate stereotypes about their academic performance"). When asked why she agreed with this statement so strongly, she said, "I would love to have a place where me and my fellow Black people in STEM can come together and converse about our similarities and difference." She also strongly disagreed (-4) with statement 22 ("Support students' sense of connection to the campus") saying that "it is not needed."

Factor 3 summary. The collective perspective representing Factor 3 is the view that African American students need support from their same race peers, but do not require the support of the institution or faculty. African American students need instruction from faculty and an institution that supports anti-racist policies, but do not require any additional supports. The researcher used the professional literature to suggest that individuals who share this collective perspective reflect a need for socialization, but with same race peers. African American students who share this perspective would benefit from having spaces like a Black Student Union and other groups where they can meet with students of the same race and similar backgrounds (Patton, Bridges, & Flowers, 2011). Based on this information, the researcher defined this group as not needing the support of the institution and only needing each other.

Factor 4. Factor 4 accounted for 9% of the explained variance with three participants (n = 1, male; n = 2, female) loading on this factor. In terms of age, the participants were 19, 20, and 21 years old. All three participants identified as African American. All three participants were full time with two majoring in health sciences, and one in biomedical sciences. One participant was working toward an associate degree and two toward a bachelor's degree. Two participants were first generation college students.

The collective perspective in Factor 4 seemed to circle around creating safe and self-affirming spaces where African American students feel supported and encouraged. These views seemed to focus on STEM self-efficacy with great emphasis placed on having African American representation on campus. Take for instance statement 35 ("Increase the number of African American students, faculty, and staff on campus"), which was denoted by a score of +4 indicating something that would be "most helpful" to STEM persistence. This perspective, like Factor 1, indicated that African American students needed support from the institution, but a very different kind. While the perspective outlined in Factor 1 was strongly academically focused requiring faculty input, strong curriculum, and interactions that cleared away racial impediments to academic achievement, the collective perspective in factor 4 reflected a need for emotional support, encouragement and mentorship from faculty and staff, and thus reflected a lack of science and math self-efficacy.

This perspective was further supported by statements that scored high +4 or +3 indicating items that would be "most helpful" to African American students' STEM persistence like statement 26 ("Help African American students to see themselves in STEM fields by teaching them about the contributions of accomplished African Americans in STEM") and statement 1 ("Empower Black student groups to create diverse and inclusive programming and events").

Other statements that were viewed as "helpful" to students scored a +2 in the factor array like statement 25 ("Encourage African American students to affirm themselves and their ability to succeed in STEM coursework, particularly within a broader university culture that may not be as affirming") and statement 36 ("Visibly and actively support Black student organizations on campus and in the community as these groups are vital components of the support network for minority students") reflected the perspective that African American students need the support of faculty and their institution.

The perspective in factor 4 also supported the idea that African American students experience mental/emotional stress that may come from being a minority pursing a major where stereotypes may exist around their academic performance. This view was supported by statements that received a +4 or +3 as being "most helpful" to African American students' STEM persistence. These included statements like 42 ("Ensure that anti-racist policies are widely known and supported by the institution") and statement 16 ("Provide access to counselors, Black or otherwise, who are trained to use culture specific interventions to effectively counsel African American students"). This view was further supported by statement 15 ("Help African American students cope with the stress of being a minority in a predominantly White institution"), which was denoted by +2 in the factor array indicating something that would be "helpful" to African American students.

Q sort 3, a 21-year old African American female student with a factor loading of 0.7345 majoring in health science identified very strongly (+4) with statement 16 ("Provide access to counselors, Black or otherwise, who are trained to use culture specific interventions to effectively counsel African American students"). She said that having African American counselors was important for African American students to "have someone to talk and relate to

on campus." She expressed the importance of having a place to go to "clear your mind." She also strongly agreed (+4) with statement 35 ("Increase the number of African American students, faculty, and staff on campus"). She said that increasing the number of African Americans on campus will bring in "more familiar faces to make us feel comfortable because we identify and understand each other." This statement reflected the need for African American students to have others that they can relate to for emotional support.

Statement 17 ("Create the opportunities for African American students to work closely with faculty as researchers") scored a +3 on the factor array indicating something that would be very help, and further supports the idea that African American students need support through mentorship relationships with faculty in order to strengthen their self-efficacy. Additionally, Statement 23 ("Value student's individuality") was viewed as least helpful (-4), which may reflect the view that all African American students need uplift, encouragement, and support. Q sort 4 a 20-year old African American male with a factor loading of 0.7363 majoring in health sciences expressed this viewpoint when he said that the "focus should be on the [African American] group as a whole. The [focus] should be on the cultural connectedness of the group and not each individual person."

Statements that were viewed as least helpful with a score of -3 or -4 on the factor array indicated a collective perspective that African American students did not want a spotlight placed on their group. Examples that support this perspective were statement 37 ("Have an orientation that introduces the whole department to new majors so that African American students get to know the faculty and staff and vice versa") and statement 10 ("Create forums for diverse groups on campus to discuss issues of race including micro-aggressions"). Statement 6 ("Faculty create and provide spaces in which African American students can share their knowledge without

feeling judged") further supported this perspective with a score of -2 on the factor array because this statement also put the spotlight on African American students.

The collective perspective representing Factor 4 depicted faculty-student mentorship and other social interactions as not being helpful (-2) when placed outside of the context of STEM like in statement 39 ("Develop faculty-student mentoring programs"). The individual representing Q sort 3 felt like the type of mentorship described by statement 39 was too broad losing focus on STEM and sight of the individual student.

Factor 4 summary. The perspective represented by Factor 4 depicted the view that African American students experienced emotional stress stemming from issues with science and math self-efficacy. The researcher used the professional literature to suggest that African American students who share this perspective may benefit from having increased exposure through research, access to equipment, group work with peers and verbal encouragement and mentorship from faculty in STEM, such as, a learning community (Dagley, Georgiopoulos, Reece, & Young, 2015). These students would additionally benefit from having more African American students, faculty, and staff at the institution (Sparks, 2016).

The literature further suggested that institutions create interventions designed to re-establish self-efficacy at each level of an African American student's academic career (undergraduate, masters, and doctoral degree) (Charleston & Leon, 2016). Based on this information, the researcher defined Factor 4 as the view that African American students need support from their institution, faculty, and other students in order to increase their self-efficacy.

Factor 5. Factor 5 accounted for 8% of the explained variance in the data with five participants (n = 3, male; n = 3, female) loading on this factor. In terms of age, two participants were 19 years old, one participant was 20, one was 21, and one was 26 years old. All five

participants identified as African American. All five participants were full time with one majoring in physical therapy, three in nursing, and one in biology. All five participants were working towards an associate degree, and four participants were first generation in college. The collective perspective in Factor 5 also represents my perspective as the researcher.

The collective perspective represented by Factor 5 depicted African American students as being goal oriented and having a strong desire to be successful in STEM. Statements that were viewed as being most helpful, denoted by a +4 or +3 in the factor array, were statement 14 (" Offer STEM focused career planning"), statement 29 ("Connect African American students early with advisors who will assist them as they progress through their STEM majors"), statement 40 ("Find ways to discuss and demonstrate the impacts and benefits that STEM occupations can have for African American students") and statement 18 ("Provide mentors in STEM professions"). The collective viewpoint depicted by this factor is that African American students are goal oriented, focused, and need guidance in order to make sound choices in their career decisions.

Other statements that support this view was the perspective that African American students want to be challenged academically. Statements that were viewed as helpful to African American students persisting in STEM were statement 7 ("Encourage critical thinking by having faculty who challenge students to think and question, not simply regurgitate information"), which was denoted by +2 on the factor array, and statement 27 ("Create learning communities in STEM designed to bring students together from all underrepresented backgrounds to work through the most challenging STEM course content"), which scored a +4 on the factor array. This indicated that African American students were concerned with high achievement.

Another perspective that emerged from the factor array demonstrated a need for African American students to be perceived as goal oriented and high achievers. For this reason, several statements appeared to be concerned with stereotype threat. For example, statements that were identified as being most helpful with a +4 or +3 on the factor array were statement 9 ("Faculty who are prepared and unafraid to lead discussions on issues of race, class, and gender regardless of the course subject matter"). Also, other statements that were identified as being helpful denoted by a +2 on the factor array were statement 28 ("The college, department, or program clearly communicate that all students have met all requirements to be STEM majors i.e. no students have been admitted under lowered standard"), statement 24 ("Educating faculty to recognize that if African American students seem initially underprepared for college that the reason is more likely to have been the result of insufficient access to rigorous high school curriculum"), and statement 13 ("Build awareness among faculty and staff of the perceptions many African American students hold that they must work harder than other students to be viewed equally, and the emotional and physical toll that doing so can have"). These statements clearly showed a concern for stereotype threat.

Another collective perspective of Factor 5 was the view of the role of faculty and staff to minimize the adverse impacts of racism, bias, and prejudice, on students which emerged from scores -3 and -4 denoted as being the least helpful to African American students' persistence in STEM. These statements reflected the perspective that African American students should be protected from racial prejudice and should not have to deal with issues of race. An example of this was statement 10 ("Create forums for diverse groups on campus to discuss issues of race including micro-aggressions") and statement 33 ("Create and maintain a campus responsive to

African American culture, music, and food). These statements suggested a perspective that African American students do not want to discuss race with peers.

Other statements like statement 31 ("More diversity in social clubs including Greek organizations"), statement 21("Increase overall diversity on campus"),statement 35 ("Increase the number of African American students, faculty, and staff on campus), and statement 37 ("Have an orientation that introduces the whole department to new majors so that African American students get to know the faculty and staff and vice versa"), which were all statements that were noted as being the least helpful (-3 or -4) in the factor array suggested that African American students did not want special treatment or a spotlight placed on their race.

Additionally, statement 4 ("Employ faculty who build relationships with students by being approachable, relatable, engaging and connected inside and outside of the classroom") and statement 26 ("Help African American students to see themselves in STEM fields by teaching them about the contributions of accomplished African Americans in STEM"), which were denoted as being less helpful to African American students had a -3 in the factor array. This suggested that African American students just wanted to focus on persisting through their STEM major and goal achievement. They were not concerned with developing positive social interactions with faculty.

With a factor loading of 0.7522, Q sort 1, an African American 21-year old male majoring in biology is the best representative of the collective perspective in Factor 5. This individual believed that statement 14 ("Offer STEM focused career planning") was "great because it gives students an idea of the courses to look forward to and a chance to reconsider [if necessary]." He also strongly agreed (+4) that statement 18 ("Provide mentors in STEM professions") was most helpful to African American students. He said that, "mentors are always

great because it gives students a guide through college to become successful." These statements further indicate the goal-oriented perspective of Factor 5. The individual identified as Q sort 1 strongly disagreed (-4) with statements that related to diversity, such as, statement 31 ("More diversity in social clubs including Greek organizations"). He said that "diversity is good, but social clubs don't need more diversity because it's already happening between the millennials." He also strongly disagreed (-4) with statement 37 ("Have an orientation that introduces the whole department to new majors so that African American students get to know the faculty and staff"). He did not like the idea of African American students being singled out and preferred to "do the work required for the course."

Q sort 20, a 26-year old African American female with a factor loading of 0.6811 majoring in nursing also strongly agreed (+4) with statement 18 ("Provide mentors in STEM professions"). She said, "sometimes we [African American students] need to be guided." She felt that African American students may be unfamiliar with many STEM occupations, so having a mentor to guide them would be helpful. She strongly disagreed (-4) with statement 31 (More diversity in social clubs including Greek organizations) by saying, "if it does not help my goal then I'm not interested." She also strongly disagreed (-4) with statement 41 ("Invest in corporate internships for African American students") by saying, "I want the same [treatment], not to be treated special."

Factor 5 summary. The collective perspective representing Factor 5 is that African American students are goal oriented and need guidance from faculty, career services advisors and STEM mentors to help them achieve their goals. The researcher used the professional literature to suggest that African American students who share this perspective may benefit from participating in learning communities, being research assistants to faculty, and working closely

with career advisors.

Another perspective in Factor 5 indicates that African American students may be concerned with stereotype threat, but do not want a spotlight placed on their race. The researcher used the professional literature to suggest that African American students who share this perspective may benefit from receiving constructive feedback from faculty that communicates high standards and confidence in the student's ability to attain them (Marx & Goff, 2005). Also, these students would benefit from having positive role models such as teachers or tutors of the same race (Sparks, 2016). Based on this information, the researcher defined Factor 5 as African American students are goal oriented and STEM focused but concerned with stereotypes.

Chapter 4 Summary

Chapter 4 is an analysis of the study's results. In this chapter, the researcher used the data to determine how many factors to extract, then used the extracted factor arrays to reveal the shared perspectives of the participants that comprised each factor. Subsequently, the researcher used individuals with the highest factor loadings to reveal characteristics of each factor.

In chapter 4, the researcher analyzed the results generated from the study. The process for factor extraction was discussed along with a description of each factor. The researcher also named each factor and linked them to the groups (stereotype threat, self-efficacy, and socialization) presented in the literature review.

Chapter 5 Summary

In chapter 5, the researcher summarizes and connects the findings to the professional literature. The researcher makes comparisons between factors and looks at the collective perspectives that emerged across all factors. Implications for institutions, limitations and delimitations of the study are also addressed.

Chapter 5: Discussion and Conclusion

Themes and Patterns in the Data

The purpose of this chapter was to examine the patterns and themes that emerged after analysis of the five factors. In order to establish themes, the researcher compared statements across all the factor arrays to find similarities and differences. These similar perspectives formed the themes in each subsection. This section also included researcher observations regarding further review of the conceptual framework as it relates to these findings, exploration into how the results of this study revealed shared perspectives of African American STEM majors, and an examination of trends in responses from UNF students. Implications for future research were also discussed.

Theme 1: African American students need support from faculty. The collective perspectives in Factors 1, 2, 4, and 5 demonstrated a need for support from faculty to assist in clearing away impediments to academic achievement. Perspectives from Factors 1 and 3 revealed the need for African American students to have faculty that encouraged and supported them. Unlike Factor 4, the collective perspectives in Factors 1, 2, and 3 demonstrated a need for meaningful relationships with faculty inside and outside of the classroom. Individuals who share this perspective would benefit from working with faculty advisors in STEM related or other social organizations. The collective perspective in Factor 4 revealed a desire for relationships with faculty in STEM related settings only. Factors 1, 4 and 5 also showed a desire for mentorship, which could be accomplished through mentoring relationships with STEM professionals.

The collective perspective in Factor 4 revealed issues with self-efficacy. Individuals who share this perspective would benefit from having faculty to encourage them by affirming their ability to succeed. For example, Q sort 3 a 21-year old African American female majoring in

health science said that affirming goes, "deeper for me because I don't think a lot of African American students believe in themselves or have the tools. [Being affirmed] promotes self-efficacy." The perspective of Factor 1 also revealed a need to be encouraged and affirmed by faculty. For example, Q sort 19, a 25-year old African American female histology major said that, "affirmation is a key to success and is a motivator." Affirming and encouraging individuals who share the perspective of Factor 1 will inspire them to work harder.

The collective perspectives from Factors 1, 2, 4, and 5 present the idea that the role of faculty is to help remove barriers to the academic achievement of African American students. Students who share this perspective want to attend institutions that intervene when conscious or unconscious faculty bias exists. Q sort 14, a 21-year old African American female nursing major explained it best by saying, "if something is not right, faculty should step in." The collective perspective of Factor 1, 3, and 5 revealed a desire for faculty who can emphasize with them and their struggles as African American STEM majors attending predominantly White institutions.

Theme 2: African American students need the support of the institution. The collective perspective across many factors was that African American students need different types of support from the institution. One type of support that most participants across the five factors agreed on was the need for financial support. The collective perspectives of Factors 1, 2, and 5 agreed very strongly that African American students needed some form of financial assistance. Q sort 17, a 21-year old African American female health science major summarized this perspective by saying, "personally, without grants and scholarships college would not be an option." Q sort 26, a 24-year old African American female majoring in nursing said, "investing in corporate internships for black students will make it easier for the student to secure the job once they finish school because they will already have experience."

The collective perspectives in Factors 1, 2, 3, and 4 demonstrate a need for the institution to ensure that anti-racist policies are widely known and supported to ensure that there are no potential barriers to African American students' education. Additionally, Factors 1, 2 and 5 demonstrated the perspective that institutions should ensure that the campus is inviting to everyone including African American students. Q sort 23, a 25-year old African American-Arab male majoring in surgical technology said that, "making sure the campus environment is inviting allows the student to feel welcomed, and they can focus on their work and education versus being uncomfortable." It is important to note that none of the factors indicated that African American students needed to feel connected to the campus or that institutions should constantly assess the racial climate.

Theme 3: African American students want guidance and a good education. The collective perspectives in Factors 2, 3, and 5 suggest that African American students should be in classrooms where faculty vary their approaches to teaching challenging content by using real world examples. Faculty should also encourage African American students to think critically and not simply regurgitate information. The collective perspectives in Factors 3 and 5 reflected the importance of African American students working in STEM learning communities designed to bring students together from all underrepresented backgrounds to work through the most challenging STEM course content.

The collective perspectives from all five factors (1, 2, 3, 4, and 5) revealed a need for African American students to connect with advisors who can assist them as they progress through their major. Q sort 27, a 19-year old African American female majoring in physical therapy said that having an advisor to help you "could boost [a student's] confidence and make

[them] try harder." Q sort 4, a 20-year old African American male majoring in health sciences felt an advisor could "help you on your career path" and "be a partner with the student."

Theme 4: African American students want to see diversity on campus. The collective perspectives in Factors 1, 3, and 4 demonstrated a need to see an increase in African American faculty, students, and staff. Q sort 3, a 21-year old African American female majoring in health sciences said, "having more familiar faces makes us feel comfortable because we identify with and understand each other." The perspectives in Factors 2 and 4 reflected a desire to see an increase in overall diversity. Q sort 8, a 38-year-old African American woman currently working as a professional pharmacist, was an undergraduate STEM major at a predominantly White institution. She said that, "ignorance and narrowmindedness are created when people are in a bubble, so increasing diversity can help shape perspectives and fix issues in society."

Theme 5: African American students do not want to discuss issues of race. The collective perspective across all factors seemed to agree that the institution and faculty should deal with issues of race when they become impediments to African American students' accomplishing their academic goals. The collective perspectives also revealed that African American students had no desire to discuss issues of race with peers. For example, the perspectives in Factors 1, 2, 3 and 4 showed a positive response regarding the institution ensuring that anti-racist policies were widely supported. Also, positive responses in Factors 1, 3, and 5 concerning faculty who are prepared to lead discussions on issues of race, class, and gender regardless of subject matter were also observed. Additionally, perspectives in Factors 1, 2, 4, and 5 showed a desire for the institution and faculty to intervene when there is faculty bias, conscious and unconscious, racism and prejudice. However, none of the collective factor perspectives (1, 2, 3, 4, or 5) had a positive factor array for statement 10 that related to creating

diverse groups on campus to discuss issues of race including micro-aggressions. Q sort 21, a 20-year old African American female majoring in nursing found statement 10 to be the least helpful saying, "some people will refuse to listen to others, so more confusion and tension will arise from it instead." Also, only Factor 4 had a positive factor array (+1) in regard to statement 3 that addresses using the multicultural center spaces for students to meet with faculty, staff, and other students to share world views. Conversely, when it came to African American students discussing issues of race with each other, collective perspectives from Factors 2, 3, and 4 found it to be positive and helpful towards supporting African American STEM persistence. Overall, it appeared that the reluctance to discuss issues of race stemmed from African American students not wanting to discuss race with students who were not African American. However, the collective perspective demonstrated a desire for the institution and faculty to protect African American students when issues of racism affect them academically and socially. The results from this study also indicated that African American students were open to discussing issues of race with faculty and staff, such as, counselors.

Theme 6: African American students do not want special treatment. The collective perspective across all five factors indicated that African American students did not want the institution and faculty to do anything for them that was not done for other students. For example, none of the factors (1, 2, 3, 4, or 5) indicated a positive response to statement 6 that involved faculty providing spaces in which African American students could share their knowledge without feeling judged. Also, none of the factors (1, 2, 3, 4, or 5) showed a positive response to having all students educated on persisting negative racial stereotypes toward African American students. Also, only Factor 5 had a positive response to statement 28 that related to the college, department, or program clearly communicating that all students had met all requirements to be

STEM majors i.e. no students had been admitted under lowered standards. Q sort 28, a 19-year old African American female majoring in biomedical sciences disagreed with statement 28 saying that it "should already be known," and it seems like "special treatment." Q sort 21, an African American 21-year old female majoring in nursing said that statement 28 is, "not important for others to know," and that it "feels like being called out."

Only the collective perspective in Factor 3 indicated a positive response to statement 37 that related to having an orientation that introduced the whole department to new majors so that African American students could get to know faculty and staff and vice versa. Q sort 1, a 21-year old African American male disagreed with statement 37 saying, "I feel like there is no need for that because most students don't like being put out in the open like that and would rather do the work required for the course." Only the collective perspective in Factor 4 viewed statement 33 that relates to creating and maintaining a campus responsive to African American culture, music, and food as helpful (+1) to African American STEM persistence. Q sort 15, an African American 19-year old male majoring in biomedical sciences disagreed with statement 33 saying that it "seems like it may cause too much tension between races and within because not everyone agrees on [how to define] African American culture." Q sort 11, an African American 35-year old majoring in cardiovascular technology responded to statement 33 by saying, "We are here to learn. We can save the culturally appropriate foods for our personal time."

Theme 7: African American students are concerned about stereotypes. When it comes to stereotypes, the collective perspectives across all five factors seem to express some form of concern with how stereotypes may impact African American students academically. There were many statements that suggested African American students were concerned about stereotype threat. The collective perspective in Factors 3 and 5 demonstrated a need for faculty

who are trained to not look to African American students to be the spokesperson for their race. The perspectives in Factors 2, 3, and 5 indicated that African American students want faculty to recognize that if an African American student seems initially underprepared for college that the reason is more likely to have been the result of insufficient access to rigorous high school curriculum. Combining this information with the perspectives in Factors 1, and 4 regarding African American students needing to be encouraged to affirm themselves and their ability to succeed in STEM, and the perspectives in Factors 1, 3, and 4 that demonstrate the need for faculty to help African American students see themselves in STEM fields by teaching them about the contributions of accomplished African Americans in STEM, it becomes clear that African American students care a lot about how they are perceived by faculty.

Revisiting the Conceptual Framework

When examining the themes and connections in the data, it appeared that the conceptual framework created based on the professional literature helped to explain some of the themes. One example of this can be seen with the intersectionality of race and gender. Several studies showed that African American women experienced stress while attending predominantly White institutions (Shahid, Nelson & Cardemil, 2018), and may view the PWIs as isolating (Booker, 2016). Factor 3 defined by the researcher as a shared perspective that African American students do not need the support of the institution and only need each other had four female participants and no males loading on the factor.

The conceptual framework generated from the professional literature also suggested that African American women may experience stereotype threat or issues with self-efficacy, which were identified as factors that may influence their view as a result of their gender and racial experiences. Issues with stereotype threat were reflected in the collective perspective in Factor 3,

and issues with self-efficacy were reflected in the collective perspective of Factor 4, which also had more women than men (n = 1, male; n = 2, female).

The professional literature and conceptual framework also suggested that undergraduate African American students might demonstrate a desire for different types of socialization like with faculty and staff (Love, 2008). This shared perspective was reflected in Factor 1 where individuals loading on this factor demonstrated the viewpoint that the institution and faculty should support African American students by helping to remove obstacles that impede their academic achievement.

The only perspective that did not seem to be reflected in the conceptual framework was represented by Factor 5, which seemed to relate to African American STEM majors specifically. This factor may have been overlooked by the researcher because the conceptual framework depicted African American STEM persistence in a broader context that could be generalized to all African American undergraduate students attending PWIs. The collective perspective in Factor 5 depicted African American students as being goal oriented and having a strong desire to be successful in STEM specifically. Thus, this factor was most representative of STEM majors. Students who loaded on this factor expressed a desire for STEM focused career planning and STEM mentors to guide them as they navigate through their program.

Trends in responses from UNF students

The researcher collected data from a variety of institutions with 33% (n = 10) of respondents being currently enrolled UNF students. A trend found in the data showed that three out of the four participants loading on Factor 3 were currently enrolled UNF students. The collective perspective of Factor 3 focused on the need for socialization of African American students with peers of the same race. This group also reflected a view that they did not need the

support of the institution. Statement 23, "Value student's individuality," was regarded as least helpful by Q sort 6, an African American 21-year old female health sciences major. She felt that African American students did not need validation from faculty instead, they should value themselves. Q sort 16, an African American 20-year old female occupational therapy major expressed a desire to see more diversity by referencing her experiences in a predominantly White high school. She described the school as not being very diverse and felt that diversity was important. This statement helped to explain why she valued interactions with same race peers and displayed a lack of faith in her current institution as a PWI that also lacks diversity. Q sort 5, an African American 20-year old female computer science major felt that it was very important that Black people "don't get singled out." She described herself as feeling the pressure of having the be the spokesperson for African Americans, and "didn't like it." It was unclear if she had experienced feeling singled out at UNF.

Another trend was in Factor 4, all three participants were currently enrolled UNF students. The collective perspective represented by Factor 4 focused on creating safe and self-affirming spaces where African American students feel supported and encouraged. This perspective reflects issues with self-efficacy. Q sort 3, a 21-year old African American female health sciences major expressed a desire to see more familiar faces on campus to make her feel comfortable. This type of response suggests that a lack of diversity on campus could be affecting her self-image and emotional stability. She also discussed the importance of counselors and having "someone to talk and relate to on campus to clear your mind." She said that there were no black counselors on campus. Q sort 4, a 20-year old African American male majoring in health sciences expressed a desire for advisors to "talk and connect" with on campus. He expressed a desire to have someone that he could "relate to." He also said that advisors play an important role

and should be a "partner with the student." These statements indicated a desire from this student to have deeper connections with advisors and other staff that interact with him throughout his academic career.

A third trend that seemed to emerge from the data demonstrated a lack of awareness of resources by these students. Some students expressed a desire to have a place to interact with peers of the same race but did not seem to be aware of the Black Student Union. Other students expressed a desire to engage with peers in STEM focused groups but did not demonstrate knowledge of the presence of learning communities on campus. These statements indicated a lack of knowledge of the resources current offered at UNF.

Implications for Institutions

It is important for institutions to understand that African American students, like all human beings, are complex. Individual students bring certain inputs to the institutions, which are perspectives shaped by their family, community, and racial histories. These perspectives may be skewed further by various experiences through racial and gender lenses. For African American STEM students, an additional layer is added, which is STEM ability. All of these factors have the potential to shape how African American students perceive their experiences at predominantly White institutions. It is very important that these institutions offer various supports to assist African American students in all of the different ways they come into the institution. This study has shown that some students require organizations where they can dialogue with others who have similar views and experiences. For these African American students, having organizations like the Black Student Union or other groups they can identify with will be helpful. Other African American students are more academically focused and want social groups where they can discuss STEM related issues. STEM learning communities can

support these students. African American students in this study expressed a desire to work with faculty as researchers and to have relationships with faculty. STEM faculty advisors in the learning communities could potentially be a great way to address that need. This study also showed a need for students to receive advising that focuses on helping them as they work through their major. These responses show a gap or something missing from the perspective of these students in the way they are currently being advised.

This study also showed that African American students are concerned with how they are perceived by faculty, but not really by peers. This means that faculty must be cognizant of the type of interactions they have with African American students because negative interactions may result in a decrease in STEM persistence.

This study also showed that African American students do not want special treatment or have a spotlight placed on them. They also have concerns about discussing issues of race but want the institution and faculty to support and protect them from racial issues if they arise.

Implications for Future Research

Limitations. The researcher had difficulty reaching students in several hard science areas such as chemistry, physics, and mathematics. Connections were made initially with STEM learning communities on various universities, and the researcher met with several African American academic and social student organizations. However, no students from these disciplines elected to participate.

Delimitations. This study was limited to African American students attending predominantly White institutions. However, only southern institutions were included in this study. A suggestion for future research would involve studying African American students in institutions across the country to see if perspectives change.

Also, African American students from HBCUs were excluded from this study. Another suggestion for future research would involve comparing perspectives of African American students from HBCUs with those from PWIs.

Lastly, the completion of the concourse questionnaire and Q sort parts of this study were initially intended to be completed through a survey link for the questionnaire provided through Qualtrics, and through a link for the Q sort part. Completion of the questionnaire was done as intended, but the Q sorting phase was completed entirely through face to face interactions with participants due to the difficulty the researcher had with getting participants to complete the Q sort online. The unintended consequence of engaging in face to face interactions with participants as they worked through the Q sorts was that it offered the opportunity for deep and enriching dialogue around participant perspectives and rationale for sorting the statements. This gave the researcher keen insight when analyzing the data and helped to unearth the intricate connections within and across the factor arrays.

Summary of Chapter 5

In this chapter, the researcher analyzed the themes and patterns that emerged from the data. Factor arrays were compared and contrasted in order to reveal the combined perspectives across all of the factor arrays. Analysis of results and how it fit into the conceptual framework was discussed along with trends that emerged from UNF students. Next, a discussion of implications for institutions and future research were addressed.

Table 1: Correlation Matrix

Correlation Matrix Between Sorts

SORTS		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	B21M11B1	100	20	4	-11	30	10	1	-2	46	20	31	-10	14	5	-4	-2	0	45	33	39	20	10	33	19	20	39	30	-10	4	-15
2	B19F63HS	20	100	7	14	-3	-9	30	34	8	40	18	3	-25	50	36	18	42	22	2	27	6	35	-6	24	21	15	41	17	-6	9
3	B21F15HS	4	7	100	43	9	-10	-37	-28	20	35	13	-28	1	9	16	31	16	10	16	-3	1	20	12	20	19	7	-21	13	8	18
4	B20M40HS	-11	14	43	100	15	6	-28	-10	27	28	20	-7	-17	-12	-7	17	16	-8	4	2	9	7	-17	7	10	3	-4	30	-18	3
5	B20F56CI	30	-3	9	15	100	39	-25	-18	40	10	30	18	-8	5	14	31	-3	23	17	-10	14	3	35	26	-2	24	14	9	10	22
6	A21F70HS	10	-9	-10	6	39	100	-23	-5	23	21	15	18	-30	1	-10	20	-11	-1	12	-19	0	-18	13	11	-6	2	11	13	-5	6
7	B26MCS2	1	30	-37	-28	-25	-23	100	36	-6	-6	-6	16	-6	34	2	-20	18	20	-19	20	-7	10	5	-35	17	13	10	4	4	-9
8	B38F2	-2	34	-28	-10	-18	-5	36	100	-17	3	17	24	-20	34	15	-15	15	12	-20	-17	-19	20	5	-1	5	-1	25	5	11	17
9	B20M60ME	46	8	20	27	40	23	-6	-17	100	36	39	16	-15	-2	19	-7	-2	3	34	20	11	4	43	30	37	29	-3	18	-5	-27
10	J20M38EE	20	40	35	28	10	21	-6	3	36	100	50	-14	2	32	35	2	30	-1	49	-4	0	26	39	1	32	34	12	42	5	15
11	B35F72CT	31	18	13	20	30	15	-6	17	39	50	100	30	10	10	40	10	14	3	33	-2	5	-1	38	0	32	37	16	9	9	17
12	A21M0CS1	-10	3	-28	-7	18	18	16	24	16	-14	30	100	-19	32	31	-2	12	-15	2	-8	13	-4	10	13	15	7	5	-5	15	7
13	B53F60N1	14	-25	1	-17	-8	-30	-6	-20	-15	2	10	-19	100	-15	-5	-10	-5	-21	26	0	-1	6	15	-22	-12	15	-4	-25	13	-10
14	B21F32N2	5	50	9	-12	5	1	34	34	-2	32	10	32	-15	100	38	-1	38	25	15	-10	10	20	10	8	18	20	16	24	28	20
15	B19M16BS	-4	36	16	-7	14	-10	2	15	19	35	40	31	-5	38	100	18	18	0	31	-13	-6	15	33	37	31	25	2	7	17	-3
16	B20F16OT	-2	18	31	17	31	20	-20	-15	-7	2	10	-2	-10	-1	18	100	-12	11	4	-22	-2	-23	-9	19	-23	5	20	-6	-13	31
17	B21F99HS	0	42	16	16	-3	-11	18	15	-2	30	14	12	-5	38	18	-12	100	-5	14	19	10	39	24	-3	14	5	24	7	9	-9
18	B19M48N1	45	22	10	-8	23	-1	20	12	3	-1	3	-15	-21	25	0	11	-5	100	8	6	23	-4	9	2	28	18	27	-6	31	20
19	B25F30H1	33	2	16	4	17	12	-19	-20	34	49	33	2	26	15	31	4	14	8	100	2	10	0	51	24	34	20	15	6	3	-9
20	B26F50N1	39	27	-3	2	-10	-19	20	-17	20	-4	-2	-8	0	-10	-13	-22	19	6	2	100	24	8	-1	29	19	16	15	-9	-9	-15
21	B20F80N2	20	6	1	9	14	0	-7	-19	11	0	5	13	-1	10	-6	-2	10	23	10	24	100	-12	-2	17	10	-8	15	20	8	0
22	B18M0E2	10	35	20	7	3	-18	10	20	4	26	-1	-4	6	20	15	-23	39	-4	0	8	-12	100	24	1	13	23	-11	26	22	-11
23	BA25M60S	33	-6	12	-17	35	13	5	5	43	39	38	10	15	10	33	-9	24	9	51	-1	-2	24	100	9	43	19	9	19	35	1
24	B19F12B2	19	24	20	7	26	11	-35	-1	30	1	0	13	-22	8	37	19	-3	2	24	29	17	1	9	100	30	5	5	3	13	-5
25	B24F60DH	20	21	19	10	-2	-6	17	5	37	32	32	15	-12	18	31	-23	14	28	34	19	10	13	43	30	100	15	-11	31	41	0
26	B24F30N2	39	15	7	3	24	2	13	-1	29	34	37	7	15	20	25	5	5	18	20	16	-8	23	19	5	15	100	28	18	33	0
27	B19F6PT1	30	41	-21	-4	14	11	10	25	-3	12	16	5	-4	16	2	20	24	27	15	15	15	-11	9	5	-11	28	100	-15	-12	28
28	B19F60BS	-10	17	13	30	9	13	4	5	18	42	9	-5	-25	24	7	-6	7	-6	6	-9	20	26	19	3	31	18	-15	100	12	15
29	B21F60N2	4	-6	8	-18	10	-5	4	11	-5	5	9	15	13	28	17	-13	9	31	3	-9	8	22	35	13	41	33	-12	12	100	6
30	B27F60N1	-15	9	18	3	22	6	-9	17	-27	15	17	7	-10	20	-3	31	-9	20	-9	-15	0	-11	1	-5	0	0	28	15	6	100

Table 2: Unrotated Factor Matrix

Unrotated Factor Matrix

	Factors 1	2	3	4	5	6	7	8
SORTS								
1 B21M11B1	0.4916	-0.1362	-0.3227	0.5712	0.2377	0.1366	-0.0009	-0.1184
2 B19F63HS	0.4984	0.4662	0.2750	-0.0403	0.5002	0.0225	-0.1511	0.1521
3 B21F15HS	0.3180	-0.3973	0.0753	-0.4811	0.2747	0.2437	0.3109	0.1860
4 B20M40HS	0.1881	-0.3559	0.2341	-0.4241	0.4150	-0.0907	-0.1174	-0.2024
5 B20F56CI	0.4176	-0.4408	0.2766	0.2968	-0.1740	-0.0358	0.0725	-0.0973
6 A21F70HS	0.1669	-0.3589	0.3733	0.2013	-0.2216	-0.2365	-0.1812	-0.3550
7 B26MCS2	0.0445	0.7397	-0.1426	0.1642	0.0016	-0.0533	-0.0602	-0.2174
8 B38F2	0.1297	0.6549	0.2715	0.0242	-0.1642	-0.0333	-0.1185	-0.0849
9 B20M60ME	0.5744	-0.3946	-0.2303	0.0971	0.0499	-0.3654	-0.2088	-0.1695
10 J20M38EE	0.6992	-0.0873	0.0321	-0.3557	0.0501	0.2610	-0.2110	-0.2243
11 B35F72CT	0.6245	-0.1311	0.0713	0.0522	-0.2403	0.1312	-0.3141	-0.0755
12 A21M0CS1	0.2185	0.2202	0.2290	0.1652	-0.4423	-0.4805	-0.2204	0.1790
13 B53F60N1	-0.0825	-0.1117	-0.5095	0.0194	-0.2112	0.5858	-0.0895	0.1834
14 B21F32N2	0.4816	0.5253	0.2749	-0.0746	-0.0734	0.0034	0.1297	0.0888
15 B19M16BS	0.5570	0.1235	0.1204	-0.1836	-0.2727	-0.0603	-0.1097	0.5502
16 B20F16OT	0.0782	-0.3407	0.6232	0.1014	0.0874	0.2675	0.0406	0.2893
17 B21F99HS	0.3811	0.3794	-0.0469	-0.2596	0.2420	0.0709	-0.2331	0.1026
18 B19M48N1	0.3029	0.1520	0.1090	0.4610	0.1827	0.1503	0.5944	-0.1443
19 B25F30H1	0.5572	-0.3052	-0.2461	0.0455	-0.1356	0.1703	-0.1567	0.1604
20 B26F50N1	0.1529	0.0873	-0.4171	0.2847	0.6069	-0.1894	-0.0610	0.0894
21 B20F80N2	0.1789	-0.1003	-0.0151	0.2484	0.2888	-0.2393	0.2490	-0.0347
22 B18M0E2	0.3308	0.3097	-0.2379	-0.4187	0.1157	0.1031	0.0280	-0.0464
23 BA25M60S	0.6194	-0.0900	-0.3005	0.0344	-0.4107	0.0779	0.0099	-0.0840
24 B19F12B2	0.3686	-0.2474	0.0834	0.0968	0.1800	-0.4326	0.1595	0.5541
25 B24F60DH	0.5948	0.0887	-0.2790	-0.1253	-0.0558	-0.3089	0.3173	-0.0148
26 B24F30N2	0.5265	0.0371	-0.1326	0.1679	-0.0538	0.2807	-0.0214	-0.1128
27 B19F6PT1	0.2672	0.2045	0.3129	0.5385	0.2390	0.3141	-0.2549	-0.0038
28 B19F60BS	0.3618	0.0125	0.1241	-0.4562	0.0385	-0.2067	0.1779	-0.4910
29 B21F60N2	0.3261	0.1984	-0.1828	-0.0244	-0.3944	0.0211	0.6165	0.0535
30 B27F60N1	0.1016	0.0335	0.6044	0.0281	-0.0884	0.3295	0.2832	-0.1208
Eigenvalues	4.8409	3.0031	2.4100	2.2653	2.0555	1.7942	1.6451	1.5014
% expl.Var.	16	10	8	8	7	6	5	5

Table 3: Scree Plot

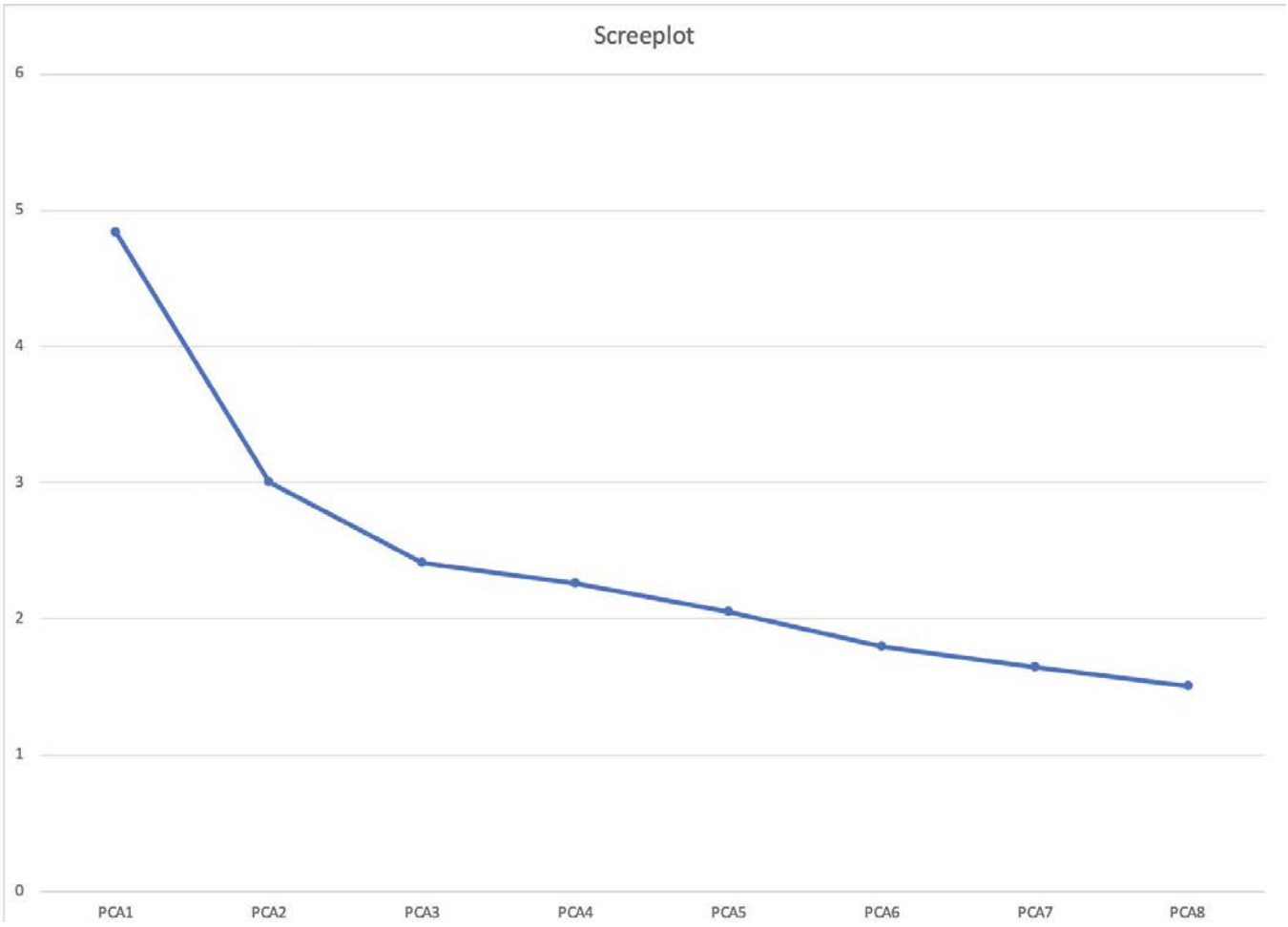


Table 4: Extracted Five Factor Matrix

Factor Matrix with an X Indicating a Defining Sort					
Q sort	Factor 1 Loadings	Factor 2 Loadings	Factor 3 Loadings	Factor 4 Loadings	Factor 5 Loadings
1	0.3912	-0.1232	-0.0440	-0.1058	0.7522X
2	0.0098	0.7322X	-0.0457	0.3011	0.4053
3	0.1473	-0.0863	0.0512	0.7345X	-0.0155
4	-0.0816	-0.0226	0.1320	0.7363X	0.0459
5	0.3848	-0.1438	0.5846X	0.0580	0.2231
6	0.1676	-0.1175	0.5858X	0.0022	0.0249
7	-0.111	0.5327	-0.3680	-0.4099	-0.0954
8	0.0197	0.6750X	0.0152	-0.2757	-0.1213
9	0.5557X	-0.2222	0.0538	0.2596	0.3494
10	0.5387	0.2429	0.0229	0.5246	0.0394
11	0.6121X	0.1159	0.2563	0.0995	0.0946
12	0.2932	0.2891	0.2788	-0.3219	-0.1437
13	0.2121	-0.3659	-0.3230	-0.1840	-0.0821
14	0.2723	0.7188X	0.0589	-0.0003	0.0014
15	0.5293X	0.3461	0.1229	0.1282	-0.1289
16	-0.1363	0.0191	0.6678X	0.2333	0.0958
17	0.1567	0.4810X	-0.2880	0.2627	0.0972
18	0.0966	0.2391	0.1514	-0.1647	0.5060X
19	0.6279X	-0.1756	0.0326	0.1557	0.1853
20	-0.0578	-0.0292	-0.4260	0.0689	0.6811X
21	0.0161	-0.0256	0.0509	0.0746	0.4223X
22	0.2484	0.3306	-0.4372	0.2866	-0.0795
23	0.8045X	-0.0298	-0.0291	-0.0526	0.0140
24	0.2098	-0.0264	0.1953	0.2537	0.3140
25	0.5824X	0.1727	-0.2221	0.1636	0.1151
26	0.4847X	0.1333	-0.0026	-0.0114	0.2728
27	-0.0309	0.3537	0.3019	-0.1878	0.5530X
28	0.2336	0.2549	-0.0070	0.4558X	-0.1693
29	0.4897X	0.1597	-0.1052	-0.1916	-0.1491
30	-0.0698	0.3136	0.5228X	0.0490	-0.0805
% Explained Variance	13	10	8	9	8

Table 5: Factor Array

No.	Statement	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	Empower Black student groups to create diverse and inclusive programming and events.	**-2**	**0**	**1**	**3**	**0**
2	Promote engagement with other students from underrepresented groups.	**-3**	**1**	**0**	**-4**	**-1**
3	Promote and use multicultural center spaces for students to meet with faculty, staff, and other students to share world views.	**-4**	**0**	**-3**	**1**	**0**
4	Employ faculty who build relationships with students by being approachable, relatable, engaging and connected inside and outside of the classroom.	**2**	**1**	**3**	**-3**	**-3**
5	Have professors who are enthusiastic about the content, vary their instructional approaches, use "real world" examples to help students grasp concepts.	**-2**	**3**	**4**	**-2**	**2**
6	Faculty create and provide spaces in which African American students can share their knowledge without feeling judged.	**0**	**-4**	**-4**	**-2**	**0**
7	Encourage critical thinking by having faculty who challenge students to think and question, not simply regurgitate information.	**-2**	**3**	**1**	**0**	**2**
8	Train faculty so they do not, even inadvertently, structure learning experiences in which students are put in a position to feel they must be the spokesperson for all African Americans.	**-1**	**-4**	**3**	**-3**	**1**
9	Faculty who are prepared and unafraid to lead discussion on issues of race, class, and gender regardless of the course subject matter.	**1**	**-1**	**1**	**-1**	**3**
10	Create forums for diverse groups on campus to discuss issues of race including micro-aggressions.	**-3**	**-2**	**0**	**-4**	**-4**
11	Hiring and preparing faculty who have culturally responsive views of teaching and learning.	**0**	**2**	**-2**	**-1**	**-1**

12	Educate all students about persisting negative racial stereotypes toward African American students.	**-1**	**-3**	**-1**	**0**	**-1**
13	Build awareness among faculty and staff of the perceptions many African American students hold that they must work harder than other students to be viewed equally, and the emotional and physical toll that doing so can have.	**2**	**0**	**2**	**-1**	**2**
14	Offer STEM focused career planning.	**1**	**-2**	**1**	**-3**	**3**
15	Help African American students cope with the stress of being a minority in a predominantly White institution.	**1**	**0**	**-3**	**2**	**-2**
16	Provide access to counselors, Black or otherwise, who are trained to use culture specific interventions to effectively counsel African American students.	**-1**	**-3**	**1**	**4**	**0**
17	Create opportunities for African American students to work closely with faculty as researchers.	**1**	**-2**	**0**	**3**	**-1**
18	Provide mentors in STEM professions.	**3**	**-1**	**0**	**1**	**4**
19	Systematically assess campus racial climate in an ongoing effort to make the institution healthier.	**0**	**-3**	**-1**	**-1**	**-2**
20	Convey the idea that diversity and inclusion matter.	**2**	**2**	**0**	**-2**	**1**
21	Increase overall diversity on campus.	**-1**	**4**	**-3**	**2**	**-3**
22	Support students' sense of connection to the campus.	**-3**	**-3**	**-4**	**-2**	**0**
23	Value student's individuality.	**-2**	**2**	**-4**	**-4**	**1**
24	Educating faculty to recognized that if African American students seem initially underprepared for college the reason is more likely to have been the result of insufficient access to rigorous high school curriculum.	**-1**	**1**	**2**	**0**	**2**
25	Encourage African American students to affirm themselves and their ability to succeed in STEM coursework, particularly within a broader university culture that may not be as affirming.	**3**	**-1**	**0**	**2**	**0**
26	Help African American students to see themselves in STEM fields by teaching them about the contributions of accomplished African Americans in STEM.	**4**	**-4**	**3**	**4**	**-3**
27	Create learning communities in STEM designed to bring students together from	**-2**	**-1**	**4**	**0**	**4**

	all underrepresented backgrounds to work through the most challenging course content.					
28	The college, department, or program clearly communicate that all students have met all requirements to be STEM majors i.e. no students have been admitted under lowered standards.	**0**	**-2**	**-2**	**0**	**2**
29	Connect African American students early with advisors who will assist them as they progress through their STEM majors.	**1**	**4**	**2**	**3**	**3**
30	Working to create and sustain a campus environment that is inviting to everyone including African American students.	**4**	**3**	**-1**	**0**	**1**
31	More diversity in social clubs including Greek organizations.	**-4**	**-1**	**-2**	**-1**	**-4**
32	Creating opportunities for African American STEM students to come together for dialogue, support and encouragement; including conversations around the broader inaccurate stereotypes about their academic underperformance.	**0**	**1**	**3**	**2**	**0**
33	Create and maintain a campus responsive to African American culture, music, and food.	**-4**	**0**	**-1**	**1**	**-2**
34	Finding ways to support students through scholarships and grants in order to reduce the financial strain.	**4**	**4**	**-2**	**-1**	**4**
35	Increase the number of African American students, faculty, and staff on campus.	**1**	**0**	**3**	**4**	**-3**
36	Visibly and actively support Black student organizations on campus and in the community as these groups are vital components of the support network for minority students.	**0**	**2**	**-1**	**2**	**-1**
37	Have an orientation that introduces the whole department to new majors so that African American students get to know the faculty and staff and vice versa.	**-3**	**-2**	**1**	**-3**	**-4**
38	Providing accurate information about the impacts and benefits that STEM has on the Black communities.	**2**	**-1**	**-1**	**1**	**-2**
39	Develop faculty-student mentoring programs.	**-1**	**0**	**-2**	**-2**	**1**
40	Find ways to discuss and demonstrate the impacts and benefits that STEM	**0**	**1**	**0**	**1**	**3**

	occupations can have for African American students.					
41	Invest in corporate internships for African American students.	**3**	**1**	**4**	**0**	**-2**
42	Ensure that anti-racist policies are widely known and supported by the institution.	**2**	**2**	**2**	**3**	**-1**
43	Intervene when there is evidence of faculty bias, conscious or unconscious, racism and prejudice.	**3**	**3**	**-3**	**1**	**1**

Table 6: Factor 1 (Institutional Support)

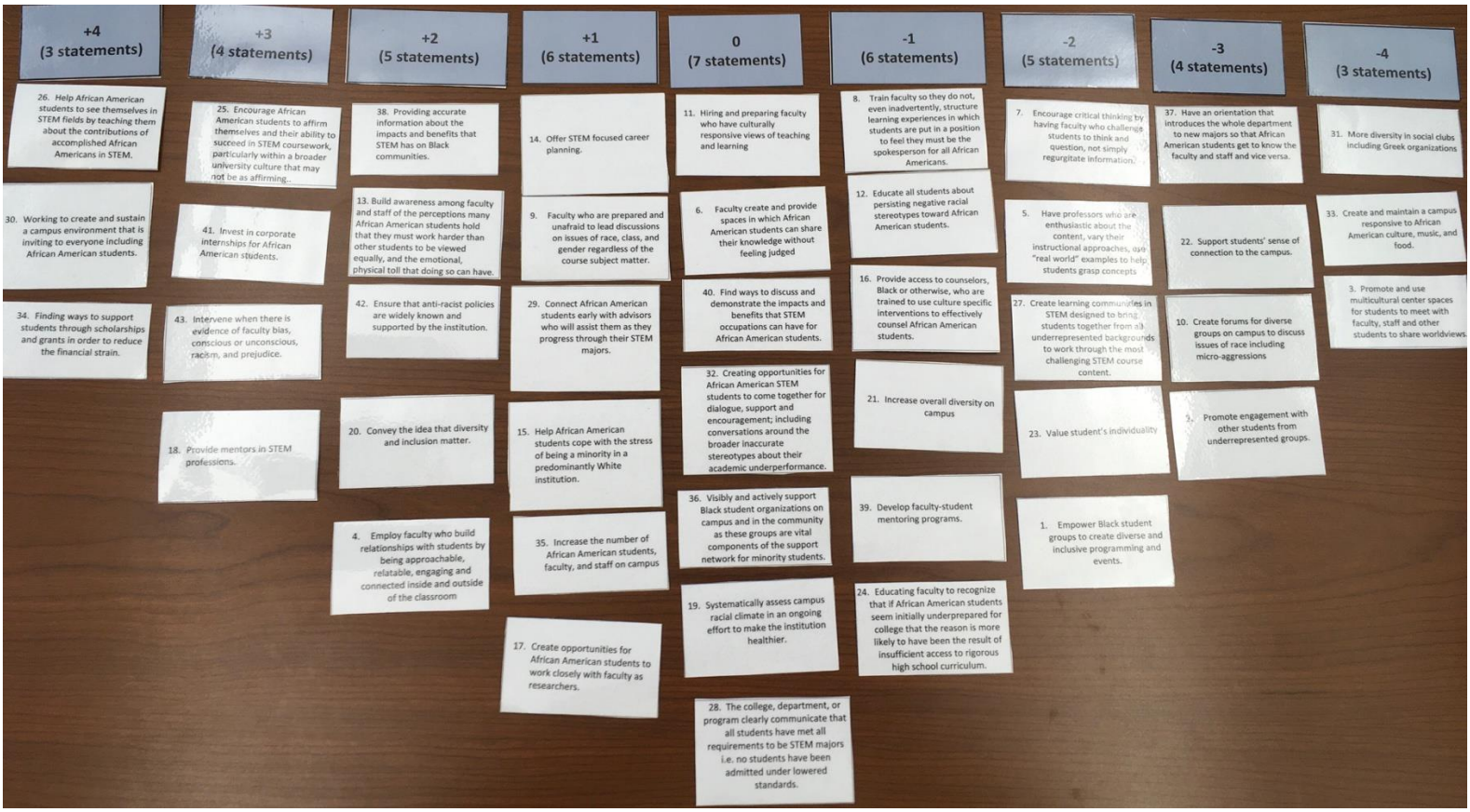


Table 7: Factor 2 (Diversity for Everyone, not just African Americans)

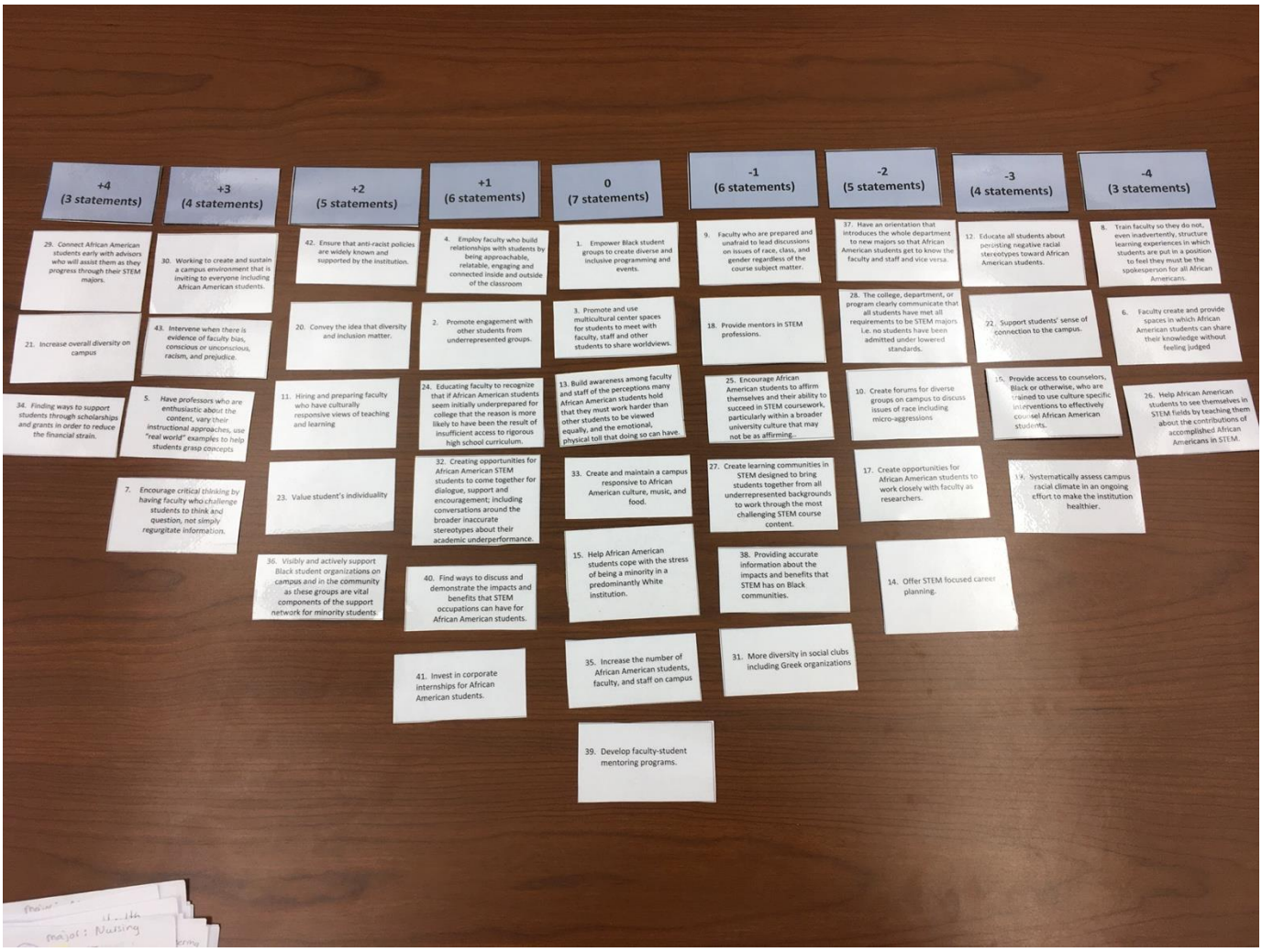


Table 8: Factor 3 (All We Need is Support from our African American Peers)

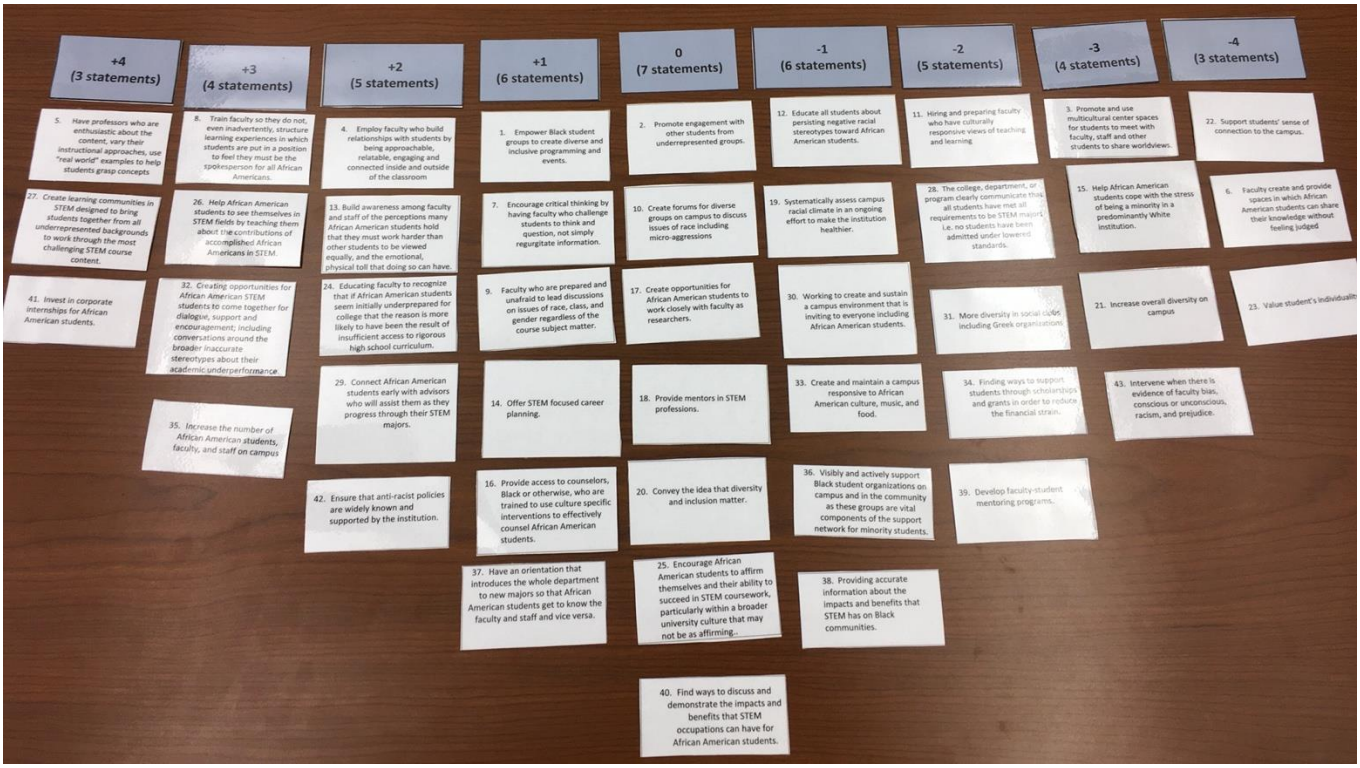


Table 9: Factor 4 (Emotional Support Needed to Increase Self-Efficacy)

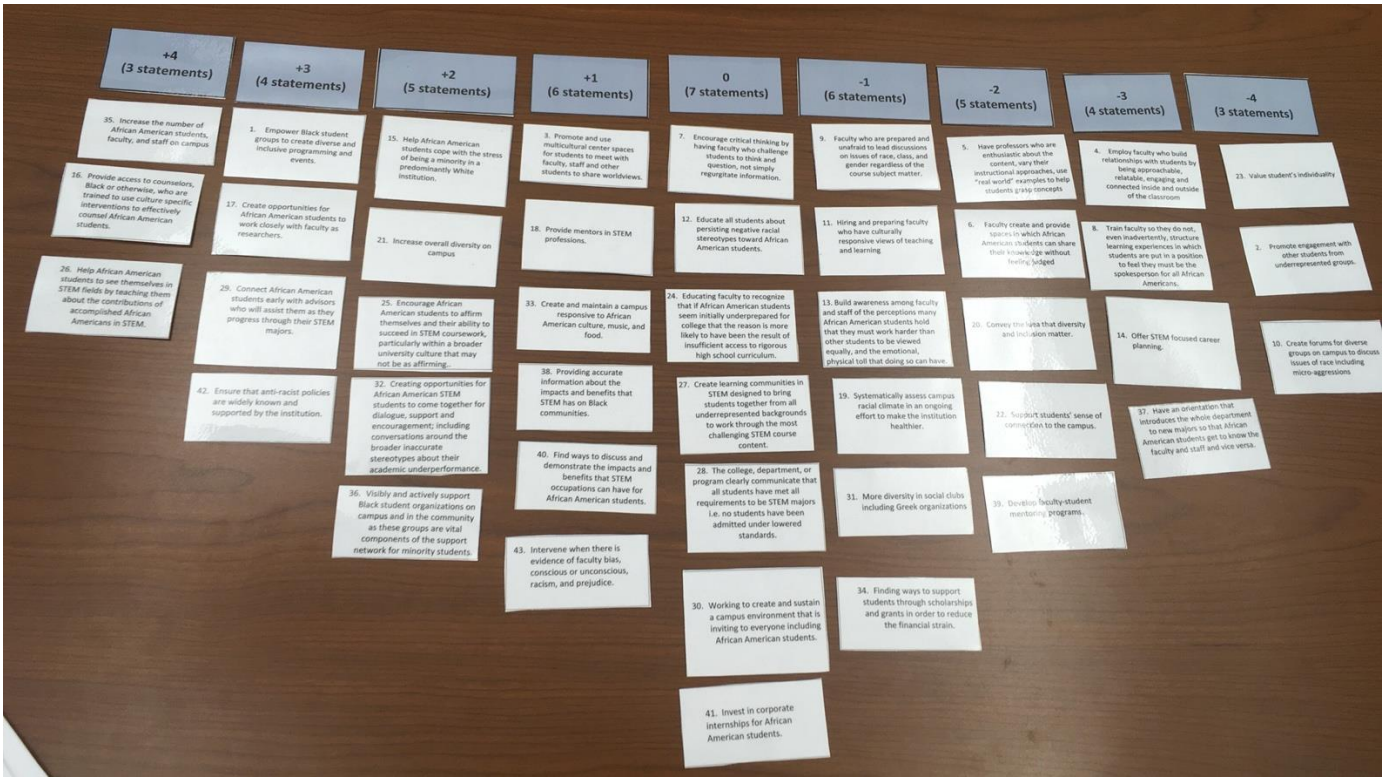
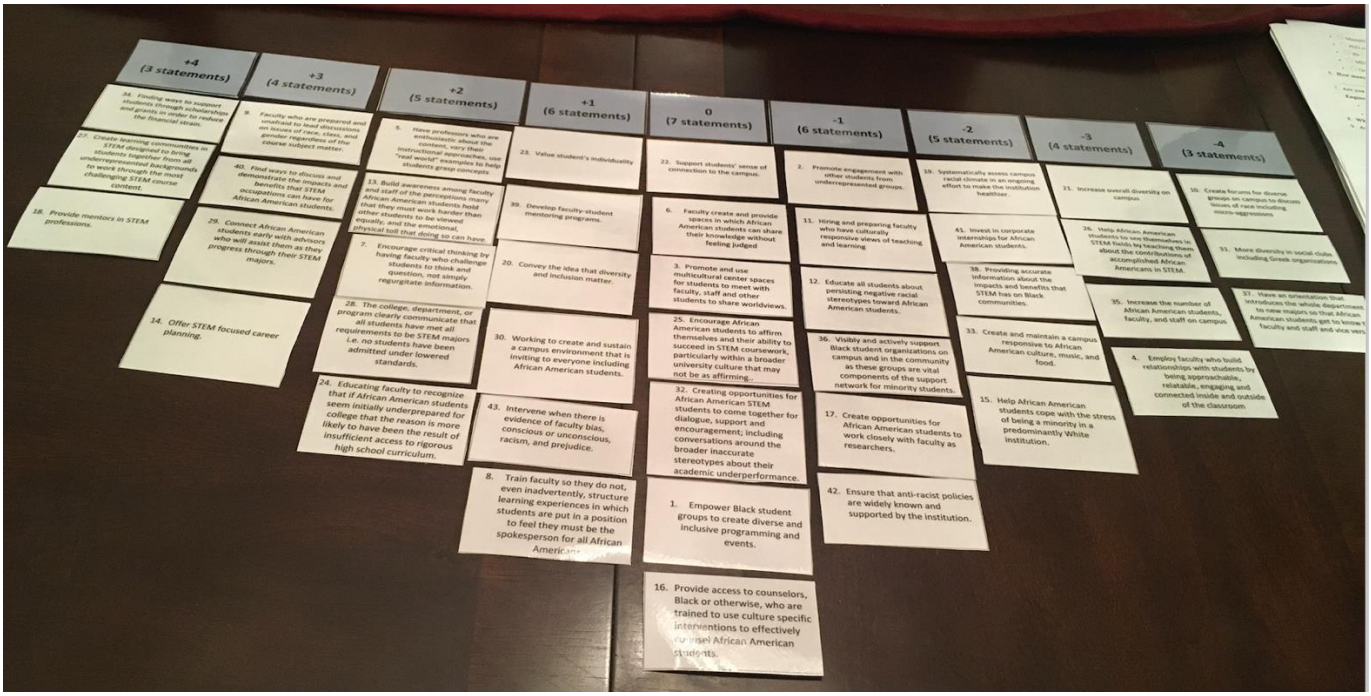


Table 10: Factor 5 (Goal Oriented, Focused on STEM Achievement)



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Appendix A. Concourse Development Questionnaire

Page 1 of 3
Dawn Washington – Principal Investigator

In the spaces below, please list and briefly describe up to eight (8) strategies that predominantly White institutions can use to support African American undergraduate students' persistence in STEM.

First strategy that predominantly White institutions can use to support African American undergraduate students attending their institution to persist in STEM (Science, Technology, Engineering, & Math).
(please list and briefly describe)

_____

_____

_____

Second strategy that predominantly White institutions can use to support African American undergraduate students attending their institution to persist in STEM (Science, Technology, Engineering, & Math).
(please list and briefly describe)

_____

_____

_____

Third strategy that predominantly White institutions can use to support African American undergraduate students attending their institution to persist in STEM (Science, Technology, Engineering, & Math).
(please list and briefly describe)

_____

_____

_____

Fourth strategy that predominantly White institutions can use to support African American undergraduate students attending their institution to persist in STEM (Science, Technology, Engineering, & Math).
(please list and briefly describe)

_____

_____

_____

Concourse Development Questionnaire – **Page 2 of 3**
Dawn Washington – Principal Investigator

Fifth strategy that predominantly White institutions can use to support African American undergraduate students attending their institution to persist in STEM (Science, Technology, Engineering, & Math).
(please list and briefly describe)

_____

_____

_____

Sixth strategy that predominantly White institutions can use to support African American undergraduate students attending their institution to persist in STEM (Science, Technology, Engineering, & Math).
(please list and briefly describe)

_____

_____

_____

Seventh strategy that predominantly White institutions can use to support African American undergraduate students attending their institution to persist in STEM (Science, Technology, Engineering, & Math).
(please list and briefly describe)

_____

_____

_____

Eighth strategy that predominantly White institutions can use to support African American undergraduate students attending their institution to persist in STEM (Science, Technology, Engineering, & Math).
(please list and briefly describe)

_____

_____

_____

Concourse Development Questionnaire – Page 3 of 3
Dawn Washington – Principal Investigator

Thank you for your responses. Could you now tell us a little bit about your background?

1. What is your sex?
    a. Female
    b. Male

2. What is your age? _____

3. What is your race/ethnicity?_____

4. Are you full time or part time?_____
5. What best describes your current level of education?

- Some high school
- High school diploma or equivalent
- Associates or other 2-year degree
- Professional trade school or apprenticeship
- Bachelors degree
- Masters degree
- PhD or EdD
- JD
- MD
- Other, please list _____

6. How many credits do you have towards completing a baccalaureate degree?

7. Are you an undergraduate student pursuing a STEM (Science, Technology, Engineering & Math) major?
    a. Yes
    b. No

8. Are you a first-generation college student?
    a. Yes
    b. No

Appendix B. Representative Q sample from the Concourse

Page 1 of 4

1. Empower Black student groups to create diverse and inclusive programming and events.	2. Promote engagement with other students from underrepresented groups.	3. Promote and use multicultural center spaces for students to meet with faculty, staff and other students to share worldviews.
4. Employ faculty who build relationships with students by being approachable, relatable, engaging and connected inside and outside of the classroom.	5. Have professors who are enthusiastic about the content, vary their instructional approaches, use "real world" examples to help students grasp concepts.	6. Faculty create and provide spaces in which African American students can share their knowledge without feeling judged.
7. Encourage critical thinking by having faculty who challenge students to think and question, not simply regurgitate information.	8. Train faculty so they do not, even inadvertently, structure learning experiences in which students are put in a position to feel they must be the spokesperson for all African Americans.	9. Faculty who are prepared and unafraid to lead discussions on issues of race, class, and gender regardless of the course subject matter.
10. Create forums for diverse groups on campus to discuss issues of race including micro-aggressions	11. Hiring and preparing faculty who have culturally responsive views of teaching and learning.	12. Educate all students about persisting negative racial stereotypes toward African American students.

Representative Q sample from the Concourse- Page 2 of 4

13. Build awareness among faculty and staff of the perceptions many African American students hold that they must work harder than other students to be viewed equally, and the emotional, physical toll that doing so can have.	14. Offer STEM focused career planning.	15. Help African American students cope with the stress of being a minority in a predominantly White institution.
16. Provide access to counselors, Black or otherwise, who are trained to use culture specific interventions to effectively counsel African American students.	17. Create opportunities for African American students to work closely with faculty as researchers.	18. Provide mentors in STEM professions.
19. Systematically assess campus racial climate in an ongoing effort to make the institution healthier.	20. Convey the idea that diversity and inclusion matter.	21. Increase overall diversity on campus
22. Support students' sense of connection to the campus.	23. Value student's individuality	. 24. Educating faculty to recognize that if African American students seem initially underprepared for college that the reason is more likely to have been the result of insufficient access to rigorous high school curriculum.

Representative Q sample from the Concourse- Page 3 of 4

25. Encourage African American students to affirm themselves and their ability to succeed in STEM coursework, particularly within a broader university culture that may not be as affirming.	26. Help African American students to see themselves in STEM fields by teaching them about the contributions of accomplished African Americans in STEM.	27. Create learning communities in STEM designed to bring students together from all underrepresented backgrounds to work through the most challenging STEM course content.
28. The college, department, or program clearly communicate that all students have met all requirements to be STEM majors i.e. no students have been admitted under lowered standards.	29. Connect African American students early with advisors who will assist them as they progress through their STEM majors.	30. Working to create and sustain a campus environment that is inviting to everyone including African American students.
31. More diversity in social clubs including Greek organizations	32. Creating opportunities for African American STEM students to come together for dialogue, support and encouragement; including conversations around the broader inaccurate stereotypes about their academic underperformance.	33. Create and maintain a campus responsive to African American culture, music, and food.
34. Finding ways to support students through scholarships and grants in order to reduce the financial strain.	35. Increase the number of African American students, faculty, and staff on campus	36. Visibly and actively support Black student organizations on campus and in the community as these groups are vital components of the support network for minority students.

Representative Q sample from the Concourse- Page 4 of 4

37. Have an orientation that introduces the whole department to new majors so that African American students get to know the faculty and staff and vice versa.	38. Providing accurate information about the. impacts and benefits that STEM has on Black communities.	39. Develop faculty-student mentoring programs.
40. Find ways to discuss and demonstrate the impacts and benefits that STEM occupations can have for African American students.	41. Invest in corporate internships for African American students.	42. Ensure that anti-racist policies are widely known and supported by the institution.
43. Intervene when there is evidence of faculty bias, conscious or unconscious, racism, and prejudice.		

Appendix C. Q Sort Data Collection Form

Page 1 of 3

1. Lay out the number cards from left to right with the negative (-) numbers on your left (see picture below):

-4 3 statements	-3 4 statements	-2 5 statements	-1 6statements	0 7 statements	+1 6 statements	+2 5 statements	+3 4 statements	+4 3 statements

2. Read through all **43** cards to become familiar with the statements.

3. As you read through the statements for a second time, organize them into three piles:

   - On the right, create a pile for the cards with statements that are you believe are like your perspective **regarding helpful strategies that predominantly White institutions can use to help undergraduate African American students persist through their STEM major?**
   - On the left, create a pile for the cards with statements that are unlike your perspectives **regarding helpful strategies that predominantly White institutions can use to help undergraduate African American students persist through their STEM major?**
   - In the middle, create a pile for the cards with statements that fall somewhere in the middle or that you are unsure about.
   - Beginning with the pile on the right, place the **three** cards that represent the *most helpful* **strategies that predominantly White institutions can use to help undergraduate African American students persist through their STEM major** and place them under the **+4** column.
   - Now, turning to your left side, place the **three** cards that represent the *least helpful* **strategies that predominantly White institutions can use to help undergraduate African American students persist through their STEM major** and place them under the **-4** column.

Q sort Data Collection Form- Page 2 of 3

4. Continue this process, working your way from the outside in, until all the cards are placed. You are free to change your mind during the sorting process and switch items around.

5. When completed, you should have the following number of cards under each row (see grid on next page):

   - You should have **three** cards under the **+4** column (most helpful) and -4 (least helpful).
   - You should have **four** cards under the **+3** column (very helpful) and -3 (not very helpful).
   - You should have **five** cards under the **+2** column (helpful) and -2 (not helpful).
   - You should have **six** cards under the **+1** and **-1** column.
   - You should have **seven** cards under the **0** column (somewhere in the middle, unsure).

Sample Q Sort Grid

-4 (3 statements)	-3 (4 statements)	-2 (5 statements)	-1 (6 statements)	0 (7 statements)	+1 (6 statements)	+2 (5 statements)	+3 (4 statements)	+4 (3 statements)

Q sort Data Collection Form- Page 3 of 3

Post-Sort Questions

1. Please briefly describe your reasoning for viewing statements that you placed under the "+4" column as being the most helpful.
2. Please briefly describe your reasoning for viewing statements that you placed under the "-4" column as being the least helpful.

Background Information

1. What is your sex?
    a. Female
    b. Male

2. What is your age? _____

3. What is your race/ethnicity?_____

4. Are you full time or part time?_____
5. What best describes your current level of education?

- Some high school
- High school diploma or equivalent
- Associates or other 2-year degree
- Professional trade school or apprenticeship
- Bachelors degree
- Masters degree
- PhD or EdD
- JD
- MD
- Other, please list _____

6. How many credits do you have towards completing a baccalaureate degree?

7. Are you an undergraduate student pursuing a STEM (Science, Technology, Engineering & Math) major?
    a. Yes
    b. No

8. Are you a first-generation college student?
    a. Yes
    b. No

Appendix D. Informed Consent Form (Q sort)

Welcome to this collective exploration of people's perspectives toward strategies that predominantly White institutions could use to support African American STEM persistence.

In order to better understand the strategies that institutions could use to support African American STEM persistence, you, as an undergraduate student taking STEM courses, are invited to participate in the following anonymous sorting activity.

I would like you to sort 43 different statements representing a distinct viewpoint on strategies that predominantly White institutions could use to help support African American undergraduate STEM persistence. It is estimated that this sorting process will take 30-40 minutes to complete. Notably, these statements were assembled from responses collected from thirteen people, professional literature, and social media. That process yielded over 113 responses which were then sculpted down into a representative sample that I hope is deep and broad enough for you to find statements to best represent your viewpoint. Many of you contributed to these statements so you may very well see one of your own statements here.

You must be 18 years or older to take part in this research study. Also, your participation is completely voluntary; you may withdraw at any time during the process. All responses will be anonymous, as no personally identifiable data will be collected. Following data collection, all data and findings resulting from this study that are eventually described in writing or presented publicly will only be in the aggregate. In compliance with IRB requirements and to ensure data security, your responses will be stored on a secure server and destroyed at the culmination of this research.

There are no foreseeable risks, direct benefits, or compensation for participating in this study. However, your participation in this research may lead to a general advancement in how we understand the strategies that predominantly White institutions might use in to support African American STEM persistence.

The University of North Florida Institutional Review Board has approved this research study. If you have any concerns, questions, or requests regarding your rights as a participant, please contact the University of North Florida's Institutional Review Board directly at 904-620-2498 or via email at irb@unf.edu. Should you have any questions regarding the design or purpose of this study or the research approach I am using, please feel free to contact Dr. Chris Janson, UNF Faculty Research Advisor at (904) 620-1520 or me, Dawn Washington at dwashing@fscj.edu.

Completion of this Q sort and the accompanying requests for demographic and background information indicates that you have read the information describing the process and consent to take part in the research.

A few last notes: 1) This online process currently cannot be completed with a tablet or smartphone, 2) It will take up to 30 minutes, 3) No identifying data will be collected from you and all results will only be shown in the aggregate, and 4) I appreciate your help here - very much!

Thanks again for your time and participation. I think this research is important and is very timely. Your contributions are crucial.

Sincerely,

Dawn Washington

Appendix E. IRB Approval Letter

Page 1 of 2

UNF
UNIVERSITY of NORTH FLORIDA.
Office of Research and Sponsored Programs
1 UNF Drive
Jacksonville, FL 32224-2665
904-620-2455 FAX 904-620-2457
Equal Opportunity/Equal Access/Affirmative Action Institution

MEMORANDUM

UNF IRB Number: 1465345-1
Exemption Date: 10-15-2019
Processed on behalf of UNF's IRB

DATE: October 15, 2019

TO: Ms. Dawn Washington

VIA: Dr. Christopher Janson
Leadership, School Counseling & Sport Management

FROM: Dr. Jennifer Wesely, Chairperson
UNF Institutional Review Board

RE: Declaration of Exempt Status for IRB#1465345-1
"Lift Every Voice: Using Q Methodology to Understand the Shared Perspectives of African American Undergraduate STEM Majors."

Your research study, " Lift Every Voice: Using Q Methodology to Understand the Shared Perspectives of African American Undergraduate STEM Majors," was reviewed on behalf of the UNF Institutional Review Board and has been declared exempt under categories 2 and 3. Criteria defined at 45 CFR 46 for this classification are as follows:

Exempt Category 2:
Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:

(i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects;

(ii) Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or

(iii) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by §46.111(a)(7).

IRB Approval Letter- Page 2 of 2

Exempt Category 3:
Research involving benign behavioral interventions in conjunction with the collection of information from an adult subject through verbal or written responses (including data entry) or audiovisual recording if the subject prospectively agrees to the intervention and information collection and at least one of the following criteria is met:

(i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects;

(ii) Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or

(iii) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by §46.111(a)(7).

Please be advised that any subject complaints, unanticipated problems, or adverse events that occur are to be reported to the IRB as soon as practicable, but no later than 3 business days following the occurrence. Please use the Event Report Form to submit information about such events.

While the exempt status is effective for the life of the study, any substantive changes must be submitted to the IRB for prospective review, including personnel changes. In some circumstances, changes to the protocol may result in alteration of the IRB review classification.

To submit an amendment to your approved protocol, please complete an Amendment Request Document and upload it along with any updated materials affected by the changes via a new package in IRBNet. For additional guidance on submitting an amendment, please contact the IRB administrator.

Upon completion of this study, please submit a Closing Report Form as a new package in IRBNet. Please maintain copies of all research-related materials for a minimum of 3 years following study closure. These records include the IRB-approved protocol, approval memo, questionnaires, survey instruments, consent forms, and all IRB correspondence.

Should you have questions regarding your study or any other IRB issues, please contact the Research Integrity unit of the Office of Research and Sponsored Programs by emailing IRB@unf.edu or calling (904) 620-2455.

UNF IRB Number: 1465345-1
Exemption Date: 10-15-2019
Processed on behalf of UNF's IRB