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EXPERIENCES OF BLACK WOMEN STUDENTS IN SCIENCE, TECHNOLOGY,
ENGINEERING, AND MATHEMATICS AT A HISTORICALLY WHITE
INSTITUTION IN THE UNITED STATES OF AMERICA: A MULTIPLE CASE
STUDY

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DOROTHY BEAUTY NKHATA
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A DISSERTATION APPROVED FOR THE
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BY

Dr. T. Elon Dancy II, Chair

Dr. Zermarie Deacon

Dr. Kelvin White

Dr. Kirsten Edwards

Dr. Junghwan Kim

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Dedication

I dedicate this dissertation to all who, unlike myself, have been denied access to higher education due to actions of those who abuse their positions of power. I am comforted by the fact that the Creator of heaven and earth, our Creator, will not let these injustices go on forever (Psalm 37: 9, 10, 11, 29). I look forward to the time when everyone will be taught by God himself (John 6:45; Isaiah 54:13).

As you will notice in the findings, many of the students I interviewed for this study were unaware of the forms of supports available (or appropriate to ask for) at their institution. It is my hope that Black women students who might read this dissertation will feel empowered with the culturally appropriate ways of seeking support in HWI environments for their own success. I dedicate this and my future work to all the women students who participated.

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Abstract

The purpose of the study was to understand the experiences of Black women students in science, technology, engineering, and mathematics (STEM) at a historically White institution (HWI) with the goal of making recommendations for changes at various levels of the institution. The study sought to answer two overarching research questions: (1) What are the experiences of Black women students in STEM departments at HWIs? (2) In what ways might HWIs and STEM departments influence those experiences? The study employed multiple case study methodology with intersectionality as a multilevel analytical tool to understand Black women students' experiences. The study identified beliefs, policies, and practices that complicated Black women's persistence in STEM majors. A major complication was the inequitable engagement of Black women students in co-curricular and extracurricular STEM initiatives for educational enrichment. These findings, which have implications for policy, practice, and future research, are related to the fact that the demographic composition of most STEM departments at this institution could be described as "too White and too male."

Chapter 1: Introduction

This study explored the underrepresentation of Black women students in science, technology, engineering, and mathematics (STEM) majors. The purpose of the study was to understand the experiences of Black women students in STEM at a historically White institution (HWI) with the goal of making recommendations for changes at various levels of the institution.

Because of the complexity Black women students' experiences, and my desire to situate those experiences within the organizational (institutional) and historic contexts, I utilized multiple case study methodology (Stake, 1995, 2005) with intersectionality as a multilevel analytical tool (Collins, 2015; Collins & Bilge, 2016; Crenshaw, 1989, 1991) to understand the experiences of 20 Black women students who were majoring in STEM at one large HWI.

Given that the goal was for the study findings to be useful to higher education policy makers, administrators, and faculty in the hopes of improving the experiences of Black women students in STEM at HWIs in the United States, I collected data from multiple sources through interviews, observations, and documents. Observations focused on curricular, co-curricular, as well as extra-curricular activities, and events organized by STEM departments, colleges, student organizations, and administrative departments at the HWI. Findings confirmed the fact that in spite of commonalities, experiences of Black women students in STEM are not homogenous; rather, they are uniquely shaped by personal, institutional, and organizational factors in intricate ways.

In this chapter, I provide an overview of the global context and background to the study. Next, I present the problem statement, study purpose and conclude with the research questions that guided the study.

Background

Globally, the underrepresentation of women in STEM disciplines and occupations has been widely documented. Despite efforts to increase participation of women in these male-dominated fields, equity is still an issue (Adam, 2002; Carnevale, Smith, & Strohl, 2010; Davis, 2001; Kohlstedt, 2004; Martineau, 1998). More recently, the underrepresentation of women in STEM fields has resulted in numerous policy statements from leaders of global organizations who are committed to uplifting women's status in society (Malcom, 2000; Smith, 2008). In connection with the need for more women to be in STEM fields, former Deputy Secretary-General for the Commonwealth, Ransford Smith, (2008) made the following statement:

Gender inequality is now generally recognised [sic] not only as a human rights issue but also as a barrier to poverty reduction and economic growth. Evidence from around the world shows that investments in women pay off in terms of both their own and their families' health, education and wellbeing. Moreover... increasing the number of women ... can reduce corruption and have significant benefits for society as a whole; and addressing social and cultural norms that allow continued unequal and exploitative power relations can reduce the spread of HIV. (p.ix)

Smith's statement is consistent with the feminist criticism of "the structures of power-knowledge in western societies ... historically rooted in an ancient taken-for-granted biological determinism," which portrays women as "creature[s] without authority," even on issues that affect them (Code, 1991, p. 181). In contrast, Smith and many influential leaders agree that the low participation of women in science is "not just a problem for them... but also for [any]...country, business, and society as a whole"

(Adam, 2002, p. 453). However, research shows that there has been slow progress toward improving the situation for poor women around the globe (Malcom, 2000; Smith, 2008).

Reports indicate that among all racial groups and at every level of education in the United States, women earn more degrees than men (American Council on Education (ACE), 2010). For instance, in 2007, women in the United States of America (U.S.) earned approximately 57%, 60%, and slightly more than 50% of all bachelor's, master's, and doctoral degrees respectively (Ryu, 2010). Yet, when broken down by field of study the same findings reveal significant gender and racial inequalities (American Association of University Women [AAUW], 2008; ACE, Ryu, 2010), with men receiving 65% of bachelor's degrees across all STEM fields combined (Ryu, 2010). Furthermore, despite the call for a more diverse workforce, disproportionately lower STEM degree attainment for Black women across institution types, such as community colleges, minority-serving institutions, and those with highly-selective admissions criteria has been reported (Allan, 2011, Pasque & Nicholson, 2011). Thus, higher education institutions remain highly gendered and racialized and thereby reproducing domination and oppression of historically undervalued people (Esler, 2009; Mabokela & Mawila, 2004). Scholars agree that there are systematic disparities in higher education, which put historically disadvantaged people at further socioeconomic disadvantage (Alfred & Swaminathan, 2004; Anderson, 2012; Andersen & Collins, 2010; Bensimon & Bishop, 2012; Collins, 2000; Esler, 2009; Espino, 2012, 2015; Forsyth & Furlong, 2003; Garces, 2012; Harper, 2011, 2012; hooks, 1989, 2000; Pena, 2012; Mabokela & Mawila, 2004). In spite of many arguments, interventions, and

support initiatives promoting racial and ethnic diversity in higher education (AAUW, 2008; Bowman, 2010; Gurin, Dey, Harper & Hurtado, 2007; Hurtado, & Gurin, 2002; Hurtado, Milem, Clayton-Pedersen, & Allen, 1998), improvements have been minimal for Black women in higher education and in STEM.

Higher attrition rates among Black students, especially Black women have been reported (AAUW, 2008; National Center for Education Statistics (NCES), 2009; National Science Foundation (NSF), 2012; NSB, 2010; Ryu, 2010). Although women still outnumber men in undergraduate enrollments for every racial and ethnic group (NSB, 2010), Black women continue to be the least represented in STEM majors (Ryu, 2010). Furthermore, research shows that a large proportion of students who dropped out of U.S. higher education were Black women, with a 35% dropout rate for those who entered STEM programs (AAUW, 2008; NCES, 2009).

Statement of the Problem

While some have argued that the underrepresentation of Black women in STEM academic programs is a result of their own natural aversion of science and math-related subjects—which leads to their apparent persistence only in other non-math-intensive programs—a number of scholars contend that there are other factors that need to be studied (NCE, 2000; Ong, Wright, Espinosa, & Orfield, 2011). It is not just the nature or rigor of mathematics or physical science courses that keeps Black women from persisting in STEM disciplines, but rather, because of a long history of oppression, Black women have unique college experiences in STEM, even distinct from the majority of fellow Women of color (Collins, 2000; Jean-Marie, 2011; Solorzano, Ceja, & Yosso, 2000).

As some researchers insist, Black women students regardless of their national origin are likely to encounter neoliberal and institutionalized racist policies and practices that intersect in multiple ways, thereby marginalizing and limiting their educational experiences at higher education and postsecondary institutions (Solorzano, Ceja, & Yosso, 2000; Banks, 2009; Winkle-Wagner, 2009; Xie & Shaumann, 2003).

Therefore, there is a need for a multilevel analysis of experiences of Black women in STEM higher education, to understand how the intersections of race, gender, class, and other identities and higher and postsecondary organizational environments interact to complicate these experiences. At the moment, there is a paucity of studies of Black women students in STEM utilizing research frameworks that account for interactions of power, belief systems, identities, and individual characteristics that affect students as they develop into scientists (Collins, 2000, 2015; Collins & Bilge, 2016; Museus & Griffin, 2009).

Moreover, the majority of studies on Black women in higher education have focused on the study of identity at the individual level (Choo & Ferree, 2009; Collins, 2015). Without intentionally focusing on the diversity within Black women at U.S. higher education institutions, such studies fall short of exposing the ways in which the intersections of identities and higher and postsecondary organizational environments complicate Black women's experiences in STEM. This dissertation study is an attempt to fill this gap through an innovative multilevel approach to the study of experiences of Black women students in STEM at a HWI (Collins & Bilge, 2016; Dill & Zambrana, 2009; Stake, 1995, 2005a, 2005b).

Purpose of the Study

In spite of commonalities, experiences of Black women students in STEM are not homogenous; rather, they are uniquely shaped by personal, institutional, and organizational factors in intricate ways. The purpose of this study was to understand the complex experiences of Black women students in STEM so as to make recommendations for changes at various levels of a HWI. To do this, I used Stake's (2005) multiple case study design along with an intersectional framework. I utilized intersectionality theory to guide multilevel data collection, analysis, and interpretation of findings (Collins, 2015; Crenshaw, 1989, 1991; Dill & Zambrana, 2009; McCall, 2005).

Given that Black women students in U.S. higher education are a diverse group comprising different ages, abilities, nationalities and ethnicities, an intersectional analysis allows researchers to represent their complex experiences. In the United States, "Black" is a term used to describe people of African descent including, African immigrant and nonimmigrants; Caribbean immigrant and nonimmigrants; and African Americans (Alfred, 2003, 2005; Alfred & Swaminathan, 2003, 2004). Although there are significant cultural, religious, and linguistic differences among different groups of Black people, they view themselves as connected by their common history of oppression through imperialism, colonialism, patriarchy, capitalism, and slavery, and as part of the African diaspora (hooks, 2000, 2004; Moyo, 2004). Within the context of this dissertation, Black women students included those who were citizens of the United States of America (African Americans) and African international students (F-1 visa nonimmigrants). I also use the term "immigrant" to refer to Black women students who

are immigrants or have an immigrant parent (permanent residents or citizens of the United States) to distinguish this group from African American students who are descendants of slaves (Alfred, 2003, 2005). These distinctions are important because immigration studies indicate that the majority of immigrants in the United States and around the globe maintain a “transnational” or “dual-place orientation” whereby they maintain strong ties with their countries of origin (Alfred, 2005, p.5).

As indicated earlier, in spite of their differences, Black women have historically been oppressed by an overarching influential political system of domination described as imperialist White supremacist capitalist patriarchy (hooks, 2000, 2003, 2004). Therefore, to allow the reader to draw parallels between precolonial, colonial, slavery, and “postcolonial” educational experiences of Black women in African and U.S. contexts, I also used a historical lens. In this way, I hoped to situate individual Black women students’ experiences within the larger programmatic, departmental, and institutional contexts. Thus, this study highlights the role of higher education institutions and their STEM departments in facilitating and/or hindering the academic success of Black women students as they contend with multiple forces that shape educational environments and experiences in predominantly White contexts (Astin, 1975, 1977, 1984, 1985, 1993, 1999; Palmer, Maramba, & Dancy, 2011; Tierney, 2000; Tinto, 1986, 1993; Wolf-Wendel, Ward, & Kinzie, 2009). The ultimate goal was for this study to be useful to higher education policy makers, administrators, and faculty in the hopes of improving the experiences of Black women students in STEM at Historically White postsecondary institutions (HWIs).

Conceptually, I organized my study around the orienting research questions,

1. What are the experiences of Black women students in STEM departments at HWIs?
2. In what ways might HWIs and STEM departments influence those experiences?

Significance of the Study

Research shows that Higher education and STEM are highly gendered and racialized enterprises, and so is STEM education (Brainard & Carlin, 1998; Espinosa, 2011; Malcom & Malcom, 2011; Ong, 2010; Ong et al., 2011; Reyes, 2011; Turner et al., 2011). Yet, equitable solutions to world problems require input from the most qualified individuals representing all population groups. Therefore, there needs to be increased access to STEM education for people of all genders, races, abilities, and nationalities regardless of their social status.

Because current efforts to increase women of color's access to and persistence in STEM majors rely on studies that have overlooked the complexities of their experiences, the resulting STEM education initiatives at many college campuses have proved ineffective in serving their unique needs (Johnson, 2005; Ong et al, 2011). Not surprisingly, women of color, especially Black women continue to be underrepresented in STEM fields. However, the underrepresentation of Black women STEM fields stems from their underrepresentation in STEM majors at the graduate level, which leads to underrepresentation at the instructor and professor ranks.

Further, research indicates that lack of Black and/or Black women faculty contributes to inadequate of attentiveness to Black women students' complex needs at HWIs and the lack of role models (Gasman & Perna, 2011). Still, increasing the proportion of Black women graduates who choose to pursue faculty careers depends on

the quality of their experiences in STEM at the undergraduate and graduate student levels. Recognition of this fact has resulted in increased focus on creating institutional programs for attracting and retaining underrepresented student groups at the undergraduate level. These retention efforts include bridge programs, support services and enrichment programs for underrepresented students, tutoring, and scholarships (Seymour & Hewitt, 1997; Seymour, 2001).

Although these initiatives have proved beneficial at the undergraduate level, there is need for more structured and mentored academic programs that influence student's desires to pursue graduate education. Specifically, the programs that have proved successful at influencing the students' likelihood of choosing to continue at the graduate level are those that provide opportunities for them to interact with their peers, faculty, to foster a strong sense of belonging to a community of STEM students (Eagan et al, 2013; Strayhorn, 2010, 2011). Therefore, this study was designed to target the complexities of the experiences of diverse Black women students to identify and provide understanding of the gaps in Black women students' engagement in STEM co-curricular and curricular activities at their HWIs to inform theory, policy, research, and practice.

First, this study is significant because the inclusion of Black women students from around the globe serves to extend conversations regarding experiences of diverse Black women in US higher education. In this way, I engage Black intellectuals to consider ways of contributing to the success of all Black women in STEM. Second, because the study provides a nuanced understanding of how Black women students' identities introduce complexity to their experiences in STEM education, it offers

implications for effective engagement for Black women students and informs efforts to contribute to the diversification of the global STEM workforce (Kuh, 2015; Patton, Renn, Guido, & Quaye, 2016; Eagan et al., 2013; Seymour, 2002). Third, the study recommends effective collaborations between faculty, staff, and administrators as they seek to leverage existing resources for supporting Black women students' transitions into STEM majors and graduate and professional schools. Fourth, the study is significant for informing future research on diverse student populations at HWIs, in particular on Black women in STEM. Lastly, Black women who will read this dissertation will gain an understanding of the culturally appropriate ways of asking for help in predominantly male, White, and/or foreign environments.

In Chapter 2, I present the theoretical framework followed by the methodology and research approach in Chapter 3. Chapter 4 focuses on the cross-case findings that resulted from the in-depth interviews with Black women students supported by additional evidence from other data sources for triangulation. I then discuss the findings utilizing my theoretical framework in Chapter 5 and provide implications, recommendations, and conclusions.

Chapter 2: Theoretical Framework

Even in the 21st century, a study of experiences of underprivileged people must necessarily be informed by knowledge of the past. Because past experiences stand as “experiments already made with life,” they can guide just interpretations of research findings, thereby validating experiences of those being studied (Davies, 2006, p.41). It is by first digging deeper into the past that we can hope to inform those who are committed to improving human relations between the historically oppressed and the historically privileged.

First, I present the theoretical framework that guided this study, namely intersectionality. I chose intersectionality as an analytic tool because it allows a deeper analysis of human experiences, especially those of historically oppressed people such as Black women (Collins, 1990, 2000; Crenshaw, 1989, 1991; Collins & Bilge, 2016). Next, I provide a synthesis of the historical educational experiences of Black women in their pursuits of education in various African and U. S. contexts. Finally, I discuss empirical studies that inform the topic of Black women’s experiences in STEM at HWIs in the U.S.A. In this way, the literature review highlights the educational experiences of Black women, including how they were influenced by sociohistorical, intellectual, and political contexts. As feminist scholars of the Africana Diaspora (Africana feminists)¹ have indicated, there are commonalities in the lived experiences of Africana under colonialism and slavery (Alfred, 2004, 2005; Jean-Marie, 2011; Norwood, 2013).

According to Norwood,

¹ According to Carolette Norwood (2013), the term “Africana” encompasses Africa and its Diaspora. “The Africana Diaspora refers to the European colonized territories where African slaves were shipped. This includes the Americas (North, South, and Central), as well as the West Indies.”

Although African women's experiences are geographically diverse, the commonality of their struggles [with multiple oppressions] unifies them in unique ways. Perhaps the most important common thread among these various geographical regions is the shared (but varied) experience of colonial subjugation. (Norwood, 2013, p. 225)

Intersectionality

Intersectionality is grounded in the fact that intersecting systems of race, class, gender, sexual orientation, nationality, and age (at the individual level) form interlocking systems of privilege and oppression, which shape patterns of social interaction at all levels (Collins, 1990, 2000) of human ecology. Not surprisingly, intersectionality has risen to the level of a “critical analytic interdisciplinary tool to interrogate racial, ethnic, class, and gender disparities and to contest existing ways of looking at disparities” (Dill & Zambrana, 2009, p.2). The origins of intersectionality can be traced back to 19th century Black feminist politics. As part of a broader social and political movement of women of color, African Black women scholars articulated standpoints that were implicit in discussions of oppression and civil rights struggles of marginalized people including, Latino/a-Chicano/a Americans, Asian Americans, and working class marginalized groups and individuals (Barnett, 2009; Brewer, 1999; Collins, 2011, 2012; Collins & Bilge, 2016; Crenshaw, 1989, 1991; Christian, 2000; Dill & Zambrana, 2009).

Although scholars emphasized the need to center experiences of Black women and Women of color in earlier publications, more recently, they have increasingly indicated the need for more inclusive conceptualizations of intersectionality, making it accessible to researchers and activists of all population groups (Collins & Bilge, 2016; Hancock, 2007; McCall, 2005). Hence, intersectionality has become recognized by

scholars in many fields such as law (Crenshaw, 1991), sociology (Choo & Feree, 2010), political science (Hancock, 2007), and higher education (Dill & Zambrana, 2009).

In this study, I utilized an intersectional framework that allowed a multi-level analysis of how institutional and STEM departmental policies, programs, and practices influenced the experiences of Black women STEM majors at a HWI in relation to their underrepresentation in STEM fields (Collins, 2015; Collins & Bilge, 2016). Collins and Bilge (2016) found that although many studies do not claim an intersectional framework, they emphasize one or more themes that are consistent with intersectionality. The six core themes or frameworks evident in studies that utilize intersectionality as an analytic tool are inequality, relationality, social context, complexity, social justice, and power (Collins & Bilge, 2016).

Scholars also agree that historically, people of color in the United States of America have faced discrimination based on their not being White (Lee & Johnson-Bailey, 2004). Often such discrimination has also been linked to their low socioeconomic status as a result of systemic patterns of disinvestment among the various groups of people of color (Dill & Zambrana, 2009). Consequently, intersectional researchers need to go beyond single-category analyses, to more comprehensive approaches whereby individual identities such as race, gender, and class are viewed as interacting to complicate inequality for individuals and groups of people (Collins & Bilge, 2016). “Class-only” or “race-only” analyses cannot provide sufficient explanations of inequality (Collins & Bilge, 2016).

Consistent with the need for a more nuanced understanding of experiences of Black women students in relation to their underrepresentation in STEM, this study was

guided by intersectionality theory (Collins, 2000; Crenshaw, 1989; Dill & Zambrana, 2009), and historical perspectives (Collins, 1990, 2000; hooks, 2004). Another ecological framework—Bronfenbrenner’s theory— exists and is applicable to understanding experiences Black women while in college and across their lifespan (Bronfenbrenner, 1994; Elder, 1974; Renn, 2004). As Bronfenbrenner (1994) maintains, in connection with human experience, it is critical to “consider the entire ecological system in which [human development] growth occurs” (p. 5). Because postsecondary institutions form significant part of a student’s ecological system, they are an important context for understanding significant developmental processes such as identity development (Renn, 2004), including professional and STEM identity development (Nkhata & Pasque, 2012). However, Bronfenbrenner’s ecological theory is limited in that it is not explicit about the need for interrogation of power and privilege in connection with experiences of historically marginalized people.

Intersectional frameworks encourage examination of relationships among systems of privilege/oppression such as race, class, or gender in light of the social context. Considering social context is useful because it requires scholars/activists to be aware of the importance of grounding their analyses within the historical, intellectual, and political contexts that shape what we think and do. Doing so takes into account the fact that different people in the same general social context may hold different understandings of it (Collins & Bilge, 2016). Because inequality, relationality, social context, and power are intertwined, using intersectionality as an analytic tool also introduces complexity into the analysis of people’s experiences (Collins & Bilge, 2016).

Social justice is the aim of intersectional analyses. Given that intersectionality “validates the lives and stories of previously ignored groups of people, it is seen as a tool that can be used to help empower communities and people in them” (Dill & Zambrana, 2009, p. 12). However, although the terms “social justice” and “social inequality” may sometimes be rendered synonymous, Collins and Bilge (2016) contend that using intersectionality as an analytic tool in and of itself may not necessarily result in social justice. Therefore, they recommend interrogating each social justice project for its social justice claims, “Not just assuming that because intersectional scholarship examines some facet of social inequality, it is by default furthering social justice” (p.202).

Power Domains

The power domains framework underscores the fact that “People’s lives and identities are generally shaped by many factors in diverse and mutually influencing ways... [so that] there is no pure racism or sexism. Rather, power relations of racism and sexism gain meaning in relation to one another,” and must necessarily be analyzed both through intersections, such as of race and gender, as well as across the domains of power (Collins & Bilge, 2016, p. 26). There are four domains or levels at which power operates, and these are interpersonal, disciplinary, cultural, and structural. All these levels are equally important and must be unveiled in order for intersectional work to result in social justice (Collins, 2000, 2009; Collins & Bilge, 2016; Crenshaw, 1989, 1991; Dill & Zambrana, 2009).

At the interpersonal level, intersectionality helps to highlight the multiplicity of individual identities; and how combinations of identities such as race, gender, and

citizen classifications interact to shape individual and group experiences (Collins & Bilge, 2016). Moreover, multiple social groups to which an individual belongs may also function to silence the voices of those who are at the intersections of those social groups as members of the dominant group choose to ignore political agendas that serve those at the intersections (Collins, 2000; Collins & Bilge, 2016; Crenshaw, 1991; Museus & Griffin, 2011; Shields, 2008). Disciplinary power operates in ways that discipline people to view certain options as feasible for some and not for others. In this domain, rules are used to exclude some people from participating in profitable enterprises such as STEM education.

The ideas manufactured at cultural level of power serve to normalize inequality. This is the symbolic dimension of oppression characterized by “widespread, societally-sanctioned ideologies used to justify relations of domination and subordination” (Collins, 1993, p. 32). The representations that are created for marginalized groups may take the form of myths, controlling images, or messages that make people believe (for example) that “all competitions are fair, and that any resulting patterns of winners and losers have been fairly accomplished” (Collins & bilge, 2016, p.11). Thus, representational intersectionality (at cultural level) connotes the use of stereotypes that reinforce externally defined identities to create perceptions of superiority or inferiority among groups and individuals, which encourage certain political stances (Collins, 1993; Dill & Zambrana, 2009). The historical experiences of Black women serve as painful illustrations of such offensive images and narratives (Collins, 2000; White, 1999).

Some Myths about Black Women in the United State of America

Scholars who have analyzed myths and misconceptions about Black people agree that the most enduring reprehensible stereotypical representations that were created three decades prior to the Civil War were the “mammy” and “Jezebel” (White, 1999; Collins, 2000; White, 1999; Conrad, 1947); other myths—such as “Matriarch, Emasculator and Hot Momma. ...Sister, Pretty Baby, Auntie, Mammy and Girl. ... Unwed Mother, Welfare Recipient and Inner City Consumer” (Harris, 1982, p. 4); the mule and the whore (Collins, 2010) — all revolve around the mammy and Jezebel constructions.

Although some of these images, Matriarch and Emasculator, for example connote power and control, slave women had relatively no power over White people. Therefore, as many scholars have argued, these images existed in the minds of Southern Whites and are misleading because they are based on misperceptions and contradictions rather than in reality (White, 1999; Conrad, 1947). For instance, the term Jezebel (originally the name of the immoral evil queen who was married to the Israelite King Ahab), encouraged the wrong view of the Black woman as a “person entirely governed by her libido” (White, 1999, p. 29). This antithesis of “true womanhood,” (Perkins, 1983, p. 18) was created by misrepresenting Blacks, especially women.

Nevertheless, my study of the life of Black women during slavery revealed that “the conditions under which Black women worked, were sold, and were punished...fostered an atmosphere conducive such thoughts” (White, 1999, p. 31). There is documentation indicating that: (1) Black women’s bodies were exposed at auction to prove their fertility; (2) lack of proper clothing also left some of them almost

naked as they worked in the fields; (3) the work itself often required women to roll up their dresses or skirts to keep them out of the dirt, mud, and water; (4) whippings of slave women and girls by White men also exposed their bodies (White, 1999). Taken together, these conditions reinforced the view of Black women as promiscuous. Perhaps what reinforced the jezebel image the most was the fact that the “choice put before many slave women was between miscegenation and the worst experiences that slavery had to offer” (White, 1999, p. 34).

In the case of the Mammy, she

was considered [or portrayed as] self-respecting, independent, loyal, forward, gentle, captious, affectionate, true, strong, just, warm-hearted, compassionate-hearted, fearless, popular, brave, good, pious, quick-witted, capable, thrifty, proud, regal, courageous, superior, skillful, tender, queenly, dignified, neat, quick, tender, competent, possessed with a temper, trustworthy, faithful, patient, tyrannical, sensible, discreet, efficient, careful, harsh, devoted, truthful, neither apish nor servile. (Parkhurst, 1938, pp. 352- 353)

In other words, Mammy was “the woman who could do anything, and do it better than anyone else [superwoman] (White, 1999, p. 47). Mammy was a Black woman who was specially “trained...in the point of honesty, morality, and intelligence” to do housework including, nursing and teaching White children in the plantation’s big houses (No Author, quoted in White, 1999, p. 46).

Apparently, Mammy was given just enough education for her to teach White children (White, 1999; Conrad, 1947). It is also noteworthy that although these images were specifically conferred on Black women, they have implications for the whole Black race—given that these images also served to reinforce the view of Black men as hypersexual because of their supposed ability to satisfy Jezebel’s hypersexual appetites (Collins, 2000). Further, these two contrasting images (the Mammy and Jezebel, created by White slavers) served to make White men and their White women look pure and

holy in spite of all atrocities they committed against Black people (Albert Einstein, quoted in Conrad, 1947; White, 1999).

As White (1999) argued, the jezebel and Mammy myths were created mainly by Southern White slave owners who needed to justify their inhumane treatment of Black women slaves (White, 1999). Thus “the image of Jezebel excused miscegenation, the sexual exploitation of Black women, and the mulatto population ... [while] Mammy helped endorse the service of Black women in Southern households, as well as the close contact between whites and blacks [sic] that such service demanded” (White, 1999, p. 61). Indeed, these conflicting and controlling images of Black women “did a lot of explaining and soothed many a troubled conscience,” thereby portraying slavery as a “positive good” (White, 1999, p. 61).

The Influence of Colonialism: Black Women and Education in Africa

Studies indicate that education and learning have always been a part of traditional African societies (Magagula & Maziboku, 2004; Mautle, 2001; Morolong, 1996). Throughout history, education (in whatever form), has played a significant role in empowering women (Amadiume, 1987; Day, 1988; Kenyatta, 1938; Sack, 1982; Van Allen, 1975). However, the purpose of education evolved depending on the policies of its providers (Awe, 1999; Day, 1988; DuBois, 1903/2003; Woodson, 1919). In the context of Africa, Awe (1999) outlines three historical stages of education for Africans and these are the precolonial, colonial, and postcolonial stages.

Precolonial Stage

In pre-colonial Africa, traditional African cultural societies or secret societies in conjunction with the family heads were the sole providers of education for girls and

boys. In those systems, there was no underrepresentation of women in educational pursuits because women of each tribe were in the forefront of educating girls (and there were parallel schools to educate boys as well). At that time, the purpose of education was to prepare girls for gendered adult roles thereby reinforcing values of their tribal conceptions of “true womanhood” and complementarity with their male counterparts (Day, 1988). This is the education that Black people left back home in Africa when they were transported to various parts of the world.

Moreover, there is ample evidence indicating that classical African education has always had structure in the form of specific principles, methodologies, epistemologies, and curricula through traditional social institutions that foster learning. Yet, traditional African education institutions are often classified as nonformal education in modern times (Collins & Bilge, 2016; Merriam, Caffarella, & Baumgartner, 2007). Owing to this, little is known about what exactly took place in these educational settings (Day, 1988). However, studies have been conducted about precolonial education settings based on the perspectives of graduates from such education societies, including women advocates who were opposed to the treatment fellow women received during the initiation ceremonies (Day, 1988).

Among the researchers who have provided empathetic understanding of the curricula content and some advantages of classical African education processes are; Day (1988), D`Azevedo (1980), (Leis, 1974), Richards (1975), and Bloch, Tabachnick, and Beoku-Betts (1998). Their studies found that traditional African education associations added value to women’s preparatory experiences as key actors in their communities.

Day (1988), an African American feminist with no personal experience with classical African institutions, argues that the terms used to describe traditional African education systems do not do justice to the crucial role they play(ed) in preparing girls and boys for adulthood (Day, 1988). According to Day (1988), the more appropriate terms for these schools are “classical African preparatory schools” or “academies” because some of them are as good as formal education institutions. In some cases, these forms of education were required and had intentionally structured curricula (Dennis, 1972) for teaching vocational skills and social values and for transforming young people into responsible adults (Day, 1988).

Written historical records also provide evidence of the existence of precolonial African women’s associations in some parts of Africa (and in many of those cases, parallel men’s associations). It was through these associations (or corporate groups) that women exercised their leadership, demanding social change (Amadiume, 1987; Day, 1988; Kenyatta, 1938; Sack, 1982; Van Allen, 1975). Although the colonial system of governance disrupted the African forms of education, research shows that in many parts of Africa, people have maintained their value systems as much as possible. Thus, these indigenous education systems may coexist with Western forms of education, focusing on preparing African women for adult roles, which is an area in which Western education is lacking. For example, Day (1988) reported that the Bundu society of the West Atlantic region with its parallel male counterpart, the Poro society were still active adding,

Although the need for formal schooling is keenly felt by many families, it has not diminished their close ties to the Bundu society; the two systems run parallel to each other. They have been and still are vigorous and extremely influential (Bledsoe, 1984; Boone, 1986; Davies et al., 1992). ...the Bundu and Poro

societies have provided cohesion and cultural continuity among the people of various regions for generations. (p. 53)

Regarding the content for Bundu education, Day (1988) reported that it centered on skills, crafts, reproduction and fertility, music, song, dance, and cultural. However, in many cases, there have been competing priorities between cultural and western forms of education, the time girls spent with traditional educators such as the Bundu instructors had declined due to inadequate resources on the part of individual families (Day, 1988). Thus because of more emphasis on western education than cultural training, there was no government funding for traditional forms of nonformal education. Nonetheless, traditional forms of education are not without criticism; Day (1988) and Walker (1983) identified some educational practices such as the traumatic clitoral excision of girls, which have been found to have negative life-long health consequences for girls.

When Western forms of education were introduced into the African education systems the colonizers became the main providers and the purposes of education shifted. Given that, the purpose of colonial education was first to consolidate imperialist aims, it reflected Victorian bourgeois' ideals of female domesticity (Awe, 1999) rather than the original African male and female complementarity (Strobel, 1982, as cited in Day, 1988). In time, colonial rule weakened the African women's associations, leading to the demise of the "dual sex organization of earlier...community politics" (Strobel, 1982, cited in Day, 1998, p. 54).

Colonial Stage

As earlier systems of lineage-based landholding and political organization were replaced by individual ownership and market production, lineage/kinship structures

weakened, thereby undercutting the women's associations that grew out of them. In addition, colonial laws and policies gave men greater access to the cash economy and formal/western/colonial education, which further eroded women's power and autonomy as they eroded men's (Alidou, 2005; Sack, 1982). Thus, European domination in Africa was characterized by

Hegemony rooted in the emasculation of other men and hegemonic patriarchy over the colonized female subjects...Ironic that when the first private French Catholic missionary school opened its doors in 1949 in Niamey [Niger], it only admitted male students with a French Catholic nun as headmistress.... the colonial women were (made) agents.... [However,] their agency did not involve sensitivity to colonized native women. Only in 1961 did the private Catholic mission school begin to open its doors to female [sic] students in a gender-segregated set-up. This gap of twelve years between the introduction of schooling...is significant in what came to account for the gender gap in educational opportunities and outcomes between male and female in both the national colonial and postcolonial dispensations. (Alidou, 2005, p. 61)

Ironic as it was, this double standard shows how French colonial gender ideology in Niger dichotomized women's agency—with colonial women on one hand and colonized (Black) women on the other. In this regard, Black women were discriminated against both as Black (native, indigenous, or less civilized racial group) and as women (Collins, 2000; Crenshaw, 1989, 1991). However, even when education was made available to Africans, any education that would make Black people critical thinkers and give them more power and control over their own lives was withheld (Hetherington, 1978).

As stated earlier, evident in the historical literature is the fact that both in the Francophone and British colonies, education was designed primarily for White men, then later for White women and then for Black men (DuBois, 1903; Perkins, 1997). Even so, indigenous African people were excluded from science education. Historical studies show that prior to the First World War (WWI), colonial administrators in Africa omitted science and critical thinking from the school curricula that was offered to

Africans. According to Hetherington (1978), *withholding power* from the natives was the main motive for limiting the education they received—as the colonial administrators believed that too much education would make Africans defiant.

After WWI, White missionaries, including a number of European colonial administrators started to feel the need to teach science to Africans; and they began to open the door to science education for Africans. Among the factors that led to the opening of doors to science education for African natives were the need for (1) professionals to fill positions that were formerly occupied by European personnel and (2) advancement of studies in health, hygiene, and agriculture through biological science courses (Hertherington, 1978, cited in Dzama, 2006). These factors and the education that Africans received from missionaries led to the establishment of three postsecondary institutions in British colonies (Fafunwa, 1971; Ruth Sloan Associates, 1962; Dzama, 2006). Programs in medicine, agriculture, engineering, surveying, and teacher training opened at Yaba Higher College in Nigeria in 1934, Achimota College in Ghana, and Makerere College in Uganda (Farunwa, 1971, cited in Dama, 2006). Thus, the introduction of science at the postsecondary level created the need to teach science at the lower levels of education. Thus, as Dzama (2003, 2006) pointed out, in British Colonies in Africa, because science rarely affected the daily life of the majority of Africans, it was first introduced into the school curricular as a means to prepare students for science-related jobs.

“Postcolonial” Stage

The postcolonial era is also characterized by new challenges for women in Africa (Alidou, 2005; Sikainga & Alidou, 2006), which I discuss next. After Western

education was offered to Black people, Black women had to wait (Alidou, 2005; Read, 1997; Smith, 1985). Even in this 21st century in many parts of Africa, Black women must exercise a great deal of agency in order to access education, let alone become a prominent scientist (Alidou, 2005; Egbo, 2000). The predicament of Black people has escalated to worldwide racial, ethnic, and gender gaps in prestigious achievements (Alidou, 2005 compare with Perkins, 2011).

The postcolonial experience of women in many of the African countries is filled with enduring conflict and civil war (Sikainga & Alidou, 2006). Moreover, the tragic consequences of war take a toll not only on their countries' economic, political, sociocultural situation but also on these women's general wellbeing and education (Deacon, 2007, 2009; Deacon & Sullivan, 2009, 2010; Sikainga & Alidou, 2006). Therefore, as Sikainga and Alidou observed, women in these conflict-prone regions of the African continent continue to experience limited access to education opportunities (Alidou, 2005), necessitating their relocation to more "peaceful" lands in search for education opportunities for themselves and for their families.

Likewise, as the United States of America continues to attract students from all over the world, Black women from sub-Saharan and other countries migrate in their pursuit of personal educational goals. Whether or not this migration of women in search of knowledge is to be encouraged or not is arguable. In addition, some critics are wary that such knowledge will lead to adoption of Western ideas in evaluating the status of women in developing countries. Yet, many scholars agree that

The greatest gains may come from encouraging women in sub-Saharan countries to project goals for their own futures; to trust in their own instincts; and to respect their own knowledge as a basis for resolving issues of gender equity, including participation in decisions about educational development. In this case,

African women will need to know more about world educational models and programs, to broaden their vision, and to stimulate inventiveness in seeking solutions to local needs. (Bloch, Tabachnick, & Beoku-Betts, 1998, p. 310)

Because of their desire to tackle social inequalities, these Black women may seek solutions through higher education from around the globe. Thus, Black women from sub-Saharan countries, who must transcend many barriers to achieve greater goals such as a career in STEM, are encouraged to broaden their vision through Western education with the primary goal of developing contextually responsive solutions to educational iniquities back home (Bloch, Tabachnick & Beoku-Betts, 1998).

Next, I focus on the experiences of Black women in the United States with particular emphasis on their strivings for better lives through education, including STEM education. In this way, I provide an opportunity for the reader to draw conclusions and/or parallels between what took place then and how Black women experience higher education in STEM academic programs at U.S. institutions today.

The influence of Slavery: Black Women and Education in the United States

Institutionalized slavery, which left an enduring legacy of oppression for Black people dates back to the notorious 17th-century trip. As described by Earl Conrad (1947, p.11):

It all began in the year 1652 when Sir John Hawkins, sponsored by Queen Elizabeth of England... captured the first boatload of African slaves ... That trip, in a ship called, of all things, "The Jesus," might well have been the planting of the seed that flowered into the whole system of slave trading, plantation slavery, and Jim Crow" (p. 11).

Thus, slavery, fueled by aspirations for capital and glory, marked the beginning of an era characterized by the devaluing of Black life in general. To add to Black people's pain, those in power, the White European men of that time, encouraged the misuse of Black women as sex objects and as producers of the next generations of labor. As the

population of slaves grew, their masters' economic goals were met by selling some of their slaves to other masters thereby tearing slave families apart as they were forced to start all over again, in far away, new plantations, under new masters (White, 1999). As I discuss later, with examples, the creation of detestable images that are used to demean Black people even today also dates back to this period in the history of Black people.

Because the slaver's economic ends were met through Black women's procreative abilities, they felt no need to educate them. Therefore, just as education was withheld from Black people in Africa, there was no formal western education for slaves in America until much later in the 19th century (Perkins, 1978, 1980, 1981, 1983). However, although racism and racial violence became an everyday experience for Black people, they made sacrifices to educate their children amid acts of outright violence perpetrated by White people (Perkins, 1978; Evans, 2007). During that time, any attempts to educate Black children were met with violence by White protesters. For instance, in 1833 in Connecticut State, a White mob destroyed Prudence Crandall's School for Black girls (Evans, 2007). Perkins (1978) reported another act of White mob violence two years later, which was followed by yet another incident ten years later: According to Perkins,

During the race riot of 1835, Columbian Academy, headed by Black educator John F. Cook, was burned and opposition to the school forced Cook out of the city for over a year. In 1836 Dr. John Fleet, a Black educator, opened another school for black pupils, but it was also destroyed by an arsonist in 1843 (Perkins, 1978, p. 13).

Although Black children were later allowed to attend public school, it was under segregation and the education they received under that system was far from equal to that of their White counterparts. Thus, throughout the first half of the nineteenth century a

larger proportion of public schools that were opened for Black children were at best “inferior to schools for Whites...substandard; providing only the most elementary curriculum thereby prohibiting people from advanced studies” (Perkins, 1978, p. 17), thereby reinforcing White supremacy (Conrad, 1947).

Owing to this, by the mid-1930s, there was a great migration of Black families from the inhospitable Southern states to the Northern states, especially to Washington, D.C. (Perkins, 1978; Conrad, 1947). However, a better life was still farfetched for Black children; they were persecuted as they walked to schools (Perkins, 1978). As documented by Perkins (1978), “White opposition persisted with black [sic] children walking to school being mocked and stoned. Barred from public schools, only private Sabbath educational institutions were available to them. Moreover, even these schools were resented by many Whites” (Perkins, 1978, p. 13).

African American Women in Pursuit of Postsecondary Education.

While historians have noted the existence of over 250 college-level institutions as early as 1833, only a negligible proportion opened their doors to Black or women students during that period (Evans, 2007; Perkins, 2011). Among the postsecondary institutions that welcomed them early were Oberlin, Antioch, and Wilberforce in Ohio State; others were Hillsdale in Michigan, Cheyney and Lincoln in Pennsylvania, and Berea in Kentucky (Evans, 2007). Still, women students were restricted to what was called the “Ladies Course,” “the less academically challenging” Literary Degree (Evans, 2007, p. 23). This is period has been referred to as “the first wave of Black women’s college attainment” (Evans, 2007, p. 21). “The second wave of attainment” for African Americans is the period between 1865 and 1910 (Evans, 2007, p. 38).

During this wave, more Black women were admitted to colleges than ever before. Even so, patriarchal attitudes prevailed, confining women to “common schools for basic literacy skills or normal schools for teacher training” (Evans, 2007, p. 38). Later, among Black college graduates, Black women outnumbered men (“Third wave,” between 1910 and 1954, Evans, 2007, p. 38), yet, it was Black men and White women who received the most B.A.s from top-tier institutions (Evans, 2007). Thus Black women were still considered relatively intellectually inferior and therefore less worthy to attend elite higher education institutions (Evans, 2007).

Hence, some Black women (with the support of their families) left the South and moved to Northern states to enroll at the leading institutions for elite White women. However, most Black women who were among the first to enroll at such institutions came from the small privileged families of “upper class Blacks whose parents were caterers, government clerks, teachers, professionals, and small merchants” (Perkins, 2011, p. 20). These women’s elite institutions, which included Mount Holyoke, Vassar, Wellesley, Smith, Radcliffe, Bryn Mawr, Barnard and are commonly known as “the seven sister colleges” renowned for graduating many of the most successful women in the United States (Perkins’ 2011).

As Perkins (2011) points out, some of the oldest of the seven sister colleges did not admit Black women until later in the twentieth century. The earliest to admit Black women were Wellesley College in Wellesley, Massachusetts, and Smith College in Northampton, Massachusetts, which were both founded in 1875, and Radcliffe (the Harvard Annex), which was founded in 1879 (Perkins, 2011). These three colleges

began admitting Black women in the mid-1880s in “token, yet steady, numbers” (Perkins, 2011, p. 21).

In the late nineteenth century, the first Black women students were admitted to Mount Holyoke and Vassar (founded in 1837 and 1865 respectively). Apparently these institutions were not ready for Black women because the first ones were admitted unintentionally—these Black women “were not known to be African American until they arrived” on campus (Perkins, 2011, p. 21). Barnard (founded in 1889) and Bryn Mawr (founded in 1884), were the last of the seven sister colleges to admit Black women in the twentieth century (Perkins, 2011). Although there were only about five hundred Black women who graduated from the seven sister colleges prior to 1960, Perkins (2011) maintains that “their influence within the African American community was significant as they went on to serve on faculties of African American high schools and colleges, and became prominent lawyers, physicians, and scientists” (Perkins, 2011, p. 21).

Regarding the experiences of Black women at these colleges, they ranged from negative to positive, majority of which were positive (Perkins, 2011). However, despite the high value of degrees from these institutions, they could only admit “token numbers” and to most of the Black women who lived in the Southern states, such an education remained a dream. Consequently, there was a need for institutions to provide Black students with competitive higher education qualifications just like their Whites counterparts. Although institutions for educating Blacks—later known as historically Black Colleges and universities (HBCUS)—were being created after the American Civil War until 1964, educating Blacks to enter the public sphere was not the main

focus (Gasman et al., 2007). Just like in colonial Africa, the purpose of Black education was premised upon reinforcing White supremacy.

African American Women in Pursuit of STEM Education

Although there is little documentation that Black women participated in scientific inventions prior to the Civil War, there is reasonable suspicion of their involvement in such endeavors as early as the colonial period (Manning, 1993, as cited in Jordan, 2006). According to Jordan (2006) “slaves were known for their inventive abilities, but their legal status prevented them from holding patents and from achieving widespread public recognition for their achievements” (p. 2). Although there were few exceptions who managed to achieve recognition for their inventions prior to the Civil War, it is noteworthy that while the first Black American received a patent on March 3, 1821, it took 64 years before the first Black woman, Sarah Goode, received a patent for a folding cabinet bed—on July 14, 1885 (Jordan, 2006).

Later, although most Black women worked primarily as servants and in other menial occupations, a fortunate few began to earn science-related degrees in medicine and dentistry (Jordan, 2006). The first woman physician was a White woman named Elizabeth Blackwell who graduated from an American institution 15 years before the first Black woman physician (Rebecca Lee) was able to do so in 1864 (Hine et al., 1993 & Davis, 1982 both cited in Jordan, 2006). According to Jordan (2006), all these women must have received their degrees from HBCUs such as Meharry Medical College and Howard University, and northeastern, predominantly White institutions. Nevertheless, the experiences of Black women at HBCUs were not always positive. Historians have documented descriptions of differential treatments of Black women by

White men at Black college campuses. As Woodson illustrated, there was a White male leader at one HBCU campus who would not refer to “colored” girls as “Miss,” but preferred to address them as his relatives—such as “auntie” (Woodson, 1919). In yet another instance Gasman et al. (citing Woodson, 1919) writes:

Woodson alludes to the white male practice of addressing black women in the familiar voice; whereas white women were treated as “ladies,” black women were simply female. Along similar lines, Woodson notes, “another...exploiter in charge of a Negro college never wears his hat on the campus. His confidential explanation is that he might have to lift it when he meets a Negro woman.” (Gasman et al., 2007, p. 765)

Nevertheless, researchers agree that HBCUs, in general, have by far remained notable institutions for promoting STEM degree attainment among Black women (Gasman et al., 2007; Jordan, 2006; Wolf-Wendel, 1998, 2000).

The above historical review of the literature acknowledges the fact that Black people descended from the African continent. Black people were first scattered around the globe through slavery, which led to the African Diaspora. Thus, rather than portraying Black people as separate groups with distinct origins, my chronological presentations of their experiences serves to reflect the common origins of their oppression and the enduring racial/ethnic disparities in education and STEM degree attainment of Black women.

Contemporary Studies of Black Women in Higher Education

Black women from around the globe experience U.S. higher education in ways that indicate the persistence of the effects of imperialism, White supremacy, capitalism, patriarchy, slavery, and settler colonialism (hooks, 2000, 2004). Drawing from research and scholarship that centers on students in college and university settings as intersecting identities, I highlight experiences of Black women students in contemporary higher

education contexts in which institutionalized oppression occurs. To illustrate this complexity of Black women's experiences, I begin with a brief overview of studies of Black women students in higher education, followed by a discussion of studies of women of color (and Black women) students in STEM at different types of postsecondary institutions.

Studies indicate that Black women students experience stresses as they navigate stereotypes at HWIs (Banks, 2009; Johnson, Brown, Carlone, & Cuevas, 2011; Reyes, 2011; Solorzano, Ceja, & Yosso, 2000; Winkle-Wagner, 2009). Based on a qualitative study of 19 Black women undergraduate students from one community college and three universities Cerri Banks (2009) maintains that “the identity markers *black* and *woman* are not homogenous descriptions or categories” (p. 18). Thus, regardless of the common desire to succeed in their education, Black women students do not experience their education in the same way (Banks, 2009). The experiences of women in Banks' (2009) study and others (Winkel-Wagner, 2009; Bond, 2011; Robinson & Franklin, 2011) illustrate that Black women face qualitatively different challenges based on the intersectional nature of their lives. For example, while Black women whose parents had college degrees were supported, first-generation Black women students came to college unprepared, and they had little support from their parents. Similar challenges were also reported among Black women students whose parents were recent immigrants and had no experience with U. S. college environments.

Winkle-Wagner (2009) found that among low-income Black women students at a large predominantly White research extensive university had to contend with external

definitions that were imposed on them by their majority peers. According to Winkle-Wagner (2009),

African American women experienced duo or dichotomous pressures on campus—a two-ness or multiple-ness that had serious implications for their college experiences. These dichotomies were not of their choosing. Rather, they resulted from the interaction the Black women had with their sense of self (identity); their peers, administrators, and faculty on campus; the larger postsecondary institution (i.e. policies, practices, and culture); and the larger social structure (i.e. media portrayals and social norms. (p. 23)

Thus in order to be successful in their college endeavors Black women must learned to navigate predominantly White environments that constantly put their identities into question; their success in negotiating and resisting stereotypes depended on how well they are able to utilize various strategies such as self-confidence in their beliefs as well as their rights to speak up (Banks, 2009). This experience is similar to the phenomenon of “cultural taxation” or “Black tax” whereby minority faculty are expected to work harder than their majority colleagues (discussed in the higher education literature, Griffin, Bennett, & Harris, 2011).

African American women students in Winkle-Wagner’s (2009) study also experienced “culture shock” and isolation. As a result, the women were faced with the double bind, whether to conform to the norm (Whiteness) or to stay true to themselves. For instance, first-generation Black women students who adjusted to the prescribed White campus culture alienated themselves from their cultural heritage; “they no longer felt like they belonged back home” (p.75). Other experiences reported among Black women students indicate that because of the predominantly White environment in college, their feelings oscillated between being in the “spotlight” and being “invisible,” continually wrestling with “the need to perform” or balance their identities—but either

way running the risk of being perceived as “too ghetto” or “too White” by their peers (Winkle-Wagner, 2009, p.23).

More subtle manifestations of racism that affect African American women and men who study at historically White campuses have also been reported. Solorzano, Ceja, and Yosso (2000) explored the connection between racial stereotypes, cumulative racial microaggressions, campus racial climate, and academic performance among African American students at three elite PWIs. African American students experienced racial microaggressions in academic and social spaces that negatively influenced their wellbeing. In order to cope successfully, African American students formed academic and social “counter spaces” on and off-campus. These and other undocumented experiences negatively influence Black women’s persistence in their pursuits of higher education.

Thus, the research indicates the existence of intersectional factors that negatively influence success even among seemingly engaged Black women students. For example, Winkle-Wagner found that academically engaged Black women low-income first-generation undergraduate students experienced unique challenges that were not common among participants who had fewer marginalized identities. Even so, Black women who identified as upper-middle class also reported feeling “a sense of two-ness [whereby Black women in college found themselves having to move] back and forth between Black and White norms or ways of being” (Winkle-Wagner, 2009, pp. 3-4). Other scholars have described similar findings as “double consciousness” (Du Bois, 1903/2003) and “shifting” (Jones & Shorter-Gooden, 2003)—both quoted in Winkle-Wagner, 2009, p. 4).

Studies of Black Women in STEM

Jordan (1999) found that race and gender were crucial factors influencing Black women's career decisions. Interestingly, responses to the question whether race and gender influenced how these women were viewed as scientists show that only 67% agreed that these identities played a role. Although this study was conducted in retrospect, it had the potential to provide some insight into these women's academic experiences and how these women successfully navigated their college environments. However, perhaps due to the limitations of the survey method, Jordan only reports on early experiences and moves on Black women's experiences as scientists, when in fact college and graduate school are a major part of one's career development (Pascarella & Terenzin, 2005). This gap in knowledge could be addressed through follow-up probing, to reveal how STEM academic departments are implicated in Black women's oppression. However, as Jordan herself admits, the survey was limited in that

Respondents were not required to answer the [survey] question, so one can only speculate on some of the reasons for this. In future surveys or studies, it would be useful to ask respondents why they felt race and gender were not important factors influencing career development. (Jordan, 1999, p. 123)

Later studies have addressed part of this limitation by focusing experiences of Black women through qualitative methodologies (Beoku-Betts, 2004).

Through a larger study on perspectives and experiences of African and Caribbean women in academic and administrative careers, Beoku-Betts (2004) interviewed 15 doctoral-level Black women scientists in research and academic institutions within English speaking countries in the sub-Saharan African region. Although retrospective in nature the study provided a description of African women scientist' perceptions of some common factors that affect their ability to succeed while

in STEM graduate training in western countries. Major themes of in Beoku-Betts' study include their experiences regarding mentoring, peer group relations, and coping with graduate work, marriage, and (extended) family. Findings show that these women's experiences with racial bias, though consistent with racial stereotyping of Black people, were nuanced due to the intersections of their identities as both Black and "Third World" Blacks. The author provided examples that demonstrate that the women felt their academic and social experiences were complicated by prejudice and discrimination of their professors and peers in their host countries. The women in the study reported feeling that their professors and peers had doubts about their ability to handle the demands of STEM academic work. They also experienced exclusion and/or isolation in and out of the academic settings based on perceptions of their language proficiencies and inferiority as Africans by the condescending faculty and peers, which led to policies and practices—such as remedial courses and insensitive comments about "accents."

Also reported in Beoku-Betts' (2004) study were experiences that that were mutually shaped by race and gender (Collins, 1996, 2000; Crenshaw, 1989, 1991) in ways that made it difficult for the women to articulate whether they were being discriminated due to race or gender. Although the Beoku-Betts did not explicate fully, evident in the quotations from study participants is this ambivalence regarding the nature of their oppression and the normalizing of the superior White "other" (p. 122-123). Scholars of intersectionality have argued that because experiences are mutually shaped by individuals' identities and social locations, the resulting experience is intersectional, which cannot be specifically pinpointed as caused by for example, race or gender (Collins, 1996, 2000, 2015; Collins & Bilge, 2016; Crenshaw, 1989, 1991).

Studies of women of color in STEM indicate that the unwelcoming culture of STEM education (Chang & Hurtado, 2014; Gasman & Perna, 2011), the lack of sense of community and belonging (Palmer et al., 2011), racial and gender stereotypes (Reyes, 2011), and perceptions of their own ability to succeed in STEM (Carlone & Johnson, 2007) contribute to their low participation in STEM majors. In some of the studies in which the authors *included* the experiences of Black women students in STEM, findings show how Black women may felt a disconnect in STEM, leading to dropping out of STEM or college.

Reyes' (2011) study found that women of color who transfer from community colleges to four-year institutions felt that they did not belong. This perception was due to their age, ethnicity, and gender and the common stereotypes about their ability to succeed. In a study of 20 women of color at a predominantly White institution, Johnson (2001) also found that women of color felt isolated, discouraged, and uncomfortable due to racial stereotypes about their intellectual capabilities. Among other things, women of color in Johnson's study felt frustrated with the "weed out" environments in STEM (Barr, Matsui, Wanat, & Gonzalez, 2010; Seymour & Hewitt, 1997). Women of color also preferred professors who interacted with them outside the classroom. In addition, Johnson found that the women's experiences with racism were different. However, because Johnson did not use intersectional analyses, she could not discuss them in relation to the matrix of domination (Collins, 2000).

Ong, (2005) conducted an ethnographic study with 10 women of color at a large research university and found that the women had to conform to the dominant White culture by minimizing their feminine identities and by working harder to excel

academically in order to be accepted. This finding is similar to what Angela Johnson, Jaweer Brown, Heidi Carlone, and Azita Cuevas (2011) found in their study of three diverse women of color. Findings of both studies show that the women exercised agency in resisting stereotypes. Their experiences also varied depending on how their social identities interacted with the structures within the institution. As they matriculated, the women learned how to “read and respond to a situation” (Johnson, Brown, Carlone, & Cuevas, 2011) or what Anzaldua (1999) calls “*La facultad*” among Latina women.

In a study that used the National Education Longitudinal Survey (NELS) Hanson (2004) Hanson compared experiences of young African American women with their White counter parts. Findings show continued involvement and interest among African American women. From a multicultural gender perspective, Hanson found that gender systems in the African American community provide young women with resources that might be important for generating interest and success in STEM. The fact that this study found differences in interest in science among younger and older women is important in highlighting the need for intersectional analyses. Findings from studies of experiences of women of color are important in exposing within race differences in order to inform higher education policy makers, faculty, and administrators on the needs of different groups of students (Hanson, 2004; Johnson, 2007).

A study that examined the relationship between campus racial climate perceptions and sense of belonging among undergraduate women of color in STEM at a PWI, Johnson (2007) found that women of color reported a less sense of belonging and more interactions with diverse peers than White students. Additionally, Black women’s

perceptions of campus racial climate were less positive compared to women of other racial/ethnic groups. Partial correlation analyses isolated another important finding—that perceptions of a positive campus racial climate were statistically significantly correlated with sense of belonging for Black, multiracial/multiethnic and Asian Pacific American women. Despite the many strengths of this study, the limitation of using quantitative studies when studying Black women’s experiences is disturbing. The challenge is that because there are fewer Black women in STEM majors, researchers tend to lump all women of color together—this study had 92 Black women out of a sample of 1,722. Nevertheless, the study brings out important findings about the experiences of Black women students in STEM, which inform my dissertation study. Other researchers (Harper & Hurtado, 2007; Strayhorn, 2011) also corroborate these findings.

In a survey utilizing multi-institutional data to estimate the influence of sense of belonging on learning and success for African American undergraduate students in STEM, Terrell Strayhorn (2011) found that

- Black students (in general), when compared to White students with the same level of academic preparation, reported a lower sense of belonging.
- There were gender differences between African American students, with women reporting a lower sense of belonging than did men.
- African American undergraduate students who were enrolled in non-engineering majors reported a higher sense of belonging than those who majored in engineering.

- Higher sense of belonging was also positively correlated with higher self-efficacy, frequency of reading or hearing about minority contributions in their field, perceptions of campus climate, and participating in undergraduate research with their mentor; and
- Undergraduate students who enrolled in departments/programs with larger proportions of minority faculty also reported higher sense of belonging.

However, these findings do not provide much insight regarding why Black women students reported lower sense of belonging than their male counterparts did. An intersectionality framework could identify the reasons for this disparity (Dill & Zambrana, 2009).

More recent studies of Black women students in STEM have claimed an intersectionality approach (Charleston, Lang, Adserias, & Jackson, 2014; Ireland et al., 2018). Utilizing intersectionality theory, Charleston, Lang, Adesarias, and Jackson (2014) conducted a phenomenological study of the role of race and gender on experiences of African American women in computer sciences. This study found that the women encountered academic and social challenges due to isolation and racist and sexist stereotypes as students in computing sciences. Because this study did not focus on exploration of intersectional experiences beyond race and gender, the findings offer limited insight on within-group differences among Black women and therefore cannot guide socially just policies and practices. As Ireland et al. (2018) point out, “the question of ‘who’ is being researched is key” (p. 244). Thus, intersectionality researchers need to attend to the diversity within social categories in order to inform equitable policies and practices for broadening the participation of Black women in

STEM. Yet, in their synthesis of empirical studies that utilized intersectionality, Ireland et al. commit the same fallacy.

For example, by the choice of studies to include in their analysis of intersectional experiences of Black women and girls in STEM, Ireland et al. (2018), assume homogeneity of Black women's experiences in U. S. STEM education.

According to their inclusion/exclusion criteria, they selected studies based on the following guiding questions:

1. Does the research (in part or as a whole) include the experiences of Black female students in STEM education?
2. Does the research include at least one of the following student populations, including retrospective accounts of STEM professionals as students: elementary school, middle school, high school, undergraduate school, or graduate school?
3. Does the publication report an original analysis and/or empirical research results? And
4. Does the research occur in the United States? (Ireland et al., 2018, p. 232)

Had the authors included Beoku-Betts' (2004) retrospective study and other studies of Black women scientists in the African Diaspora, the findings could have contributed to policies and practices for addressing the needs of immigrant and non-immigrant Black women students who attend HWIs in the U.S.A.

Institutional Factors Influencing the Success of Women of Color in STEM

Several studies (Chang & Hurtado, 2014; Espinosa, 2011; Gasman & Perna, 2011; Johnson, 2007; Margolis & Fisher, 2002; Palmer, Maramba, & Dancy, 2011; Pascarella & Terenzini, 2005; Perna et al., 2009; Whitten et al., 2007, 2003) indicate that Black women's success in STEM is dependent on institutional capability to foster a culture of inclusion, which promotes student involvement and engagement (Wolfe-Wendel, Ward, & Kinzie, 2009).

Espinosa (2011) conducted a quantitative study utilizing hierarchical generalized linear modeling (HGLM) to examine the experiences of 1,250 women of color and 891 White women from 135 institutions nationwide. The results show that women who persisted in college frequently interacted with their peers, discussed course content and joined STEM-related student organizations. They also participated in undergraduate research programs and other altruistic pursuits. In addition, these women seemed to have a background of having attended private colleges and institutions that provided a strong community of STEM students.

Perna et al. (2009) reported findings of a case study of Spellman College, which has a reputation of supporting Black women in STEM. Perna, et al., argue that although efforts to prepare Black women for academic success in college are important, they are not enough considering the many non-academic barriers that hinder women's attainment in STEM fields. Perna et al. explored the ways that Spellman College promotes attainment of African American women in STEM. The findings show that the institution plays a major role in sustaining women's persistence in STEM. Highly important are the structural characteristics of the institution in promoting student interactions with faculty and their peers—, which are major constructs of student involvement theory (Astin, 1984). Gasman and Perna (2011) found similar results in another study of women at an HBCU. Several studies of experiences of women of color have focused on how women students experience the campus racial climate, their opinions on diversity policies such as affirmative action, and their participation in diversity-related activism (Espinosa, 2011; Flores & Rodriguez, 2006; Hurtado, Milem, Clayton-Pederson, & Allen, 1999; Rankin & Reason, 2005; Sax & Arredondo, 1999).

Thus, these studies show that women of color who persisted in STEM majors had the following privileges:

- Frequently studied with their peers and discussed course content;
- Joined STEM-related academic organizations;
- Participated in undergraduate research and other altruistic pursuits; and
- Had a high academic self-concept.

Studies of retention also indicate that among the institutional factors that are important for attracting and retaining Black women in STEM majors are programmatic and cultural environmental improvements and faculty and peer attitudes (Margolis & Fisher, 2002). In a study of women and computing at Carnegie Mellon University's Computer Science Department Margolis and Fisher found that rather than changing departmental culture to support to retain them, women students in computer science were expected to conform to the dominant culture. This practice has proved counterproductive to increasing equitable participation of women in STEM (Margolis & Fisher, 2002; Whitten et al., 2003, 2007). Thus, retention studies recommended

- Improving student experiences by eliminating any peer cliques that dominate departments as “the ideal way of being in a (particular STEM) major (American Association University Women, 2010, p. 63),” thereby allowing for alternative perspectives of who can succeed in STEM;
- Widening the range of introductory STEM courses to include options that do not assume preparation among all students; and

- Increasing informal opportunities for student-faculty interactions such as providing spaces where students will feel welcome and organizing STEM major-specific student groups and other faculty-led social activities.

However, at the majority of HWIs, the recruitment and engagement of Black women students in undergraduate research and other structured academic initiatives still need attention (Strayhorn, 2010). In contrast, HBCUs and women's colleges promote a supportive culture of inclusion through creation of "pathways" for students of varying academic preparation interested in STEM majors (Gasman & Perna, 2011; Whitten et al., 2007).

Conclusion

In this chapter, I have presented the literature review and theoretical framework for this study in the context of STEM higher education. The literature review focuses on the influences of colonialism, White supremacy, and slavery on the experiences of Black women, with particular emphasis on their strivings for a better life through education, including STEM education. In doing so, I hope to encourage the reader of this dissertation to draw parallels between what took place in the past and how Black women experience higher education in predominantly White STEM programs at contemporary American institutions.

I have also presented the theory of intersectionality (Collins, 2000, 2009, 2015; Collins & Bilge, 2016; Crenshaw, 1989, 1991). Most important are the intersections of individual's identities, circumstances, and the structures of power within the institutions they traverse. In Africa, the teaching of science and critical thinking were excluded from school curricular prior to the First World War, because the powerful colonial

masters believed that too much education (or critical thinking) would make Africans defiant (Hetherington, 1978). What is not discussed frequently in the literature though is the fact that in most countries education became accessible first to men (Alidou, 2005)—in the United States it was available to white men, then later to white women (DuBois, 1903). Even today, Black women must exercise a great deal of agency in order to access higher education, (Egbo, 2000; Alidou, 2005), let alone become a scientist. This is the history of the worldwide racial, ethnic, and gender gaps in prestigious achievements (Alidou, 2005; compare with Perkins, 2011).

Given that intersectionality underscores the need for a multilevel analysis of complex human experiences, it is an appropriate analytic tool for situating experiences of Black women students in STEM. Therefore, it is well-suited for the multilevel, organizational approach of this study. Above all, the intersectional framework promotes the notion of “working at the intersections,” which means that scholars/activists must use the experiences and struggles of disenfranchised groups to add breadth and depth to understandings of human life, thereby linking theory with practice in their efforts to empower communities and individuals (Collins & Bilge, 2016, p. 36).

The fact that even in predominantly Black cultures and institutions of higher learning, such as HBCUs, Black women were perceived and treated as inferior may feed into our fears of encountering even more negative experiences at HWIs—where the majority of students, faculty, and leaders are White and male (Gasman, et al., 2007; Franklin, 2002; Perkins, 1980; Woodson, 1919). This skepticism is further perpetuated by the continued invisibility and underrepresentation of Black women in highly

rewarding academic programs as well as in top leadership positions in STEM fields (AAUW, 2008).

Inevitably, for Black women, higher education resides at the intersection of imperialist White-supremacist capitalist patriarchy, colonialism, slavery, anti-Blackness, (Dancy II, Edwards, & Davis, 2018) and other systems of domination (hooks, 2004). Oppression of Black people in the form of denial of formal education and segregated schools and their struggle for economically rewarding opportunities can be traced back to the colonial and slavery periods (Conrad, 1947).

In this study, I am concerned with STEM higher education for Black women. While higher education policy makers have implemented efforts to promote inclusive education practices, progress for Black women in STEM has been inequitable and too slow. Contemporary studies of educational experiences of Black women indicate that imperialist White supremacist capitalist patriarchy introduced by our colonizers is still an issue (hooks, 2004; Dancy II, Edwards, & Davis, 2018). Therefore, efforts to provide accurate representations of Black women students in higher education must necessarily involve analytical considerations of their identities and university settings as these intersect (Collins & Bilge, 2016). In chapter 3, I present my methodological approach for the study to address these issues.

Chapter 3: Research Design

According to Leslie McCall (2005), a methodology is “a set of coherent ideas about the philosophy, methods, and data that underlie the research process and the production of knowledge” (p. 1774). Therefore, although this chapter includes the methods used in this study, I also make evident the philosophical underpinnings of the methods and how they could impact the knowledge produced in the process. The purpose of the study was to understand the complex experiences of Black women students in science, technology, engineering, and mathematics (STEM) majors and make recommendations for changes at a historically White higher education institution (HWI) in the United States of America (U.S.).

I begin this chapter with an overview of my research approach, including highlights of findings of a pilot study that shaped my current research methodology. Next, I present the research questions, issues, and research design that guided this inquiry. Included in my methods section are also subsections discussing my approach to selection of cases and participants, the methods for data collection, analysis, verification strategies, and my positionality. Evident throughout this chapter is the epistemological orientation underlying the methodological decisions and choices I made during the course of this study. The chapter ends with a concluding summary.

Approaches to the Research

Researchers with varying worldviews and epistemologies from fields such as psychology, education, and sociology have studied women’s underrepresentation in STEM (Blickenstaff, 2005; Seymour & Hewitt, 1997; Malcom, 2000; AAUW, 2008; Espinosa & Orfield, 2011; Xie & Shaumann, 2003). However, as argued earlier,

findings of many of these studies do not mirror the multiple perspectives of diverse historically marginalized groups of students, especially Black women (hooks, 2000; Collins, 2000; Crenshaw, 1989, 1991; Dill & Zambrana, 2009). In addition, findings of my pilot study indicated that in order to capture the full complexity of experiences of diverse students, to inform equitable policies and practices, a more nuanced approach was needed. Therefore, the methodological decisions I made in this dissertation study reflect the processes of refinement and evolution in my intellectual understanding of studying Black women students in the context of U. S. STEM higher education.

To better understand the underrepresentation of Black women in STEM and possible reasons for its persistence, a qualitative case-study approach was the best option (Stake, 2010, 2005, 1995). I believed that such a context-dependent research approach would provide a deeper understanding of how Black women students' intersectionality may introduce complexity to their experiences as their identities interact with the multiple forces that influence their experiences at HWIs (Collins, 2000).

Accordingly, my research design takes into account the fact that, as organizations, higher education institutions must interact with demands from their macroenvironments (Birnbaum, 1988; Bolman & Deal, 2005) as well as imperialist White supremacist capitalist patriarchal ideologies (hooks, 2000, 2004). In addition, for Black women students, just coming to grips with racism and sexism in society and at their institutions can be stressful as policies are formulated that impact their perceptions of opportunities and constraints regarding the pursuit of a STEM degree. Thus, because human experiences are multilayered and complex, my approach needed to embrace that

complexity, intentionally connecting the theoretical framework of intersectionality with findings about Black women's experiences in STEM at a HWI so as to inform institutional policies and practices for the success of all students in higher education (Stake, 2005).

Pilot Study

During the pilot phase of the dissertation (2009-2012), I utilized Charmaz's (2006) constructivist grounded theory approach to analyze in-depth interviews with 9 Black women students at a large historically White institution (HWI) in the United States, which I refer to as International University (IU) throughout this dissertation. The women students interviewed included sophomores, juniors, seniors, and three graduate students, all majoring in STEM at IU. The purpose of the pilot study was to understand Black women students' experiences so as to develop a theory of their persistence in STEM majors. The pilot interview questions elicited educational stories whereby the women talked about their family and educational background and how they became interested in their STEM majors.

Through the pilot study, it became apparent that the goal of developing substantive theory grounded in data, with limited experience and resources, was ambitious at best. Yet, in the process, I gained practical lessons on how to study complex issues related to Black women in STEM. More important, this experience allowed me to assess the appropriateness of my interview questions (Seidman, 2006) as I designed the current study. I also received constructive feedback through the peer review process when I presented at the *Association for the Study of Higher Education* (ASHE) conference in Las Vegas, Nevada (Nkhata & Pasque, 2012). I provide an

overview and visual representation of the pilot study findings, including how they relate to the current study (see Figure 1). Picturing the processes of choosing and persisting in a STEM as a journey, I wrote the following:

Given that the findings show that different individuals had qualitatively different experiences, there cannot be only one journey but many. I also found that each woman had a purpose (motivation and goals) and journey with a beginning (assessment of self and preparation). Rather than knowing exactly what the lengths and ends of their journeys would be, the women in our study only imagined certain possibilities (for example, becoming a scientist). All participants faced hardships in the form of challenges or discouragements. Some participants contended with multiple personal and environmental issues (just as some travelers may carry heavier baggage than others). Yet, all women recognized that not only did they need a guide (support) throughout their journeys, but they also needed to work hard. Perhaps more important, at every step of their journeys, they weighed their circumstances and options and, when necessary, they recalculated their pathways (that is (re)assessment/ (re)evaluation) and proceeded according to their circumstances and resources. (Nkhata & Pasque, 2012, p. 17)

The perspectives that emerged from data analysis represented experiences even more diverse than the number of participants because some participants had different experiences at different times and in different contexts during their developmental journeys. These qualitatively different ways in which Black women students spoke about their experiences needed further exploration through a more nuanced ecological/multilevel theoretical approach and more purposive sampling. As Charmaz (2008) recommends, with such methodological sophistication, qualitative researchers can hope to achieve saturation of the elements within and between the individual students, programs, institutions, and culture.

Although based exclusively on interviews Black women students at one HWI, some findings pointed to what other researchers had reported in the higher education literature. As a case in point, although every participant engaged in a reassessment of her life at certain points in time, it was a back-and-forth process, unique for every

individual. While for some of the Black women this process could be characterized as a reassessment or an evaluation to find what they were good at, others were inevitably “responding to their circumstances” at that point in their life time. (In the current study, I found that many of the women also spoke about finding what could get them a job). This multiplicity of perspectives in the pilot study was consistent with what Cabrera (2011) found on racial hyperprivilege on college campuses and social dominance orientation (Sidanius & Pratto, 1999).

More specifically, Cabrera’s (2011) findings support Sidanius and Pratto’s theory as expressed in the following quotation:

Racial and other ideologies can be either hierarchy-enhancing or hierarchy-attenuating, depending on whether a person’s worldview is more in support of inequality (hierarchy-enhancing) or egalitarianism (hierarchy-attenuating; Sidanius & Pratto, 1999) [sic]. In their social dominance orientation work, Sidanius and Pratto (1999) found that those who are in the most privileged social locations (e.g., men, wealthy people, and White people) tend to subscribe to hierarchy-enhancing ideologies, while those who have socially marginalized identities (e.g., women, poor, and nonwhite people) tend to subscribe to hierarchy-attenuating ideologies. (Cabrera, 2011, p. 79)

Insights from Cabrera’s (2011) and Sidanius and Pratto’s (1999) studies led to my awareness of the limits of studies that do not utilize multilevel approaches. I realized that in order to connect macrosystem level forces such as the “hierarchy-enhancing and hierarchy-attenuating” ideologies with Black women students’ privileged and/or marginalized identities and experiences at individual/interactional level, I needed data from the other levels of their HWI environments (Collins & Bilge, 2016).

Another key finding of the pilot study showed that Black women students continually had to contend with multiple forces (i.e. the intersections of their multiple identities and institutional/departmental structures) as they developed their respective

professional (STEM) identities. Based on this emergent finding, I provisionally concluded that

At every level of a Black African woman's professional developmental journey, she was confronted with feelings of being unprepared for what lay ahead. And the fact that individuals needed support throughout their academic journeys to accomplish this developmental process makes the study of identity the hallmark of higher education and student affairs work. Student affairs professionals and faculty members need to become aware of this process in order to support students as they aspire for STEM identities. An understanding of this process is crucial for addressing critical issues related to persistence, success, and retention of all students in STEM. (Nkhata & Pasque, 2012, p. 35)

These findings also indicate that even a seemingly homogenous group of Black women students may experience the same educational contexts differently.

Thus, in spite of its limitations, the pilot study revealed that a deeper analysis of Black women students' experiences in STEM could lead to a more accurate understanding, which is essential for creating empathetic environments for all students (Rogers, 1957).

The Current Study

The purpose of this dissertation was to understand the experiences of Black women students in STEM majors at HWIs in the United States. The current study was organized around two overarching research questions: what are the experiences of Black women students in STEM departments at HWIs? And in what ways might HWIs and STEM departments influence those experiences? I drew from intersectionality theory because of its effectiveness for analyzing people's experiences within and across domains of power at different levels of an organization (Collins, 2015; Collins & Bilge, 2016), with respect to sociohistorical and intellectual contexts. Moreover, because intersectionality theory is grounded in the idea that intersecting systems of race, class, gender, sexual orientation, nationality, and age (at the individual level) form

interlocking systems of privilege and oppression, which shape patterns of social interaction at all levels of the human ecology, it is well suited for informing policies that promote social justice (Dill & Zambrana, 2009).

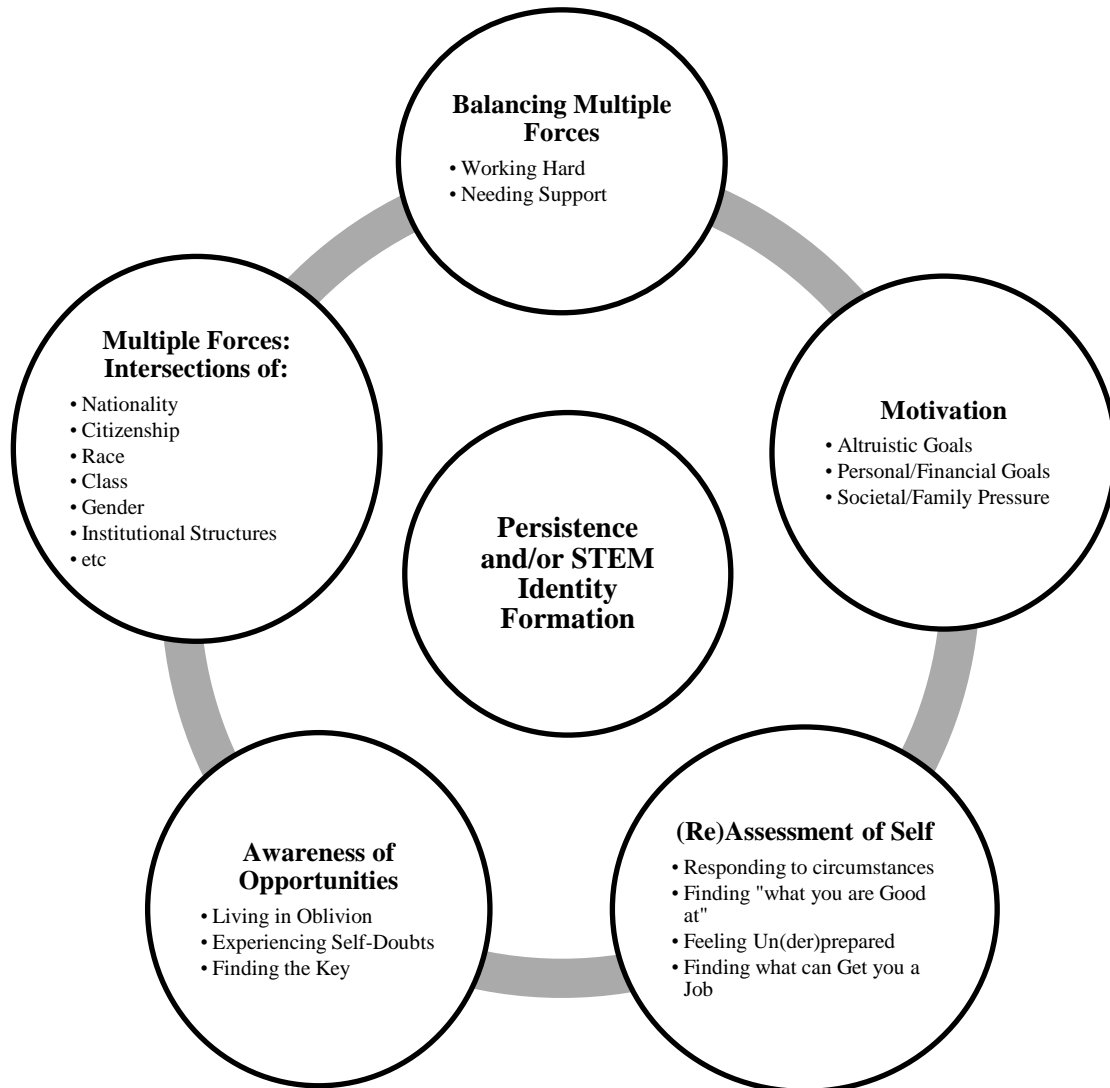


Figure 1. Black Women Students' Persistence in STEM at HWIs

Methodology: Multiple Case Study

Although scholars do not totally agree on what a case study is, their definitions are consistent with the fact that it is “an empirical inquiry that investigates a

contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (Yin, 2003, p. 13). Other scholars have summarized the main distinguishing features of case study “as (a) the in-depth study of (b) one or more instances of a phenomenon (c) in its real-life context that (d) reflects the perspective of the participants involved in the phenomenon” (Gall, Gall, & Borg, 2007, p. 447). Owing to this, case study design must necessarily begin with the choice of “what is to be studied,”—the case (Stake, 2005b, p. 443), phenomenon of interest, or “unit of analysis” (Schwandt, 2007, p. 27). More important, the case study design is distinguishable by its emphasis on a clearly defined unit of analysis, which could be “a person, process, event, group, organization” bounded in time and place (Schwandt, 2007, p. 27). Moreover, the emergent design calls for flexibility and adaptability, requiring researchers to respond to emerging/evolving issues. As such, case delimitation continues throughout the entire research process, up to the report writing phase (Schwandt, 2007; Merriam, 2009).

The goals of this study were consistent with case study research (Stake, 2005, 1995; Merriam, 1998). As indicated earlier, the purpose of the study was to understand the experiences of Black women students in STEM at HWIs and to recommend changes at various levels. I used multiple case-study data from interviews, documents, and observations to gain a more nuanced understanding of experiences of Black women students in STEM majors.

According to Stake (2005b), although case study strategies predominate qualitative studies, case study is not essentially qualitative. What makes case study

qualitative or quantitative is both the process and product of inquiry about the case.

Therefore, case study is necessarily

A choice of what is to be studied. If case study research is more humane or in some ways transcendent, it is because the researchers are so, not because of the methods. ... We could study it [*the case*] analytically or holistically, entirely by repeated measures or hermeneutically, organically or culturally, and by mixed methods—but we concentrate, at least for the time being, on the case. (Stake, 2005b, p. 443)

Thus, my epistemology and axiology played an important role in pushing the boundaries to transcend traditional methodological cannons (Stake, 2005b). Doing so required privileging methods that helped optimized my understanding of the single cases (STEM departments) selected for the multiple case study (Stake, 2005b).

Consistent with the epistemological underpinnings of this inquiry, I drew from the principles for designing and conducting qualitative case study research as outlined by Stake (2005a, 2005b). Thus, although I used multiple cases, I was primarily interested in studying individual cases thoroughly because they “shared a common characteristic”—experiences of Black women students in STEM with regard to the influence of the institution and STEM departments (Stake, 2005a, p. 4). Therefore, this was the overarching issue, the phenomenon of interest, or “binding concept that held my cases together”—also known as the “Quintain” (Stake, 2005a, p. 9).

In line with the research questions, my research design also demonstrates how higher education researchers might utilize Stake’s (2005a) multiple case study design with the notion of intersectionality as an inclusive multilevel analysis of experiences of diverse students in higher education contexts (Museus & Saelua, 2014). Because the current study involves analysis of complex experiences of a historically marginalized group of people, I deliberately chose to privilege “complexity” as opposed to objectivity

and/or consensus (McCall, 2005) by following Stake's (1995, 2005a, 2005b) guidance—a path least followed by case study researchers in education.

I also chose Stake's approach because of its compatibility with the systematic pursuit of multiple emergent leads in case-study data (Stake, 2005a, 2005b). Postpositivists insist that a case study must be conducted according to the rules of evidence, requiring one to be rigorous with regard to observations, in order not to confirm the researcher's commitments but to investigate a problem (Biddle & Anderson, 1986). Thus a case study with such intentions is distinct from a "case story," which is designed solely for the purpose of illustrating conclusions to which the author is already committed (Biddle & Anderson, 1986).

In this study, I used stories of research participants to provide valuable multiple perspectives and insights in light of other case study data. However, in order to answer my research questions, I also went beyond just providing case stories (Good & Levin, 2001) by bringing together multiple interpretations from multiple sources and employing a number of strategies throughout the research process—from data collection, analysis and interpretation, to report writing.

Also, as I discuss later in the "Researcher Positionality" section, adherence to the reflexivity principle required making my role, as producer of knowledge, explicit. A researcher's role involves not only the writing of the research report but also the description of their personal experiences in the field, focusing on how their approach to data collection and analysis could influence the research process (Gall, Gall, & Borg, 2007), including the findings and interpretations (Foster-Fishman, Nowell, Deacon, Nievar, & McCann, 2005).

However, although I entered the research process with such an open mind, ready for the ambiguities of qualitative research, I was guided and informed by the research problem and emergent issues. This allowed me to collect data that helped answer the main research questions. Thus, I collected the information required to answer the research questions based on the (1) research questions (2) specific issues, including emergent issues that were specific to the contexts of the individual cases and (3) theoretical framework.

As presented in Chapter 1, the study was designed to answer two questions and these are: “What are the experiences of Black women students in STEM departments at HWIs?” And “In what ways might HWIs and STEM departments influence those experiences?” The first research question is important because it is by analyzing human experiences that intersectional scholars can inform institutional policies and practices that oppress those who live at the intersections (Collins & Bilge, 2016). Based on the literature review, Black women students who persisted in higher education were supported in various ways by individuals and the institutions where they studied. Therefore, the second research question aims at understanding the influence of the HWI and/or individual STEM departments on the experiences of the participant in the study so as to provide other institutions with examples of effective ways of ensuring positive experiences for all students at their campuses, especially those historically marginalized. More important, the answer to this research question could guide Black women students in determining what they can expect from (individuals at) their institutions as they seek to leverage resources for their personal success.

Consistent with the qualitative research tradition, more especially the emergent design, researchers must be prepared to learn and to deal with surprises due to issues that emerge/evolve while in the field (Stake, 1995, 2005; Ragin & Becker, 1992). Stake (1995) argues that, “issues evolve. And emic issues emerge [during the course of the study]. These are issues of the actors, the people who belong to the case[s]. These are issues from the inside ... In a qualitative research project, issues emerge, grow, and die” (Stake, 1995, pp. 20-21). Therefore, although I sought to find answers to my research questions, I remained open to issues that emerged throughout the research process. Nevertheless, I had to consider all emergent issues in light of the goals for the study (Stake, 1995, 2005). Because issues that emerged reflected the unique circumstances of individual STEM departments selected for in-depth study, they are presented within the single-case study reports (that is, the findings within each of the STEM departments selected for the multiple-case study). As you will notice from findings in the single case reports for the selected departments, there were a number of issues that cut across the single cases. These are listed in the data analysis section of this chapter and presented in as cross-case findings in Chapter 4.

International University

The purpose of this multiple case study was to understand the experiences of diverse Black women students who were majoring in STEM at International University (IU), a doctoral-granting historically White institution (HWI) in the United States. In order to understand the influences of the institution and the selected STEM departments on the experiences of Black women students, multiple data sources at various levels of

the institution's ecology were pursued. This section provides the context within which the multiple case study was conducted.

International University's existence dates back to the late 19th Century when the State Territorial Legislature founded it with intentions to provide academic programs that served the state, regional, and national educational, cultural, economic, and health-care needs. Based on IU's mission statement, the institution's focus was on providing the best possible educational experiences to students through excellence in teaching, research, and creative activity, and service to the state and society. IU endeavored to fulfill this mission with an annual operating budget of \$2 billion and over \$1.5 billion in endowments.

During the 2016-2017 fiscal year, there were more than 2,700 full-time faculty members within 21 colleges at IU's three campuses, offering a total of 166, 153, 79, and 36 majors at the baccalaureate, master's, doctoral, and doctoral professional levels respectively—and 34 graduate certificates. The main dissertation study was conducted between fall 2015 and fall 2017 at largest campus where the majority (over 27,000) of the students were enrolled. The combined enrollment for all three campuses was over 31,000 students.

Out of 12,911 people employed at the campus where the data were collected, 1,882 were faculty. The number of employees included all Graduate Research Assistants (GAs) and Teaching Assistants (TAs); student employees; full-time; part-time; and temporary employees. The total number of Black women who were employed at this campus was 380; representing 3% of all employees. There were 1,587 full-time and 295 part-time faculty members. Black women made up less than 1% of all full-time

faculty and 4% of part-time faculty. The breakdown of all faculty employed at the study location by race/ethnicity, full-time status (or rank), and gender is presented in Table 1.

All non-Black faculty in the table are grouped under “Faculty of Other Races”

Faculty Rank	Black Faculty		Faculty of Other Races		Total	
	Women	Men	Women	Men	Women	Men
Professor	3	2	93	278	96	280
Associate Professor	3	3	116	194	119	197
Assistant Professor	4	4	130	172	134	176
Instructor	0	3	61	42	61	45
Lecturer	0	1	47	49	47	50
Library Faculty	0	0	9	7	9	7
Researchers	1	2	102	217	103	219
Deans/Associate/Assistant	0	2	16	26	16	28
Total	11	17	574	985	585	1002

Source: Institutional Fact Book, fall 2017

There were 105 undergraduate- and 125 graduate-STEM-related programs within 39 departments affiliated with 11 out of IU’s 16 schools and colleges at the campus where the study was conducted (IRR, 2016). The College of Arts and Sciences (CAS) was the largest, comprising 29 academic departments, 18 of which offered majors that were classified as STEM majors.

Not surprisingly, the largest student enrollment was in CAS, which represented 32% of the total student population. Second in enrollment were the College of Engineering and School of Business, each representing an enrollment of 14%. IU enrolled international students from over 200 countries. Among them were also students from 221 men and women from predominantly Black countries of the African continent (Sub-Saharan Africa=200; North Africa=21). The STEM enrollment details for 2010-

2017 indicated that there were negligible number of Black women in all graduate programs, with more enrolled at the undergraduate level.

International Exchange and Study/Education Abroad Programs

IU offered a number of opportunities to experience education over 240 cities, representing 82 countries in Africa, Asia, Middle East, Europe, and the Americas. Through IU's College of International Studies, students could participate in study abroad programs focusing on a variety of topics selected by the facilitating faculty members. There were also opportunities for student to attend IU STEM classes through the various STEM departments in Italy (Arezzo), Ecuador, and Scotland. Between 2010 and 2016, CAS offered 13 STEM courses Chemistry, Biology, Zoology, Microbiology, and Psychology in the above countries.

Student Life and Student Organizations

There were 779 registered student organizations sponsored by the university's divisions of Student Affairs/Student Life, Leadership and Volunteerism, and Academic Affairs. The Student Affairs division sponsored the majority, 570 (73%) of all student organizations while the Leadership and Volunteerism sponsored 26%. The Academic Affairs Division sponsored less than 1%.

The student organizations were further classified as cultural, service, academic, and special interest organizations, based on their individual missions. These organizations included the Botanical Society (or Botany Club), a Model United Nations, Black Student Association (BSA), African Students Association (AFSA), and Pre-Medical Professions Club.

Scholars Programs and Undergraduate Research Opportunities

IU offered opportunities for undergraduate students to participate in culturally focused and/or academically rigorous educational enrichment through the Honors College Program, McNair Scholars Program, a university-wide multicultural program, and the Multicultural Engineering Program. In addition, the Office of Undergraduate Research (OUR) was the main resource for funding research activities for all undergraduates in collaboration with the Louis Stokes Alliance for Minority Participation (LSAMP) program.

The OUR director was dedicated to supporting individual professors who were dedicated to integrating research experiences throughout their courses (including STEM). At the beginning of data collection in 2015, CAS through the Department of Chemistry/Biochemistry's First Year Research Program (FYR), offered mentored research experiences to a diverse group of 70 students from 10 STEM departments at the campus. The students in FYR were all concurrently enrolled in the Honors College Program as a requirement for participation. By the end of the data collection phase of this dissertation, 12 STEM departments were represented in the FYR program. There were no Black women students who qualified to participate in FYR from its inception.

STEM Majors at IU

The various academic majors at IU were classified in two STEM categories: "Base STEM and Extended STEM" (IU IRR, 2015). Base STEM included areas of study that were more narrowly defined by the State Regents, NCES, and the Consortium for Student Retention Data Exchange (CSRDE). Under this classification, only those majors that are traditionally recognized as "hard" sciences are considered STEM. Extended STEM included broader areas of study as defined by NSF for funding

purposes. Thus, with the more inclusive extended STEM classification, academic majors in the social sciences such as Women’s and Gender Studies, African and African American Studies, and Communication Studies were considered STEM at IU. A third more restrictive classification of STEM exists based on the Department of Homeland Security’s designation of STEM academic programs (the “STEM Designated Degree Program list”) for U.S. immigration purposes. Within the context of this dissertation, STEM refers to extended STEM. As described in the next subsection, all the Black women students who participated in this study spoke about their experiences in relation to the “hard” STEM courses offered in three STEM departments—Biology, Chemistry and Biochemistry, and Psychology Departments. These departments offered introductory courses required for undergraduates at IU. The Psychology Department had relatively more Black women, with the exception of the Industrial and Organizational Psychology program, which was as masculine as the rest of the “hard” sciences.

The Research Sample

Black women undergraduate STEM majors were the primary source of data for this dissertation. The number of Black women students who were contacted for interviews was 35. However, 14 of them did not participate. Therefore, the total number of Black women students who actually participated in the in-depth interviews was 20. There were also 23 other participants who were administrators, faculty, or staff at IU. Hence, the total research sample was 44. Tables 2 and Table 3 show the two groups of participants. Because there were no graduate students who were also Black women students in the majority of STEM majors at IU—there were only a handful in

Chemistry—interview data pertaining to experiences of Black women graduate students are lacking. Therefore, the findings reported in Chapter 4 represent the experiences of Black women undergraduate students in STEM majors at IU. I report data from the other sources only when necessary to emphasize and/or clarify a point, for triangulation purposes.

Participant and Case Selection

Sample selection was multifaceted and iterative. It involved selection of people to interview, documents to review, events to observe, and STEM departments as cases for in-depth study. Higher education institutions as organizations have faculty, chairs of departments, policies, and facilities that constitute technical subsystems (Birnbaum, 1988). The administrative subsystems include department chairs as well as deans, regulations, budgets, and other elements that coordinate (or are coordinated) in carrying out the main functions of the institution (Birnbaum, 1988). Therefore, purposive sampling of people, documents and events to observe allowed me to gain insights into how, for example, institutional rituals and symbols served to legitimate certain practices that impacted individual levels of the institution.

As the main criteria for selecting cases, Stake (2005a) recommends answering the following questions:

- “Is the case relevant to the Quintain [i.e. the binding issue or the phenomenon of interest]?”
- Do the cases provide diversity across contexts?
- Do the cases provide good opportunities to learn about complexity and context?” (p. 23).

In order for the answer to be “yes,” the selected case studies must share some characteristic in connection with the nature of the research problem (Guba & Lincoln, 1981) and be diverse enough to provide maximum variation in perspectives for the study (Charmaz, 2008; Stake, 2005a, 2005b). This was the case in the current study.

I began the case selection process after obtaining institutional level data from IU’s IRR Office. The IRR Office provided access to confidential spreadsheets containing enrollment details for all 43 STEM departments within 11 of IU’s schools and colleges for the fall 2014 semester. I then used the data to identify STEM departments that had at least 3 Black women students enrolled in any of their majors (in undergraduate and/or graduate programs). Only 22 out of the 43 STEM departments qualified. This ensured that I would meet a Black woman student who was also a STEM major at IU during the study period. I started asking any IU Black woman student I met or read about in the campus newspaper or on social media if they could participate in the study. This involved going wherever I thought I could meet students and talking to as many Black women as I could find on campus. On many occasions, I chose to ride the campus shuttle and ended up meeting some participants that way. I did this discreetly in order to protect participants’ identities—by targeting only one person each day and talking with her about the study after we got out of the bus and were alone.

Once I had initial contact with at least two Black women students from a department, I added that department to my list of potential departments for in-depth study. Among these 22 departments that had enrolled at least three Black women (on my list) were also STEM departments that offered majority of the introductory STEM courses. Not surprisingly, the Black women students I conversed with often

talked/complained about these courses as they were the science requirements for many other majors, including non-STEM majors. These STEM departments fall under the three most dominant disciplines that make up what are commonly referred to as the biomedical and behavioral science fields (BBS fields), which include biology, microbiology (biological sciences), chemistry and biochemistry, psychology, and physics (physical sciences). They also happen to be fields in which minorities are critically underrepresented (NSF, 2007). Therefore, I contacted the chairs of three of these departments to arrange for interviews. All the selected departments were affiliated with IU's College of Arts and Sciences (CAS).

The department chairs provided more sources of information within and outside their departments. During the interviews, I took notes of all the suggestions in terms of events to observe, people to contact, and documents to review. I did the same during student interviews, taking note of student organization events to observe and academic advisors and information about important IU staff to contact for triangulation to gain multiple perspectives (Stake, 1995). By the end of each student interview, I had names of advisors, support services staff, faculty, directors of programs, and student organizations whose activities the individual Black woman students said they had participated in. I then contacted the people of interest on my list to gain their perspectives on specific issues. Thus, rather than sampling from a list of academic advisors and faculty to interview, I narrowed down to specific people mentioned during each student interview, who were likely to provide more information on Black women's experiences.

This purposeful combination of bottom-up and top-down approaches to participant and case selection proved particularly useful for triangulation of findings pertaining to the specific issues that emerged during the study (Stake, 2005a, 2005b). This selection strategy, though messy, was also helpful in confirming information and identifying collaborations that existed among individuals within the departments and hierarchies at IU. I later added more participants as needed throughout the two-year period of data collection and analysis.

Table 2. Black Women Student Participants

Pseudonym	Nationality/Citizenship	Major/Minor	Age
Aisha	Somali/Dutch	Biology Pre-Pharmacy/Chemistry	20
Courtney Brown	African American	Biology Premed	19
Leah	Burundian	Biology Premed/French	21
Jessica	African American	Microbiology Premed	22
[†] Natalie	African American	Microbiology Pre-Nursing	21
Jackie	African American	Psychology	19
[#] Jessica Brown	African American	Psychology Premed	22
[*] Kerri Smith	African American	Health & Exercise Science/Psychology	18-24
Sabrina	African American	Psychology	18-24
[#] Tiffany	African American	Psychology Premed	18
Joy	Malawian	Economics/Mathematics	24
Kathy	Ugandan	Management Information Systems	21
Carmen	Nigerian	Economics	18
Annie	Nigerian	Chemical Engineering	18
Kitty	African American	Electrical Engineering	20
Lisa	Sotho	Industrial Engineering	21
Senabile	Swazi	Chemistry/Political Science	23
[*] Addy	African American	Chemical Biosciences	19
Oklahoma	African American	Chemical Biosciences	25
Sandy	African American	Chemistry/MD PhD Program	>24

⁺ Parents were immigrants from Cameroon and she was a first generation immigrant.

[#] Parents were U.S. permanent residents from Nigeria. Jessica Brown and Tiffany were both first generation immigrants.

^{*} Kerri and Addy were first generation immigrant children of Nigerian fathers. Although Kerri changed from Premed to her current major, she wanted to apply to Physical Therapy school after graduation. Addy also did not declare a Premed major, but she said that father and uncle wanted her to pursue a career in medicine.

Table 3. Other Participants

Pseudonym	Title	Department/Program
EE	Associate Dean/Professor	Biology
AR	Associate Dean/Professor	Information Science
GAPS	Associate Dean for Students	CAS
TMT	Associate Dean/Professor	CAS/Mathematics
SEA	Study & Education Abroad	CAS
QUANT	Chair/Professor	Psychology
RM	Chair/Professor	Biology
DIVERSITY	Chair/Professor	Chemistry
COLLABORATE	Postdoctoral Researcher	Chemistry/Biochemistry
GRAD ED	Presidential Professor	Chemistry
ATHLETIC	Assistant Professor	Chemistry
RELATABLE	Assistant Professor	Chemistry
EPSCOR	Professor	Microbiology/Biology
PREPARED	Academic Advisor/ Biology Majors	CAS
NICE	Academic Counselor/ Psychology Majors	CAS
AWESOME	Academic Advisor	Chemistry
DISSEGREGATE	Academic Advisor	Psychology
HUMANISTIC	Study & Education Abroad	Student Affairs
SMART	Advisor for Black Students	Student Affairs
FRIEND	Program Director	McNair/Student Affairs
WOW	Program Director	TRIO/Academic Affairs
TRANSACTIONAL	Program Director for Student Learning	University College
COLLEGIAL	Assistant Director	United World College

Data Collection

This dissertation study is part of a larger multiple case study of STEM departments at a HWI. The main data collection activities were conducted between fall 2015 and fall 2017. At the beginning of the study, I assumed that I needed to focus exclusively on Black women students who were majoring in the three departments selected for in-depth study. Yet, preliminary analysis of interviews with students in other majors helped unearth more information about courses, especially introductory courses offered in the selected STEM departments. Therefore, I decided to include all

the Black women's perspectives in the study because their experiences and what each of them knew about the "hard" courses offered in the biology, psychology, or chemistry/biochemistry departments have a bearing on why they chose/avoided these majors.

Interviews

From my experience during the pilot study interviews, some STEM students seemed surprised by the flexible approach to the interview process, which deviates from the traditional ways of interviewing used by many social researchers. Therefore, I described the interview process and study purpose to the participants before each interview—that I had no predetermined categories of what I was looking for, but rather, I was interested in learning new information about the college experiences of diverse Black women students in STEM.

I also took precautions to gain participants' trust in order to encourage them to share as much about their experiences as possible (See Appendix A for interview guides). As for interviews with faculty, administrators, and staff, I informed them that I was interested in learning about the experiences of Black women students in STEM departments and that I also needed to learn about their department as a whole. I welcomed any information and issues they felt I needed to know. I also asked them if they had any specific issues they wanted me to focus on, in addition to what I thought was important. I did this because the intersectionality framework promotes social justice by translating research findings in practice. In this way, I hoped to form trusting relationships with individuals such as department chairs, program directors, postdoctoral researchers, and faculty at the institution for future collaborations. Such

relationships could go a long way in promoting social justice through “working at the intersections” together for the wellbeing of underrepresented students in STEM.

The interview questions for student participants elicited responses related to their experiences in order to understand how their experiences reflected the interactions of their social locations in different contexts at IU (Collins, 2000; Pasque, Carducci, Kuntz, & Gildersleeve, 2012). Each interview lasted approximately 45 minutes to 90 minutes. I also asked follow-up questions, to explore details regarding a participant’s experiences as a Black woman at IU (“with the participant,” Seidman, 2006).

Observations

As I discuss in the verification section of this chapter, observations are an important data collection strategy for gaining multiple perspectives. Therefore, I conducted over 33 observations. These observations helped identify contradictions between words and actions of those in positions of power (Jones, 1996).

Most of my observations were also “participant observations” (Jones, 1996, p. 25). According to Van Maanen (1983, cited in Jones, 1996), while observations can provide valuable insight, being a participant observer can maximize opportunities for learning about people. Commenting on Van Maanen’s (1983) ethnographic study of patrolmen, Jones (1996) contends:

When people lie ... it is probably about things that matter to them. Filled with meaning, the seeming falsehood is a symbolic construction. In this instance, “It was of some importance apparently to these patrolmen that they be seen as autonomous, independent actors in the police drama for they took great care to present themselves in such a manner” (p. 45). For other researchers, the discrepancy in data might have constituted a verification issue, raising questions about what is true; for Van Maanen, it is an example of meaning making through symbolic expression ... Van Maanen witnessed the contradiction between words and actions ... He was a researcher who also functioned in a role

typical within the group studied, and he took part in the same activities. (Jones, 1996, p. 25)

Hence, I conducted participant observations at every opportunity in order to access insider behaviors—this meant participating in student life programs and a semester-long undergraduate research program coordinated by faculty members in the (Bio)Chemistry STEM department. And consistent with the constructivist epistemology, observations also helped identify meaning making among the people within the cases rather than confirm my preconceived ideas.

Document Review

The two forms of written communication for understanding the historical, cultural, physical, social, economic, and political contexts of any case are documents and records. The difference between documents and records is that whereas the former are primarily for private use, the latter have an official purpose (Gall, Gall, & Borg, 2007; Lincoln & Guba, 1985). Therefore, both documents and records are important for refining other data collection approaches in order to expose values and belief systems affecting participants in the cases (Marshall & Rossman, 2011).

The IU Community Impact and IUIRR Office Reports, the IU student daily newspaper, and the Faculty Senate Journal were the main sources of contextual data for key institutional issues. The main issues identified were related to the climate for minoritized students, position statements on racial and ethnic diversity policies, and IU's attention to Black women students' unique challenges through efforts to collect institutional- and program-level diversity data. Thus, through document review, I also explored the systemic and structural factors that influenced experiences of Black women students in STEM majors.

Data Management

Case study research generates an enormous volume of data in the form of copies of documents and records, interview audio tapes and transcripts, notes on readings, field observations, and analytic memos (Schwandt, 2007; Seidman, 2006). Therefore, developing a system for organizing and storing the data is important as it allows easy retrieval of data for analysis throughout the research process and beyond (Schwandt, 2007).

Although there is no one right way to manage data, I found Seidman's (2006) advice congruent with how I organized the materials generated by the current study. According to Seidman,

Keeping track of participants through the participant information forms, making sure the written consent forms are copied and filed in a safe place, labeling audiotapes of interviews accurately, managing the extensive files that develop in the course of working with the transcripts of interviews, and keeping track of decision points in the entire process all require attention to detail, a concern for security, and a system for keeping material accessible. . . . Every moment the researcher spends paying attention to order, labels, filing, and documentation at the beginning and in the formative stages of the study can save hours of frustration later. (p. 113)

Thus proper data management involves attention to detail in terms of meaningful labeling of every interview audiotape, transcript, memo, document, document summary form, and data analysis worksheet. After careful labeling, I stored all data as computer files. Each student interview was transcribed verbatim and data were stored as a word documents on a password-protected computer in my locked office—my office was inside a hospital, which used a secure server. Interviews with additional participants who were not Black women were only transcribed as needed for important issues that I was pursuing for cross-case analysis.

Data Analysis

Data analysis is the science or art of “making sense of, interpreting, and theorizing data” (Schwandt, 2007, p. 6). As a science, data analysis proceeds through a number of clearly documented procedures, which facilitate the iterative processes whereby the researcher interacts with data and ideas (Schwandt, 2007). Therefore, the scientific approach to analysis calls for thorough understanding of the “right way” to apply analytic procedures—such as constant comparison, analytic induction, or grounded theory procedures (Schwandt, 2007).

Other researchers view qualitative data analysis as distinct from interpretation. In view of that, they do not emphasize procedures, arguing interpretation (which includes writing case study reports) is an art of understanding that defies documentation of formalized procedures (Schwandt, 2007). Both views were important and are exemplified in how I approached analysis of my data—as both an art and a science. Indeed, there were certain intuitive decisions that I made in data analysis that remain silent in the pages of this dissertation. Wherever possible, I have provided enough details of the process.

Although data collection, analysis, and interpretation are inextricably intertwined, there is no substitute to a thorough study, reduction, and breaking down of interview data to identify themes. Data analysis and interpretation began during the first interview whereby tentative interpretations influenced the path of questioning during interviewing. Moreover, I used such preliminary data analysis to guide subsequent data collection (Seidman, 2006).

After uploading all data files, I continued to analyze data manually. I also typed and formatted or scanned any handwritten notes, to store as computer files, ready for analysis. I then (re)examined case study data to create constructs, themes, patterns, and meanings useful for understanding the experiences of Black women students (Gall, Gall, & Borg, 2007). The categories emerged from the data analysis consistent with the principles of coding (Charmaz, 2011, 2008, & 2006). Through the process of constant comparison, I grouped the coded data segments to form descriptive and/or theoretical categories and subcategories (Gall, Gall, & Borg, 2007). In order to “add depth” to my descriptions, I searched for themes—the salient characteristic features of each STEM department (Gall, Gall, & Borg, 2007, p. 452).

According to Charmaz (2011) data analysis can begin with either incident-by-incident or line-by-line coding. In this study, I began with line-by-line (open) coding (Charmaz, 2006, 2011), which forced me to stay close to the data. While analyzing subsequent interview data I followed the constant comparative method (Charmaz, 2011, 2008, 2006) whereby different segments of the data are compared to determine similarities and differences to form categories (Merriam, 1998). This type of initial coding differs from general qualitative coding in that it helps to clarify the phenomenon under study, thereby allowing researchers to interact with their data by following emergent leads (Charmaz, 2008). During this initial coding, I also paid attention to participants’ own words to understand and explain their emergent meanings.

Selective or focused coding involved synthesis and scrutiny of data in identification of codes that best explained the experiences of participants in relation to the influence of their STEM department and/or their institution (Charmaz, 2008).

During this process, I continued writing analytic memos of my thoughts about participants' experiences. In order to keep track of my memos, I emailed them to myself and later created a word document (over 100 pages) for reference.

As Charmaz (2008) argues,

Grounded theorists scrutinize their focused codes to evaluate which ones best explain or interpret the empirical phenomenon. These codes then become tentative theoretical categories. Like their scrutiny of initial codes, which codes grounded theorists select to develop is an emergent process. They test their focused codes against the data by using them to examine large batches of data. When deciding which codes to raise to theoretical categories, they look for those codes that carry the weight of the analysis ... [or] "carrying capacity"—and that provide "analytic momentum" (Charmaz, 2006). Grounded theorists then treat these major focused codes as tentative categories subject to further analytic treatment. (p. 164)

Therefore, through the "analytic momentum" acquired by means of this back-and-forth process of studying and comparing my data, field notes, and analytic memos with focused codes, I formulated tentative categories (Charmaz, 2008; Merriam, 2009) as follows:

1. Student development support offered by STEM departments at IU, including support for transitions between high school and college, undergraduate and graduate education, and higher education and employment.
2. Student access to/use of the student success initiatives such as tutoring, writing centers, living/learning programs, study abroad, and student organizations that are available at this HWI university
3. The ways that students talked about their successes and challenges in relation to their STEM major/minor, race, class, gender, and other identities and institutional structures.

Analysis of Data from STEM Departments

Because individual participants' interpretations of situations or experiences may influence whether or not they choose and persist in a particular major, my desire was to represent those multiple perspectives. To facilitate data analysis, management, and writing the cross-case report, I utilized a number of worksheets to organize the emergent findings. I listed all the themes that I identified throughout the study period in (Stake, 2005a), recording all notes based on my (re)readings of data from each STEM department as these were useful for identifying commonalities and/or differences across the three STEM departments (Stake, 2005a, p. 44). I also kept in mind the "uniqueness/ordinariness" and the anticipated usefulness of each case with regard to the main issues or themes (Stake, 2005a). My goal was to document a "thick description scene" that would provide a vicarious experience of what life was like for Black women students in the STEM departments at IU (Geertz, 1973, quoted in Stake, 2005a, p. 109).

Cross-Case Analysis Procedures

Cross-case analysis involved reading and rereading the situated findings for all the STEM departments. Although cross-case analysis does not mean simply listing pertinent case findings, it requires maintaining contextual meanings derived from each case in the final multiple case study report. Therefore, as the analyst of this study, I needed to keep "a vast amount of information in mind [about each single case] over a long reading and analysis time" (Stake, 2005a, 47).

Using memos, notes, and themes, I generated theme-based statements. Because this process began with deciding "which findings [would] feed into which themes?" (Stake, 2005a, pp. 53-54), I discussed my theme-based assertions with Dr. Elon Dancy

II. Because all human activities, including well-conceptualized studies, have limitations, I have described the methodology, with guiding principles to adhere to in each part of the inquiry process, based on clearly delineated theoretical and conceptual frameworks to justify methodological decisions throughout the research process. I also discuss some perceived delimitations and how I addressed issues of trustworthiness through verification strategies for qualitative research and triangulation (Lincoln & Guba, 1985; Stake, 1995).

Verification

Case study research is an art (Stake, 1995, 2005a; 2005b). However, for good case study researchers to “facilitate greater insights,” they must provide verification for assertions they make (Stake, 2005a, p. 110). In order to ensure trustworthiness of findings, a number of techniques have been proposed, and these have to do with establishing credibility, transferability, dependability, and confirmability of findings (Lincoln & Guba, 1985).

Credibility

Credibility is a parallel term to internal validity in quantitative research (Schwandt, 2007). In qualitative research, establishing credibility challenges researcher’s ability to represent the multiple realities of participants as accurately as possible (Lincoln & Guba, 1985). From a constructivist stance, my goal is to understand and present the experiences of Black women students from their perspective—i.e., their reality. Therefore, spending enough time with my participants ensured congruence between the meanings they made of their experiences and my reconstructions and representations of those realities (Schwandt, 2007). Moreover, spending more time

interacting with participants in the field resulted in access to more sensitive information—as we became more familiar with each other (Lincoln & Guba, 1985).

Transferability

Transferability or applicability implies the extent to which context-dependent findings might be generalized from one setting to another (Schwandt, 2007). Whereas ensuring transferability (external validity) in quantitative research requires a representative sample in order for the researcher to calculate the probability that findings are applicable to the population, this is not the case in qualitative research; it is the responsibility of those who wish to transfer findings to make their own judgments on the applicability of findings. While not the main goal of this multiple case study, transferability was addressed through the thick descriptions about participants, STEM departments, and other aspects of the multiple case study. Because I provide thick descriptions of contextual findings, others may make their own judgments as regards to the transferability of my findings to other settings (Lincoln & Guba, 1985).

Dependability

The criterion of dependability allows qualitative researchers to account for the complex and ever changing contexts they study. Dependability or auditability in qualitative research refers to researcher's responsibility to allow others to follow the trail of methodological decisions (Lincoln & Guba, 1985). This calls for thick descriptions, audit trail, and peer debriefing (Stake, 1995, Lincoln & Guba, 1985). Doing so also satisfies the criterion of confirmability because other researchers may draw similar conclusions from the same data and context.

Confirmability

Confirmability is concerned with establishing authenticity of data so that interpretations of an inquiry are “not merely figments of the inquirer’s imagination. It [calls] for linking assertions, findings, interpretations ... to the data themselves in readily discernible ways” (Schwandt, 2007, p. 299). Because of this, being critical of and making explicit my own social and intellectual positions were important.

Accordingly, I end this chapter with a discussion of my positionality in terms of my identities and social location to allow fellow researchers the opportunity to make their own inferences concerning the trustworthiness of my interpretations (Torres, Jones, & Arminio, 2014; Merriam, 2009). With the same goal, I have also discussed the theoretical underpinnings of this study as they relate to my own epistemology, axiology, and methods (Pasque, Carducci, Kuntz, & Gildersleeve, 2012).

More important, all of the above facets of trustworthiness, with the exception of transferability, can be addressed through (a) use of multiple data sources (data source triangulation), (b) other researchers (investigator triangulation), (c) theory triangulation, and (d) methods triangulation (Stake, 1995, p. 107-115). Given that triangulation is important and highly contested among qualitative researchers, I devote the next subsection to its discussion in terms of congruence with the epistemological position underlying this study (Pasque, Carducci, Kuntz, & Gildersleeve, 2012).

Triangulation

Although the original purpose of triangulation within the realist paradigm was to ensure internal and external validity, it has been the technique of choice by many researchers from different philosophical paradigms. According to Stake (2005b),

triangulation is a process whereby multiple perspectives are sought out to aid in verifying the confirmability of researcher observations and interpretations. Although Seale (1999) acknowledges the contradictory philosophical origin of triangulation, he also recommends it for ensuring the quality of qualitative research.

In connection with triangulation, Seale (1999) argues that there is nothing incongruous about individual researchers adapting research skills taken from other research genres to enhance their own approaches. A number of constructivist researchers have also argued for the use of triangulation. The most prominent arguments for triangulation among constructivist researchers include using it to help “deepen understanding of different aspects of an issue” (Cain & Finch, 1981, as cited in Seale, 1999, p. 474); as a way of accounting for interrelationships among contexts—since what is said and done in one setting influences actions in others (Dingwall, 1997); to help “address the situated work of accounts” as opposed to “using one account to undercut the other” (Silverman, 1993, p. 158); and as an alternative to validation in the interest of increasing “scope, depth, and consistency of findings” (Flick, 1998, p. 230). The above constructivist perspectives on triangulation (Flick, 1992, 1998; Silverman, 1993; Cain & Finch, 1981; Dingwall, 1977) are congruent with the perspective of multiple realities constructed by individuals, and consistent with Stake’s (2005b) view that although “no observations or interpretations are perfectly repeatable, triangulation serves also to clarify meaning by identifying different ways the case is being seen” (p. 454) so as to expose multiple realities.

In this multiple case study, I draw from multiple sources of data—students, faculty, administrators, among others. I also had the privilege of sharing case study data

with a team of expert researchers and methodologists in my dissertation committee. Because the committee comprised experts with diverse theoretical viewpoints—phenomenologists, feminists, pragmatists, and constructivists—they discussed my findings to see if there might be any overlap in their interpretation (Stake, 1995; also see Pasque & Neubauer, 2013 who have compared and contrasted theoretical frameworks, methodologies, methods and analysis through the feminist lenses of postmodernism and constructivism). Lastly, I triangulated methodologically through use of multiple data collection techniques—observations, interviews, and documents (Stake, 1995).

Researcher Positionality

To insure integrity as a qualitative researcher and as a human research instrument, one needs to engage in the process of critical self-examination (Lincoln & Guba, 2000; Jones, Torres, & Arminio, 2014; Packer, 2011). To use Martin Packer's (2011) words, "Reflexivity does not mean personal reflection, let alone the celebration of one's subjectivity ... The focus of reflexivity is the way researchers' positions in the intellectual field limit the knowledge they produce" (pp. 330-331). Thus reflexivity is "the focus on the researcher's self as an integral constructor of the social reality being studied" (Gall, Gall, & Borg, 2007).

As Torres, Jones, and Arminio (2006) emphasize,

Understanding one's standpoint and social position before entering into a research project is imperative so as to guard against hearing, seeing, reading, and presenting results that conform to the researcher's experiences and assumptions of self and other, rather than honoring the participants' voice in the study.... Researchers must also guard against assuming their experiences are similar to those of their participants. (p. 103)

Since this dissertation focuses on aspiring Black women scientists' experiences, I would be remiss if I left out my early experiences in connection with STEM. I want to

acknowledge my own identities as a Black African married mother of two college students—my daughter and son are both in STEM related majors at a large HWI in the United States.

As a young girl, I attended coed primary schools in the Republic of Malawi, a former British colony. Later, I transitioned to a girls' boarding secondary school where I spent four years developing into a caring individual through the compassionate academic and personal support I received from both teachers and administrators. During the same period, the loss of loved family members brought serious depression. I benefited from the love and consideration of teachers and staff who worked tirelessly, taking turns to support me until I completed (the final, highly, competitive) national examinations. I excelled academically and was privileged to attend the prestigious University of Malawi at Chancellor College campus in my home country. At the university, I immediately fell in love with physics and African philosophy and wanted to pursue my dream in medical physics. Little did I know that I would take unending detours along the way; I needed to relocate overseas to get a higher degree in any field—and this took twelve years to become reality!

From my experience, I am fully convinced that my professors both in Malawi and the United States of America did not always choose to act in oppressive ways; when and if they did, it was not always conscious or intentional. Although I obtained my physics undergraduate degree and postgraduate diploma in health personnel education and health system research at institutions in two different African countries, and everyone there was Black, I still felt that I did not belong in my physics classes. Because all of us were mostly poor Black people, with a few expatriate White

professors, I often wondered why I felt that way. I needed an explanation as to why I felt the way I did especially as a physics student.

Later, I learned that even in the United States and in many industrialized countries, men outnumbered women in STEM—I was not alone. In trying to make sense of my experiences and possibly find my place in the advancement of African women in STEM, I made the tough decision to leave everything I had worked for (back home), to enroll in a master's program at Indiana University Purdue University Indianapolis (IUPUI). I graduated with a MS in secondary science education in less than two years. However, that was not my eventual academic goal; I did not sacrifice my career for anything less than a Ph.D., no.

Therefore, in the fall of 2008 I enrolled in the Ph.D. program in Adult and Higher Education at the University of Oklahoma. My experiences in the United States have confirmed some of my suspicions. For me as a Black woman, doors have not always been left open. Such experiences in turn led to internal struggles with feelings of not belonging and of being an impostor (Brookfield, 2005). I must also confess that I was not always able to “read” subtle forms of racism until late into my master's program at IUPUI. Through my work as a graduate assistant in a number of research projects with professors both at IUPUI and at my current university, many of which involved interactions with K-20 students, staff, and administrators, I have become adept at recognizing even the subtlest racial and other microaggressions (Solorazono, Ceja, & Yosso, 2000) in educational settings.

In part, this is why I have come to appreciate research frameworks that embrace the complexity of human experiences, including the notion of intersectionality (Bowleg,

2008; Collins, 1990, 2000, 2009; 2015; Dill & Zambrana, 2009; McCall, 2005).

Bowleg's (2008) advice for researchers who use multilevel analyses is to broaden their analytical scope by becoming intimately acquainted with the realities of historically marginalized people. Accordingly, for this project I actively sought out knowledge and insights from other fields of study, including women's and gender studies and sociology.

Consequently, the process of conceptualizing this study involved developing the necessary skills and multicultural, theoretical and empirical sensitivities through a number of multidisciplinary projects. In particular, the pilot study, presented earlier in this chapter, helped me to expand my knowledge about Black women in STEM at HWIs. Furthermore, I followed the advice of members of my dissertation committee and capitalized on a number of opportunities, such as higher education STEM-related conferences and workshops, including events focused on issues that affect women in STEM.

During the pilot study, grappling with the challenge of situating my participants' stories within the social hierarchy of their race, nationality, and sex in the United States led to more consumption of relevant literature (Bowleg, 2008; Collins, 1995), to come to an appreciation of how knowledge of the historical and contemporary social contexts in which institutionalized oppression occurs is indispensable to those who embrace the complexity of human experiences (Bowleg, 2008; McCall, 2005; Shields, 2008). Also, the process of submitting a proposal and presenting (twice) at the Association for the study of higher education (ASHE) conference was enriching in terms of understanding issues affecting Black women students in the context of the United States.

Also, the constructive feedback I received from the Dr. Lisa Wolf-Wendel, who served as discussant for my research session at ASHE conference, led to further refinements of the focus of my study of Black women in STEM. A major criticism was that my presentation was “totally silent on race.” As I continue to reflect on my past limitations *vis-à-vis* intersectionality and Women of color in the United States of America, there is no doubt; what I omitted in my preliminary analysis is a significant lens for studying historically marginalized people (Collins, 2000). Although this silence on race in my pilot findings could have been, in part, due to the overrepresentation of Black women international students in pilot sample, I acknowledged my own bias in framing the questions that guided the inquiry and by not digging deeper into the rich history of Black people (Dancy, Personal Communication, 2013). Nevertheless, the pilot study informed major aspects of this dissertation.

At this point in my career, I have become aware of the power of case studies as a research, teaching, and learning method, that they are “at the very heart of expert activity” (Flyvbjerg, 2001, 2004, p. 222). Moreover, scholars agree that because being a professor involves teaching and research to facilitate student development—among other expectations—case study as a method of learning is necessary for me as an aspiring professor (Flyvbjerg, 2006).

Therefore, the motive behind my desire to master case study designs should be obvious; both the process and findings of this multiple case study have drawn me closer to my scholarly goals. In short, this dissertation is a step in my pursuit of a research and teaching career in higher education. It is with these experiences and aspirations that I embarked on this project through the theoretical lens of intersectionality. I hope that

others will discern the influence of my positionality and strong desire to understand what I experienced (as the only woman student majoring in Physics) on the research process. I urge all of you to make your own interpretations of the findings from the rich data and thick descriptions I provide in the findings chapter of this dissertation.

Ethical Issues

Before the interviews, each participant had the opportunity to read and sign the consent form to ensure voluntary participation. I also asked each student participant to choose a pseudonym² to protect their identity. Although many student participants gave permission to use their real names, I opted to protect their identities and offered them the option of choosing a preferred pseudonym. One woman refused to provide a preferred pseudonym but allowed me to use any pseudonym/name I chose. I finally decided to call her Leah. I recorded all formal interviews using a digital audio recorder. During the recorded interviews, I specifically reminded each participant not to use their real name. For those who forgot to use their pseudonym, I assured them that no one had access to the audio recordings except myself and that the transcript would not contain their name. After each interview, I labeled the audio files and uploaded them into my password-protected work computer.

As for the staff, faculty, and administrators, I used their social media profiles on LinkedIn, Facebook, or Twitter, and their published biographies to coin creative pseudonyms for each of them. This was particularly helpful because it allowed me to use some of the salient themes pertaining to their influences on the experiences of students as they emerged during my interviews and conversations with them. This

² Three participants chose pseudonyms that had first and last names. These are Jessica Brown, Courtney Brown, and Kerri Smith. The rest opted to use only one name.

strategy also served as a memory aid during case report writing. For example, an associate dean for research in one of the colleges (CAS) was assigned the pseudonym based on his disciplinary background in biology. The appropriate pseudonym for him was EE. As for one academic advisor, whom I felt exemplified excellence in supporting underrepresented students and was always ready to talk and comfort them. Her pseudonym is “PREPARED” (Table 2).

Conclusion

This dissertation draws from a larger study that I conducted at one HWI through the multiple case study approach to the research design (Stake, 2005a, 2005b). In this chapter, I have provided the rationale for the research approach, namely to provide further insights on the less explored facets of Black women’s underrepresentation in STEM majors so as to inform policies, programs, and practices that are rooted in the notion of “working at the intersection” at various levels of HWIs (Collins & Bilge, 2016).

According to Stake (2005b), in order to optimize understanding, case study researchers must adhere to five guiding principles, which are selection of key issues, contexts, activities of the case (interactivity), experiential knowledge, and triangulation (Stake, 2005b). Consistent with intersectionality as an ecological/multilevel framework, this inquiry is also congruent with organizational perspectives (Birnbaum, 1988; Bolmann & Deal, 2005; Weick, 1976). Using intersectionality as an analytic tool allowed analysis of the complexities of the experiences of Black women students within and across the levels at which power operates in organizations such as IU. This

ecological approach also required triangulation, which also served to ensure credibility of my descriptions and interpretations presented in the next chapters.

Chapter 4: Findings

The purpose of the multiple case study was to understand the experiences of Black women students in STEM majors and how these experiences were influenced by their institution. This chapter presents the cross-case findings supported by evidence from 23 in-depth interviews with 20 Black women students (including three follow-up interviews), as well as from 23 faculty members, staff, and administrators. Additional data sources, including observations and documents were also consulted. However, the findings are based primarily on the interviews with Black women students; I use data from the other participants and sources for triangulation purposes and when necessary to emphasize or clarify certain findings. The following six central cross-case themes emerged from the analysis of the interviews with Black women students in STEM:

- Choosing and changing a major;
- “Too White, too male: “Feeling insignificant;”
- A transnational sisterhood;
- Self-doubts: The compulsion “to prove that I belong here” (Intersectional impostorship);
- “This is the way things are:” Pushing through structural challenges and obstacles; and
- Finding communities and thriving while Black, female, and/or foreign

What follows is a detailed presentation of the findings with evidence to represent the multiple perspectives among the participants in the study. Where appropriate, to further support or clarify each finding, I weave together findings drawn from other data sources—i.e. from the interviews and conversations I had with staff,

faculty, administrators, or student leaders, and from documents, social media, and observations.

Choosing and Changing a Major

Because choosing and changing a chosen major was inextricably linked to choosing a college or university, I first present the factors that participants considered important when choosing a college or university. I then turn to the second and major aspect of this finding namely, the external and internal influences on a participant's choice of major (motivation), including the multiple perspectives that emerged regarding the thought processes behind choosing or changing a STEM major. In the concluding part of this subsection, I present the experiences and motivations of participants who chose Pre-health/medical majors.

Choosing a College or Institution

All participants discussed their reasons for choosing to study at IU. These included but were not limited to

- Potential for opportunities to interact with different others at a big university campus;
- Knowledge about financial support and positive experiences of their friends who had studied (or were studying) at the university;
- Availability and perceived rigor of courses in the academic majors of their interest; and
- Career opportunities due to perceived prestige associated with a degree from the institution.

Majority of the participants were attracted to IU because, as one returning first year African American student (her pseudonym is “Oklahoma”) said, they “wanted that big university experience” IU could offer.

Aisha, a 20-year old F1 visa sophomore and an only child of a Somali immigrant couple who were citizens of the Netherlands also agreed with Oklahoma and discussed other reasons that represent what the majority of F-1 visa participants said:

Actually, IU was my last choice while I was applying to universities. When I got in I wasn't even like...I was like okay, I got it. But then as I started looking into it more, I applied primarily to private colleges but then IU was like one of the few big universities, I felt like because it is such a big community, it will help me more. That's where I could like meet more people because I always went to smaller schools growing up. So I felt like may be a bigger community will help me, not become more open, but become more integrated like; just have so many people around me so I can like be influenced in a positive way and like have many inputs from like different people. And also the people who graduated before me, there were students that I knew; they were already here...I asked them “How is IU? How is the school? How are the teachers?” and then they said, “Yeah it's really nice.” And then IU is very generous so I said, “okay then, I'll come.” (Aisha)

Because Aisha was a Davis United World College Scholar, which meant a full ride scholarship (the UWC scholarship), I wondered why IU's generosity “in terms of the scholarships” was important to her. Therefore, I sought further clarification from the UWC Assistant Director (Dr. COLLEGIAL) who explained that when universities accept UWC Scholars, they must provide additional/matching funding for each scholar they admit—and indeed some institutions seemed to be more generous than others. Like the majority of African students, IU was not the first choice of a university for Aisha. Yet, they all agreed with Carmen that coming to IU was a good decision.

Another UWC Scholar was Joy, a Malawian woman. Joy started high school in her country and later attended an International Baccalaureate High School Program (IB)

in British Columbia, Canada. After high school, she went on to study at a small faith-based college in Missouri (USA). She also indicated that unlike IU, her former college was not generous. She was a first generation college student from a humble background, with six younger siblings and parents whom she supported financially—from her on-campus student job. She said,

When I was in Canada, I met friends. Some of those friends came to IU and I chose to go to Westminster. And when I began to not enjoy Westminster—for both academic and personal reasons—I began looking for schools and began reaching out to friends. From the information I got, I chose IU because my friends seemed to be enjoying it. [They are both from Swaziland, a man and woman] ...obviously, they are my friends so they wanted me to come here. ...When I was at Westminster College, I was buying my own books; so when I asked them they said their scholarship covered books here [at IU] so I was like, okay, that's one reason I should go. So I wouldn't have to buy books anymore if I go to International University. [The male friend] is also studying Economics and I asked him "What courses are you taking?" And like "What's the approach that the professor using, like are you writing any papers?" ... So he told me; he's like "Yeah;" they were analyzing articles. Like articles about real world issues and like use the Economics skills you have learned and then apply them to analyze that article. I didn't have that [experience] at the school where I was. I was in the same year as [the male friend] and were taking the same level of courses; so me not having that experience but him having that experience I was like; I better go to the same school [so I transferred to IU]. (Joy)

Kitty, another first generation college student (both of her parents started but could not finish college), was an African American Electrical Engineering major from Texas who also chose IU primarily because of the funding and the opportunities she would have in her major. Kitty was in a scholars' program named after the first African American professor at IU, which I will refer to as The Multicultural Scholars Program (MSP). Through the MSP, she had an annual scholarship award of \$2,500; and she also had four additional partial scholarships—the Multicultural Engineering scholarship, IU's Presidential Leadership Class scholarship, the Halliburton Women's Scholarship

and the Hattie Engineering Scholarship. She too expressed her heartfelt appreciation for IU's generosity in this way:

I chose IU, honestly, for the opportunities—like scholarship opportunities. I can't afford to just pay for school on my own so I needed those scholarships and they have them most here. ...I was like ok, paying for school is like a really a hassle so I'll go where I get the most money. And that was pretty much it. ...College is so expensive...and because of work, my friend had to go back home ...because he just can't afford it right now. (Kitty)

Although participants who identified as African American also believed in the value of the degree from IU, all who articulated this sentiment were not (yet) U.S. citizens. Leah, a Burundian F1 Biology senior who self-identified as middle class was a transfer student from a two-year institution in Houston, Texas. She spoke about the affordability of IU and the perceived value of a U.S. degree in the medical field saying,

I applied to...three [schools in the USA and Canada] and I got accepted everywhere. And then I chose IU because my *parents wanted me to stay in the United States because getting a medical degree from the US is very prestigious, you can work anywhere in the world* without having to go back to school, unlike medical degrees from other places in the world. So then I stayed in the US but then I chose IU because it was cheaper than Texas Tech. I don't remember another reason why I chose IU but I think it was cheaper than Texas Tech. (Leah)

Motivations for Choosing a STEM Major

As each participant described their unique experiences, it became apparent that all F-1 visa participants and majority of those who identified as U.S. permanent residents or African American with at least an African immigrant father experienced pressure to do “exceptionally well” (Natalie & Annie) in their chosen majors. As illustrated in the words of the participants, these pressures seemed to emanate from their families' economic concerns as well as from society in general. Remarkably, some of the women were determined to channel these pressures into a force that proved to be a

strong motivation for choosing and persisting in male-dominated STEM majors. In other words, choosing to pursue higher education was a form of resistance through which they displayed their rebelliousness, to do what Black women were not expected to do.

The society and everyone else around who thought that women could not go into science (laughing). It wasn't about them telling me to go but it was about them telling me not to go [into science]. I grew up in an environment that was very; I mean *the lot for women is to be a teacher or be a nurse* or you know, those like very gender-specific roles or jobs and stuff, and secretary. And so you know, I was always the person who... *my mother taught me to like take risks at a very young age so I was always very nonconformist*; and so for me it [going into science] was like...initially, it was because I needed to prove to everyone else that I could do the things that were traditionally attributed to men. So like I took like physics classes, math classes in high school because I was like, "you think women cannot study physics and do well? So *I'm gonna show you*. And so then, in addition to that, my dad is a very scholarly kinda guy; like he's working on his second Ph.D. right now, bless his heart, and so he was always a very big advocate for education and doing things. And so he always referred to me as the future engineer of the family, which I was like, "*because you want me to be an engineer, I will not be an engineer* (laughing). ... Because I feel like African families that's what happens—you are going to be a doctor, you are going to be a lawyer, you are going to be an engineer—it's like there's those things that they can say "oh you've made it," if you can achieve them. And so I feel like that combination of like parents who are very pro-education and like testing your limits, and the society that was like "you cannot do it because you are a woman," or because you are a Swazi female[sic] in a very patriarchal society that expects women to submit to everything else or everyone else. So it inspired me to go into the sciences and then I fell in love with Chemistry because I was like, I'm making new things; I'm making something different every day. (Senabile, F-1 visa student from Swaziland)

The experience of family pressure was clearly articulated by Natalie, Addy, and Annie who happened to have African parents, including their college-educated family members and relatives. Natalie, a Microbiology senior said she came from a family with a long line of college graduates. She was African American but mentioned that she was a first generation immigrant, with both of her parents from Cameroon. Addy was also an African American first generation immigrant because her father was from Nigeria—

her mother was also African American. Annie was a Nigerian F-1 visa Chemical Engineering first year student who had siblings at other universities in the USA. Her parents in Nigeria were also college graduates. These are their experiences:

My dad has four sisters; one got her Ph.D. in Accounting, my dad got his Master's in Industrial or Electrical Engineering. His other sister became a pharmacist. She became a Registered Nurse and then she worked her way up; now she is the Regional Manager for CSL Plasma...she travels a lot through these companies. My last aunt became a nurse first, and then she went to pharmacy school here at IU after that. And then my brother just graduated from pharmacy school this May. So, *pressure* [laughing]...and then *influence* too because I'm inspired by them to *see* that like they can do it. ... My dad started all over when he came to America. You know, they didn't really honor his...I think he had a Bachelor's in Engineering when he was in Liberia and they didn't honor that [in America]. So he had to start all over. And then they had us when they started. So that was inspiring. So if they can do it while they had three kids, raising kids and starting over in America, and then what they tell us, and that's what inspires us. So yes...positive pressure. ...It does seem positive at the time, you know. But like I know they mean well and they want us to succeed and stuff. ...This past year I know I was kind of ready to pull my hair because *I didn't know what I want to do...Now I chose Nursing. I feel better.* ...If I would have done anything different, *I would have chosen nursing sooner, and then I would have graduated* [sooner] this May [2016]. I have a friend who will graduate this May from Nursing School and we all started at the same time. I think I just didn't know exactly what it was that I wanted to do and *I was very heavily listening; not listening to my parents, but more so trying to choose something that I might impress* them more or something like that. So that's probably why I chose, I mean I would most likely have chosen Biology still. But that's most likely what propelled me probably to look into PA [Physician Assistant] school and med school. ... I think with Nursing, you know, like once you pass everything, you're guaranteed a job. Everyone needs nurses everywhere. So I think that's also another thing that comforted me; just like, "this is a good choice," as far as Nursing. My dad kind of asked why I switched; I've figured he wants me to be done with school, most of all. ...He's just glad I'm just wanting to be in school, I guess, and wanting to be successful in life. ...I think the older I get...he has more trust in me. But in the beginning, like my freshman year, it was more so him telling and now he's just like okay, "What do you want to do?" ...he's just asking now. I feel like he's more supportive of my decisions...Both of my parents, they both listen [to me] now. But before it was kind of like, "Why do you do this like that?" So I like it now. (Natalie)

My father watches a lot of news...He said, "You should change your major because it wouldn't be good if you graduate and you have no job because no one is really hiring; most in petroleum industry are laying off a lot of people. ...Like my friend's boyfriend, he used to work in [a big energy company in this state]

and then he got laid off because the industry isn't just moving forward. They just have to lay off people...My sister is studying Mechanical Engineering [here in the USA] ...she's my like my little challenge, but I like that my father doesn't compare me to my sister. (Annie)

Sabrina was an African American McNair Scholar who was a junior majoring in Psychology. She said that her background was unique in that unlike many African American women, she “flip flopped between schools,” attending predominantly White private and public schools as a child. In her sophomore year of high school, she finally transferred to an Art Charter School. She did not mention her father but emphasized the critical role her mother (like Senabile's mother) played in instilling a strong sense of self and the value of a college education for the Black community. In fact, she said her mother was also pursuing a graduate degree in the medical field. As for her motivations, Sabrina said:

I am intrinsically motivated. ...Typically, the majority of psyche classes that I have had to take, there is probably may be at least five or more girls in the class. And so like *we* don't necessarily have like charged discussions about race; it kind of almost encourages me to like continue with my education; like I will go to graduate school because I really want to go into that field and *I want to be the representation for Black women*. I just...it really pushes me because I know that by going higher up in my education and getting a Ph.D., eventually, I can be the representation for another girl who has the same experiences as me or another girl who has different experiences as me but *we have the commonality of being Black or maybe of being the only Black in a Psychology class, a math class*, and just to have that person there to say, “You are gonna do it; you can make it.” (Sabrina)

These findings also highlight the fact that the majority of the participants might have been motivated by their family's legacies of exceptional achievement in higher education, to the point where even in the absence of words, some of the women got the message—Natalie's experience well demonstrates the complexity of this career choice phenomenon.

Parental pressure to be in a specific STEM major may have led to stressful college experiences, characterized by unhappiness and/or ambivalence with regard to the career paths the women had taken to please their influential family members. Yet, as seen from the above quotes, none of the women seemed to have discussed this pressure with their parents; they seemed to interpret this pressure, coming from their loved ones, as positive.

A few exceptions who exhibited silent rebelliousness were Sabrina, Senabile, and Addy who emphasized the importance of basing one's choices on intrinsic motivation for their own personal wellbeing, and for the benefit of society. Below is Addy's perspective:

I'm daddy's girl [but] I think [you] have to know what [you] like; I would say don't go to medical school if you are thinking that that's what you have to do; or if you are thinking that that's what people want you to do. If you *really wanna go into medicine*, then you should go to medical school. But if you are going to push yourself through that, then *your heart isn't going to be in it*. And I've heard too many stories of people who met doctors who don't care about their patients. I think if you are a doctor, you have to care for your patients, that you want them to get better not just because this is your job, but because you actually care about people. One of the other things I want to say is that your degree doesn't have to specifically be used for just this purpose; I think it's more general that they [employers] would like someone with more of these *qualities* more than just your degree. The degree is the way to help you encompass the things that they are looking for but there might be something else that doesn't necessarily fit in, if that makes sense. And sometimes it's just this extra stuff that helps you; not just having the degree but what you are also interested in that could help you land that job on your career path. ...passions can be what sets you apart from others. (Addy, First Interview)

Thus, the majority emphasized the desire to use their education to benefit society. Three African American women in particular, Oklahoma, Sandy, and Sabrina, wanted to help others by pursuing graduate degrees. Oklahoma was an African American first generation nontraditional part time student who was majoring in

Chemical Biosciences. She explained that she already had a Bachelors in Business Management with a Minor in Sociology from a smaller Christian university and was working full time at IU. She said she came to IU because she wanted to take courses that would prepare her for the MCAT (the medical school entrance exam). For this woman, graduating with a Bachelor of Science in Chemistry was not the goal. The other African American woman, Sandy, also had a Bachelor of Science in Microbiology. Sandy's first degree was also from IU. When we met in the spring of 2016, she had just graduated with a second Bachelor of Science in Chemistry and was preparing to join the fall class of graduate students in the Chemistry and Biochemistry Department. These two women, Oklahoma and Sandy also expressed their goals and motivations for returning to college as follows:

...I've been here two semesters...I'll be finished with the classes I need to take in 2019. ...I don't plan on graduating, with a second bachelors; I was planning on ...well, because my advisers are like "it's pointless." Because I wanna go to grad school and I wanna do medical research and with that, I only need prerequisites. ...I chose to take my prerequisites in this major because...it was actually a combination between wanting to be able to use Chemistry to better the world and at the same time wanting to be able to apply that same background with the medical world. And so you get that in the Chemical Biosciences major. ...My goal is to go to grad school to do medical research...probably the MD Ph.D. (Oklahoma— pseudonym)

This has been the basis for encouraging me in my education. I do come from a background where my grandmother and her sisters—they were nurses, of course, during the time when they were dealing with so much racism and ... Most in my family are in either Education or nursing. .. My mom ended up in Human Relations and Social Work; and my dad, he's a Psychotherapist so kinda set a footing for me to at least, you know, to really narrow down and focus on what I wanted to do. But the reason why I went the way that I did was because it was something new; it was exciting; nobody in my family has ever gone into research, Chemistry, anything like that. So I decided that this would be the field for me; I have always wanted to be a doctor. .. I decided that I needed to go into Chemistry because it was something new; it was something that I needed to move forward in my career and expand and do something I had never done before and hopefully encourage other students as well, especially Black women

because there are not many of us in this area. To encourage them to check this area out to see if it is something you may like; see what your talents are and you know, just market yourself; get out there and maybe we can have a whole new market area where we are not used to be seen in ...And as well other people around here, including [Dr. COLLABORATE] and that's been my encouragement to go forward to try to get the Master of Science for the Analytical Chemistry first, and then from there I'm going to apply to Medical School with the possibility of doing the MD Ph.D. ... The MD Ph.D., I didn't know about that until about 2005; but at the time, it wasn't something that I was looking into. At first, it was really just the medical portion. ..That's what's happened to me here at IU. (Sandy)

Although the majority of participants (including those quoted above) seemed to desire degrees that would allow them freedom to be able to choose other career paths at any point in the future, there were also a few who preferred more focused majors solely as a bridge to medical/nursing school. Natalie said,

When I first came in [in Fall 2014], I had hopes of going to PA School [Physician Assistant school] afterwards. ... I knew I liked Biology...I actually started off with [majoring in] Biology first but then it was *too broad for me*. And then I took a Microbiology class and I liked the smaller classes and looking into diseases and things like that, which *Microbiology kind of focused* on whereas Biology ... covered anywhere from you know, like Plant Biology to animals, to humans, and all that. So it's *too broad for me*. I wanted something *more concentrated*, I think, when I first started. But *I really like Biology*, I do; not like the Chemistry part. ... I don't like ... how much Chemistry they make you take with this [Biology] major. *But I'm really good at Biology*, everything like that. ...The Biology is actually interesting. ...But if I didn't choose Biology, I would probably choose Psychology. (Natalie)

Of the participants who wanted to go join the medical and health professions, only a few were aware that it was unnecessary to declare Premed as their major—more than likely, they found out when it was too late to change their majors without significantly impacting the time it took to graduate (Natalie's experience).

There were also participants who changed their majors soon after learning that they did not need to be Premed in order to be able to help people. These were those who

also became aware earlier on in their college careers. Leah, a Biology Premed major introduced earlier in this chapter, admitted:

I knew I could do a major that is not necessarily Biology BUT Biology related; so Biochemistry, Microbiology, Chemistry, or Biology. I didn't know that I could have a major like Dance or Music, or any other art form; or even Anthropology and still go to medical school. I didn't know. I learnt about that way too late. ... I wanted to focus into something. But even though I regret not doing something else, I don't regret biology. (Leah)

Courtney Brown, a Biology Premed sophomore also self-identified as “middle class.” I first met Courtney Brown for a 45-minute interview in fall 2016 when she was still a Biology Premed major. Later in February 2017, we met again at a Black women’s conference at the campus, where I was also a participant observer. It was during one of the breakout sessions that I heard, from her introduction that she was now in a different major; I followed up with her in a private conversation to confirm that she had indeed switched to Health and Exercise Science and found out that she was still thinking about applying to medical school after graduation.

Overall, the percentage of participants who had changed their majors (at least once while at IU) was slightly over 55% (11 out of 20) — but this finding was not unique to those who had declared a Premed major. Other participants who had never declared a Premed major also reported changing their majors for various reasons. Annie changed from Petroleum to Chemical Engineering at her father’s advice while Carmen, Nigerian F-1 visa student changed from Economics (CAS) to Economics offered by the College of Business while Kathy, Ugandan F-1 visa student also changed from Economics (CAS) to major in Management Information Systems (College of Business).

Each participant was asked why they were interested in their current majors. There were seven main of reasons for choosing to persist in a particular STEM major.

Figure 2 shows the number of participants who chose a major for a particular reason grouped by U.S. citizenship or immigrant status.

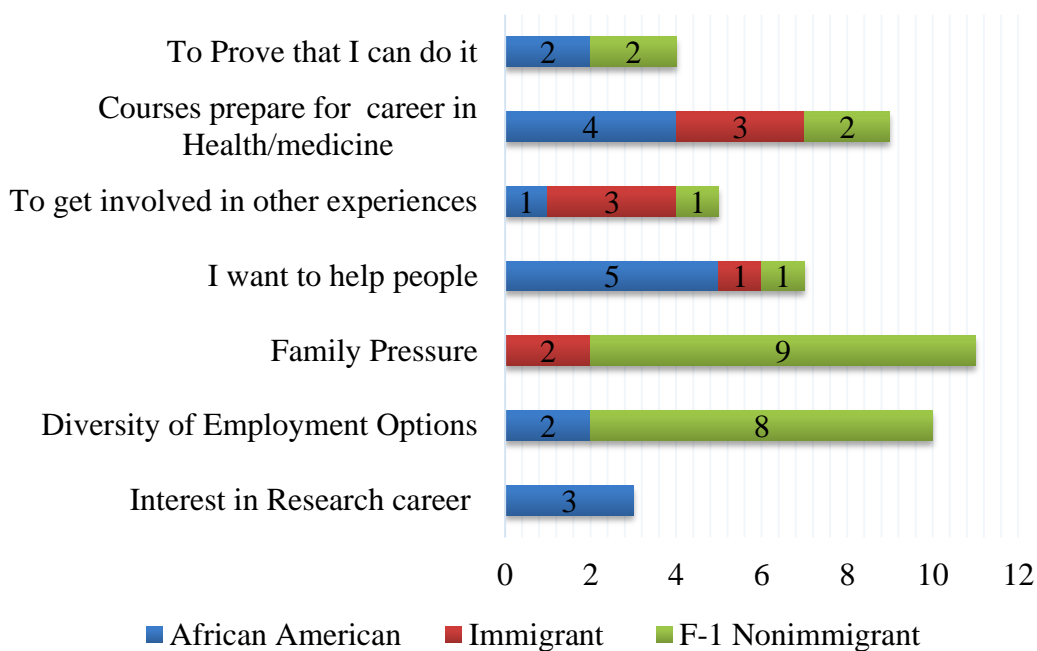


Figure 2. Reason for Choosing a STEM Major by Citizenship/ Immigrant Status

As shown in Figure 2, among all participants, the most popular reason for choosing their major was family pressure, seconded by perceived diversity of future employment options in the chosen field. These top reasons were frequently cited by participants who had African parents including, those who had fathers who were immigrants. All participants who indicated that they had immigrant parent(s) were first generation immigrants. Further, all of the participants who were inclined to enter the health and medical professions agreed that having a solid foundation in the Biological and Physical sciences would serve them well in their pursuits of these careers. Because of this realization, the majority of participants endeavored to be in science majors that also prepared them for the MCAT. The Chemistry and Biochemistry, Biology, and

Physics Departments offered most important courses for all Premedical students. The majority of participants said that Chemistry and Physics courses were hard, and often responsible for lowering GPAs.

Coming in I knew that Biology goes like with med school; it goes hand in hand with the classes that you have to take. Some of the Chemistry and Biology classes are already required for like med school, PA school, nursing school, and then they're also part of the [Biology] degree requirements too. ... I think that's why a lot of people choose it [Biology] initially because they think that it gives them better chances... But if I didn't choose Biology, I would probably choose Psychology. ... Sometimes I feel like the majors are so structured... Like I said, I like Biology; but they have all these Chemistry and Physics courses that you have to take. ... I think it does relate in some way but I don't think as much as they emphasize it; I don't think they should force people to do as much as they emphasize it. Chemistry is part of Biology [but] I doubt Chemistry [majors] have to take all the Biology classes we have to take, I doubt it. ... But Biology majors have to take Chemistry... and then when it comes to Organic Chemistry, that's why they call them *weed-out classes; where they separate the boys from men* because once they take some of these classes, it changes people's majors; it makes people change. (Natalie)

Later, I met other participants, including Tiffany, Kerri, and Courtney Brown, who also agreed that Chemistry "is hard," and that the Biology program was too structured for them to be able to pursue other interests such as minors and getting involved to "experience the whole campus" (Senabile).

I was in Biology but I switched to psychology. For biology, I felt like I had to stack on more. I felt like I needed to make my course load as concise as possible [to be able to get involved in other things]. .. Well, I was a Biology major before psychology... I didn't really take any Biology courses before I switched because I'm like a really planning person so I did a lot of research and like asked around; what are the classes? The Premed program that I am in I like that it fit together. I just wanted to be in a department that I would be interested in as well as to like be able to expand and do other things and I didn't think that Biology was like my place to be. So I chose psychology... To me it just seemed like a lot of unnecessary classes that I wouldn't be interested in taking... I don't know. ... Because for my program that I am in, I have to get a minor as well as my major; for like Biology I would have to like stack on more than I needed ... for me. So I try to like basically make my schedule and like my course load as concise as possible, pretty much. ... with Psychology Department, I just like it, it goes well with my minor. (Tiffany)

These findings raise questions regarding the challenges and supports for STEM majors, especially considering that the majority of Black women indicated that they chose IU specifically as a step toward careers that hinged upon using science “to better the world, ...to help people” (Oklahoma) through graduate and professional schools. In fact, 86% (12 out of 14) of the participants who were in majors offered in the three departments that I selected for in-depth study indicated that their goal was to join the medical or health professions.

Of the five participants who indicated a strong desire to apply to graduate school, three (Oklahoma, Sandy, and Senabile) were Chemistry majors while two of them (Sabrina and Jackie) were Psychology majors. Noteworthy though was the fact that only Sandy was interested in doing graduate work in Chemistry while concurrently pursuing a medical degree. I also met Sandy during her transition into IU’s Analytical Chemistry Graduate Program in the Chemistry and Biochemistry Department in fall 2016. At that time, Oklahoma was still enrolled as a part-time student and working full time; but she was determined to follow in Sandy’s footsteps in the near future. Like the other participants who indicated that they might consider graduate school, Sabrina and Senabile did not choose graduate programs in their fields—Psychology and Chemistry respectively. Instead, Sabrina transitioned into a Women’s and Gender Studies Program at another reputable university to pursue her goal of an academic career, to be “the representation for Black women.”

There were other complexities involved in choosing a major. As indicated earlier, the majority of Participants said they chose IU because of the availability of the majors they were interested in. In addition, their choices of majors also hinged upon the

diversity of future employment possibilities. When I followed up with a question regarding what the participants wanted to do with their life (and degrees) after IU, like the majority of participants, Kitty and Kathy admitted:

I came here because of scholarships and opportunities I would get...and they [also] had my major here. And that's all that really mattered; I feel like I chose this major just because there would be like so many *opportunities career wise* and also like it just gave me so much *diversity; like I wouldn't be just pigeonholed like in one specific thing like Petroleum Engineering*; like I could be in any field like energy, technology; I can pretty much do anything with my major. ...I really (pause) like honestly, I'm not really sure [what or where exactly] but I know, for sure I wanna work, I wanna have some real work experiences; and from there, I will decide. I think I wanna go to law school; or get my Masters in Electrical Engineering; so we'll *see*. ...I don't wanna go to grad school right after. ...I wanna work, and may be like just kind of live life a little bit, you know (pause) and may be date and do all that stuff; but I don't wanna just go back to school, I wanna live life a little bit...outside of school...it's different. (Kitty)

I changed my major from Architecture to Management Information Systems (MIS) because I know I like project work, but it felt like if I was in one area I was more confined but with MIS... I mean I haven't done much of it yet, but I feel that you can work in different departments. So *it's more versatile*—because I'm not exactly sure what I want to do—but I know what I like. (Kathy, F-1 visa student from Uganda)

Although both Kitty and Kathy indicated feeling less confident about their future career options, they emphasized the need to “not be pigeonholed” into one specific career option. The *ambivalence* experienced by participants in their career choices was evident in the comments made by the overwhelming majority of the participants, including those who were nearing graduation.

Other F1 visa students elaborated further regarding the source of such fears—the thought of earning a degree and not being able to make a living. Like the other F1 visa participants, Aisha said she that loved to write. However, because she desired to work in the United States after graduation, she needed to get a degree that would increase her

chances of getting a job [that would sponsor her Green Card]. Thus, the decisions the participants made seemed to also hinge upon the constraints applicable to their unique situations such as not having “real work experience” (Kitty) or not having a Green Card (for all F1-visa participants), or struggling to make a living.

“Too White, Too Male:” Feeling Insignificant

All the participants recognized the fact that different Black women experienced and interpreted their challenges in different ways. The overwhelming majority seemed to have reflected on their past educational experiences. Without prompting, each of them talked about their primary school, high school, and previous college experiences (for those who were returning or had transferred to IU). The quotes below contain participants’ past experiences as they shaped/informed their experiences at IU and are representative of the other participants’ experiences.

My high school experience is really interesting because I began to be more aware of my race...because I went to a predominantly White school...Overall; I’m a person who loves making friends and meeting people. ...I prefer to be liked than disliked—and that’s really common for most people. And so when that didn’t happen in high school, I mean I had a group of really good friends; but in my class it was really hard to be similar or relate to them. Also coming from a *lower socioeconomic status* and these people are from, you know, *upper middle class*. And so there was like (long pause), just a distance between us, I guess. It was really like a rough experience for me going into that school. I switched schools in the middle of the year and went to the Art School; I felt very relieved because I was still kind of going through my internal identity struggle like you know, being Black. But I was able to be more comfortable in that experience because it was a more diverse school. ... (Sabrina)

So far so good [laughing]. ... I wasn’t at MIZZOU but we did have different racial tensions there; and also *it was a predominantly White school so there are certain things I experienced there that I also experience here...* Well, it’s just kind of tensions that come with being the only person that looks like you in a big group of people...Even socially, there were certain student groups and organizations that they didn’t have because they were...they just didn’t exist because they didn’t have any minorities that made those groups so umm...it wasn’t...socially it wasn’t probably the most ideal setting; I did enjoy myself

some, *but I think IU has been a better experience for me...* [but] there are things that get in the way sometimes, especially like being a minority (Jessica Brown, African American Psychology Premed Senior)

I think as it relates to me in academia, I know I had to face some hurdles like GPAs and standard testing. Some of the other things that I just couldn't avoid; like *being in an institution that still needs some amount of work in how to treat minorities especially when you are a minority woman*. Now it seems like more often than not for those of us that make it to college, it is the minority women more so than the minority men that are trying to go back, you know, to get more education and try to grow and get into the careers that they are interested in. It's just a little bit harder at an institution like this but it's still doable. (Sandy)

The above comments about IU mirror what every department staff, chair, and faculty member I interviewed said. There was unanimous agreement regarding the need for more faculty of color across the board, but more especially in STEM departments. In fact, the Biology and Psychology Department Chairs indicated that they had no Black people on their faculty. The Chemistry Department had at least one Black man who was a senior professor (former Chair of the Department); but they had no Black woman professor. Concurring with the above observations, a Black student organization expressed (in a letter to IU President) the fact that Black students' negative experiences would continue to escalate as long as the faculty body remained White and male, which could lead to poor retention of Black students. A professor of Chemistry whom I met at a graduate student social event also admitted, "Our student body this year is too White and too male."

The Black women students I interviewed also felt that the underrepresentation of Black faculty was more prevalent in their STEM departments. Jessica, an African American senior in Microbiology/Premed said:

I don't know how hard this is [for IU to change] but just having [Black] faculty in these [STEM] majors; I feel like the only Black faculty are in the AFAM (African and African American Studies) Department...actually today, today my

original professor was out so one of his colleagues Dr. [Name], taught my class today! The first time I've ever had an African American professor...I believe she may be mixed, but she's definitely a person of color. I was like, oh my goodness! Because I didn't know; the only other Black person I've seen in my department [Microbiology and Plant Biology] is a graduate student that was helping one of my professors. She would come in and help during testing time. But I think she did research for my professor. These are the only Black people I've seen. (Jessica)

Mirroring the above observations, the Black student activist organization demanded that IU should "hire Black faculty beyond the African and African American Studies" (AFAM) Department. Also, enrollment details from the IU IRR Office showed that there was only one Black woman graduate student enrolled in Microbiology and Plant Biology Department during that year. In addition, Dean EE knew this graduate student by name because she was in some of the undergraduate courses that he taught. Thus after graduating with a Biology degree, she chose to pursue a graduate degree in Microbiology and Plant Biology Department.

Evidently, the majority of participants experienced isolation inside and outside the classroom because they were often one of a few people who had marginalized identities, interests, and experiences. Naomi, an IU first year Biology Black woman student whose story appeared in the student newspaper also shared her experience in dealing with being different in ways that were also echoed by the majority of participants, especially international students. In the newspaper that was published in 2016, Naomi described her experience and how she dealt with such tensions:

Self-love and acceptance is the most important thing to me over everything else. Especially as an international student I discovered people don't know where you come from. I'm from Swaziland, but people think I'm from Switzerland... Sometimes I let them think that. Swaziland is a tiny country in southern Africa. I've met a lot of people who like learning about other cultures, but some other people are not interested. So sometimes it can make you feel insignificant, especially in such a big community where you have people from all over the

world. I've learned that as long as I know where I'm from, I accept where I am from, who I think I am, and who I am, then I feel that's all that is important to me. Accept yourself and try to accept other people. Some people have never really been exposed to different situations where they have to deal with someone who is different from themselves. You have to have self-love and self-acceptance to show people "Hey, this is where I'm from, and this is what I'm about." (Naomi, the Student Newspaper, 2016)

Thus, Naomi seemed to indicate that if you love yourself, you can thrive even in seemingly unwelcoming environments. According to Naomi, if you do not fare well at your U.S. HWI, it may be your own fault, not the institution's fault. However, Sandy and other participants seemed to point to the need for structural changes. She indicated that IU as an institution "still need[ed] more work" toward making diverse Black women comfortable.

Referring to her own situation, Addy also admitted feeling lonely. Yet, she said she could not attribute her loneliness to race or gender but rather to her own personality and a lack of interest in science among her IU peers.

When I first came to the university, it was pretty lonely; when I think back then, I felt lonely, most of the time because I didn't really find anyone who was interested in science like I was. It was just lonely and boring because some of the girls wanting to go to parties or something. I'm like my dad, my mom says we have dry personalities; that's fine with me. I like my *quality time*; I don't have time for all that nonsense. I think just adding more things that help everyone adjust to the campus [realizing that] not everyone likes to go to parties or have party time to make friends. I think the band really helped me with that. *I'm still kind of lonely* but it helped. ...I really would have been lonely [if I didn't have the talent to be in the marching band]. I don't even know if I would have went to IU if didn't know how to play an instrument; it's just because of how things worked out. ...I still couldn't find anyone that likes to talk about science; I tried to strike a few conversations. ...I would like test the waters to see how far they were willing to delve into a topic and they were not really willing to go past the surface. After that, I lost interest; I realized that it wasn't going to work out. (Addy, First Interview)

Another participant who did not attribute her challenges to race or gender was Aisha. Although she spoke about her experiences with race while growing up in the

Netherlands in her first interview, she emphasized that “I was too young to understand” then and did not feel like those experiences shaped who she was as a person. Regarding her experience with being different at IU, she felt like she stood out because she was “the only [Black] girl with the scarf.” Later, in a follow-up interview she admitted:

It’s true that there are not many people that are colored but (pause). It is very true, there is definitely a lack of diversity; I definitely agree, although I haven’t felt excluded yet by any of these faculty members that I have been in contact with. It’s definitely true; I’ve never had an African teacher at IU or anyone that looks like me and that’s you know, it’s about race (very uncomfortable with the topic) but I’ve never felt discriminated or anything. But it’s nice if you see someone like you to look up to...I’ve never been put in a difficult situation where I felt that I was being discriminated because of my race. ...that’s why for me now I’m like, it is what it is...I should actually say there is a lack of them in the sciences [Black faculty] rather than in the other departments. For example, my English teacher [at IU] was a Black woman. Maybe there is a lack of minorities in the sciences and like higher up in graduate degrees and maybe professors. (Aisha, Follow Up Interview)

Thus, regardless of whether they felt or did not feel discriminated against based on any of their identities, all the participants agreed that it would have been beneficial to have more people who looked like them “to look up to” or “to lean on” at IU, if they needed to.

A Transnational Sisterhood

As shown in Table 1 in Chapter 3, out of the 20 Black women who participated in the study 12 (57%) were African American. Over half (7) of the participants who identified as African American had parents who were descendants of slaves while five indicated that they were first generation immigrants because either their father or both parents emigrated from Nigeria (4) and Cameroon (1). The remainder of the participants was international students (F-1 visa students) from Burundi (1), Lesotho (1), Malawi

(1), Netherlands (1), Nigeria (2), Uganda (2), and Swaziland (1). Thus, all participants represented eight countries, including the United States of America.

From the interviews, it was apparent that although American immigrant participants and their parents were proud to be American they also identified with their African tribal heritage. Tiffany and Jessica Brown, both Psychology Premed students of the Igbo Tribe said they felt more Nigerian than American but cherished their African American identity. Jessica Brown said, “I feel both of them but if you ask me what I am, I’ll say I am Nigerian.”

This pride was also described by Aisha who said that she was Dutch by citizenship but identified more with the Somali community. Here is what she said as she compared her immigrant experience in the Netherlands with the pride expressed by her relatives who were immigrants in America.

I was born in the Netherlands but my parents are from Somalia; but I usually say that I am Somali...I mean it’s who I am...As for citizenship, I’m Dutch; I’ve never been there [Somalia] but I’ve been raised in such a way where I know my native language [Somali]; I know my culture; so I’m both [Dutch and Somali]. We do have tribes [in Somalia] but it’s only in the northern part where we have different dialects; but I am from the southern part [of Somalia]. ... [In the Netherlands] growing up we lived primarily in a White neighborhood. I went to the Dutch primary school...Up until I went to the UWC school, I was always the only girl that was like colored or different...In the Netherlands they call you Dark; actually, Foreigner. There are different words so for example, if you are a person who wasn’t born in the country, then you are called Foreigner; then there is another word to explain that this person’s parents are from a different country but he himself was born there—and the word is *Autochton*. So I am called *Autochton* and my parents are *Allochtoon* because they weren’t born in the country. Some people are saying oh, we shouldn’t use that word but its just the way you identify.... [It is different in here in the USA] ...I feel like a lot of people here; although when I’m in the Netherlands, I also say that I’m Dutch, I feel like here it’s a lot; people say it here *with a lot of pride*; like “I am American.” Although they may not have been born in this country they say, “*Yes, I am American.*” And then in the Netherlands, you would say the same thing but not as fast as you would say it here. I feel like especially my aunties, they are quite young; *they are very fast to say “I am American.”* And then in the

Netherlands you are, I mean, I would “I am Dutch”, yes. But it’s really... something that I have to explain. I always like to add, “But my parents are from Somalia” (laughing). Because I feel like when I don’t add that like I’m denying where I’m actually from so I like to add that. ...Honestly, right now, it doesn’t matter for me; I’m not sure whether I’m going to work in the Netherlands, not because I don’t like it, but because I’ve been there all my life; like I know everything; I wanna have like a different experience... We will see. (Aisha)

Sentiments of an identity that seemed to transcend the nation state were prevalent among the participants who were children of immigrants regardless of country of origin (e.g. Cameroon, Nigeria, or Somalia). However, there could be differences between immigrants in the United States versus immigrants in other countries as observed by Aisha.

As presented under the subsequent themes, certain issues were more prevalent among the experiences of some groups of participants than others were. For example, evident in the quotes from F-1 visa participants are issues related to federal immigration laws and policies governing employment in the United States of America, which limited their opportunities for internships.

It’s very hard to get a job here [in the United States]; that’s one thing that I know. ...Many companies are saying that if you are an F-1 visa student, they have to kind of pay for you to work in their companies...because the government requires them to sponsor you. So every time you go to a career fair, they discourage you, every time; because I went to career fair last semester, and I was talking to different company representatives. You could see that they really understand up to the point where you say you are an international student; that’s the point where they cut their concentration; they’re like we have to stop here; we don’t actually hire international students. ..I really want to get an internship because going back home without any experience doesn’t do any good especially when I’m in Industrial Engineering; I have to market myself and tell people that they need me in their companies because at the moment people [back home] have no idea what Industrial Engineering is. ... We all want internships because when you go back home, they always say okay, especially in South Africa because that’s where I think I will get a job, they really want people with South African IDs. They really look for people with degrees from South African Universities. So if I go and ask for internships there, they obviously will not give it to me so I have to get an internship where I studied;

and where I studied [here in the United States], there is a problem because I am an F-1 visa student. So it's really hard to find out where you are going to get an internship because *both sides don't want you* [i.e. both the United States of America and South Africa don't want you] ...and this is not IU's fault, but transport is a problem in this town. International students have to take the [free] taxi [a university sponsored taxi service which run only on Thursday, Friday, Saturday between 10pm and 3am to reduce drunk driving among students].
(Lisa)

I wouldn't put this as a challenge...I don't want to put this as a challenge because *it's just the way the way things are* so I don't know (pause). There was, for example, like my friend, uhm. She had a friend who was working at a hospital like volunteering; then he was like "Do you want to take over my place?" but then she doesn't have a car to get to it so she had to miss that opportunity because of lack of transportation. Transport especially in [this state] is challenge. Definitely that's a challenge because sometimes you hear there is something in [the city] maybe at the Medical Center; maybe there are some opportunities there. And I have never looked into that because I know that there will not be constant [regular] transportation there. I mean I can ask my friends, my American friends who have cars to bring me one day; but it can't be every week and you have to be like to find someone who can do that. (Aisha)

The issue of reliable public transportation to off-campus internships and jobs was a challenge among both F-1 visa students and African American participants. Indeed, the SGA leaders also felt that transportation was also needed to make campus resources more accessible to all students. They indicated that although there were shuttles that connected the three campuses, they did not go to all the buildings on the main campus. The SGA Presidential Candidate (2016) criticized IU's administration for not addressing transportation issues as they affected student access to resources, especially disability resources. He said, "We need shuttles to get to disability resources." Also, the Black Student Adviser (SMART) agreed that transportation was not just a problem among international students. She gave the example of her friend, an African American woman student at IU, who had no way to get to her off-campus job. She said:

I would drive her whenever I could...Transportation program or system is needed for jobs and internships...it limits what they [Black women students who do not own vehicles] can do” (SMART).

The majority of African American participants also expressed frustrations with the federal policies, but even more so with the definitions of low-income status as they impacted their eligibility for federal financial aid and other programs. Although the majority (9) of African American participants were eligible for in-state tuition, they still struggled to earn enough to pay for college—tuition, fees, and the rest of their needs.

All African American participants, with the exception of Courtney Brown and Sandy, indicated that they had to work to pay for their college needs. In fact, the majority had already taken out student loans because they did not qualify for enough financial aid to cover everything. Jessica reinforced this sentiment by stating:

I don't have any academic scholarships but I get a small scholarship because I am in a program called the Leadership Scholars Program and I think it's like \$1,500 per year. That's it. ... This is a program only for kids [students] in the CAS. We have to interview for it and they pick about 20 students from each grade. ...My family pays, and I have one loan from my freshman year; and then my parents graciously pay the rest. ...My dad said that if I came here [IU] and I did well, he would pay for it. ...I work in the Western History Collections Library [on campus]. ...The loan is \$20,000 ...but then there is med school; and then I will also be taking loans in med school. I tried to fill out the FAFSA but they said my parents make too much and I can't get any money for that, which is really hard to believe. ... And my mom retired a year ago so it's just been my dad's income. (Jessica)

As for Oklahoma, she said she faced challenges because she was a part-time student who already had a bachelor's degree. She said:

Some things I looked up [regarding financial support] like you have to be full-time [full-time student] and because I work full-time, I can't do that. ... I mean I was very fortunate because for undergrad I was a Bill Gates Scholar and so that helped a lot; that helped me to come in debt free for this one. ...I just got like the state's Right to Work Scholarship (RTW) [I'm not sure]. ...I also get tuition assistance from IU because I work here and then there is a \$2,000 scholarship also—but it's not a recurring scholarship; it was like a one-time thing. I wanna

say the other scholarship is just some scholarship that they had available, like left over; I don't have one specific to my major. I didn't have to apply for the scholarships but I guess when you are coming in [as a transfer student], they have like a financial aid package for you. So as part of my package they gave me those two scholarships, which ended up being like \$1, 500 each semester...for one year, so I don't have it anymore. Because I'm on my second bachelors, there is not much money [for me]; even though I do really well in class, there's not really any money available and plus because I'm not full time. ...I am taking loans. The loan amounts are like \$1, 200 for the federal government ones. I don't have institutional loans. I just have the federal and that's probably like [pause] I wanna say like a little over half of what I will need [is from loans] as a part-time student. (Oklahoma)

In spite of all these disparities, the majority recognized that they were united by the commonalities they shared. This was expressed in the following ways:

Here it's a predominantly White school so it's kind of hard. I feel like all Black students; we stick together too. All the African students, we stick together too. But recently since like my friends now are in AFSA [African Students Association] more, I'm like getting to (pause). I've seen the BSA [Black Students Association] side my first year so I'm getting to see the AFSA [side]. And I really like it a lot; because like everyone, we are almost the same, you know. Some of the kids [students] were born there [in Africa] and they came to America. But then a lot of them are like us who we all have African parents. You know they expect that (pause). *There are different things that we all share—similar stories of how our parents have positive pressure.* It does seem positive at the time, you know. I know they mean well and they want us to succeed and stuff. So I like being able to relate to them on that. So finding more friends like that. (Natalie)

My mom is from Louisiana and it's a different culture from the general African American culture—like different food; just different. Like people are just different...because of so many influences. I feel like when I was younger, I struggled a lot with my Black identity; living in America, just the way we are socially; just the social issues here I think it has a really big impact on Black children and them really understanding who they really are as a Black person and like understanding their African heritage; and the beauty of it. So I think that I really struggled with as a child. And now that I'm older I think that I really have a greater appreciation for my African heritage...*even though I wasn't born in Africa, it's like yeah, I still am like an African.* I think a lot of us struggle with that, like understanding just how beautiful that is; just *our African roots made us really who we are today*, you know. Just like from the music that our grandparents made to the foods; you know like a lot of Black people like their food to be well seasoned or just very flavorful versus other people that are here. So it's interesting ...I think I know a lot of Black people who are trying to wake

up and to realize that they have to be comfortable with who they are as a Black person or an African American. ...I think I struggled with my hair texture...and just wanting to straighten my hair all the time –and this is my real hair. .. I think from high school to now it's just like a transition to like just being comfortable with who I am; and just having like more curiosity in just like Black people throughout the diaspora. [in high school] I knew a guy who was Ethiopian; we were cool but like we didn't talk a lot. Every now and then we would talk and he would tell me about Ethiopia. It was interesting. ..It's a beautiful thing; of course we are all different but there are some things that really make us you know, similar. ...I'm considering a minor in AFAM [African and African American studies]. *I've learned a lot; I think just understanding the importance of also just connecting with people on the continent of Africa and people in the Caribbean; Africans, you know, just everywhere, not just in America.* It is important that we all kinda connect and just work together. (Kitty)

Among the commonalities expressed by participants who were first generation immigrants and their African sisters, the pressure to aspire for specific careers that they considered more rewarding was most prevalent—as shown in Figure 2.

All participants acknowledged that there were differences and commonalities among Black women. Yet, only a few African participants were able to articulate some of the cultural and historical barriers that could threaten the unity among Black women in the United States:

I only realized I was Black when I came here [to the US]...I had never been aware of my blackness until I came here. : It's sad; because you are born with a load that you did not choose (speaking slowly with sadness). You know there is nothing wrong with being Black but once society tries hard to tell you that your Blackness is wrong, then you get sad because you're like "I never chose to be Black." Most of my American friends are White; I only have like three or four White friends [laughs]. White American friends I have three; not that I'm very close to? It's three but acquaintances, I have a lot of those; Back home, everyone is Black. Back home, we don't have a lot of White people in Burundi. Even when they come, they come as missionaries, as NGOs, and they're friendly... *I don't relate with the African Americans.* I don't know; I think...I don't know... I've thought about it but I relate more to White Americans than I do to African Americans. *And it's sad because we actually come from the same place. But I think that African Americans grow up in a society that hates them; that oppresses them; and so the only thing they relate to is...so if they meet another Black person, the only thing that will help them to relate to that Black person is the oppression that they've been in together; so they relate on negative points.* I

come from a place where I wasn't oppressed; I come here and they try to talk about race. They share negative experiences; I am not saying that's all they relate on, but it's mostly that. It always like dances around this issue of oppression. I come from a place where we are the ones that oppress; if there is anyone that has to be oppressed, we would be the ones to oppress. And so I come here and I tell them how beautiful my life is and they don't understand; they tell me about how hard their life is and I don't understand. So we can't be friends, we can't. ...*they view the world a lot more differently than I do.* For example, what they think is disrespectful; I think it is a mistake. So if for example, you step on their shoe, they view it as being disrespectful because *they know nothing else but being disrespected; growing up in America, everything that happens to them is disrespectful because they are seen as less than human beings.* Back home, I'm comfortable in my humanity, I'm comfortable in Blackness so if you step on my shoe, it's not disrespectful; I will be like, "it's just an accident". If they say "sorry" and I will say "it's okay, it's okay." So it is small differences like that that add up to create this huge divide.... but there are some I've been friends with but we're just not close at all.... And I've heard a lot of things such as (1) Africans hate African American because we think we are better than them in the sense that we were not oppressed (2) African Americans supposedly hate us because we let the White man take them and (3) the White man likes us better because hasn't had to live with us for 400 plus years...*So there is that conflict and so it's very historical, it's deeply historical. And it's bad; it's bad. But then if we're both educated and we are able to overcome that,* I think I will be more willing to even be friends. (Leah)

In the end, all women seemed to agree with Leah and Kitty; that we share the same origins and experience oppression due to our Blackness. Indeed, they recognized that "we are all connected" and can be united for our own good.

"Self-Doubts" and the Compulsion "to Prove that I Belong Here"

Staff, faculty, and administrators who seemed to care about the success of Black women were quick to point out the apparent lack of confidence expressed by the majority of the participants in this study. Notably, these individuals cared enough and expressed a desire to reach out to encourage every Black woman with whom they interacted. When I approached the Dean for Students in the College of Arts and Science (CAS) to ask if she could help me identify some documents for my study, she proved to be helpful. She also emphasized the need for me to focus on identifying "gaps in

policies within the documents” and report to the CAS to address those gaps. Referring to the Black women students, she knew she said:

Because Black women don’t see someone like them in STEM they don’t think they can do it; but they are stronger than they think. They can do it [they can succeed]. ... I try to help them realize their strengths. I tell them about resources; I share my story with to encourage them. (GAPS)

Senabile, Lisa, and Sabrina were determined to prove this at the societal level for the whole world to see that “they can do it.” As quoted earlier in the first theme, Senabile and Lisa wanted to show that women could succeed while Sabrina emphasized similar intentions, “to be the representation for other Black women.” Another Dean (EE) who was a Biology Professor also recognized the fact that it could be challenging for Black women who were in STEM majors. He said:

The first thing everybody notices is that, of course, there are so few Black women in STEM...Is it because they are actively repulsed? Is it that they are not attracted to the field? ... [The Black women] I have worked with in my classes that I know personally...they seem to me more like any other student...I’m not sure from talking to them, what specific challenges they face individually. I think it takes a very high level of knowing each other and sort of knowing each other for the student to open up; and most of my interactions were in the classroom where typically students don’t open up that much but I am just assuming that they experience problems that have to do with their skin color. We would be naïve to assume that there is no racial discrimination. So I’m sure they experience other challenges that are associated with gender. So I guess they are experiencing the combination of that but how it plays out, I really can’t say anything; but I think that those are the challenges that these students are facing. ... I feel like I’m pretty approachable and easy to talk to; *but I’m also the authority figure*. In the classroom, I’m the instructor and the professor so they may just not reach that level of comfort with me to talk about personal things like that. ... Based on the interactions I’ve had with them in the classes that I teach, I didn’t really see a major difference. They were doing very fine; they were as good as everybody else. (EE)

In fact for the majority of the participants, their interview for this study was the first time they had ever felt safe to candidly share their challenges with an older person while at IU. Indeed, the challenges the majority of participants said they faced seemed

to have contributed to self-doubts, which fueled the urge to prove themselves through performance in predominantly White and male environments. Moreover, because IU is located in a predominantly White anti-Affirmative Action state, the participants who were aware of this policy might have felt the need to prove that they were equally capable of engaging intellectually. In other words, they might have felt obliged to show everyone that they were not at IU because of the Affirmative Action Policy.

For some participants, self-doubts seemed to also emanate from poor performance in coursework as measured by their GPA. In connection with her self-doubts, Jackie said,

Recently, especially since coming to IU and at the high school where I was, I had a higher thinking; but here, it's a different surrounding and so recently my struggle and my challenges have been to (long pause here) *not underestimate myself*; and seeing everyone else around you is like, "Hey, I'm graduating early, and like, yeah I'm taking this and that class;" I'm like (sighing) I'm just focusing on my end goal, you know. It's *definitely... my own self-doubt has been my biggest challenge*, which is strange because you know, other people have challenges like you know, financial or that "I haven't been able to do this." But mine is literally myself; like *I've just been struggling with (pause) almost like not feeling adequate to be here. ...* I'm a Christian, so that helps. ... Literally I would not have made it through this past year without like praying to God to strengthen me and understanding that everything happens for a reason, even whenever you have a B in a class; because coming from my school where I had straight As, I was used to that standard. But then coming here, I've gone through this past year with a 3.45 overall GPA. To me that's just terrible; that's also another reason why I'm taking less hours, more spaced out, so that I have hopes of getting a higher GPA—if I have less classes to worry about. ... Being able to talk to people and understanding the importance of networking. I feel like I have met so many people that have encouraged me even when dealing with this stuff that I tend to beat myself up on. I have moved past them because of these people. That is definitely a success for me—meeting people that will help me grow (Jackie)

According to Jackie, it was even more discouraging because she had an identity of a "straight A" student in high school, which changed in college.

For the majority of the participants, self-doubts led to the feeling of a compulsion to “prove themselves.” This proving process is a form of labor that could have stood in the way of having meaningful participation in activities inside and outside the classroom. Not surprisingly, Black women were often absent in the majority of the educationally-enriching activities that were organized by mainstream campus student organizations as well as those organized by various departments. Thus, self-doubts due to the perceived emotional and intellectual cost of throwing themselves into spaces that were “too White, too male,” and often historically elitist might have prevented the majority of participants from capitalizing on academic programs at IU. IU’s academic engagement programs for undergraduates included the Honors College and its associated research experience programs, the LSAMP program, and the McNair program.

While the McNair Program Director actively recruited underrepresented students through collaborations with the TRIO program and academic departments, my observations and discussions with the director indicated that the number of Black women students who had participated in this program was still low. By analyzing the comments made by the few women who were able to “prove that [they belonged]” in academic settings and/or those who had participated in these “merit-based programs” such as Tiffany, Jessica Brown, and Aisha, we get a sense of what the “proving” process entailed and possibly what it might have felt like for these women. Their experiences are presented in the following quotes:

It doesn’t really crash me because I am actually bossy; because I am like one of those kids; I like to get things done, and get my grade. So like I’ve been in a situation too where like people, if they don’t know you, *they just see like oh, a Black woman; like they don’t like cherish [her emphasis] what you have to*

contribute until you have to like prove yourself while you see other people just walk in; it's like, 'oh just because you are like me it's cool.' But you have to like take that extra step...to prove that you are smart; and that's what I really noticed when I first came here too and probably toward the end of my senior year of high school and like while growing up. *Even though I thought I was doing things for myself, I was solely proving myself to other people even though I wasn't trying to.* Like at my high school, when we started talking about grades and when they announced the Valedictorians, when we started talking about my ACT and college applications, and me being announced as one of the Valedictorians, that was when people were like turning their head and said 'oh, I didn't know that you actually did stuff,' you know, until you are actually smart. And after I started coming here, making good grades, *I noticed that like me doing well was like my way of saying 'I deserve to be here,' even though I wasn't trying to do that.* ... At first I didn't really notice; like I thought I was just doing...like getting good grades like my parents told me to get; and then I started seeing people's reactions and then I was like 'dam...what made you think that I was dumb?' (Tiffany)

Sometimes we have group work and sometimes you are that...being the only Black person; sometimes people form their groups very quickly and you are kind of just left to like pick; and then sometimes, especially being in STEM, sometimes people don't want to listen to you. Whether it is because you are a woman or because you are Black or both, it's like you say something to kind of contribute to the group and they just don't want to really listen to what you are saying. That's happened to me multiple times and then *it wasn't until they see me going up in front of the whole 300-student class and work out a problem that then they start to believe what I say because then it's like you have to prove that you are smart* [her emphasis]. So that can be frustrating...I mean it's never really stopped me; I still do what I need to do to get a good grade. (Jessica Brown)

My academic advisor (UWC advisor) told me about honors in my freshman year—but then I regret now [for not participating]. I thought it was too much work [laughing]...He just said you can apply to the Honors College and then I went to the website and then I saw all the extra classes I needed to take in order to qualify for Honors; and then my grades—by that time I think I had like 3.9 [GPA]. So then I told my parents; they were like yeah, you can do it. But then I thought, 'What if those Honors classes are hard and my grade lowers?' I was like 'No, no, no' but now I heard that I can still graduate with honors even though I wasn't in honors, if my GPA is greater than 3.6...My GPA dropped to 3.75 because of physics. Oh I hate physics (Aisha)

Thus, after successfully “proving” herself, Jessica went on to participate in the Honors College Program through which she enrolled in her required Chemistry course

that she had already taken with another professor, she ended up improving her grade (from a C to an A). Tiffany was also on track to enrolling in the Honors College Program. Later, Aisha was allowed to join a team of undergraduate researchers through the First Year Research Experience Program in the Chemistry and Biochemistry Department. In the lab, Aisha was under the supervision of graduate students, a postdoctoral researcher, and a faculty member. Aisha pointed out that although she “learned many things” in that lab, she was also *stressed out* by feelings of needing to prove herself. These feelings emanated from the fact that she felt privileged to have been invited to this opportunity.

There were also doubts due to other challenges the participants knew would stand in the way of their being able to prove that they were capable students. Thus, although the participants did not make any references to the Affirmative Action Policy, they expressed this compulsion to prove that a woman or a Black person could succeed in higher education as a common stereotype.

As Aisha learned from her predicament, there were many factors that complicated the experiences of the participants. These included the lack of awareness of opportunities for them to explore what they were interested in and were good at *earlier* in their college experience. Some of these factors were structural in nature and are presented in the next theme.

“It’s Just the Way Things Are”: Pushing through Challenges and Obstacles

The challenges for most participants were also related to structural barriers, which interfered with other pursuits of interest, including meaningful participation in co-curricular and extracurricular activities and preparation for graduate and professional

school careers. Because there were no graduate students who were also Black women in Biology and Psychology—there were only a handful in Chemistry—interview data pertaining to experiences of Black women graduate students in the other departments are lacking. Based on Sandy’s interviews and conversations I had with faculty in Psychology, Chemistry and Biochemistry, Engineering, Mathematics, and Biology Departments, I was able to get some insight into issues related to funding for graduate students. Therefore, the structural issues mainly pertain to undergraduate experiences with IU and STEM department structures. I begin with the first-year experiences with transition supports, time and scheduling, advising, pedagogy, preparation for graduate school through research experiences, and funding issues.

First-Year Transition Experiences

At the institutional level, there were organizational structures in place for supporting undergraduate students’ transitions that were offered through the University College (UC). According to the CAS dean for students, the transitions from high school to IU were facilitated through programs, including a new student discovery program offered to incoming first-year students in the summer and also a new Bridge Program. The Dean also said that her college had worked hard to “ease the application process” for high school students interested in transitioning to IU. However, none of the Black women students who participated in this study had the privilege of attending the Bridge Program.

When asked, Natalie talked about how the Bride program helped her “little cousin” to make friends and get situated at IU.

Like I said, we are at a predominantly White college so sometimes you may not feel comfortable. ... Actually, my little cousin is coming to IU; he’s about to

start Engineering. But then right now, he was here in a summer program; it's called Summer Bridge and it's for all Engineering students. I don't know if it's specifically multicultural, but I know a lot of them are in multicultural; and so for that program, he's been here for a month; he's in the dorms; and from that program, they've developed their friends for him. Like I know people that met and we're like oh, we met in Summer Bridge. Yeah, till senior year, till they graduate. They became best friends because...like those were the first people you met here; they have the biggest impression on you...you have to make new friends...he told me yesterday that he already has his roommate. I was so happy. *But I didn't have that experience.* (Natalie)

The majority of participants talked about the various orientation events they attended in their first semester at IU. Not every first-year or transfer student attended the official orientation for IU first year students. Among the participants, only Courtney Brown expressed the benefits of attending this specialized orientation during her transition to IU. The other participant who might have benefited from a similar experience was Kerri, who also happened to be of middle-income background like Courtney Brown. These women both made positive comments about their orientation and campus tours.

It was a little overwhelming because being from Tennessee, I didn't know anybody here...just like meeting all these new people. It was just me and another Black girl in the group. One of my SGLs (Small Group Leaders), he was Black. So that helped to see someone that looked like you. One SGL was a Black guy, one was a White girl, and one was Indian. They were pretty diverse with different people so everybody feels welcome. It was like really fun because we got to do these really cool activities that helped you bond with different freshmen. I really liked the diversity thing that we had to do. Our year was the first time because it was after [a major racial incident] ...that was my favorite thing. That was amazing. (Courtney Brown)

Other participants attended orientations organized by the UWC advisers.

Carmen was one of them and she said:

[I haven't had any problems] I got to IU. IU is like my place. I tell everyone that. It is because of UWC. There is an office here on campus dedicated to UWC students. There is a UWC Program—we just won the Davis cup again because we have the most UWC freshmen in the country...so we are celebrating that on

Friday, February 5th [on campus—you can come]. We had orientation together; we came a week before move-in day and we had the UWC students showing us around. ...And then all the UWC Nigerians; because every UWC has their National Committee, so I knew all the UWC students from back home who were already here. So I guess the fact that I already knew people, I didn't have to adjust to like find new friends; I didn't have to worry about meeting new people. I already knew some people. And so I really love my classes. I've never enjoyed more until I got here. I love all my classes; I love IU in general. My challenges are like pre-IU. I didn't have any when I came here. (Carmen)

I also had the privilege of speaking with a Black Student Adviser (SMART) who shared her perspectives on the needs of Black students and how she approached her work (she resigned her position at IU a few months after our meeting). She emphasized the importance of using a combination of strategies to identify and meet the needs of students who self-identify as Black or African American. She said,

It's a combination of all those things. So I do work with the Recruitment Services when they bring students from predominantly Black high schools to campus and talk to them about different things that we offer; I am working on three different recruitment events with them right now for high school students coming in. The one in December will be high school students largely interested in business and engineering, largely. There will be some extras but it will be a lot of engineering students that come from there, because they are coming from Houston. In the summers I also get a list of all the students that have self-identified as Black and so I send them an email in the summer saying, "Welcome to campus, I can't wait to meet you," and we host orientation for Black students as well. And so what we do is: we do the orientation, we invite students that self-identify as Black there; go through the different resources, different events and where they can find me, where my office is, my contact information. And then from there, it's just, if I meet people who identified but didn't make it to orientation and still don't know how to get in touch with me, inviting them up here, they email me or just walk by. So it's a combination of all those things. But I try to make contact with as many as I can. I try to make it easy to get in touch with me. But because of the number of students that I have, it is not always possible. (SMART)

Despite her remarkable work, she still dealt with issues that negatively impacted the quality of support for the students she served. Although she was designated as Black Student Adviser, she also had to serve other student groups; this she said she had to do

with very few staff. Concurring with the academic advisers that I met at IU, SMART admitted:

I definitely could do more, especially because I don't just work with Black students. I have other job responsibilities that require me to work with other students as well. I try to make sure that Black students are my priority; but it doesn't end up working like that. So *the workload is very, very, heavy.*
(SMART)

Regarding first-year student orientation at IU, in spite of their positive experiences, all student participants who talked about their orientation and campus tours agreed that the activities could also focus more on introducing students to the various majors offered at IU.

In addition, some international students felt that while the orientation was beneficial and well-organized, it could be more detailed and specific to show an appreciation for the diverse needs of students. As Lisa and Aisha observed,

At the University College they advise you about choosing different majors, they give you a lot of perspectives; but in the end it depends on you. About careers, they don't really say much to international students; they just come to talk to us in general but I always feel like they're more general in terms of *assuming that we are all Americans* and so we don't need all those details about what companies want from international students. They are all concerned about the resume, getting your speech right, getting dressed in the right way, and getting a good GPA. But they don't really tell us about, "Okay, F-1 visa students you have to go to certain companies; those are the only ones that will consider you." Just so we don't have to waste time going to all these companies that don't hire us. (Lisa)

I think the biggest challenge so far has been getting internships as an international student because mostly when you go on the internet and you look for internships, it's always like you need to be an American citizen. And obviously, I'm not American. So I think that is a very big challenge. I mean I'm not saying there aren't internships for international students; but it's a lot less and especially when it comes to the sciences because I know a lot of people—my friends who are in Business Management Department who are able to get internships. I'm not saying it's easier, but I feel like there are more chances for them compared to people with science degrees. ... This is a big challenge because it affects my future goals; *because in order to get into graduate school*

or to even work, it will be like “Where is your experience?” ... Honestly, I wouldn’t mind if the internship was paid or unpaid because I just need the opportunity to gain experience. (Aisha)

Thus these participants would have appreciated information about internships early in her first year. Majority also admitted that they had forgotten most of the information provided during orientation so the university needed to consider repeating the important information sometime during their second year.

Time and Scheduling Constraints

During conversations with academic advisers, I found that they all recognized that when students first arrived on a college campus, they experienced challenges due to the fact that “they are still learning to be a college student” while also dealing with other developmental issues such as racial, intellectual, and professional identity development (PREPARED). In addition, a White woman professor of Microbiology (EPSCOR) also noticed the fact that the majority of undergraduates she had supervised in her lab also struggled with time and scheduling challenges. Based on the perspectives of the student participants, I found that not all students “were still learning to be a college student;” the majority struggled with the barriers due to the structures of their programs in unique ways. Thus, there were intersectional differences in the quality of experiences depending on the majors they chose, their goals while at IU, and/or whether or not they had a full scholarship.

All the participants agreed that scheduling of classes interfered with involvement in activities that were considered critical to Black women’s success in college. Thus, the majority of participants were not always able to attend co-curricular and/or extracurricular events of their interest; they attended only when their schedules

allowed. Joy and Addy said they had to put off their active membership in some student organizations when there was conflict band practice. That is why Joy waited until her final year when she had a more manageable class schedule before becoming an active member of her organizations. My conversation with Addy went as follows:

Dorothy: I see you joined the Botany Club; they have a sale tomorrow...

Addy: Yeah, I can't go. I can't go to any of that stuff because in the fall because of the Band but I had some time yesterday so I said, Oh, maybe I can go to the meeting every other Monday. But on that same email they had a flier for [the Association for Women in Science, AWIS] meeting. So I said, oh yeah, maybe I can go to that. I'm glad I did.... [To be a member] you just show up and they write your name, email, student ID, and at the end of the spring semester they actually have the officer elections for the next semesters; you just show up. Sometimes they have speakers and they talk about different group ads and they talk about their experience in their graduate programs, and professors...they really do try set things up, which is nice—but I can't come to those—or just things about research; and then there is also the plant sale where we help pot plants to get ready for the plant sale; or they have a new plant in the green house, different things.

The issue with IU's ill scheduling of classes also came up at a town hall meeting organized by an exemplary Black women student activist organization at the campus in conjunction with IU's Delta Sigma Theta Chapter. The purpose of this meeting was to get to know the SGA Presidential Candidates. The Black male student, who would win the elections in 2016, concurred with what the Black women student activists said at this meeting and in the student newspaper:

We have an unresponsive administration...people are not being heard. They do not listen...We need a voice...We are not being heard...Scheduling of classes after 4pm conflicts with recreation for our health. (SGA Candidate, paraphrased)

Clearly, for the majority of participants, participating in student organization activities served an important purpose in ameliorating the gaps in advising because

students seemed to gain awareness of opportunities for their own personal wellbeing and professional development.

Academic Advising/Enrollment Assistance

Another structural challenge was due to gaps in the advising experience. The CAS at IU had a two-tier advising system whereby each student was assigned an adviser at the college level and another at the department level. At the department level, advisers meet with students every semester, to “get them enrolled in classes” (NICE). At the college level, another adviser said, my job is

To advise students towards degree completion and I am typically meeting with students who have 90 hours or more and they’re about two semesters away from graduation. I look to make sure they’ve completed their degree requirements; how many elective hours they’re going to need; what semester they’re going to graduate. ... I also meet with Biology students who are on academic probation with the college. So their GPA is below 2.0. I also meet with incoming transfer students who have declared Biology as a major...So it’s kind of a diverse group. ...Arts and Science is the only college on campus that has a two-tier advising system just because of our size. The other colleges just have one adviser who is helping them pick classes every semester and that same adviser is also doing the degree check to make sure that they’ve met all the degree requirements. So we are unique in that way, different from other colleges. It has advantages and disadvantages because there can be miscommunication between the department and adviser and the college adviser sometimes; but it’s also advantageous because it’s more than one set of eyes on the student’s record who are helping the student to make sure they have everything they need to complete their degree. ... [The miscommunication:] What happens with Biology is that they may have a new course that they can decide, that counts for major credit; and maybe in all the shuffle of things, and they’re certainly busy over there, and they didn’t tell me that this new course counts towards the electives...and if I don’t know that, I’m not including...So if I have a student for a degree check and then I’m telling them, no, your department adviser made a mistake...*sometimes students are kind of caught in the middle*. They feel like I’m hearing one thing from department adviser and another thing from my college adviser.
(PREPARED)

As PREPARED, who advised Biology students at the college level admitted, miscommunications between the college and department advisers and between the

advisers and the student were not unheard of. These issues manifested in the frustration expressed by the majority of participants, especially participants who were first generation college students. In the case of a Psychology first-year student named Jackie, her University College adviser misadvised her. Jackie described her experience and how it affected her as follows:

I took 15 hours my first semester and then I took 15 after that [and now I'm taking 12]. The only difference is that because I had my remedial math class; those three hours—six hours together because I had it for two semesters—they didn't count [toward my degree requirements]. I didn't know that they didn't count until I had already gone past my first year and then I realized “Oh, I'm behind by six credits.” And then also, at IU they require you to take with any kind of remedial classes that you ever have to take, you also have to take a Gateway class. And the Gateway is basically like an extra help class; and that class is one of the ones that I had to take. If I didn't take this I literally...before I got accepted actually, there was a sheet that I got; it was a contract that I signed understanding that I would have to take this class in order to stay enrolled at IU. So that put me behind because it was like two hours but my adviser told me that it was three hours; little did I know that it was only two. So it put me behind by another hour. So on my transcript it shows that I took 12 hours when I really took [and paid for] 15 hours; just because those remedial classes went away but I got some passing grades in these classes. Also, didn't realize that these classes would completely disappear; and so *I focused so much of my energy* (her emphasis) on these classes thinking “Oh, I need to keep all of my classes, keep all of these good grades,” and then now I look at my transcript and because I was focusing on these classes, I didn't pay much attention to the other classes where I thought “Oh, this is easy.” So Psychology? I got an 89! And I'm thinking right now what I'm probably going to do—if I am here an extra year—I'm going to retake the Psychology class (laughing) just because it's like, now that I know that it's important to take the major classes versus the class I was going to go in anyway. ... My [University College] adviser kinda gave me false hope that these classes I wouldn't need; he was not very helpful as in like—he gave me classes, like the one class I struggled with my first semester, was Human Geography! And I was like this class should not be hard; I wanted to take some other classes about music and like African American Studies. Both of those classes I wanted to take but he told me “No, you don't wanna take that class. I took this class, it was so much fun; it was so easy.” That sounded really appealing to me; and me trusting him, believing him, took that class. It was my worst class; I got a B in it. And it's like I should have had an A if I took another class that was related to my major even. Human Geography and that professor that he made me take, was terrible, and was absolutely terrible; I was lucky to get a B. (Jackie)

Other occurrences of miscommunication and misadvising regarding the courses required to graduate for particular majors and which courses could be transferred into the STEM majors involved UWC scholars who were also F-1 visa students. These included Joy (Economics) and Aisha (Biology). She was ready to graduate in May 2017 but ended up graduating in the summer because she said, “My adviser just told me that I need to take one more course so I will graduate in July [2017].”

Those who transferred from other institutions were not spared this disadvantage. The majority of transfer participants said some of the courses they could transfer to other U.S. institutions were not accepted in their major at IU. For example, Addy came from high school with some college credit but she was not even going to ask because she found out (online, on IU’s website) that her courses were not among those eligible for transfer into her Chemical Biosciences major. Yet, students who were equipped with knowledge of the advising system and awareness of the loopholes could push through this barrier. Leah who transferred from a community college and managed to graduate in exactly four years (two at the community college and two at IU) shared her experience:

That's true, and that's because some of the credit hours are not accepted. If you take a biology class there like General Biology 1, they don't take it here. You have to retake it. So that's money wasted. But I got lucky and every class I took got accepted. They tried to refuse one of my biology classes but when I went to class the class was too easy so I asked them for an exam. A placement exam so that I could not pay money and waste my time in that class; and then they just let me go, they didn't give me the exam. They just let me go through and then I excelled in every class so... Oh, I went, in the school I was in Houston, we had this prerequisite, no, not prerequisite, you are required to take foreign languages courses to get your bachelor's degree, 12 credit hours of foreign and I speak French, which was my first language. So I told them I do not want to pay money to take French, is there any way that I could prove to you that I speak French without having to pay? Because I wanted to take Spanish, oh no, no, no, I wanted to take Spanish, I even enrolled in that class and in that class I met

another friend who knew another language but it was from Africa, it wasn't considered foreign, it was Swahili... yeah it was Swahili and even Kinyarwanda is not considered foreign, which is wrong because they should consider them foreign languages [laughing]. And then she told me that if you know another Western language, you can take an exam and she was also an international student from Africa, from Tanzania. She is my roommate now. She is the one that told me that. I took the exam and I passed and saved 12 hours. So those 12 hours that I saved, it helped me finish on time; in exactly four years even though I transferred. So I saved 12 hours, and then the biology classes that they refused they accepted them, and then I took summer classes so that I could speed up the process. Yeah... CAS, not Biology department but like, college level adviser. And I have talked to her, her name is [PREPARED], she was so helpful. And she helped me... yeah, I asked her, "This class is too easy, I know everything that they are teaching, I have already taken it." She told me she would give me someone in the Biology Department that I could ask and she said his name was T.B., she told me. (Leah)

Thus, gaps in advising could cost the students more in terms of time, tuition, fees, and emotional stress. Transfer issues were also reported among UWC Scholars who said they were worried and stressed out when their advisers said they still had one course because their scholarship was only for four years (all UWC Scholars brought IB credit hours to college). As Aisha described her experience, she emphasized the need to “double check with the adviser early on” because, unlike in Joy’s case, it happened to her in her sophomore year—and not too late to fix. Yet, she also admitted “crying” when she was first told (by her Biology adviser) that she needed to add a class.

As I was preparing to submit this dissertation to the committee and prepare for my defense, the student newspaper carried an article regarding the gaps in policies governing the transfer of credit hours at IU. Specifically, the newspaper reported that the Student Government Association (SGA) had passed a resolution in which they requested the core academic departments to reevaluate the way they distributed college credit to students who had International Baccalaureate credit hours (IB credit). In fact, all UWC students who participated in the study had attended UWC high schools where

they earned International Baccalaureate (IB) credit. One of the SGA student leaders who said she had repeatedly contacted various IU departments regarding this issue expressed her optimism in this way:

I'm hoping that we'll hear the departments actually listen to our concerns as students and take into consideration that we have a lot of students who take IB credit and it should be treated the same as Advanced Placement credit. (Student Leader, quoted in Student Daily Newspaper, March 13, 2018).

Research Experience Opportunities for Students

The majority of participants indicated that they did not want to do research in their majors. With the exception of Sabrina and Aisha, none of the participants had participated in any kind of mentored undergraduate research. Some participants said their dislike for research made them avoid certain majors. Senabile indicated that although she was Chemistry major, she thought her department was “too research focused.” Much as she enjoyed Chemistry, she did not plan to do graduate work in Chemistry.

Aisha, a Biology major who was minoring in Chemistry thought that doing research in Chemistry would prepare her for a research career in Pharmacy said, “Participating in research helped me to find out what I like and what I don't like.” That is why she decided to try participating in research in the Biology department instead. However, from her experience, she said she would recommend getting involved in research early during the freshman year (she was a sophomore when she first participated in research).

In contrast, a professor (EPSCOR) indicated that it was better for undergraduates to start research later after their first year at least or to do it while still in

high school. She said she had decided to focus on mentoring high school students because most undergraduate students she had in her lab had time, scheduling, and intellectual development challenges. She said was willing to engage undergraduates in the summer when they had enough time.

The student participants agreed that they experienced some of these challenges.

In a follow-up interview, after she had opted out of the research program, she said:

I felt like, these people chose me; but I feel like I'm not contributing. ... Being in the lab helped me to really think about what I like and what I don't like. ...I felt like my motivation was decreasing over time the more I was finding that no, I shouldn't do this, the more I was like ah, I don't know... It [my motivation] was lowering because I felt like there were many other things that I was good at but not in this; and I couldn't show it—I don't necessarily mean that I want to show off or anything—but just as a person I want to perfect my skills. Whenever I was asked a question, I wasn't like confident when I was saying it. As I am saying it, I felt like maybe I'm saying something wrong. But whenever I was in something else, I realized I was more confident. For example, this semester with Dr. EE, we are doing the fish—it's like a short research course called "Cornerstone;" it's not required and it's actually a mentoring opportunity if you are willing and want some research experience, but you can't get because the labs are like full. ...I didn't know about it; the thing is that I needed an extra class so I was just googling; then on ClassNav I saw this class. I was like oh, maybe. ...I emailed Professor EE and asked him what this class was about and he emailed me back. ... In that class we are divided into groups and I'm working with my group. He asked us to come up with our own research proposal and like to find out more about the fish and then we are talking about sexual selection, and evolution. I feel like when I'm speaking about it, when we have to present, I *know what I am talking about*. But when I was asked the same in the lab experience, I was like I don't know whether this is true or not; the *motivation* for this class is much higher than in the lab. I felt overtime. In the fall semester, I felt like okay, I am going to give it my best, but the less time I had for it, the more my motivation lowered; and also with the first year students coming in, it was like there was not time for me to do more independent research. So it was more like helping, all the time; and I also felt like I personally wasn't exactly confident into conducting completely independent research in the lab. So just *many factors like were, many things made sure that I wasn't going to work out*. ...I told the grad student who was there because she also had said, "I'm sorry Aisha that there isn't much to do in the lab anymore." Then I also ended up telling the Director like last week about it. I told him that I liked it [the lab experience] but at the same time I don't know; maybe I should try like Biology lab because now like the "Cornerstone." I like it so much; maybe it's not

Chemistry but maybe it's Biology that I wanna do; he was like yeah, try to find a Biology lab although now it's going to be harder because I'm graduating in May so it's like there is not enough time. ...I feel like time is a challenge but more so just not knowing about the program is a bigger challenge; if I had known in my first year, I would have done it the moment I came. I didn't know that it was possible. (Aisha, Follow-Up Interview)

Thus, participants who tried to participate in undergraduate research had to deal with the interactions of their intellectual and identity development, with time and scheduling challenges.

In spite of these challenges, there were STEM faculty who were willing to support all students in this regard. Also, the university's OUR organized workshops to support faculty (and encourage administrators to support faculty) who wanted to integrate research activities in their courses and curricula. The majority of the faculty expressed the need for the university to consider implementing a number of ideas. I also participated two of the workshops and found that there were no Black faculty or TAs in attendance. The majority of the faculty in the workshop agreed that on the following:

- Introduce students to research early, never underestimate their potential;
- Reward faculty for undergraduate research mentoring;
- Target "at risk" [student] populations for in-depth research courses for retention;
- Independent studies [should] count toward teaching load;
- Community research work collaborative;
- Learn how to engage all students;
- If I have a research project, post a welcoming note at my door for all [students] to see and approach me about it;
- Define the role of research for outcomes;
- Cross-communication for what [research] means;
- How do we define research?; and
- Use undergraduate research products and presentations as a recruitment boost.

These ideas also indicate that as an institution, IU's undergraduate research experiences were not as equitable and that the faculty reward structure had something to do with it.

Courses and Pedagogy

The majority of participants found chemistry and/or physics prerequisite courses more challenging; they blamed these courses for lowering their GPA scores. These courses also offered classes that were among the largest at IU. As Tiffany observed, not all professors explained course content well enough for her to understand Chemistry.

For me I think a professor should be able to explain what's going on; and like why it's going on; I had a professor in Zoology who is kind of the opposite of that. It's just hard to explain. He just kind of glides through stuff... He's like... I don't know, it's hard to explain; he's like 'Yeah, let's do this...' He's more like, 'this happens, this happens, this happens, and ...' He keeps on going [too fast paced]. ... I go to things like office hours, tutoring and stuff; but in that class, I personally learn better from reading the [text] book. I would just read the book because the book explains it better; it is like step by step so I would just stay and read and spend more time. So I actually learn more when I am studying for like tests; I learn probably like I would say 75% more than I do in class. That's why I really like my CHEM professor. She's like very experienced teaching at smaller universities so she is more used to one-on-one, she explains things, she takes the time for like if we have questions; after class she's one of the professors who would stay outside her lecture hall, have a lot of people, and be talking to everybody. She's just more available; she makes it to where like if you don't get it she will make sure like to give you some resources and helps you to understand the topic. ... Sometimes professors do think that they are doing a good job when students get an "A"...but it is actually the [text] book. (Tiffany)

Thus Jessica Brown, Tiffany, and the majority of the participants agreed that the most important ingredients for them to get a good grade in Chemistry courses, in addition to the textbooks and hard work, were a conducive learning environment and better professors. Although they understood their roles and responsibilities in the learning process, they also felt that it depended on the professor's ability to create such an environment. Jessica Brown added:

Yes, absolutely. Because of Pre-medicine I've taken several classes. ...I actually took Organic CHEM II twice; first with Dr. B. and then with Dr. M—Dr. M. is awesome. I really liked him—he's probably my favorite professor. I did. ...it's hard but if you study and put in the work. ... I took Organic CHEM I, II, Zoology. I got a "C" in Organic CHEM I first time with Dr. B. Then I took it

again with Dr. M—it was for Honors—and got an A. I got an “A” this time because Dr. M is a better teacher and because I put in the work and everything together was just better; it was a better environment [for success]. So, for me, his style of teaching was not just, ‘This is green and this is blue, remember that.’ [Rather] It was, ‘This happens, this happens, this happens, and then this happens. Therefore, this is green.’ So in other words, he doesn’t just tell you information; he explains it. He lets you know what he is doing and why you are doing it so that when you are taking your exam or your quizzes you can actually think through the process of what you are doing and why you are doing it; and it makes it not just memorization but you are actually learning it. And then in addition to that, he didn’t just have only three exam grades and then you are done. He gave us opportunities to have quizzes; we had class quizzes, and we had exams, we had homework. So not only do we have opportunities to make a good grade but we also had more opportunities to practice. And so overall, it was really good. He was very good for me. And also he is very available; like anytime I had a question, he wasn’t very hard to reach...I don’t know, but how your students do is such a *big* [her emphasis] indicator of your job *but* [her emphasis]...well, I will say that with a grain of salt, *but* [her emphasis] sometimes people [students] just don’t put in the effort and then they blame the teacher; *but* [her emphasis] if you have an overwhelming amount of feelings towards it, then something needs to change [laughing]. (Jessica Brown)

The majority of participants also had challenges with Physics courses required for Premed students. In fact, although Tiffany did not explain, she admitted that “I am scared of my Physics professor.” The situation in the Physics classroom was also described by other participants, including Aisha and Annie. Other participants changed their majors to avoid the Physics requirement. Among those who had taken Physics, they reported lowering of their overall GPAs. My conversation with Annie shades light on what could have been happening in the Physics, Chemistry, and Mathematics classrooms:

Annie: First, I would not really blame the professors. I would say that the professors did do a really good job, it’s just up to me to pay attention; it’s if I don’t fall asleep in class [laughing].

Dorothy: So what would make you fall asleep or stay awake in class?

Annie: I’m not very sure, I go to bed really late sometimes [pause]. Even when I don’t; [pause] there is just a certain way that professors just ... they would just

bore me. For example, like, I would have 8:30 a.m. Physics and I would never sleep in a Physics class. Then I would have 9:30 am Math and I would fall asleep. [Laughing] ... It doesn't make sense but I don't know [laughing] but sometimes, I lose interest; I just need like something to pull me back.

Dorothy: So what “pulled you back in Physics?”

Annie: Um Physics? I couldn't fall asleep because I wasn't doing so well in that class; now I'm fine but I wasn't doing well initially so I know that if I fall asleep, I'm hurting myself. In Math, it was just about being overconfident; if you do well the first test, you get like a 90 or 95 [%], then when you go to class you are like, I know this, and you could sleep. And then the next test comes and you are like huh. So I think that's what was happening to me, overconfidence, because I did really well on the first test and if I go to class I just fall asleep if he [the professor] is saying something that I believe I already know or if I just get like lost. I ask a lot of questions in class. But like sometimes I just don't feel like asking questions in class; I just feel like it's too much, maybe I shouldn't ask.

Dorothy: What makes you feel like it's too much?

Annie: Like if he's gone too far; if he's proving something and then he goes too far and then I didn't understand like from far back, I just hope it doesn't come on the exam... Other students don't usually ask questions but I ask questions, especially if it's like a small lecture [about 20 students] ... I like it when my professor knows me by name; I like it when he is sharing the assignment back, he asks everyone 'what's your name? What's your name?' and then he comes to me and just gives me my paper...because I make an effort to go for it; even if I fall asleep in class, I'm like I have to get this somehow, I have to go to office hours. So I like to go to office hours that no one else goes to. I like it because when you spend time with them they get to know you more and sometimes when they are marking [grading] assignments they could be more lenient because they like trust you more. [For example,] We wrote a math test—it was our first math test—and there was a question that was 10 points. He gave me 3 points on that question but then I should have gotten 7 points; I didn't even have to show him when I said there is a question that I was supposed to get 7 points on, he just said 'okay.' He didn't even want to see it! So that trust, I don't know but it's something really, really, good because especially if you need like letters of recommendation, like they are always there for you. Like my Chemistry professor, [Name], it's like I just have her this semester, I didn't have her last semester, but at a point, I was having [Name of Professor] last semester, I had a really hard time last semester. At a certain point, he wasn't explaining—I don't know—bot in my opinion, he just wasn't giving enough examples in the lecture. So he would like basically read through the slides—not that he was doing such a bad job but then I wasn't really catching on as fast as I should because I would go back, I would do practice questions and I'm like, he didn't teach us this in class. In chemistry there is this thing—to every rule there is an exception. That's

the only thing I don't like about chemistry. They're like okay, use this formula for this *except*... So I'm like Oh Gosh. ... I used to have classes on Tuesdays last semester so my last class on Tuesdays; I would go to LC's [female professor's Name] lecture. I would go to lectures at PS [male Professor's Name] Mondays, Wednesdays, and Fridays. But Tuesdays and Thursdays, I would go to LC's [female Professor's Name] lecture—but she wasn't my professor. And then I would go to her office hours and she would explain it to me—that's how I got to know her.

Dorothy: So how did that work out? Were these two different sections of the same course?

Annie: Yes, same course content but different ways of teaching it.

There seemed to be a connection between what a White woman Mathematics professor said about the Mathematics curriculum at IU and the participants' experiences. She said she led an initiative that was aimed at improving the teaching of Mathematics; at that time, she had started using more collaborative pedagogical styles. In fact, apart from Annie—who also admitted that it was her own overconfidence that contributed to her low grade—none of the other participants seemed to blame any Mathematics professors.

Yet, the majority of the professors who taught Chemistry and Physics to non-majors seemed to have been unresponsive to pedagogical styles that the participants favored. According to minutes of the faculty senate meeting that took place on November 13, 2017, a team of senior faculty members representing 10 academic departments, including the provost and vice provost, the Director of Assessment, Associate Dean of Computer Science, and a Graduate College representative were appointed to serve on the 2017-2018 Academic Review Committee. However, Chemistry and Physics were not among the academic units recommended for review.

The strategies that were used by the participants who succeeded in these courses seemed to work well for those who did not have to work because they had relatively more time to take advantage of different pedagogical approaches by different professors. This strategy depended on the flexibility of the participant's schedule—after factoring in work and other class commitments.

As presented earlier, the majority of participants also reported challenges due to time and scheduling of classes and co-curricular activities. Although, all the participants (except Oklahoma) seemed to respond well to face-to-face educational settings, the majority despised large classes. As a returning adult part-time student with a 4.0 GPA who worked full time and enrolled in courses solely for the purpose of preparing for Medical School, she favored online courses rather than face-to-face courses.

The flexibility in timing of classes and also the requirement of discussion groups for classes; I mean like that was really different for me; like it's actually causing me to have to redo my schedule because getting off work to be able to do Monday, Wednesday, Friday, it's okay. But then I have to add in a discussion group on Thursday. That's like an hour. I mean it's senseless to me; I'm quite sure they did a study and found that it's helpful; but for those who are very ambitious and driven, I feel like it's unnecessary. It's like I'm gonna be like "why am I here?" So you know, flexibility in times for the offerings of the classes. That's been a challenge...I feel like it should be optional, not required. So I took online Chemistry classes so *I can like teach myself*. The lectures are prerecorded and if I need a deeper understanding of something, I can go back to them. It helped me to not have to go to a class that I will be bored at; it helped me to move at my own pace and it helped me to just move on into the material. ...I can self-teach. (Oklahoma)

Also, because the introductory courses offered by the Chemistry and Biology Departments were often large, most participants took advantage of opportunities to interact with their professors, Teaching Assistants, and peers. These opportunities included office hours, tutoring, and study groups. In spite of these experiences, the participants were determined to capitalize on institutional and family resources in

innovative ways so as to remain enrolled at IU, leading to graduation or achievement of subsequent goals such as moving on to graduate or professional programs.

Funding: Scholarships and Financial Aid

Apart from the merit- and need-based scholarships, IU offered other financial assistance through a centralized scholarship application system. The majority of participants said they financed their education through the following ways: the UWC-Davis scholarship, IU Multicultural Scholarship Programs awards, federal student loans, and financial aid. Leah was the only F-1 visa participant who was sponsored by her family financially.

As a graduate student in the Analytical Chemistry Graduate Program, Sandy had an Assistantship through her Department. According to the faculty and the Chair for the Chemistry and Biochemistry Department, all their graduate students were supported through meaningful assistantships. During an informal conversation at a social event, a Chemistry professor told me that one way that his department endeavored to attract and retain students, including underrepresented students such as Black women graduate students was by making what he called

The economic argument... [Which,] applies to every student? So if you come to Chemistry, we will pay you a stipend to teach and we have a curriculum that allows you to graduate faster. So you don't have to get student loans; you could graduate faster, get into the workforce faster, you could earn more money. If we make that economic argument, it cuts across all demographic backgrounds.
(ECONOMIC)

Nevertheless, Oklahoma, who was a part-time student in Chemistry, was not supported financially by her department; she had to take student loans although she too, had the goal of becoming a medical researcher (like Sandy who was also a returning student). Also, the "economic argument" seemed to fail in that Senabile, who said she

wanted to be a Chemist, ended up not applying to the Chemistry graduate program. She said was going into a graduate program in a different STEM department.

Another F-1 visa student, Joy, who was an Economics (CAS) major, was later accepted into graduate program in Public Administration at IU. However, because Joy had not yet succeeded in securing funding, she deferred her graduate enrollment, to hopefully return to the United States in fall 2018.

Evident in many of the quotes presented earlier is the fact that funding was also a major barrier to meaningful involvement in pursuits of interest for the majority of the participants. In addition, it was also a major setback for new students to fulfil their academic obligations if they needed to work in order to earn money for tuition and fees.

Jackie said:

I don't have any scholarships from IU. ... First off, I should have gotten more scholarships just because I'm a first generation college student. But my recruiter did not tell me what qualifies you to be first generation so I didn't even put that down when I was applying to the university. But of course I filled that out last year; but I guess you can't get any scholarships unless you do it from your high school to college; you can't. That's the only way to get the first generation scholarship; but nobody told me until I was already here; and then of course, when I filled it out, they're like you already should have gotten some scholarships when you applied. And so ...it's the fault of the recruiter because he didn't tell me.... because my parents didn't go to a four-year college but they did go to a community college and just now they are working on getting their bachelor's degrees. So I am [first generation] but my parents probably didn't know because they had never filled out one. ...I feel like, my recruiter, I love him to death; but he was really like *focused on other people*... [Recruiter's name] ...he's a super sweet guy. Because he knew my mom and when he would call her, my mom was like "Why aren't we getting any scholarships [for Jackie]? So he put me in for one scholarship—small scholarship. It was called IU Society because we basically work in the Recruitment Office. And so we work around the Tour Guides and things like that. ...I was thinking about applying for the Work Study scholarships...I might have to look into the Work Assistance scholarship. (Jackie)

As presented earlier Jackie was a student who was admitted conditionally on the agreement that she would first enroll in remedial courses. She indicated struggling academically. But then she also had to work for the only partial (“small”) scholarship she got.

This was also observed by the SGA President who urged the university community to “Be inclusive in the classrooms with regard to scholarships and opportunities.” Like his fellow Black students, he felt that “diversity short of inclusivity was like being invited to the dance but not asked to dance.” Thus, without an equitable distribution of financial and other resources, some groups of students were not able to fully engage intellectually and socially at IU. That seemed to be the lot for the majority of the Black women students and fellow historically marginalized students at IU. As Tiffany observed,

Many students don’t know about scholarships. But that’s their [the institution’s] fault. Yeah, that’s their fault. (Tiffany)

The majority of the participants who had no full ride scholarships such as Jessica Brown, Tiffany, and Leah faced difficulties with enrolling in their courses early because they still owed the university in tuition and fees. According to Jessica Brown, it was frustrating because not only did it affect her enrollment, but it also meant she could not get any transcripts to apply to medical school. As for Leah, her situation tested IU’s commitment to retaining disadvantaged students. She said she was very grateful to her CAS and the University President, Registrar, and Alumni for assisting her financially. She also said she wanted me to tell her Academic Adviser (PREPARED) that her job was “a great service.” She shared her story as below:

Last year, my last two semesters... they were very stressful because a war broke out in Burundi. The economy had been going down but my parents were still ok. and then they burned the market, then there was the whole world crisis, like the oil crisis also affected Burundi. We don't export oil; we only import so it's gonna affect us. And then...people started fleeing Burundi, like my mom went to Rwanda. So she didn't have...like part of the income completely stopped; like completely stopped coming through because of what happened in Burundi. So I was only receiving income from my dad who has a child in Canada, my sister here, and me here [her sister is in high school in the U.S.]. And I was working full time; no, not full time; full time for international students. That's 20 hrs a week and I was also a full time student and I am premed so I have to like have a great GPA, and extracurricular; and I have to work on top of that and all that. So I told her about it. I said "I might not be able to take any classes next semester; it's already too hard for me to [pause] to pay for this semester...to finish paying for this semester. And I am a senior so my classes are not that common. Senior classes are very...they fill up fast." So she helped me; contacted people. We contacted President B. She helped me write a letter to him and then she contacted the graduation office, the Alumni...Alumni Association and she contacted a lot of people and they donated. They helped me donate. And I was supposed to pay \$3000; that was what was left for that semester but then they took it down to \$600... She was extremely helpful. Even at the end of it she was like, next semester, contact me and if you can't, I will just clear you for graduation and then you can take the rest of your classes when you want, when you are able, just let me know. She was extremely helpful, extremely helpful. And like, her responses were *very prompt, she kept checking on me* and yeah. She's [can't find another word to describe PREPARED, her adviser]; she is *an extremely amazing person*. ... The reason why I started looking for help in the first place is because my enrollment window had opened and it had been a long time since the window was already opened and classes were filling up and *I had zero classes for the semester that was coming because I had a hold on my account*... Exactly. So you also have that. Every semester. But that semester was extremely hard because given the situation. So my advisor kept saying uhm...my Biology department advisor, he is in charge of telling me, "Here is the classes you're supposed to take and this is when they will open, and if you need me to like unlock the class for you, I will do that." So he gave me the list of classes but my enrollment window opened and I couldn't...I couldn't uhm pay for the semester. So I kept waiting and waiting and waiting. And then my...uhm...she [PREPARED] contacted me, "Is there a problem? Why aren't you enrolling? This will set you back, you are about to graduate, this is your last semester, you just need to pay... you just need to enroll for this. This is your very last semester, I wanna clear you for graduation but you are not enrolling so what's wrong?" Then I told her. Then she was like, "Oh, okay, why don't you come and meet with me and tell me more about this." That's why I told her... Yes. She's in charge of helping me graduate. That is her job, for like my college journey, she's in charge of like supervising it. yea, so she helped me. And it's a

great service, it's a great service. I didn't know she would be helpful. I had contacted the dean of CAS.

Thus, what happened in Burundi due to the political unrest affected Leah's parents' financial situation.

According to PREPARED, the CAS dean had already educated all his staff in how to respond when students had extenuating circumstances. She said her dean had also advised the staff to pay special attention to Black students and other minoritized students because of the campus racial incidents that happened in the spring of 2015. Her dean emphasized the need to be attentive to the emotional needs of students who might have been frightened due the incidents. She said,

There is a good culture of allowing time for professional development...The biggest challenge probably is just our case load. You know we are the biggest college on campus and we're dealing with a lot of students and it can get hard to provide that individualized level of services that would support a student who really needs that support. When you are just swamped with appointments and emails...But I think our college is good in supporting advisers...and providing context to our jobs, making us feel supported in what we are doing. (Getting very emotional) I know I had a conversation with a Black female Biology major who for just a semester or two she had some academic difficulty and she let me know that that was directly related to the [racial incident perpetrated by a fraternity]; that she felt, you know, personally affected by that and it was stressful and it impacted her GPA...It was a real eye-opener for me because I felt like "wow, this is something that for most students on campus it is not affecting their grades..." I feel like as a college we're very open to having those kinds of conversations. When that incident occurred, our administration addressed it directly with us; they said, "We want to be open to our students. We want to be available to all our students who are experiencing stress and grief because of this incident." You know, I think the college [CAS] is very good about that; and that comes from the top-down and that's really important. (PREPARED)

Funding for Student Organizations

In regards to funding for student organizations at IU, the Black Student Adviser (SMART) said, "it is not good to rely on SGA for funding...it is not much. So we also

fundraise.” That is why the activist group of Black students demanded, among other things, that the university address the following issues:

Equitable funding for Black student organizations—SGA and Student Affairs (SA) have been uncooperative with attempts to address funding issues. The budget allotment for BSA is inadequate. (Student Daily Newspaper)

BSA also demanded an outline addressing how SGA and SA would make funding changes in April 2016. Thus, Black students, led by Black women students were not satisfied with the response from IU administration regarding proper communication and demanded more awareness and access to information regarding financial distribution and other issues affecting the Black student community. Also, IU received funding through endowments from White donors. However, endowments for advancing the interests of Black women students were nonexistent at this institution (based on what the newspapers reported). This was particularly striking because the university had been expanding in terms of both the physical buildings as well as in the number of academic majors being offered. These expansion works were reported to be funded by a number of donors, which meant that such fund could not be diverted for other uses.

Finding Communities and Thriving While Black, Female, and/or Foreign

In spite of the challenges, the majority of participants found communities in which they could thrive at their HWI. All the participants were members of at least one student organization, with the majority belonging to more than three student organizations. Indeed, participants considered belonging to a student organization an import part of their professional and intellectual development and a necessary endeavor for their personal wellbeing and happiness. As the following quotes illustrate,

participating in these organizations also fostered a sense of community and offered opportunities for networking with individuals at the local, national, and international levels. When Jackie first came to IU, she joined the CAC and was a member of the “Spark Crew.” However, she expressed the lack of inclusiveness in this student organization as the reason for ending her membership.

I didn't feel the connection that I felt when I went to BSA. I love CAC but it just got too (long pause) excluding. I mean I love, love the people in there. But you could only find certain people. When I go to BSA inside any event, it's not just the few people who are looking out for me. With BSA, any event you go to you feel like you are part of it. ... Also, this next year [fall 2016], I'm going to be a Gateway Teaching Assistant (Gateway TA) for [Name of a woman professor]. She's very sweet; she was my Gateway Teacher and so whenever I applied to be TA I requested to be in her class. (Jackie)

Like Jackie, Courtney Brown also emphasized the importance of getting involved in college:

You need to join clubs to meet people...get involved...to balance out studying. (Courtney Brown)

Indeed, getting involved had benefits for the participants. Annie's story also illustrates how finding community through involvement served as a facilitator for persistence at IU. When we first met, although she was a Chemical Engineering major she chose to volunteer with the Rotary Club for college students (ROTACTION) and also belonged to two professional organizations—the Society of Women Engineers (SWE) and National Society of Black Engineers (NSBE). Because she also loved public speaking, “giving presentations,” she was also an active member of the state's Model United Nations Club. In addition, as an underrepresented student in the College of Engineering, she participated in other activities organized by IU's Multicultural Engineering Program. In spite of her strong desire to transfer to the University of Texas

(UT), Annie admitted that her decision was getting harder to make the longer she stayed at IU and the more involved she was getting. She said,

I don't know, like since the time I started wanting to transfer, IU has been looking better, to me. I don't know. ... Because when you get involved in things and you hold positions in some clubs, *it just makes you not want to leave because you're already attached to people or to some things*. But I'm still going to apply though, I will see how I feel by the end of the semester [laughing].
(Annie)

Like the majority of participants, Annie was introduced to many other networking opportunities through her involvement in one volunteer activity. Annie said she met an alumnus (a White woman) at a ROTACT volunteer event in the local community who introduced her to the SWE and NSBE. By April 2018, Annie announced that she had been selected to be NSBE's Regional Chair and was still in good academic standing in her program at IU. She had not left IU for UT.

Annie's experience also illustrates the fact that *the institutional benefits of student involvement seemed secondary to the intellectual growth the individuals experienced*. Through these communities the participants indicated that they gained more in the way of the skills and mindsets that were valuable in reaching their academic and career goals. The participants seemed to thrive when they found communities that supported their developmental goals; and these communities were not necessarily those prescribed for them. Some participants (Jackie, Joy, Kerri, Oklahoma, & Senabile) found community at their churches.

Such support sometimes came from unexpected sources. For example, Kerri, a psychology minor majoring in Health and Exercise Science said that besides her family and friends, the staff at her former on-campus job "were very supportive," helping her with "scheduling work hours, to balance school, life, and work." During our informal

conversation outside the Student Government Building, she pointed to a middle-aged White woman and a young White man who were approaching us and said: “These two, right here, that’s who I’m talking about.” The two continued to converse with Kerri while I observed this unique situation. The staff told me they were not student affairs professionals but restaurant employees and added, “We work here because we love kids [meaning college students].” It was amazing to watch; the affection they displayed was consistent with Kerri’s description of her experience working under their supervision.

Nevertheless, the majority of the participants also joined other organizations that supported their career and altruistic goals such as the Society for Women in Science (Oklahoma) and Rotaract (Leah & Annie). Through these communities, Black women also experienced the happiness that came from volunteering (Acts 20:35). The majority seemed to agree with Oklahoma who said, “In giving I gained more.”

Chapter 5: Discussion

This study found that the commonalities among Black women students at HWIs center on their shared history of marginalization. All the participants reported experiences with their peers' perceptions of their abilities to succeed in STEM. For example, Tiffany's classmates made comments that indicated that they did not expect her to succeed in her major. Like previous studies, this study also found that over 52% of the Black women who participated had changed their majors at least once by their sophomore year. Indeed, these stereotypes discourage Black women and other underrepresented students who have lower self-confidence from entering STEM fields, persisting and excelling academically (Chang et al., 2011; Reyes, 2011; Carlone & Johnson, 2007; Seymour, 2001; Seymour & Hewitt, 1997).

The majority of those who changed from Premedical majors did so because of their negative experiences with the teaching and assessment of chemistry (organic chemistry in particular) courses. This finding also supports what Barr, Matsui, and Wanat (2010) found regarding the negative effect of chemistry courses for students who declare premedical majors. In particular, they found that women and underrepresented groups of students were more likely to give up their goals of a medical degree because of these courses. However, although Chang and Hurtado (2014) reported similar findings, they found that underrepresented students who aspired for a medical degree, worked full-time, and had negative interactions with faculty were less likely to persist in a STEM major. My study found that although the majority of those who changed majors had previously declared a premedical major, this phenomenon was not unique to

this group as reported by these earlier studies. In fact, students changed from other non-premedical majors for various reasons, including chemistry courses.

Other scholars indicate that stereotypes that devalue Black women limit their intellectual engagement at HWIs (Collins, 1990, 2000, Collins & Bilge, 2016; Harper & Quaye, 2008), especially in fields that are considered highly rewarding (AAUW, 2008). Winkle-Wagner (2009, p. 23) found that Black women students' experiences at HWIs oscillated between being in the "spotlight" and being "invisible," continually wrestling with "the need to perform" or to balance their identities; but either way running the risk of being judged as "too ghetto" or "too White." These feelings are also reported in this study but in the form of individual women's compulsion to prove that they belong to their predominantly White and male STEM communities of STEM at their HWIs.

In addition to their shared histories of marginalization and oppression, this study found that Black women students also share a capacity for caring for and nurturing others for a better world. Given their challenging class and work schedules, coupled with the unforgiving structural barriers and disciplinary demands, not to mention the stresses they endure from having to prove that they belong in their STEM majors, they must exercise a great deal of agency to chart their own career paths (Banks, 2009; Johnson, Brown, Carlone, & Cuevas, 2011; Smedley, Myers, & Harrell, 2010). My study findings are consistent with some of the conclusions drawn from earlier studies. Black women students in this study also reported experiences that were impacted by prevailing myths, stereotypes, or ideologies (Collins & Bilge, 2016) in ways that were interpreted by individuals through the lens of their lived experiences and knowledge of the history of colonialism, slavery, and anti-Blackness in the context of the U.S.A

(Dancy, Edwards, & Davis, 2018; Jean-Marie, 2011). As transnational sisters at HWIs, Black women also experience an “outsider within” status in higher education (Taliaferro-Baszile, 2006; Collins, 1990; Lorde, 1984). This is not surprising because U.S. higher education is rooted in imperialism, colonialism, patriarchy, which devalue both women and Blackness.

As a result, Black women (whether students, staff, or faculty)

“Live at the nexus of race and gender hierarchies...in the spaces in between, not quite here and not quite there. We are/we be in between Black and White, male and female, and even race and gender as categories that contradict in defining Black women’s identities” (Taliaferro-Baszile, 2006, p. 200).

This current study extends the notion of “outsider within” to describe the experiences of F-1 visa Black women students who feel marginalized when U.S. higher education policy makers, administrators, faculty, staff, and their peers (both Black and White) peers overlook the heterogeneity and complexity in the *experience of being Black or African* (Bloch, Tabachnick, & Beoku-Betts, 1998). Even notable scholars have sometimes overlooked this heterogeneity and called for an oppositional kind of Black intellectualism that is in fact an African American intellectualism (Taliaferro-Baszile, 2006). Although problematic, this essentialist view of Black intellectualism can serve as an important starting point in coalition building among the various groups of Black intellectuals from around the globe.

Implications for Theory and Research

The majority of previous researchers have studied Black women in higher education as students of color, women of color. Unlike previous studies, this study allowed other socially defined categories such as STEM major, citizenship, class, and national origin to emerge from analysis of interviews with Black women students who self-identified as

Black. Because the multiple case study design was combined with intersectionality as an analytic tool, the study provides an empathetic understanding (Stake, 1995) of the complexities of the experiences of diverse Black women students in science, technology, engineering, and mathematics (STEM) majors at historically White institutions (HWIs) in the United States of America.

In addition, I highlight the ways in which these institutions, along with their STEM departments, might influence those experiences. By conducting this qualitative case study (Stake, 1995, 2005, 2010) through a multilevel (intersectionality) approach (Collins, 2000, 2009; Collins & Bilge, 2016; Crenshaw, 1989, 1991), I situate the experiences of Black women students within the organizational and historic contexts. Thus, while this study makes significant methodological and theoretical contributions to the field of higher education, it also offers implications for all stakeholders for improving the experiences of Black women students in STEM at HWIs. Ultimately, this study informs national and institutional efforts to broaden participation of minoritized students in STEM.

A number of studies have documented the experiences of Black women students at HWIs, including dealing with isolation, invisibility/marginalization, and microaggressions (Malone & Barabino, 2009; Solorzano, Ceja, & Yosso, 2000; Winkel-Wagner, 2009). Findings from this study support the assertion that in spite of commonalities, experiences of Black women students in STEM are not homogenous; rather, they are uniquely shaped by historical, personal, institutional, and organizational factors in intricate ways (Collins, 1990; Collins, 2000; Collins & Bilge, 2016; Dill & Zambrana, 2009).

Because the study has reported nuances in terms of Black women students' perceptions of White spaces, which could, in turn, influence the quality of engagement at and attachment to their HWIs, future studies should investigate whether there are differences between the levels of student engagement among different groups of Black students. Wolf-Wendel, Ward, and Kinzie (2009) provide a clarified understanding of the terms student involvement and student engagement. According these scholars,

The concept of engagement is grounded empirically in the indicators of “good practice” in undergraduate education (Chickering & Gamson, 1987), involvement theory (Astin, 1984), and Pace’s (1980) quality of effort measures. ... [It] is about encouraging institutional reflection and action on effective practice...it includes consideration of the institution’s role in channeling students’ participation in effective educational practice. As a result, it is a concept related to institutional improvement [or transformation] because it immediately pinpoints activities that can be influenced directly and indirectly to improve student learning.

Thus, student engagement is not just about individual students’ involvement in clubs and student organizations of their choice but also about the role of the institution in structuring those experiences in meaningful ways. Therefore, when investigating the levels of engagement among students, future studies should focus, not on “the amount of involvement or catalog[ing] student experiences... [but on] studying the depth of those experiences” (Harper, 2008, quoted in Wolf-Wendel, Ward, & Kinzie, 2009).

Also, the study found differences in college experiences among African, African American, and African American women who had immigrant parents with regard to their motivations for choosing STEM. There is a need for in-depth understanding of these differences to inform policies and practices for equitable engagement of these students. Lastly, studies of the experiences of Black men and other groups of minoritized college students should be conducted using the same approach.

Study Limitations

Given that the categories of differences among Black women students were allowed to emerge during the research process, it was impossible to keep on adding participants with the goal of achieving representation for all known social identities. For example, despite efforts to include Black women students who identified as members of the LGBTQ communities, none of those who were willing to participate in the study identified *both* as a Black woman student *and* as a STEM major. I understand how the inevitable exclusion of one student group might affect the study findings, interpretations, and even translate into future inequality.

Ideally, multiple case studies are conducted by more than one researcher. Because this study was a dissertation, I was the sole investigator; I conducted all interviews and observations, and relevant document reviews, and wrote this report. Therefore, I cannot claim to have attended every meeting, consulted every suggested source of information, and pursued every emergent issue. Yet, in the interest of doing justice to the goals of the dissertation, I devoted the time that was needed to conduct this research as multiple cases of three STEM departments. In addition, the fact that I was the interviewer, data collector, and analyst made for a better report—because I knew the details and contexts for all the cases. Above all, my dedicated dissertation chair, along with a diverse committee of expert researchers provided guidance to ensure the final research questions were sound and that the interpretations of my findings were warranted. Nevertheless, the findings of this study have significant implications for policy, practice, and future research.

Implications for Policy and Practice

This study found that Black women students were involved in student organizations at their institution and beyond. However, they were grossly underrepresented in co-curricular academic programs and other structured educational enrichment activities such as undergraduate research and merit-based academic scholar's programs. Thus, this study makes a significant contribution because it identifies gaps in the collegiate experiences of Black women at HWIs. These academic forms of involvement in which Black women are underrepresented have also been linked to significant gains in terms of student development and preparation for graduate school (Astin, 1975, 1977, 1984, 1985, 1993, 1999; Kuh, 2001, 2008; Kuh, Kinzie, Schuh, Whitt, & Associates, 2005; Pascarella & Terenzin, 2005; Strayhorn, 2010; Tierney, 2000; Tinto, 1986, 1993; Wolf-Wendel, Ward, & Kinzie, 2009). Other studies also show that Black women's success in STEM is dependent on institutional capability to foster a culture of inclusion, which promotes student involvement (Gasman & Perna, 2011; Perna et al., 2009; Margolis & Fisher, 2002).

Consistent with the above, Palmer, Maramba, & Dancy (2011) also agree that Women of color who persist in STEM often report having had opportunities to discuss course content with their peers; joined STEM-related student organizations; participated in undergraduate research programs and altruistic pursuits. Regarding undergraduate research, the study found that the majority of Black women did not have a clear understanding of what research is in their specific fields. Not surprising, when asked why they were not seeking out research opportunities, the common response was that they did not like to do research. Researchers have found that participating in

undergraduate research is a form of student involvement that provides opportunities to acquire skills that set students up for success in graduate and professional schools or employment (Strayhorn, 2010).

The findings of this study are not surprising to intersectional scholars as they confirm the following assumptions of intersectionality theory:

- Inequalities derived from race ethnicity, class, gender, and their intersections place specific groups of the population in a privileged status with respect to other groups and offer individuals unearned benefits based solely on group membership;
- Historical and systemic patterns of disinvestment in nonprivileged groups are major contributors to the low social and economic position of those groups;
- Representations of groups and individuals in media, art, music, and other cultural forms create and sustain ideologies of group and individual inferiority/superiority and support the use of these factors to explain both individual and group behavior; and
- Individual identity exists within and draws from a web of socially defined statuses some of which may be more salient than others in specific historical moments. (Dill & Zambrana, 2009, p. 4).

Thus, consistent with its goals, intersectionality scholarship should always aim to analyze social structural processes, which create inequality in order to bring about change and/or transformation (Choo & Ferre, 2009; Collins, 2009; Collins & Bilge, 2016; Dill & Zambrana, 2009).

Findings from this study also show that the experiences of Black women students in STEM are compounded by intersecting factors related to student perceptions of lack of community due to low numbers of non-White students, self-doubts, structural constraints, and ineffective communication regarding the benefits of participating in research activities. Studies have shown that these perceptions of lack of community among underrepresented students in higher education are in part a result of the lack of diversity and inclusivity among faculty and peers ((AAUW, 2008; Bowman, 2010;

Gurin, Dey, Harper & Hurtado, 2007; Hurtado, & Gurin, 2002; Hurtado, Milem, Clayton-Pedersen, & Allen, 1998). The National Center for Education Statistics (NCES, 2016) reported that nationally, minoritized faculty members made up about 21% of full time faculty at degree-granting institutions in the United States—with 16% representing the number of faculty from minoritized racial and ethnic groups at the professor rank. In addition, while minoritized students enrolled at four-year public postsecondary institutions make up about 39% of the total student population, on average only 31% enroll in graduate degree programs at similar public institutions (NCES, 2015). At IU, although undergraduate enrollments are consistent with national trends (IU Institutional Research and Reporting (IRR), 2016), graduate enrollments for minoritized students are below the national average. Based on analysis of enrollment details data for 2010-2016 enrollments, the majority of minoritized students were clustered in some academic majors than others; and even in majors in which their enrollments were relatively higher, their proportion at the graduate degree level is negligible.

Notably, the above situation sends a negative message to Black women and other underrepresented or minoritized/ disadvantaged students that they do not belong; based on these, they do not feel that they have the potential to be eligible for favorable consideration to participate in activities within these apparently less-diverse environments. Therefore, minoritized students may hesitate to seek out research and other graduate school preparation opportunities (self-doubts). For instance, although IU offers many curricular and co-curricular activities to prepare students for success in graduate schools, an alarming proportion of minoritized students – especially Black women students, American Indian, and students with physical disabilities – are

underrepresented in these experiences (Kuh, 2008). Such opportunities include research, internships, and service-learning programs, and other co-curricular opportunities, whose effectiveness in preparing students for success has been documented (Kuh, 2008). By not participating in research and graduate preparatory activities while at the baccalaureate level, minoritized students do not acquire the skills they need to gain admission to/succeed in graduate degree programs—and many are plagued by self-doubts or feelings of unpreparedness for the challenges of graduate school and/or subsequent employment.

While some underrepresented students may be aware of the opportunities within and beyond their academic departments, they are unable to participate due time and scheduling constraints. Even experienced faculty members who have supported minoritized undergraduate student researchers face the challenge of creating meaningful learning experiences for students who are struggling to balance the most difficult conundrums—i.e. structural barriers, intellectual and identity development, and financial obligations that may necessitate off-campus employment.

The “switching” (Seymour & Hewitt, 1997) phenomenon needs to be viewed as a normal part of the intellectual development process for all college students. Because it is often characterized as a failure to survive in the so called “hard” sciences, it brings added complexity to the negative experiences of Black women, especially those who have been high achievers; it brings a stigma that can lead to unhealthy outcomes for those who have experienced it. Based on this study’s framework, faculty, advisors, and parents should prepare Black women students for this possibility and assure them that it is a normal developmental process. By viewing it in a negative light, higher education

policy makers may not seek solutions. Students who change their majors early do so based on knowledge of the options available to them. The support offered to students as they go through this process is a form of empowerment.

There are also implications for recruitment and engagement of underrepresented STEM faculty and graduate students to serve as role models for STEM Black women in these majors. Professional development for all non-Black faculty regarding inclusive ways of teaching and engaging Black women. Such programs should focus on sensitizing faculty to recognize that the act of teaching involves grappling with people's ideas, cultures, and identities. Above all, there should be a special focus on how to actively recruit underrepresented students in all structured academic programs and initiatives whose efficacy for preparing students for graduate, professional schools, and employment. Along with that, STEM departments should establish partnerships with businesses or other departments on their campuses to provide opportunities for internships for students to gain skills that will serve them in future employment or in graduate school. This will reduce the anxiety that many underrepresented students suffer from as they approach graduation.

There are also implications for “academic counter-spaces” for Black women on college campuses (Solorzano, Ceja, & Yosso, 2000). As pointed out by seasoned “outsider within” scholars, doing so requires “Directed investments in the creation of counterintellectual and economic spaces” (Dancy, Edwards, & Davis, 2018, p. 191). Now is the time for Black alumni to look back and invest in programs that validate the unique strengths and needs of diverse Black women students and faculty to pursue goals that allow them to stay true to who they are.

There are three major programs that emphasize preparation for graduate school through undergraduate research experiences: the McNair and Honors Scholars programs and the First-Year Research Experience, which was housed in the Chemistry and Biochemistry Department. However, these programs recruit a limited number of students who are citizens or permanent residents of the United States. While First Year Program was for first-year students who declared a major in certain STEM departments, to be a McNair Scholar, a student must be at least a junior and meet GPA and Federal Government low-income status restrictions. As for the Honors programs, despite clear communication about it, some underrepresented students may perceive it to be elitist, a program that seems unwelcoming. As renowned higher education diversity and inclusivity scholars have noted, when it comes to feelings of belonging to a community, perceptions are important (Hurtado Milem, Clayton-Pedersen, & Allen, 1998; Rankin & Reason, 2005). Therefore, there is a need for a program that will focus on Black women students who may have missed opportunities to prepare for graduate/professional school during their undergraduate years—such as Oklahoma and Sandy who had to return after earning first degrees.

University administrators should continue to keep the lines of communication open to students and encourage faculty and staff to emulate their example. This is important because meetings with individual students and student groups are an effective strategy for diffusing racial tensions during trying times for the Black student community. The promises and demands made during such meetings can be the basis for keeping the institution accountable regarding progress toward an inclusive campus culture. As the participants in this study agreed, the President should keep up the

generous spirit shown to low-income students of all races, including international students and encourage the Vice President for Student Affairs, STEM Department Chairs, and faculty members to do the same. Given that grades are a significant part of self-doubts (identity dissonance) among Black women in STEM, reevaluating the courses required for STEM majors would go a long way in identifying discrepancies in course content to align coursework with 21st century STEM skills and interests.

Findings point to the need to look into Chemistry and Physics courses for non-majors and Premedical students. The undergraduate degree requirements for STEM departments need to reflect students' career goals. As regards undergraduate research experiences, the Chief Academic Officer and the Vice President for Research should consider extending the reward structure to encourage and reward professors who show commitment to minoritized students' success. In addition, the faculty should raise awareness of research experience opportunities for undergraduate students and make clear what it means to be a researcher in their field. Above all, Black women undergraduates need to be supported and encouraged in interdisciplinary research interests that may call for designing STEM-related research projects that focus on solving local community problems and/or are linked with local businesses or organizations (Sykes, Pendlly, & Deacon, 2017).

Colleges and STEM departments need to encourage Academic Advisors, Counselors, and Program Directors who collaborate with the center for social justice at their campus to understand the contemporary issues pertinent to the success of all students. I found that advisors who were well-informed and up-to-date on issues such as the interactions of race, class, and gender with other systems of power often spoke with

and treated Black women students with empathy. This was appreciated by the concerned students during my interviews with them.

In addition, because of the high prevalence of cases of miscommunication among students and advisers, the University College needs to consider professional development for advisers and counselors to better guide students. The knowledge about the courses that are available to students in specific majors, including all electives need to be communicated clearly and early on. Even for general education and elective courses, advisers need to understand that certain majors align with certain interests; if a student is interested in a major, there are courses that they may or may not fit with their goals. New Black student orientation especially for Black international students needs to be offered through the Colleges of International Studies to educate Black women regarding career services and U. S. immigration laws governing internships and employment, American history, and African American history. Potential partners to collaborate with are the Departments of History and African and African American Studies, Women's and Gender Studies, and the Center for Social Justice.

Conclusion

In conclusion, this study makes significant contributions to the field of higher education by approaching the study of Black women's underrepresentation in STEM through a multilevel approach. Although the underrepresentation of minoritized students in higher education is a national trend, this study supports the fact that it must be addressed simultaneously at all levels of the higher education ecology (Arnold, Lu, & Armstrong, 2005; Bronfenbrenner, 1917-2005) and provides a framework for doing so by centering the experiences of historically underrepresented students (Dill &

Zambrana, 2009). By analyzing the influence of power at the interpersonal, disciplinary, structural, and cultural levels, this study identifies gaps in institutional efforts toward increasing participation of Black women students in STEM (Collins & Bilge, 2016).

Another major contribution of this study is with regard to how institutions could engage Black women students in STEM at the undergraduate level to diversify the pool of applicants to their graduate and professional programs (Strayhorn, 2010). However, there seems to be reluctance on the part of HWIs to engage Black women students in structured/mentored undergraduate research and graduate/professional preparation programs through effective communication to raise awareness of the critical role of such programs in preparing students for successful careers.

Findings show that Black women students face intersectional challenges that hinder their participation in career and graduate education preparation activities offered during their baccalaureate years at HWIs. In spite of efforts to recruit students from diverse backgrounds in the existing programs, the participation rates for Black women have remained low, leading to the shortage of Black women faculty in STEM.

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Appendix A: Interview Guides

Interview Guide for Black Women Students

Introduction

I would like to learn about experiences of Black women students in STEM departments.

I have no predetermined categories of what I am looking for, but rather, I am interested in learning new information about the college experiences of Black women students in STEM.

Demographic Information

Pseudonym:

Nationality

Visa or Citizenship Status

Gender

Full-time Student?

Transfer Student?

Age

Academic Major(s)

Academic Minor(s)

Freshman, sophomore, Junior, or Senior

Years in College (at this institution)

Graduation date

Scholarships

Loans/Estimated total student debt

GPA (Overall)

Bursar Issues?

Mother's Occupation

Father's Occupation

Family Size

First Generation College Student?

Disability Resources Utilized?

Student Organizations

Questions

1. Tell me about yourself for example, who you are, what background you came from, or anything that helped to shape who you are today.
2. Why did you choose to come to IU?
3. What made you choose your current major? Are you still interested in your major?
4. What challenges (if any) have you faced as a student in trying to reach your personal, academic, and/or professional goals?
5. (*Follow up*) How do you manage despite the challenges you have mentioned?
6. What have been your successes in your personal and academic life?
7. What support systems (if any) have helped to persist in your goals? Please describe any resources/programs on- or off-campus that have helped you.
8. What advice would you give to Black women who want to join this major?
9. What do you think your department and/or institution has done or should do to make things better for Black women students in your program?
10. Is there anything else I need to know?
11. Thank you very much for your time.

Interview Guide for Other Participants

Introduction

I would like to learn about experiences of Black women students in STEM departments. I have no predetermined categories of what I am looking for, but rather, I am interested in learning new information about the college experiences of diverse Black women in STEM.

Guiding Questions

1. Tell me about what you do as part of your work; please include what committees you serve on at the university level and at the college (CAS) level, and at the department level.

2. Are there any other faculty or staff members who can provide specific information on STEM initiatives at the university or department levels? Or initiatives for underrepresented students such as Black women students?

3. Would you please comment on recruitment and participation of underrepresented students?
 - a. How are students who participate in these opportunities recruited?

 - b. How are students informed about the opportunities?

4. What are your observations as far as the success of the STEM programs and/or initiatives?
 - a. Do you think students take full advantage of these opportunities?
 - b. Are there any obstacles that might may be responsible for whether or not intended student groups participate in these?
 - c. May I please, attend some of the activities?

5. In your opinion or based on data, which STEM departments, if any, have STEM initiatives that have been successful at recruiting and retaining Black women students in STEM, at the undergraduate or graduate levels?

Thank you very much for your time.

Appendix B: Data Analysis

Cross-Case Analysis

1. All participants reported being the only Black or Black woman student in majority of the STEM classes.
2. The overwhelming majority of participants said they had never had a Black professor in any of their STEM courses. All participants indicated that there were no Black women professors in their department.
3. All participants expressed the need to participate in co-curricular and extra-curricular activities. Majority of the participants experienced scheduling challenges that made it difficult for them to participate in activities of their interest in meaningful ways.
4. The majority of participants found chemistry and/or physics prerequisite courses more challenging; they blamed these courses for lowering their grade point average (GPA) scores. These were among the largest classes at IU.
5. None of the participants had intentions to continue in their STEM field at the graduate level. The majority (10 out of 14) of the participants in the selected STEM departments indicated that going to medical school was their eventual goal.
6. The majority of participants indicated that they had felt pressured to live up to what they perceived to be their parents' expectations—pressure to do exceptionally well.
7. All participants relied on themselves, peers, family members, and institutional resources when making academic and career decisions.

CROSS-CASE THEMES/THEORETICAL CATEGORIES/INTERPRETATIONS

1. Reclaiming power (Choosing or changing a career path)
2. External/societal influence: A double-edged sword---compare first generation college students and those with a long line of college graduates in their family
3. Feeling the need to prove that you belong: Identity struggles: science, racial, & other identities

4. Institutional influence: Creating the conditions for student success: inclusive learning communities/environments, good/sensitive professors, & hard work (student engagement)
5. Communication: A key to awareness of and access to policies, opportunities, and resources
6. I am Black...I am an African American of the Igbo tribe...I am Somali but Dutch: Diversity of perspectives on the “Black experience”
7. Faculty/staff support and development

BIOLOGY DEPARTMENT CASE STUDY NOTES

DESCRIPTION OF CASE

CASE FINDINGS

1. Majority of the participants experienced scheduling challenges that made it difficult to participate in activities of their interest outside the classroom.
2. The majority of participants indicated that they had felt pressured to live up to what they perceived to be their parents' expectations—pressure to do exceptionally well.
3. All participants reported being the only Black and/or Black woman student in majority of the STEM classes.
4. None of the participants who were Biology majors had intentions to apply to graduate school. They all had intentions to apply to medical, pharmacy, and physician assistant (PA), physical therapy (PT), or nursing schools.
5. All Biology majors considered Biological Science courses important in their preparation for medical and health careers.
6. All participants relied on themselves, peers, and family members when making academic and career decisions.

ANTICIPATED CONTRIBUTION OF CASE TO CROSS-CASE THEMES

- Active recruitment of minority faculty—there are not many in applicant pool
- Choosing/changing major--Importance of role models

CHEMISTRY/BIOCHEMISTRY DEPARTMENT CASE STUDY NOTES

CASE FINDINGS

1. Majority of the participants experienced scheduling challenges that made it difficult to participate in activities of their interest outside the classroom.
2. The majority of participants indicated that they had felt pressured to live up to what they perceived to be their parents' expectations—pressure to do exceptionally well.
3. All participants relied on themselves, peers, and family members when making academic and career decisions.
4. All participants reported being the only Black or Black woman student in majority of the STEM classes.

ANTICIPATED CONTRIBUTION OF CASE TO CROSS-CASE THEMES

- Undergraduate Research Experience
- Collaborations
- Graduate education—reducing completion time for Ph.D.
- Classroom observation
- Facilities/physical space
- Diversity
- Advising

POSSIBLE QUOTATIONS FOR FINAL/CROSS-CASE REPORT

- Diversity 101
- Too White, too male
- “As an institution we do a poor job of managing Premed students” (compare with Jessica Brown’s Premed program in Missouri and others. This approach could be a solution)
- Transactional advising

- (effects on Addy's switch to Microbiology, OK's choice, also positive experience for a former student who withdrew to a two-year college—with the student learning center director)
- The gateway to the awesomeness of the department (OK)
- Chemistry courses are hard—Former chair of department said about general chemistry to students in research experience class I observed

PSYCHOLOGY DEPARTMENT CASE STUDY NOTES

CASE FINDINGS

8. All participants reported being the only Black or Black woman student in majority of the STEM classes.
9. Nearly all participants indicated that the structure of their program allowed them time to get involved in other activities outside the classroom. They said this was the reason for choosing to major in Psychology at IU.
10. The majority of participants found chemistry and physics courses more challenging; these courses were often blamed for lowering grade point average (GPA) scores for many participants.
11. The overwhelming majority of participants pointed out that they had never had a Black professor in any of their STEM courses; all participants pointed out that there were no Black women professors in their department.
12. None of the participants had intentions to study Psychology at the graduate level. The department had no Black woman enrolled in any of the graduate programs. Majority (60%) of the participants indicated that going to medical school was their goal. (The other 2 (40%) who indicated intentions to continue on to graduate school in other fields were (a freshman and a senior) who participated in TRIO programs.