ABSTRACT

Title of Dissertation:	READY FOR TRANSITION: FACTORS THAT FACILITATE TRANSFER TO UNDERGRADUATE ENGINEERING PROGRAMS AMONG BLACK AFRICAN AND AMERICAN STUDENTS
	Bruk Tesfai Berhane, Doctor of Philosophy, 2016
Dissertation directed by:	Assistant Professor Victoria-María MacDonald, Department of Teaching and Learning, Policy and Leadership

This study examines the factors facilitating the transfer admission of students broadly classified as Black from a single community college into a selective engineering college. The work aims to further research on STEM preparation and performance for students of color, as well as scholarship on increasing access to four-year institutions from two-year schools. Factors illuminating Underrepresented Racial and Ethnic Minority (URM) student pathways through Science, Technology, Engineering, and Mathematics (STEM) degree programs have often been examined through large-scale quantitative studies. However, this qualitative study complements quantitative data through demographic questionnaires, as well as semi-structured individual and group. The backgrounds and voices of diverse Black transfer students in four-year engineering degree programs were captured through these methods. Major findings

from this research include evidence that community college faculty, peer networks, and family members facilitated transfer. Other results distinguish Black African from Black American transfers; included in these distinctions are depictions of different K-12 schooling experiences and differences in how participants self-identified. The findings that result from this research build upon the few studies that account for expanded dimensions of student diversity within the Black population. Among other demographic data, participants' countries of birth and years of migration to the U.S. (if applicable) are included. Interviews reveal participants' perceptions of factors impacting their educational trajectories in STEM and subsequent ability to transfer into a competitive undergraduate engineering program. This study is inclusive of, and reveals an important shifting demographic within the United States of America, Black Africans, who represent one of the fastest-growing segments of the immigrant population.

READY FOR TRANSITION: FACTORS THAT FACILITATE TRANSFER TO UNDERGRADUATE ENGINEERING PROGRAMS AMONG BLACK AFRICAN AND AMERICAN STUDENTS

by

Bruk Tesfai Berhane

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2016

Advisory Committee:
Assistant Professor Victoria-María MacDonald, Chair
Dr. Leigh Abts
Professor Alberto F. Cabrera
Professor Daniel I. Chazan
Professor Sharon L. Fries-Britt

Dedication

This dissertation is dedicated to the countless individuals that helped blaze the trail upon which I walk. I am honored to be a descendant of the involuntary streams of Africans who survived some of the most heinous abuses ever known. Your strength is an enduring legacy from which the generations that followed have derived an indomitable character. To you and your memory I say, "Your labor was not in vain."

With a second but no lesser emphasis, I dedicate this work to the first-generation African immigrants whose lives stand as a testament to the willpower found "back home." The long road that you have trodden reminds me that the success of the individual is inextricably linked to the success of the family. Although my world has been almost entirely Westernized, I am growing to embrace a more holistic version of myself as you take up a greater space in my heart. To my Eritrean family I say, "Tebarek" and "Yekenyelei!"

Finally, to the numerous students of color who are or will be in the STEM pipeline, I can only hope that your lives will be in some small way enriched by this study. To my African American brothers and sisters, so often "we" have been portrayed as "they." Our accomplishments have so often been overshadowed by stories of underperformance. I dedicate this work to you in the hopes that we as a people embrace the fact that "we" are more than some have portrayed us to be. At the same time, I look to the growing numbers of young Black Africans who are on a STEM trajectory. In the United States of America, your story is only now beginning to be told. I am privileged to be able to tell a part of your narrative, which really is part of my own story.

Acknowledgements

Although there are numerous individuals to thank and honor for their unwavering support, it is fundamentally necessary to begin by thanking my Lord, my God and my King, Jesus Christ. You and I have been on a special journey that predates my years of post-secondary education. I say this with the understanding that without You in my life, there would be no me. There would be no academic list of achievements, nor would there be a professional life that I have enjoyed. Moreover, it is because of You, LORD Jesus, that I have had the spiritual strength to endure up to this very point. I remember fondly our times together before I would begin hours of dissertation writing, and in those times You reminded me that my life in Christ supersedes all else. Thank You for spending hours with me to help me keep it all in perspective and – for the most part (smile) – keep my composure. You are the Light, and indeed, the Difference, that people see in me.

To my beloved wife, Amarachukwu, you have demonstrated the very essence of your name. Thank you for showing me the grace of God during the hours upon hours when I was away writing. When I would "emerge from hibernation," I was always blessed to have my best friend. You waited for me on so many occasions when you could have fallen asleep, just so we could have our time watching television at the end of a long day. Beyond that, you made home a safe and warm place, and if that were not enough, you gave me an office where I could complete this body of work! Thank you for understanding my love language and "speaking" to me through countless acts of service. I love you for the woman that Jesus made you. He made you as an answer to prayer, and He made you just for me. I love you.

To my mother, Ellen Berhane, and my father, Tesfai Berhane, what can I even begin to say? You laid a foundation of love and support for me that was invaluable. You have never doubted me and because of you, I came to know love early on in life. For all of the support from

childhood until now, I am grateful. Mom, thank you for the faith in God that you instilled in me, and for being a tenacious advocate from my youth. I still remember you telling me that you believed that I would earn a full scholarship, and the Lord brought your very words to pass! Dad, your temperament is part of my core. When people physically hear me, they often think that they are talking to you. I hope that the same is true of how they think that I treat others. My desire is to leave a legacy of enduring love and devotion to my family, just as you have.

To my sister, Tara, what greater love could a sister show? Through it all, you've never wavered. Our love has transcended hundreds of miles. Thank you for raising two beautiful young people that I am privileged to call my niece and nephew. Thank you, Tiffany and Tyler, for letting me be an uncle to you. To my extended family, both in the U.S. and abroad, I love you all. And to my newest family members, including my father-in-law, Dr. Daniel Okoroafor and my mother-in-law, Mrs. Evelyn Okoroafor, thank you for embracing me with the greatest affection. Okwuchukwu (Matthew) and Ozioma (Blessing) Enekwe, I love you both and it makes me smile when I think of the coolest in-laws that I have! In reality, you all are more than in-laws. You're my family and I know that you have my back!

I am also extremely indebted to Dr. Victoría-Maria MacDonald for being an incomparable advisor. The time that you took to help me "review, revise, and resubmit" was simply beyond anything that I have ever known someone in your position to provide. You went above and beyond the call of duty, and you did it with a smile and helped me develop a regimen of laughter. Thank you for helping me to be humble with your many colored pencils and pens. I am a better writer because of you.

My heart is also grateful for the support of my Minority and Urban Education family. To Dr. Tara Brown and my fellow MUE alumni – Dr. Jason Rivera, Ms. Michelle Udeli, Dr.

Wyletta Gamble, Dr. Laura Yee, Dr. Roderick Carey, Dr. Jihyun Kim, Dr. Shasha Lowe, and Dr. Traci Dula – you have done more for me than I would expect a cohort to do. Thank you, Jason, for the mantra, "No MUE student left behind!"

In these last four years, my professional network has grown immensely. To the numerous educators who have helped create this network, I celebrate each of you. I am continually appreciative of my committee members for all that you have and continue to do to support me. Dr. Fries-Britt, thank you for adopting me into your research family and caring enough to speak life into me. I have never left your office uninspired. Dr. Alberto Cabrera, I cannot imagine coming to my research interest without your thought-providing class some years ago. Dr. Daniel Chazan, not only did you let me share my research interests with you, but you helped me cast a broader vision as to what "life after the dissertation" could look like. Dr. Leigh Abts, you regularly model what it means to be an engineer who wants to also educate.

As if my world was not already rich with mentors, I have also been privileged to come in contact with so many other close allies in my "Terrapin family." Dr. Stephanie Timmons-Brown, thank you for the lunch at Adele's years ago that preceded my enrollment in this amazing program of study. To my dean, Dr. Darryll Pines, you have been a blessing to me in what seems like countless ways. Not only has my acumen developed under your tutelage, but at the same time I have witnessed a marked increase in my self-confidence. To my supervisors, Dr. William Fourney and Dr. Nicole Roop, I cannot imagine going through the last four and a half years without your trust in me. Your willingness to allow me to have professional freedom has been beyond anything I could ever deserve.

Throughout my 10+ years at the University of Maryland I have also encountered several faculty, staff, and students that have influenced my journey. I have to thank Aishah Briscoe for

keeping the ship sailing when I was called away for periods of intensive writing. I also extend my deep gratitude to our Ambassador team, colleagues across the Clark School, and associates across the campus, for being there just to lend an encouraging word from time to time. To my good brother, Fitz Walker, thank you for believing in me before I believed fully in myself. Beyond our UMD borders, I thank the faculty, staff, and students from Maryland community colleges that have enriched my perspective and understanding of the transfer experience.

Over the last few years, I have been blessed to also witness my personal network expand significantly. To Pastor Edwards and the entire Apostolic Church of Jesus Christ family, you all are the most caring church that I have ever been part of in my life. To my Circle of Friends, the laughter that we've shared on Fridays has been healing. To my morning men's group, thank you for the constant prayers, especially during some of the roughest points in life.

Finally, I honor each of the men of excellence who have undergirded my life. Daahjah Noubiap, thank you for sharing the tools of transparency and confession with me. Uncle Tony, you have encouraged me over and over again, and I thank you for an energy that is almost infectious! Deacon Bennie Foreman, whether you know it or not, you and your wife have been exemplars of a loving marriage; by watching you and Sister Regina Foreman, I have been inspired to be a better husband even in the midst of this busy season of life. Dr. Ayodeji Ojofeitimi, you blazed a trail ahead of me and I thank you for your honesty and calmness that has settled me time after time. Marcus James, your prayers and ability to make me laugh have definitely been a medicine to me. Last but not least, Dr. John Jackson, where do I even begin? A relationship that began in 1998 over a lost backpack has continued for nearly 20 years. I am proud of you for all of your accomplishments, and I am also proud to call you my friend.

Table of Contents

List of Tables

List of Figures

Chapter One: Introduction to the Topic

Statement of the Problem

Recent reports have decried the extent to which the United States of America's lack of science and engineering professionals is compromising its competitive edge (Carnevale, Smith, & Melton, 2011; National Science Board, 2014; National Academy of Science, 2007). According to the National Science Board,, while only about 16% of bachelor's degrees offered in the U.S. are in a Science, Technology, Engineering, and Mathematics (STEM) discipline, in China the corresponding percentage is 44%. The relative population differential in the U.S. as compared to China notwithstanding, the situation is nonetheless bleak for the American workforce as it seeks to hire more STEM professionals. Another study found that 38% of students in the U.S. who initially choose STEM majors in post-secondary schools do not graduate in these fields (Carnevale, Smith, Melton, 2011). This same report noted that over 43% of students who earn degrees in STEM choose not to work in STEM professions.

At this period in history, the U.S. finds itself in another "Sputnik Moment," in which other nations' strides in mathematics and science threaten American dominance (Bybee, 2013). In fact, the Committee on Prospering in the Global Economy of the 21st Century, part of the National Academy of Science (NAS, 2007), acknowledged its "fear" of "the abruptness with which a [U.S.] lead in science and technology can be lost" to other countries (p. 2). The call for more STEM degree production is not focused on undergraduate programs alone. Scholars note that among doctoral degree recipients in science and math-based fields in the U.S., 42% are foreign-born, which highlights the need for more American-born intellectual capital in these disciplines (National Science Board, 2014).

In response to this need, in 2012 President Barak Obama announced an initiative to create a STEM Teacher Corps (Larson, 2012). The White House affirmed in this announcement the importance of a strong STEM workforce, and the idea that this workforce is critical for meeting many of the nation's objectives (Larson, 2012). The United States Congress similarly echoed the importance of these professions recently by approving the *STEM Education Act of 2014* (United States Congress, 2014). Among other objectives, this legislation aims to enhance existing STEM outreach efforts, particularly those that federal agencies administer. Thus far, the Administration has allocated at least $1 billion to support this new effort (Larson, 2012).

Within the broader challenge of increasing the number of STEM graduates, agencies have also focused more specifically on the low numbers of underrepresented racial and ethnic minorities (URMs) – classified as African Americans/Blacks, Hispanics/Latinos, American Indians, Alaskan Natives, Native Hawaiians, and Pacific Islanders – in these disciplines (National Science Board, 2014; National Academy of Engineering, 2014; Museus, Palmer, Davis, & Maramba, 2011). For instance, the National Science Board (2014) reports that URMs comprise only about 10% of the total number of professionals in STEM fields; this percentage is below their proportion of the U.S. population. The National Academy of Engineering (NAE, 2014) looked more specifically at engineering rather than STEM as a whole, and disaggregated their findings by racial/ethnic subgroups. Their work found that the number of Hispanic engineering undergraduate recipients was generally on an upward slow trajectory between 1980 and 2010, when their share of engineering bachelor's degrees increased from less than three percent to over eight percent. In addition, the NAE determined that the number of Black/African American and American Indian bachelor's degree recipients rose from 1980 to the mid-1990s. However, from the mid-1990s until 2010, Black/African Americans and American Indians'

proportion of the total number of undergraduate engineering degree holders was fairly constant at around 5% and 0.5%, respectively.

While the NAE (2014) and a number of other scholars disaggregate students by subgroups, much of the literature to date has combined women and URMs as somewhat of a monolithic population (Griffith, 2010; Chubin, May & Babco, 2005; Burke & Mattis, 2007). Further research, however, evidences some prominent differences between the two groups. Generally speaking, scholars have noted that the paucity of women in STEM can be largely correlated with a lack of role models (Blickenstaff, 2005; Stout, Dasgupta, Hunsinger, & McManus, 2011; Hill, Corbett, & St. Rose, 2010). Although this group of scholars is very conscious of the significance of gender in STEM education, they rarely – if ever – discuss the intersection of gender with race. That is, these scholars suggest that the "silver bullet" (if one existed) for addressing the lack of women in STEM – regardless of their race – might be finding more faculty and industry mentors. Yet, when one compares these challenges to those facing URM men and women alike, the literature to date indicates that the pathway toward success for URM students seems much more complex. Later in this study, I address these complexities, which often include considerable financial need and emotional stressors that can leave indelible impressions on aspiring STEM professionals.

Another group of scholars has been more sagacious in acknowledging the unique burdens that *Black, Latina, and Native American* women in the science and engineering disciplines face. A number of scholars have pointed out that, compared to their already underrepresented male counterparts, some URM groups of women make up an even smaller segment of the total number of STEM graduates (Perna, Wagner, Drezner, Gasman, Yoon, Bose & Gary, 2009; Lord, Camacho, Layton, Long, Ohland & Wasburn, 2009; Ryu, 2010). Their work substantiates the

notion that the challenges that URM women face are different than those of White or Asian women (Hill et al., 2010). A full discussion of the distinctions between the STEM educational trajectories of URM versus White and Asian women is beyond the scope of this paper, but researchers have quite effectively dealt with the differences between these subsets of students (Lord et al., 2009; Carlone & Johnson, 2007; Ong, Wright, Espinosa, & Orfield, 2011).

Furthermore, Ohland, Brawner, Camacho, Layton, Long, Lord and Wasburn (2011) assert that the retention rates of different minority groups in STEM are more stark when looking at race than when looking at gender. Put another way, they posit that there is more of a contrast between URM and majority students than between male and female students in STEM. Scholars explain the smaller gender gap by referencing the considerably large number of women who continue to graduate with degrees in the biological sciences (Ceci, Williams, & Barnett, 2009; Chubin et al., 2005). Although researchers generally do not discuss the reasons that women choose biological sciences in large numbers, recent work illustrates that women often are interested in careers in which they can make a positive impact upon society; women often perceive disciplines like biology and medicine as having more social relevance than the hard sciences or most engineering careers (Tulshyan, 2010; P. Smith, personal communication, March 11, 2015). Apart from these sub-disciplines within STEM, however, researchers argue that there remains a compelling need to increase the representation of women in general, and of URM women in particular, in engineering.

According to Chubin et al. (2005), increasing diversity in the engineering workforce will lead to a more culturally "competent" field of professionals (p. 74). Therefore, to improve the quality of the engineering profession as a whole, these scholars suggest that improving racial, ethnic, and gender diversity in engineering degree programs is extremely crucial. In fact, for

racial and ethnic minorities, scholars note that there are added financial reasons that these underrepresented students should pursue STEM degrees. Specifically, success in STEM degree programs will translate into greater economic benefits for URM graduates, permitting significant upward mobility for families and communities of color (Palmer, Davis, & Maramba, 2013).

Engineering itself is a multifaceted field, and the four most popular disciplines – civil, computer, electrical, and mechanical engineering – account for approximately two-thirds of all undergraduate engineering degrees awarded (Staudinger, 2006). Aerospace, biomedical, chemical and industrial/manufacturing engineering graduate the next highest numbers of students each year (around 20%) (Staudinger, 2006). Last, there are a number of lesser known or specialty programs within engineering that graduate small numbers of students (fewer than 10% of all graduates), which include majors like agricultural and architectural engineering (Staudinger, 2006). Interestingly, while some literature has explored the tendency for some disciplines to attract more women – such as industrial engineering – few have looked at specific majors that may attract higher numbers of URM students (Brawner, Camacho, Lord, Long, & Ohland, 2012).

In addition to STEM disciplines, the federal government's recent emphasis on community colleges has placed increased attention on the nation's two-year schools. Early in his first term, President Barak Obama charged higher education leaders with the goal of producing five million new community college graduates (The White House, 2009). With this announcement, the federal government – among other points – allocated increased funds to support stronger partnerships between community colleges and the business community (The White House, 2009). In 2015, President Obama further proposed that community college tuition should be free to students (Calvert, 2015).

These shifts in federal policy are noteworthy because in recent decades, two-year schools have found themselves competing with public and private four-year colleges and universities (Mellow & Heelan, 2014). For-profit institutions, in particular, have been able to recruit students who might have previously elected to enroll in a community college (Mellow & Heelan, 2014). With increased resources, including a stronger media presence than two-year schools, for-profit institutions have contributed to a decline in the amount of support that community colleges receive from stakeholders (National Association for College Admission Counseling, 2015). Given these recent developments, it may be interesting to explore how educational scholars with STEM emphases are including community colleges in their research.

President Obama's administration has also established a goal of producing eight million new bachelor's degree recipients by 2020 (Handel, 2011). Handel posits that this goal has direct implications for the vast numbers of community college students who will need to transfer to four-year schools. Large amounts of URM students would be directly affected by any changes to the transfer process because of the disproportionately high number of students of color that are concentrated in two-year schools (National Center for Education Statistics, 2012; Malcom, 2010). Scholars further emphasize the importance of mitigating barriers to transfer, particularly because few URM students ultimately transfer from two- to four-year educational institutions (Reyes, 2011; Dowd, 2012; Hagedorn, Moon, Cypers, Maxwell and Lester, 2006). According to Bailey, Jenkins, and Leinbach (2005), African Americans and Hispanics were underrepresented among associate degree recipients in 2003. Their findings showed that while African Americans and Hispanics represented 17 percent of those who recently completed high school, their share of associate degree holders was only 11 percent. Hispanic students fared similarly, comprising 16 percent of students completing high school but just 10 percent of students who earned an

associate degree. While it is not required to earn an associate degree to transfer to many four-year institutions, tracking those who obtain it may be a proxy for estimating the share of students that go on to complete a bachelor's degree.

Although researchers have documented the need to support more URM students in community colleges – as well as those in four-year schools – the characteristics of these students are painted broadly with little attention to nuance. Thus, for example, a general pan-Latino or pan-African approach in the literature disregards generational status, country of birth (e.g., Colombian or Mexican, Ethiopian or African American), English language levels, and citizenship/documentation status. As a result, consumers of scholarly literature may unwittingly believe that all "Black" or "Hispanic" college students have similar backgrounds and face similar challenges.[1] In reality, "Black" and "Hispanic" students have noteworthy within-group differences. For instance, at Eastern College (EC), the site of this study, 287 of the 523 "Black" engineering undergraduate students (55%) are non-U.S. citizens (M. Mehalick, personal communication, May 15, 2014).[2] Among Hispanic students, the number of non-U.S. citizens in EC's engineering program proportionately similar. 51 out of a total of 104 Hispanic engineering students are non-citizens (M. Mehalick, personal communication, May 15, 2014). Many of these students may be classified as international students, ostensibly in need of additional considerations and support programs to ensure their educational success. For example, Andrade (2006) explains that international students in English-speaking countries are particularly challenged by language and cultural barriers.

[1] Although researchers and government publications use the descriptors "Black" and "African American" interchangeably, the term "Black" is better suited for this study. "Black" encompasses students born both in sub-Saharan African countries and those born throughout the modern African diaspora. I use the terms "Hispanic" and "Latino" interchangeably throughout this study.

[2] Eastern College is a pseudonym for the primary research site in this study. It is a community college that enrolls large numbers of URM engineering students. I describe Eastern College in more detail Chapter Four.

A number of educational researchers have begun to acknowledge the within-group differences of Hispanic students. For instance, Torres (2004) cautioned the research community against basing its understanding of all Latinos' educational experiences only on those of Mexican Americans. Although people of Mexican descent represent nearly two-thirds of all Latinos in the U.S., historical context shapes the pathways of other groups, such as Puerto Ricans, Cuban Americans, and Central Americans (MacDonald & Carrillo, 2009). In Ryu's (2010) research, she distinguished Mexican Americans, Puerto Ricans, Cuban Americans, and Colombian Americans separately, allowing readers to understand nuanced differences between students classified as Hispanics. Later in this study, I speak more specifically to the within-group differences among Black students, which include distinctions by country of birth.

Research Questions

This study examines factors impacting the transfer admission of students broadly classified as Black, who transfer from a community college into a selective engineering college. It is noteworthy that although I have unpacked themes germane to URM STEM students thus far (and, indeed, continue to speak to broader URM themes in the literature review that follows), this study specifically explores the transfer of *Black* engineering students. As I discuss in the literature review, scholars appear to have devoted more attention to *Hispanic/Latino* STEM transfer students than they have to *Black* STEM transfer students. The reason that Blacks receive comparatively less attention may be because they are more likely to attend four-year schools than two-year schools (Perna, 2000). In fact, Black students often pursue STEM disciplines in Historically Black Colleges and Universities (Harper, 2010; Perna, Lundy-Wagner, Drezner, Gasman, Bose, & Gary, 2009). Because of the numbers of Black students who ultimately decide to initially enroll in community colleges, however, more research is necessary to ascertain the

factors that influence their transfer in STEM majors. In addition, the educational histories and trajectories of other URM groups (such as Latinos and Native Americans) are distinct. As such, it is beyond the scope of this study to explicate the factors that support Latino and Native American engineering transfer students.

With this scope as a foreground, my first research question is as follows: *What do Black undergraduates perceive as factors that facilitate community college student transfer to competitive engineering programs?* I intend to explicate only those components that Black transfer students themselves believe to have been important for their transition to four-year schools. The factors that students identify are not necessarily the only components that assisted them in transferring. However, this study is primarily concerned with transfer *students'* voices and lived experiences up to the point of transition from a community college to a four-year engineering school. I acknowledge that students' perspectives may be different from those of others, such as campus administrators, who may know of other components that students do not necessarily recognize.

The second question that I address in this work is, *What are some of the within-group differences among Black students who transfer from community colleges to competitive engineering schools?* In an earlier footnote, I defined "Black" students to include students born in sub-Saharan Africa. I used the term "sub-Saharan Africa" as opposed to Africa in a broader sense because scholars tend to distinguish the educational, health, and economic trends in sub-Saharan Africa from those in North Africa (Hargreaves, Bonell, Boler, Boccia, Birdthistle, Fletcher, Pronyk & Glenn, 2008; Michaelowa, 2001). This is not an attempt to conflate sub-Saharan African people as a monolithic group, nor do I wish to imply that North Africans are entirely dissimilar to their counterparts in other regions of the continent. However, researchers

have often subsumed North Africans with groups from the Middle East, essentially drawing a distinction between them and their sub-Saharan counterparts (Akkari, 2004; Klasen & Lamanna, 2003). I likewise note that the vast majority of first-generation African students that I have encountered in my own professional experience with engineering transfer students have come from sub-Saharan African countries.

In his work in which he delineates African diasporas from ancient history until the modern era, Palmer (2000) defines five different "streams" that have moved throughout the world. The fourth stream, which he determines to be the group that is most commonly studied today, is connected to the African slave trade throughout the Atlantic Ocean. According to Palmer, this movement displaced 11 to 12 million Africans to North, Central, and South America, and shifted as many as 200,000 Africans to different regions of Europe. The fifth stream commenced once slavery ended in the Americas, and has endured until the present. Drawing from Palmer's research, I define African diaspora in this study within the context of the fourth and fifth streams.

While I employ the term "Black" to include both students from sub-Saharan Africa and those in the African diaspora, I note that some Black students may not identify themselves as such. According to some scholars, there are other categories or names that students from Africa may use to self-identify, such as "Habasha," a term that Ethiopian and Eritrean students use to describe themselves (Habecker, 2012). Habecker notes that some "Ethiopian[s] and Eritrean[s]…[view] their Habasha identity as a separate *and* racial category that is not black and emphasizes their Semitic origins" (p. 1203). For this reason, an Ethiopian or Eritrean immigrant who studies in the U.S. may find the idea of identifying as Black/African American to be challenging.

First-generation students who recently arrived in the U.S. may also identify with their country of origin or their tribe, such as the Igbo or Yoruba people of Nigeria. Interestingly, in my experience, students from West African countries like Nigeria will more readily adopt a Black identity (in addition to their national or tribal identities) than those from Ethiopia or Eritrea. I unpack this theme in more detail in the literature review. At this point, it is sufficient to note a Black identity may be more salient for some African students than for others (Akyeampong, 2006). Moreover, according to Renn (2008), a Black student may perceive himself/herself differently dependent upon the setting in which s/he happens to be at a particular time. This may also be true of students who understand that they are Black according to the United States' racial classification system, but who may self-identify as biracial (e.g., having one White and one Black parent).

To be clear, this study does not in any way attempt to exclude students who identify as African Americans. On the contrary, I attempt to explicate the academic experiences of students who adopt more nuanced "Black" identities, including, but not limited to, "African American" identities. In my professional experience, which I develop more thoroughly in the *Researcher Positionality* section of this study, I have found that the majority of students who transfer into engineering majors have more of a *Black African* identity than an *African American* identity. In this work, I illuminate the experiences of students across multiple categories of Black students.

Although the notion of Black identity is at the heart of this study, I am cognizant of the importance of gender diversity in the engineering transfer pipeline. As stated earlier, women make up a disproportionately low percentage of professionals in technical fields. For this reason, I explore factors that may specifically support Black women who transfer into engineering. This

study does not attempt to examine gender independent of Blackness, but hopes to give voice to both Black women and men who have transferred into engineering colleges.

In the literature review, I explore the work of researchers who examine factors which support transfer students in their transition processes. Prior studies utilized the term "vertical transfer" to refer to such students who move from two- to four-year schools (Townsend, 1999; Ignash & Townsend, 2000). These studies distinguish "vertical transfer" students from others who may have transferred from one four-year school to another, or who may have moved from a four-year to a two-year school. For the purposes of this study, "transfer" thus refers specifically to vertical transfer.

I also acknowledge that there are different types of two-year schools, which can include vocational-technical colleges, community colleges, and career colleges (The College Board, n.d.). For this research, "two-year college" refers specifically to community college, and as such I will use the terms "two-year college" and "community college" interchangeably throughout this document. Finally, I underscore the point that in this study, the student participants transferred to a competitive engineering program. In the Glossary, I define "competitive" for the purposes of this study.

Rationale

In the following two subsections, I develop a series of points that undergird the import of this study. The first subsection explores the relevance of responding to a need for more STEM professionals in a U.S. context. I distinguish this from the second subsection, which examines the portrayal of Black students in STEM from other countries, mainly those in sub-Saharan Africa. I maintain that it is important to view Black students in STEM through a combined

African-U.S. context, particularly for a study of this nature that acknowledges the increasing numbers of non-native born Blacks.

Section 1: The case for educating STEM professionals in a U.S. context

This research topic is especially pertinent for several reasons: 1) The ability to educate future STEM professionals responds to a national mandate for the U.S. to become more globally competitive; 2) The President of the United States has issued a new call for two-year colleges to graduate more students; and 3) Improving the number of STEM graduates in under-resourced communities of color has the potential to mitigate economic barriers that they may encounter and foster upward mobility. Apart from these considerations, this study is a timely response to the country's new demographic reality that has moved away from a Black American/White American paradigm. It acknowledges the significance of the changing face of "Black America," which now includes a more diverse population than previously.

While developing a focus for this study, I considered the idea of looking both at issues of *transfer* as well as *retention and graduation.* Indeed, as indicated in the literature review that follows, URM students have faced obstacles when attempting to transfer from community colleges to four-schools. At the same time, the literature review underscores the challenges that students face after transferring, which can often serve as roadblocks to graduating in a STEM major. However, the low transfer rates of URM community college students to four-year schools, particularly in STEM disciplines, are especially stark (Reyes, 2011). In fact, according to one recent study, only about 30% of all community college students even transfer to four-year schools; this rate is even smaller for students in lower socioeconomic groups (Cabrera, Burkum,

& La Nasa, 2005).[3] On the other hand, retention and graduation rates are notably higher for students who have already transferred to a four-year STEM program. For instance, at the A. James Clark School of Engineering at the University of Maryland, a competitive school with a strong research focus, the one-year retention rates for Black and Latino Maryland community college transfer students who transferred in the fall 2011 term were 92.9% percent and 91.3%, respectively (University of Maryland, 2015). The three year graduation rates for Black and Latino students in the Clark School for the same cohort were 81.2% and 76.3%, respectively (University of Maryland, 2015). Given the disparities between the aforementioned transfer rates and these comparatively high retention and graduation rates, an exclusive focus on transfer students in STEM is warranted.

Section 2: Math/science motivation and competency in an African-U.S. context

Against the backdrop of a changing "Black" population in the U.S., which includes higher numbers of African immigrants than in years past, students born in sub-Saharan Africa often enter American schools with strong math and science competencies. A number of dissertations have acknowledged African immigrants' academic strengths and interests (Gebre, 2007; Hailu, 2012; Kagume, 2010; Powers, 1994). Gebre (2007), for instance, noted that African immigrants often choose majors in science, mathematics, and even mathematics-based business disciplines like accounting and finance. Gebre (2007) also determined that African immigrants' academic challenges have more to do with their English language skills than their math/science backgrounds. In fact, Gebre (2007) found that in general, African immigrants' high aptitudes in math and science can serve as foundations for learning new subject matter.

[3] To be sure, not all community college students intend to transfer to four-year schools. Some students utilize the community college to prepare for a vocational career or certificate program. However, this study concerns community college students who intend to transfer to a four-year school.

Hailu (2012) similarly discovered that students from different African countries may excel in mathematics and science, and encouraged scholars to highlight these competencies rather than solely discuss the academic challenges that they may encounter.

Kagume's (2010) doctoral work illuminated the existence of a Science, Mathematics, and Technology (SMT) self-efficacy that some Kenyan women may possess, and added that these students might be encouraged to explore these disciplines when they have the support of parents, mentors, and teachers. Research that has appeared in peer-reviewed publications has also alluded to the importance of encouraging women from African countries to pursue STEM careers (see, for instance, Aderemi, Hassan, Siyanbola, & Taiwo, 2013). However, these studies mainly explore the challenges that they face en route to STEM degrees (e.g., gender stereotypes that contribute to the gender gap between African-born men and women in STEM careers). Other peer-reviewed work decried the Black-White STEM degree attainment gap in South Africa, but did not explore the means that allow Black South Africans who are successful in STEM to be able to overcome academic obstacles (Downs, 2010).

These trends in the literature on Black African students suggest several challenges that underscore the need for this study. First of all, although dissertations provide excellent starting points for future research, scholarly literature at large has yet to acknowledge these students' aspirations and competencies in science and mathematics. Second, the narrative in peer-reviewed journals on students of color in Africa – like the scholarship on Black and Hispanic students in the U.S. – primarily emphasizes the paucity of these students relative to their White or male counterparts. Looking at STEM enrollment only through this lens, scholars may overlook African-born Blacks that have both an interest in and acumen for STEM disciplines. My research therefore offers a different perspective from this established vantage point by

illuminating the factors that encourage first generation students (many of whom may have been high achievers in their home country) to pursue STEM degrees in the U.S.

Researcher Positionality

According to Lincoln (1995), one of the criteria for performing robust qualitative research is that scholars acknowledge their own positionality. As for my own background, my father migrated to the U.S. in 1971 from what is now known as Eritrea, a country positioned just north of Ethiopia. For this reason, I identify both with Eritrean Americans and Habashas. Because my mother is an African American and I was raised by her in a very "American" context, I also retain a strong Black American identity. Since I associate with more than one ethnic group, I personally relate to Renn's (2008) identity framework, which asserts that a member of a group can identify with more than one community depending on the environment in which he/she finds himself/herself. These multiple identities undergird my commitment to topics pertaining to "Black American" students, both those that are native (U.S-born) and non-native.

My interest in STEM disciplines, and in engineering specifically, is borne out of my own experiences as a child and later as a young adult. After completing elementary school, I began participating in a summer and academic-year enrichment program that targeted African American males. The initiative was designed to increase the number of African American young men who tested into a competitive STEM high school program. After being selected for this opportunity, I enrolled in that high school in ninth grade and graduated with a full scholarship to the University of Maryland, Baltimore County (UMBC), where I was part of another selective STEM program for minority students: The Meyerhoff Scholars Program. I spent my first two years at UMBC, and then transferred to the University of Maryland in College Park, where I

earned a degree in electrical engineering. As a former transfer student, the focus of this study is particularly intriguing because it allows me to unpack some of my own academic experiences.

After working in a high-tech laboratory for two years after graduation, my career transitioned me to the Clark School of Engineering at the University of Maryland. Shortly after joining the Clark School, I obtained a Master of Science degree at the George Washington University in Engineering Management. For over a decade I have served as a recruitment specialist at the Clark School, where I have focused on increasing the number of URMs in the college. In recent years, I have visited multiple community colleges in Maryland to advertise the Clark School's undergraduate programs, and have generally found three trends to be consistent among the prospective transfer students that I meet: 1) Depending on the school, Black students can be a small percentage of the prospective engineering students that I encounter; 2) In schools that do have higher numbers of Black pre-engineering students, the majority of those whom I have interacted with (e.g., through college fairs, e-mail correspondence, etc.) were born outside of the U.S., specifically in sub-Saharan Africa; and 3) Although diversity support programs are already in place at numerous engineering schools, few seem to acknowledge the within-group diversity of first- and second-generation African immigrants. This suggests a need for increased attention on students' national or ethnic identities, rather than on their racial identities alone. As a professional, I continue to be struck by the lack of attention placed on the challenges that these students may face, such as assimilation into different U.S. school contexts. I hope to be able to explicate these challenges and research their impact through this study.

Other Key Definitions

For the purposes of this study, I define URMs using racial and ethnic classifications that are consistent with the U.S. Census (2013a). According to the Census, "Hispanic" or "Latino" are generally interchangeable terms that can be used to describe individuals of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of their race. As such, I use both of these terms throughout this paper. The Census also provides five general racial categories, which I also utilize for this study: 1) White; 2) Black or African American; 3) American Indian or Alaska Native; 4) Asian; 5) Native Hawaiian or Other Pacific Islander (U.S. Census, 2013b). In this study, URMs in STEM refer to the following racial or ethnic populations: 1) Black or African Americans; 2) Hispanics or Latinos; 3) American Indians or Alaskan Natives and 4) Native Hawaiians or other Pacific Islanders (Museus, Palmer, Davis, & Maramba, 2011). Due to the limited amount of information on Native Hawaiian/Pacific Islanders in STEM, the scholarship that I critique below on racial/ethnic subgroups mainly highlights Black, Hispanic, and American Indian populations. However, in many cases I speak more broadly to the state of URMs in STEM as a whole; in these cases I include all four of the aforementioned URM subgroups in my assertions.

Additionally, I use the term "competitive engineering program" in my research title to describe a highly ranked engineering school. For this study, I consider a college of engineering competitive if it has been included in the *U.S. News and World Report's* list of its top 25 engineering programs for undergraduates at least one year since 2010. The ranking system is based on a survey of deans and senior faculty at peer institutions, and is based on a scale in which respondents rate components of each college between 1 and 5 (Morse, 2014). I note that there are two different lists of rankings for undergraduate engineering programs; one is for

colleges that offer doctoral degrees in engineering and the other is for colleges that offer a bachelors or masters degree in engineering as the terminal degree (Morse, 2014). For future reference, I consider only those colleges that offer a doctoral degree when discussing "competitive" engineering programs.

Chapter Two: Literature Review

This section synthesizes and critiques peer-reviewed studies that address the topic of transfer students from underrepresented racial and ethnic minority (URM) backgrounds in engineering fields. It addresses the following question: What factors have scholars determined to facilitate community college student transfer to competitive engineering programs among underrepresented minorities? Although my literature review addresses factors impacting engineering students, I also examine the broader literature concerning STEM students as a whole because of the richness of published information available on STEM students. Therefore, I draw from five topical areas, which I enumerate in the following paragraphs. Throughout the analysis that I provide in this review, I take a macro-level view of the literature and point out critical gaps that should be addressed. I also suggest future studies that can address these gaps. While the literature review will not nearly exhaust all of the challenges around the scholarship on these topics, I hope that it will begin to give voice to some emerging themes.

The first two topics, which are the broadest and address issues surrounding URMs in STEM in higher education, are scholarship that explores what leads to the retention and graduation of URMs in STEM, and which illuminates what causes the attrition of URMs in these fields. The third section of this review briefly examines the scholarship on community college students enrolled in STEM majors. This body of work is critical both because it provides information on the URM students who choose community colleges, and because it presents factors that distinguish these students from some of their majority peers. Establishing the background of research on community college URM students leads to the next section of this review, which explores the scholarship on URM transfer students.

In the fourth section, I highlight major themes that emerge from research about URM students both before and after transfer from community college. I discuss and critique the framing of factors that leading scholars have credited with influencing transfer success. Initially, I point to research that contrasts the campus climate at two-year schools with that of four-year schools. In this section, I address scholarship that shows the negative impact on URM students who transfer. According to the literature on this subject, students have difficulty transitioning from more welcoming environments in community colleges to four-year schools, where they can experience feelings of isolation. Additionally, I analyze scholarship which explores factors that either help facilitate or inhibit transfer for URMs. Finally, I explore scholarly perspectives on URM transfer student retention and graduation trends. When addressing these various transfer-related themes, I look at scholarship on both URM students more broadly, and on URM students specifically in STEM fields. For this reason, in some parts of this review I unpack macro-level themes in the research on URM transfer students across all disciplines. In other places, however, I speak exclusively about the scholarship on URM transfer students *in STEM disciplines*.

In the fifth and final portion of this paper, I review literature that explores some within-group differences in the Black population. As a demographic that educational researchers tend to homogenize, I articulate a number of differences – including educational and socioeconomic distinctions – across subgroups of people of African origin who now reside in the U.S. Through this analysis, I suggest that educational scholars should view "Black" students as a heterogeneous group. I also suggest ways that STEM education research can be more responsive in acknowledging this diverse population.

I conducted my research using the EBSCO database and the Academic Search Premier search engine. For the most part, I limited my search to peer-reviewed journals and referenced

scholarly articles published within the last ten years. In cases in which I did not use EBSCO, I looked for peer-reviewed articles cited in previous dissertations; I utilized the dissertation database located on the University of Maryland library website to look for these articles. Apart from these tools, I leveraged Google Scholar to query additional articles. Search terms that I used were combinations of the following: 1) "STEM" and "Engineering"; 2) "Black," "African American," "Hispanic," "Latino," "American Indian," or "Minority"; and 3) "transfer" or "community college." Finally, I used a small number of sources provided by my dissertation advisor and experts who have studied African immigrants to further explore the within-group differences of Black students in the U.S.

Section One – URMs in STEM: Factors for Success

A substantial amount of research explores components that scholars have attributed to being beneficial to URM STEM populations. Literature suggests that these components lead to greater retention and graduation in STEM fields. I therefore define "success" for the remainder of my research as retention and/or graduation in a STEM discipline at the undergraduate level. Although the majority of the articles that I analyze are qualitative in terms of their methodological approaches and therefore do not lend themselves to drawing correlations, they point toward a framework for improving the numbers of URM STEM graduates. In the following subsections, I summarize the findings of the peer-reviewed articles on this subject, and offer a critique of the contributions and limitations that they offer to education research.

A. Faculty and staff support

Faculty and staff support of students ranked the highest among factors influencing the success of URMs in engineering majors. More broadly, scholars defined this factor as one that

encompasses integration in on-campus research initiatives as well as less formal mentoring relationships; these relationships, according to their work, invariably involve faculty or staff interactions in some form (Figueroa et al., 2013; Griffin, Perez II, Holmes & Mayo, 2010; Hurtado, Newman, Tran & Chang, 2010; Palmer, Maramba, & Gasman, 2013). Several scholars point out that staff support is often manifested specifically through advising (see, for example Figueroa et al., 2013; Griffin et al., 2010; Maton & Hrabowski, 2004; Museus et al., 2011; Palmer & DuBord, 2013). A number of writers suggest that faculty and staff from URM backgrounds can be a critical factor leading to success in STEM majors (Griffin et al., 2010; Griffith, 2010; Hurtado et al., 2010). In fact, Griffin et al. (2010) provide evidence that both URM and non-URM professors and administrators have been cited by former URM STEM students as critical to their ability to graduate in these disciplines.

However, a subset of this literature points to the idea that faculty of color have a distinct ability to assist URM students with navigating what can be an enervating racial climate (Griffin et al., 2010; Hurtado et al., 2010). In a paper that addresses the nexus between faculty-student mentoring in STEM fields, Griffin et al. (2010) point out that "many professors of color once matriculated at predominantly white institutions (PWIs) where they encountered racist stereotypes" like some of the students of color in their classes. (p. 95). As a result, they add that these professors are able to "connect with students of color in deep and meaningful ways" (Griffin et al., 2010, p. 95). Later in the paper, they opine that students of color benefit from having campus administrators who are not only URMs themselves, but actually of the same racial or ethnic group. Yet, the literature is inconclusive as to whether having URM faculty or staff support actually leads to higher success rates than having the support of a member of a non-URM group. It would seem then that there are three possible recommendations from the

literature regarding supportive faculty and staff: 1) Any administrator, regardless of race or ethnicity, can provide support to URM STEM students; 2) The involvement of URM faculty and staff lead to higher success rates for students in these fields; and 3) Campus administrators should not only be URMs, but actually of the same race or ethnicity as the students of color with whom they interact in order to make the most significant impact (i.e., Black faculty and staff are best suited to support Black students; Latino faculty and staff are best suited to support Latino students, etc.). This poses a quandary in the scholarship that reflects similar challenges in K-12 literature. For instance, Dee's (2005) work intimated that hiring teachers from underrepresented racial backgrounds could help to reduce the achievement gap, but limited his findings to low-income students from the South. For this reason, the results were not necessarily applicable in other contexts. Scholars should continue to try to determine the set of attributes that make a particular faculty or staff member a good fit to support students of color in STEM.

B. Pre-freshmen and pre-college preparation

Another consistent theme in the literature on what leads to successful outcomes in STEM is the significance of pre-college preparation (Dowd, 2012; Figueroa et al., 2013; Museus et al., 2011; Palmer & DuBord, 2013). Figueroa et al. (2013), for instance, mention that Black and Latino STEM majors are more likely to request assistance in college if they completed a high school internship or pre-college program. Museus et al. (2011) go on to say that the strength of one's pre-college background can lead to success in a science or math-based discipline. Another study determined that pre-college summer programs have been proven to have a greater impact on Black and Hispanic students' decisions to choose engineering than for White students (Tsui, 2007).

A specific type of pre-college support that researchers have lauded is the summer bridge program model (Armstrong & Thompson, 2003; Maton & Hrabowski, 2004; Tsui, 2007). A bridge program can be designed as a summer experience in which students take courses in mathematics and science before the freshman year commences (Maton & Hrabowski, 2004). Scholars posit that the bridge experience can be a positive one for URM students, often leading to stronger academic performance for program participants than for students who do not participate in this experience (Armstrong & Thompson, 2013; Tsui, 2007). They also commend other factors that make bridge programs successful, such as sessions on study skills (Tsui, 2007).

While scholars like Tsui (2007) speak both about the importance of bridge programs and pre-college preparation while enrolled in high school, others like Maton and Hrabowski (2004) focus primarily on the bridge program and the support that URM students receive after the bridge experience. Maton and Hrabowski (2004) seem to focus almost exclusively on high-achieving URM students who – aside from the bridge program – possess the requisite skills that they need to be successful in STEM majors. This rather narrow focus appears to be at odds with scholars like Museus et al. (2011) and Palmer and DuBord (2013) who devote more attention to students with weak math backgrounds who need help prior to enrolling in college. A framework that acknowledges URM STEM students across all levels of the academic continuum – from high achievers who mainly need support after enrolling in college to those who may have struggled in STEM courses during secondary school– seems necessary.

C. Peer support and engagement

Across the spectrum of research on URM students in STEM fields, another consistent theme is the importance of peer engagement (Hurtado et al., 2010; Maton & Hrabowski, 2004; Museus et al., 2011; Palmer & DuBord, 2013). Hurtado et al. add that URMs who are involved

in departmental or pre-professional clubs on campus are more likely to be successful in undergraduate degree programs, and other studies support the idea that these students should be engaged with informal social networks on campus (Figueroa et al., 2013). Yet another group of scholars speak to the importance of garnering support from peers of the same race; these scholars infer that Black students are more likely to describe the existence of a supportive environment at Historically Black Colleges and Universities (HBCUs) than at Predominately White Institutions (PWIs) (Fries-Britt, Younger & Hall, 2010).

Scholars have also written about the importance of peer support for Hispanic students in STEM majors (Cole & Espinoza, 2008; Perna et al., 2010). However, this research has not yet examined how or to what extent peer interactions influence success among Hispanic students enrolled in Hispanic Serving Institutions (HSIs) or Hispanic Enrolling Institutions (HEIs). Understanding this influence is particularly important since nearly half - 42% - of all Hispanic students are enrolled in HSIs (Harmon, 2012). Similarly, researchers have not explored the significance of peer engagement as a means of retaining STEM students at Tribal Colleges and Universities (TCUs), which educate 19% of all American Indian students in the U.S. Their studies more often have addressed the idea of *recruiting* students in STEM as opposed to *retaining* students in STEM (Harmon, 2012; Lord, 2010; Zaffos, 2013).

As was the case with faculty support, the extant literature seems to offer two viewpoints on the issue of race as it relates to the peer support. On one hand, it suggests that students can – and arguably should – interact with diverse groups of peers where possible. Yet, it is inconclusive whether peer support leads to better outcomes when students are all URMs or even of the same race/ethnicity. Furthermore, although a body of research evidences the reality that strong peer networks exist at HBCUs, it is not as clear whether these networks positively

influence student graduation rates. As for American Indian students, studies have discussed the strong respect for culture on TCU campuses, but additional research similarly needs to be done to determine whether this respect allows for the development of peer communities in STEM (Zaffos, 2013). Perna et al. (2009) likewise add that it is important to do more research on the impact of HSIs on student success in STEM. They point out that research on this topic would be of interest because HSI designation is based on enrollment numbers, rather than a mission to serve a particular demographic. Last, very little, if any work has been done to explore how racial and ethnic student affinity groups in the STEM fields create a greater sense of camaraderie for undergraduate students of color. For instance, scholars should consider the impact of organizations like the National Society of Black Engineers (NSBE), the Society of Hispanic Professional Engineers (SHPE), and the American Indian Science and Engineering Society (AISES) upon URM students, especially if they have the potential to increase the number of URM STEM professionals.

D. Campus racial and cultural climate

A number of scholars have emphasized the idea that a supportive campus climate can lead to better URM persistence in STEM majors (Museus et al., 2011; Palmer & DuBord, 2013). The authors of these studies highlight the relevance that a group of faculty and administrators can have in creating an overall familial culture. Yet, other contemporary scholars have suggested that the HBCU environment is inherently better positioned to create welcoming and encouraging environments for African Americans than PWIs (Hurtado et al., 2010; Perna et al., 2009). Hurtado et al. suggest that HBCUs often prioritize good teaching, and they contrast this idea with research-intensive universities that place a more of a premium on what takes place in the laboratory than what occurs in the classroom.

Aside from pedagogy, Museus et al. (2011) posit that "institutions can have a positive impact on the success of racial and ethnic minority students by creating meaningful connections between campus cultures and minority undergraduates and by validating the cultural backgrounds of those students" (p. 68). Perna et al.'s (2009) work on Spelman College adds a unique dimension to the idea of a supportive postsecondary institution because it is the premier HBCU for African American women. The researchers in the study demonstrate how the school has created a supportive community that empowers Black female students to achieve at high levels in STEM. As an extension of this work, it would be interesting to understand how their study might extend to other contexts, such as those with large numbers of Hispanic or American Indian women.

Similarly, scholars have found that TCUs are successful in supporting American Indian students because they show respect for students' cultural backgrounds and use pedagogical methods are congruent with their unique histories (Lord, 2010). Robbins and Hoke (2013) also note that HSIs also have shown the capacity to empower Latinos with the belief that they can be successful. Their work, however, explores the ability of Latino *nursing* students to excel, and does not explore how this belief system is actualized for students who major in physical sciences or engineering at HSIs. Future studies should explore how this actualization affects URMs across *all* STEM disciplines.

Museus et al. offer another perspective along these lines, namely, that a supportive department or college culture within the larger institution is important to the success of underrepresented students of color. Their work suggests, for instance, that it is not only important to have a welcoming climate across campus, but that a college of engineering or department of computer science should likewise strive to maintain this kind of atmosphere.

Overall, the scholarship on this topic suggests that the more campus' climate and culture can aid in "fostering connections" with underrepresented students of color, the more likely they will be to have "[positive] outcomes" (Museus et al., 2013, p. 68-69). Whether the department or college makes a greater impact upon students than the university as a whole is another matter, but at least the literature seems to coalesce around the overall importance of positive campus climates.

E. Individual persistence

A factor that consistently appears in the research is the importance of individual persistence and resilience (Figueroa et al., 2013; Griffin et al., 2010; Hurtado et al., 2010; Museus et al. 2013). According to some, personal ambition and intellectual curiosity can serve as a positive influence on URMs in STEM disciplines (Griffin et al., 2010; Hurtado et al., 2010). Figueroa et al. (2013) posit that underrepresented students of color particularly benefit when they pursue additional academic support, which may imply that URMs must be self-motivated to seek this outside assistance. Museus et al. (2011) consider the relevance of self-efficacy for helping to ensure student success, suggesting that a person must be mentally resilient enough to withstand the rigors of the STEM discipline that they are studying. However, the majority of their work focuses on the adverse impacts of a STEM culture that is extremely individualistic and can lead to feelings of student isolation. I address this issue later on in this paper when I explore the factors that negatively impact URMs in STEM.

To the contrary, Maton and Hrabowski (2004) do not discuss individual persistence, seeming to value the support that students of color receive when working together with others. They emphasize that peer networks as well as supportive faculty and staff are critical to producing URM STEM graduates. This is a theme that emerges in some of the aforementioned

work on HBCUs and TCUs. For instance, work by Hooker (2013) established the idea that some American Indian students at TCUs thrive in mathematics coursework when they can work with peers rather than in isolation. However, it seems aberrant from other literature that describes URM students in majority-White classrooms where they have to work in individualistic settings (Fries-Britt, Younger & Hall, 2010; Hurtado et al., 2010). As such, it may be that URMs at PWIs may have to negotiate a sort of dual consciousness – thriving in group settings while learning how to navigate an individualistic culture – that they do not have to contend with at HBCUs and TCUs. At this point, it is not yet clear from the literature whether HSIs prioritize group dynamics in the same way as other Minority Serving Institutions. In general, however, researchers that write about URMs being successful at PWIs – compared to those that study Minority Serving Institutions – may be compelled to acknowledge the necessity of individual perseverance and collective, concerted effort.

F. Other forms of support

Among the other factors that the existing literature links to success in science and math-based disciplines are strong family support and financial assistance (Griffin et al., 2010; Maton & Hrabowski, 2004; Museus et al., 2011). Another consistent theme is the importance of internships, while still a separate component explores the need for students of color to see their disciplines as having social relevance (Figueroa et al., 2013; Hurtado et al., 2010; Maton & Hrabowski, 2004). Hurtado et al. (2010) explain that science has "relevance" when students perceive that it offers some "value" that can lead to "improving conditions" (p. 7). This notion connects with yet another area that scholars credit for helping URMs in STEM fields, namely, involvement with community service (Maton & Hrabowksi, 2004). Finally, Palmer, Maramba

and Gasman (2013) discuss the significance of smaller class sizes on helping underrepresented students of color achieve in STEM majors.

Although these factors seem to be well-established, it is not clear how some of these components are operationalized when it comes to students' academic and extra-curricular lives. For instance, among college students, do research (on-campus) internships lead to better outcomes than off-campus internships with companies? Another question has to do with family support; in particular, scholars should grapple with the idea that "family" may look very different depending on particular subgroups of URMs. For children of single parents born in the U.S., there may be a paucity of biological relatives to support the student, yet an extended "family" through one's church or home neighborhood may play a bigger role than the literature acknowledges. On the other hand, children who migrated to the U.S. with their families from, say, East Africa or Latin America may intrinsically value and connect with their immediate family differently.

Section Two – URMs in STEM: Barriers to Success

Unlike the literature on factors that lead to successful outcomes, a fairly large body of work has instead focused on the challenges that URM students face en route to obtaining a degree in a STEM major. In this section, I explore this set of challenges, explicating those that appear with the most frequency in peer-reviewed articles. As in the previous review of factors for success listed in published literature, I again describe the emergent themes around this topic and carefully critique the approaches that scholars have used in their work.

A. Environmental challenges

The idea of an unfriendly and possibly intimidating college environment has been in existence for some time in educational research. The term "chilly climate" was an early term used by scholars, and its use predates recent work in STEM education; in fact it first appeared in education research in the 1980s. Hall and Sandler (1982) developed this notion to describe the unwelcoming environments that many women were encountering in institutions of higher education. Their work posited that "a chilling classroom climate puts women students at a significant educational disadvantage" leading to a "profound negative impact on women's academic and career development" (p. 5). Drawing upon Hall and Sandler's research, other scholars have adapted this term more recently to articulate the barriers that URM students encounter in STEM majors. Cole and Espinoza (2008), for example, connected Latino STEM students' higher levels of extra-curricular activities as a possible response to a chilly climate in their academic environments on campus. Utilizing this analytic lens as a perspective to understand URM students' challenges is valuable in this review because it helps to reify their experiences through an established perspective.

According to Palmer et al. (2013), African American, Hispanic, or Native American student withdrawal from STEM majors may be precipitated by an unwelcome or unsupportive environment. In their work, they disaggregated students by grade point averages, and found that students with GPAs below a 2.0 were less likely to feel welcome on campus. Among the URMs that they studied, a number of them decided to change their majors; these students perceived the campus as a "cold, uncaring place with classes too large to feel important" (Palmer et al., 2013, p. 38). While the authors of this paper do not specifically cite the campus' climate as the cause

for these students to change their major, the environment that they portray is similar to the negative one that Cole and Espinoza (2008) illustrate.

Similarly, Strayhorn (2009) describes a concept called *invisible man syndrome*, in which a group of URM men in STEM fields perceive that their thoughts go unacknowledged. His work suggests that underrepresented men of color may feel excluded from conversations in class, while their White and Asian American peers are more readily included as part of the dialogue. Participants in his study "described feeling 'invisible' or nonexistent in engineering classrooms as they were usually 'one of few' URM men, if not 'the only,' enrolled in a [STEM] course" (p. 2). Strayhorn's (2009) respondents included African American and Hispanic students, and the negative experiences that they encountered seemed consistent across both URM groups.

A related, but separate issue in the literature concerns the challenges of students' social interactions with peers and faculty on campus. Cole and Espinoza (2008) found there to be a negative relationship between URM STEM students' involvement in campus activities and their grades. The authors posit that students' participation in activities involving student organizations and ethnic affinity group-sponsored events can serve as negative predictors for minority students' weaker academic performance in STEM majors. It is worth noting that these findings seem somewhat inconsistent with earlier findings in the success-factors section that linked on-campus engagement with positive outcomes. This leads to a question of whether the determining factor for success is the number of activities that students join. That is, researchers should determine whether students become overcommitted by joining too many activities and resultantly suffer academically. The coalescence of this work seems to be that underrepresented students of color are especially challenged by a campus culture that feels insular and tenuous.

Finally, the aforementioned ideas hearken back to classic work by Steele and Aronson

(1995) on the notion of stereotype threat. Their research opines that the performance of minority students may be adversely impacted when they become overly concerned about how their performance may be judged in relationship to their majority – often White and male – counterparts. Years later, Pronin, Steele, and Ross (2004) used this framework as a means of depicting how this sense of anxiety can affect women's grades in mathematics. More recently, Chang, Eagan, Lin and Hurtado (2011) used it to explore issues of persistence in the biomedical sciences for URM students.

To be clear, researchers do not use the term "stereotype threat" interchangeably with "chilly climate," nor have they used the idea of "invisible man syndrome" synonymously with the latter two frameworks. On the other hand, their work suggests that may be more than one way to describe the challenges and effects of unwelcoming environments for URM STEM students. Whether these terms can be used to describe the exact same phenomena on college campuses may be beyond the scope of this paper. However researchers define these challenges, their work provides solid evidence that underrepresented students of color are facing cultural challenges in STEM majors.

B. Academic preparation

Researchers have also explained that aspiring URM STEM majors are often underprepared for the rigors of these disciplines (Figueroa et al., 2013; Palmer, Maramba & Gasman, 2013). Figueroa et al. (2013) add that underrepresented students of color are less likely to have attended an academically rigorous high school, and thus less likely to have the requisite skills to be successful in such a major. Works like these often cite the achievements of White and Asian students and juxtapose them with the weaker academic rigor that URM students receive. Such comparative studies, while valuable, can perpetuate a narrative in which

underrepresented minorities continue to appear in the literature only as academically underprepared students. A more contextualized approach, perhaps one that disaggregates students of color by geography or socioeconomic level, would be useful.

C. Perceptions about STEM

As a final note, some scholars have found that students classified as Black, Hispanic and American Indian struggle because of their own negative perceptions of STEM environments (Palmer, Maramba & Gasman, 2013). Researchers conjecture that because of these perceptions, underrepresented students of color are more likely to withdraw from these majors. Strayhorn (2009) argues that URM students may have difficulty conceptually applying engineering to practice. He points out that "participants [in his study] struggl[ed] silently to understand how engineering theory and curricula apply to [their] cultural interests" (p. 2). This notion connects with the idea that science and engineering must be "relevant," as stated earlier. However, when articulated in the context of URM student challenges – rather than from looking at it as a strategy to help them become successful – this kind of perspective in research can once again underscore notions that students of color are inherently inferior. When framing challenges that underrepresented minorities face, scholars should be careful to avoid broad statements that can reaffirm existing stereotypes about supposed academic weaknesses.

Similar to the earlier discussion about supportive staff and faculty, role models may be extremely important to helping minority students succeed in STEM. However, the literature is surprisingly one-sided in addressing issues of *female* role models as opposed to *URM* role models (Blickenstaff, 2005; Dowd, 2012; Stout, Dasgupta, Hunsinger & McManus, 2011), with the exception of articles like those by Palmer, Maramba and Gasman (2013) that look at mentoring for students who are both *females* and *URMs*. Dowd briefly comments on the lack of

mentors that URMs students have as part of a broader discussion, but stops short of explicitly advocating for more mentors. Scholars should focus more on researching the extent to which faculty and staff in STEM fields can serve as role models for URMs, since – as discussed in the prior section – they can serve as academic navigators throughout college.

Section Three – Community College Enrollment

As stated in the Introduction, there has been an increased emphasis at the national level on community colleges, and with it a greater push for students to enroll in these schools. With this heightened attention on two-year schools, there is a need to better articulate the demographics of students who enroll in these schools. This section explores the literature on community college student enrollment, and the implications that this enrollment has upon STEM degree attainment among URM students.

African American and Latino students are more likely to enroll in two-year schools than in four-year schools (National Center for Education Statistics, 2010; Malcom, 2010). This enrollment trend is also true of students from low socioeconomic backgrounds (Cabrera, Burkum, and La Nasa, 2012; Dowd, 2012; Hagedorn and Purnamasari, 2012). Yet while Hagedorn and Purnamasari (2012) posit that community colleges may be a good option for students who may not have had the best academic preparation in secondary school, Dowd (2012) is more cautious and states that lower income and URM students are more likely to have weaker mathematics backgrounds. Dowd (2012) also notes that students from these populations are more likely to take remedial classes than their wealthier peers at two-year institutions. These findings are particularly concerning when one considers that in order to pursue a challenging field of study like engineering, a student will need to take extremely rigorous mathematics courses. Given the popularity of engineering in many two-year schools, this has dire

implications for prospective engineering URM students who are academically underprepared (Dowd, 2012).

There is an unfortunate tendency in the literature to treat low-income and URM students in community colleges as a monolithic group (Dowd, 2012; Malcom, 2010). On one hand, it is true that many URM students in postsecondary schools have financial need. In fact, according to the National Center for Education Statistics (2012), 90% of African American students attending a postsecondary institution have some level of financial need[4] [5]. The corresponding numbers of Hispanic, American Indian, and Native Hawaiian/Other Pacific Islanders are 84%, 84% and 87%, respectively. However, the numbers of their White and Asian counterparts are not much lower, listed at 74% and 83%, respectively, according to the most recent statistics available. This data reveals that the gap between the percentage of minority students with need and their White and Asian counterparts is very small. Yet by not including White or Asian populations in discussions of low-income students in community colleges (or in higher education, more generally), educational researchers can make an incorrect inference: They can mistakenly assume that students who belong to racial majority groups are much more financially stable than their underrepresented minority counterparts. This may lead scholars to make improper comparisons between majority and minority students in community colleges.

Whether or not they have financial need, researchers suggest that Hispanic students in particular are able to navigate pathways from two to four-year STEM degree programs. Literature to date finds that anywhere from 50 to 60 per cent of Hispanic students with four-year STEM degrees began their college careers at two-year schools (Hagedorn & Purnamasari, 2012;

[4] Financial need is calculated by subtracting a student's Expected Family Contribution from his/her Cost of Attendance (US Department of Education, 2012)

[5] While the concept of "low-income" is not entirely identical to financial need, the data from the US Department of Education is rich and nuanced. Among other considerations, it defines four levels of financial need, the first being the lowest, ranging from $1 to $5,799. The highest level of financial need is at or above $19,500.

Malcom, 2010). Malcom (2010) adds that older and first-generation Hispanic students are more likely to first earn an Associate's degree in STEM prior to earning a Bachelor's degree. However, Malcom (2010) also states that the majority of Hispanic students who start their careers at two-year schools do not earn an Associate's degree en route to their four-year STEM degree. This implies that many of them may not find it necessary to first complete an Associate's degree in these disciplines; they may instead transfer to four-year institutions after completing certain prerequisite courses.

Hagedorn and Purnamasari (2012) as well as Malcom (2010) suggest that some Hispanic students in STEM majors may benefit from the community college experience. It is nonetheless unclear which set of factors may lead to greater success for Hispanics. For example, future studies might look specifically at Hispanic community college students' and their probability for STEM success as a function of their age. Future research should further disaggregate the "Hispanic" students who start at two-year schools and persist in STEM majors. Students' country of origin, family income levels and parental levels of education are just some of the factors that should be considered in this sort of analysis.

While there is a clear body of literature on Latino STEM transfers, most scholarship on Black students focuses broadly on factors that impact their enrollment in the community college, rather than on their performance/persistence in specific disciplines. Wood (2010) conducted a detailed analysis of the extant literature on Black American males in two-year schools, and determined that scholars generally examined barriers that negatively impacted this population. Examples of some of these barriers include poor academic preparation, economic setbacks, discrimination, and a lack of diversity in the campus. In his own research on a group of Black male community college students, Wood (2014) found that the following four themes were most

critical determinants of students' success: 1) The role of faculty; 2) Family involvement; 3) Students' focus on their academic studies; and 4) Personal motivation. Whether or not any of these factors influence Black male students' persistence within STEM disciplines seems to be an unexplored area in the research to date.

The above findings suggest that scholars who explore community college trends among racial/ethnic groups may have somewhat different foci. Among studies that explore academic trends of Hispanic students in two-year schools, the research community seems to balance its concentration on general enrollment and retention patterns with analyses that look specifically at persistence in STEM majors. A search on the EBSCO database using the terms "community college," "Hispanic* OR Latino," and "STEM" yields several articles that address students in science or math-based majors. The literature that looks exclusively at African American students in two-year schools seems primarily to examine their general enrollment and retention at the school level rather than in STEM majors. An EBSCO search using most of the aforementioned terms, but replacing the words "Hispanic* OR Latino" with "Black OR African American" mainly yields studies that look only at community college enrollment and persistence; few of these studies explore STEM-specific issues. Similar searches on American Indian college students do not produce many results that examine their enrollment in two-year schools to study STEM. In fact, the articles that these searches produce suggest – to the contrary – that American Indian students are electing to enroll in Tribal Colleges and Universities to pursue math and science-based careers.

I do not wish to assert that other research has not examined African American and American Indian STEM degree aspirants in community colleges. However, when scholars discuss either of these student groups, they tend to subsume them as part of the broader category

of URMs (Hagedorn & Purnamasari, 2012; Wladis, Hachey, A., & Conway, K. M. 2015). Future studies should examine the relative proportions of URM STEM students who enroll in community colleges versus schools with a race or tribal-based mission. In fact, more Blacks and American Indians in STEM may choose to enroll in HBCUs and TCUs, respectively, than in two-year schools; if this is true, it may explain the paucity of research devoted to these student populations in community college.

Section Four – Issues of Transfer in STEM

According to Dowd (2012), "the body of literature focusing specifically on transfer in STEM is not robust enough to substantiate conclusions about the unique programmatic features that are necessary to design effective STEM transfer pathways" (p. 122). More specific to underrepresented groups, Palmer and Wood (2013) likewise note that researchers have written surprisingly little about URM students in STEM who begin their postsecondary careers at community colleges. Moreover, because there is no single subject from which to draw to address URM STEM transfer - let alone URM transfer in an area as specific as engineering – the critiques in this particular section examine the scholarship in three areas: 1) Climate disparities at two-year schools compared to those at four-year schools; 2) Predictors of and obstacles to transfer; and 3) Student retention and graduation after transfer occurs. Part of the research that I critique relates specifically to URMs in STEM who transfer, while other scholarship looks more broadly at URMs who transfer across various majors.

A. Climate disparities with two vs. four-year schools

According to recent literature, students who move from a community college to a four-year institution of higher education often experience their own form of environmental

challenges. These challenges often manifest when staff or faculty at the receiving school believe that two-year curricula are of substandard quality (Dowd, 2012; Reyes, 2011). Reyes' (2011) study also revealed that female STEM transfer students of color grapple with having professors who appear to be uncomfortable and therefore behave in an awkward manner towards them. According to Reyes' (2011) research, such professors seem to be unsure as to how to support the students, particularly since they are different from the majority of the STEM student population. Reyes (2011) points out that not only are they female and from URM backgrounds, but they can be older and are more prone to ask questions that their younger counterparts are less likely to pose. Another finding was in Hagedorn and Purnamasari's (2012) research, which explored the impact of the faculty to student ratio upon student performance; they determined that the higher faculty to student ratio at four-year schools may lead to less positive interactions on campus than when these students were at their two-year schools.

The generally unwelcoming climate with faculty can, according to Dowd (2012) and Reyes (2011), be exacerbated by what the same researchers also refer to as *transfer shock*, which explains the academic and social challenges that transfer students can face when they begin their work at four-year schools. Their research maintains that URM students transferring from two-year schools experience difficulties due to the rigorous nature of the courses. Reyes (2011) points out, for instance, that students who were earning A's at their two-year school may begin earning C's in STEM courses at the four-year university. The same study found that grading on a curve – changing lower grades like C's and D's to A's and B's based on a scale set by the instructor – can create a sense of competition that is markedly different from what they may have been accustomed to earlier on in their academic careers. Reyes (2011) also concluded that the competitive nature of the four-year institution can include certain "weed-out" classes. These

courses can discourage women of color who have been accustomed to more supportive environments earlier in their collegiate careers. Similarly, Dowd (2012) determined that students of color can be adversely impacted by the faster pace and intensity of the courses. Transfer shock can also arise when new URM students on campus are excluded from study groups and other social spaces through which students develop social capital (Reyes, 2011).

Whether justified or not, the extant literature seems to have adopted the vantage point that the academic and social problems that arise with transfer students are almost entirely the fault of the receiving institution. There appears to be little, if any, conversation about the degree to which community colleges are preparing future mathematicians, scientists and engineers for the rigors of STEM disciplines. To what extent, for instance, are two-year schools reaching out to four-year schools to attempt to align their curricula and grading rubrics to those that students will experience once they transfer? Similarly, how and in what ways are community colleges tracking their students in STEM once they transfer from their schools? By no means is this an attempt to absolve the four-year colleges and universities of their responsibilities to help students in their adjustment to their new learning environments, but it does raise questions about how the literature can begin to question culpability when it comes to the issue of student success.

Rather than focusing on the challenges that four-year colleges and universities pose to transfer students, Palmer et al. (2013) explicate the elements that can lead to retention and graduation for URMs in STEM fields before transfer. Extolling the merits of community colleges, they note some salient themes, one of which is the *momentum of success literacy.* Effectively a paradigm for describing the idea of positive reinforcement, the momentum of success literacy is manifested when students experience moments of affirmation. A second theme that Palmer et al. describe is a *structure for success* on many community college

campuses, which is manifested through offices that provide resources like mentoring, financial advice, and student services.

Similar to the points about curricula and rubric alignment, the research seems not to address the idea of communication with four-year and two-year schools about creating support structures for students. Indeed, if two-year schools are the de facto experts in pedagogies for supporting students in STEM, the universities to which they transfer should necessarily be interested in replicating the kinds of environments to which they are accustomed. On the other hand, if any such partnerships have been instituted, the scholarship to date has devoted scant attention to them.

B. Predictors of and obstacles to transfer

Scholars also lament the fact that URM students transfer to four-year colleges and universities at disproportionately low rates (Dowd, 2012; Hagedorn, Moon, Cypers, Maxwell and Lester, 2006; Reyes, 2011). Where URM students have been able to transfer, particularly in STEM disciplines, researchers have determined a number of factors that contribute to their success. Hagedorn, Cabrera, and Prather (2010) cite race, ethnicity, gender, and English language proficiency as some of the factors that contribute to being able to matriculate into schools from which they can directly earn baccalaureate degrees. Generally, these scholars find that being White or Asian, and male are factors that are positively correlated with students' likelihoods of transferring to a four-year school. Hagedorn et al. (2010) also find that the closer community college students are to their expected reading levels, the better chance they have of taking the most challenging mathematics courses offered on campus. As it relates to STEM course enrollment and performance, the authors of the study determined that the levels of math and science courses in which students enroll and the number of courses that students take are

good predictors of transfer. Dowd (2012) looks at different components than Hagedorn et al. (2010) and finds that transfer can be correlated with students' ability to manage the higher costs at four-year schools and the extent to which they interact with college advisors and faculty.

While race, gender, financial need, and other classifications certainly may be predictors of transfer, there is little research that triangulates these demographics. Triangulation would aid in determining the set of factors that collectively lead to the highest levels of student achievement. It would be interesting, for instance, for future studies to explore how a West African student from an Anglophone country compares in his/her mathematics course sequence to a student from a Francophone country with different linguistic, cultural, political and colonial legacies. Other possible work could look at whether being a wealthier African American student at a two-year school leads to greater transfer rates than being a White or Asian student from an impoverished background. Furthermore, if even more variables are considered simultaneously – say, race, gender, ethnicity, English language proficiency, socioeconomic levels and country of origin – qualitative studies like ethnographies may begin to gain broader acceptance in scholarly communities where quantitative research has been the norm (see, for example, Hagedorn et al., 2010). This kind of acceptance would make an important contribution to educational research, particularly if it can advance the idea that qualitative research can influence public policy (Tierney & Clemens, 2011).

Dowd (2012) offers a number of recommendations for increasing and improving transfer within STEM disciplines. Among the recommendations, she suggests that colleges and universities compile teams of STEM faculty and administrators to investigate novel pedagogical approaches. Dowd also recommends increasing funding available to students pursuing these degrees and recruiting highly talented URM STEM students at sending institutions who are good

candidates for four-year schools. Yet, she minimizes the significance of academic or curricular structural changes, and instead opines that other initiatives – such as bridge programs, undergraduate research opportunities and student learning communities – can provide greater support for students after they matriculate to new schools.

C. Transfer student retention and graduation

Another body of literature explores the trends associated with URM STEM students *after* they transfer. Malcom (2010) points out, for example, that Latino students who first obtain an Associate's degree in a science or math-based discipline are less likely to graduate from a highly selective four-year college or university. Reyes' (2011) work on women of color similarly finds that the retention rates for this group are relatively low at the receiving institution. Cabrera, Burkum and La Nasa (2005) opine that prospective transfer students from higher socioeconomic backgrounds are more likely to earn a four-year degree when their first institution attended was a four –year school. As such, vertical transfer – leaving a two-year school and enrolling in a four-year college or university – ostensibly reduces the likelihood that a URM student will earn a STEM degree if s/he comes from a wealthier family. Interestingly, Cabrera et al. (2005) found the opposite to be true in the case of students from lower socioeconomic levels: they were more likely to earn a Bachelor's degree if they started their careers at a two-year college.

The aforementioned findings in the literature suggest that longitudinal studies that track students' trajectories before, during and after transfer are extremely critical. The lack of this kind of work represents a gap in the work to date, and may lead practitioners and even researchers to conclude – incorrectly – that matriculation to a four-year school will necessarily lead to graduation with a Bachelor's degree. Malcom's (2010) research leads to the question of whether or not an Associate's degree is in a sense more of a hindrance than a support en route to

earning a Bachelor's degree, particularly for the large number of Latino students enrolled in community colleges. This point has potential implications for the types of questions that scholars who study other URM students in community colleges should be asking.

Section Five – Within-Group Differences among "Black" Students

This final section explores the relatively small but critical body of literature that attempts to describe the differences among the entire group of students who would typically be classified as "Black" or "African American." It attempts to provide a nuanced explanation of those students who, despite being grouped under this general term, are in fact migrants from other countries. Those students – specifically those from Africa and even more specifically, certain countries in Africa – have an academic profile that differs drastically from that of many Americans. As such, *African Americans* have educational experiences that may be extremely different from that of Black "African" or "immigrant" students.

In conducting this review, there was a comparatively large amount of data on groups of "Blacks" who migrated to the U.S. from African countries. As a result, this critique primarily synthesizes the information available on those who migrated from Africa rather than those who may have come from countries in Europe, the Caribbean, Latin America, or elsewhere. The critique juxtaposes this body of work on African immigrants with some established ideas about Black American educational achievement. In so doing, this review challenges the scholarship that homogenizes "Black" students and fails to recognize the nuances of subgroups that were born in other countries. As stated in the beginning of this chapter, while some scholars have made inroads toward disaggregating groups of Hispanic students, Blacks have been overgeneralized in education literature. Current government reporting categories in the U.S.

Census and the National Center for Education Statistics (NCES) hinder parallel analyses of African subgroups by country or origin.

In order to more fully conceptualize the full diaspora of people of African heritage, social scientists outside of education research circles have developed classifications based upon what they term "generational" status. According to Thomas (2011), "first-generation" is a term that refers to anyone that was born in another country and lived in their country of birth until adulthood. "Second-generation" children or adults are individuals who were born in the U.S. to first-generation parents. Another recent classification has been the "1.5-generation" child or adult, which refers to a person born in another country but who migrated to the U.S. before the age of 10 (Ellis & Goodwin-White, 2006). Finally, African immigrant families are defined as those in which either the head of the household or the spouse is a person who emigrated from an African country (Thomas, 2011). It is important to understand this typology because doing so can provide a richer understanding of the diverse "Black" students who may enroll in higher education institutions in the U.S. In the following paragraphs, I review the scholarship on African immigrant migration to the U.S. and conclude with an analysis of the work on African degree attainment in the U.S.

African immigrants are responsible for the largest increase in the overall Black immigrant population increase in the last three decades (Migration Policy Institute, 2010). Economically, first-generation African immigrants tend to have higher rates of poverty than their African American counterparts (Thomas, 2011). These challenges seem to become less acute by the second generation, when families become more integrated and assimilated into the American economy and ostensibly move closer to the middle class (Thomas, 2011). In addition, Thomas (2011) found that English language proficiency is correlated with income levels among first-

generation African immigrants; adults with greater proficiency in the language tend to earn more. Thomas (2011) adds, however, that poverty still affects African immigrants, particularly at a macro-level, where they are to some degree still limited by the same race-based constraints that impact "Black Americans" as a whole.

In terms of their educational trajectories, Awokoya (2012) adds that African youth, particularly 1.5 and second-generation students, may struggle with retaining a particular cultural identity while at the same time attempting to assimilate into the Black American culture. Her research finds that children of Black immigrants may contend both with typical discriminatory practices that other African Americans face, as well as with additional ridicule from their U.S.-born Black peers. However, children of Black immigrants typically outperform Blacks born in the U.S. in terms of their postsecondary education levels (Thomas, 2009). In fact, by the second generation, Black students born to first-generation parents demonstrate significant educational strides (Thomas, 2009).

Other information that analyzes educational trends for Black students comes from government or non-profit supported publications. The Migration Policy Institute (2012) points out, for example, that African immigrant representation in the U.S. has grown as a result of the diversity immigrant visa lottery program, which was designed to increase the numbers of immigrants from countries that have historically sent relatively few of its citizens to the U.S. Recipients have to have a minimum of a high school degree or two-years of training in some key discipline to benefit from this program (Migration Policy Institute, 2012). Moreover, some countries, like Ethiopia, Nigeria, and Ghana, tend to be better educated than other African immigrants (Migration Policy Institute, 2012). Eritrea, Somalia and Liberia, for instance, tend to send greater numbers of refugees to the U.S. and so they are not required to meet any minimum

education benchmarks for entry into the country (Migration Policy Institute, 2012). On the whole though, researchers have found that African immigrants – most of whom come from sub-Saharan countries – have higher rates of bachelor's and advanced degree attainment than the U.S. population (Migration Policy Institute, 2012; National Center for Education Statistics, 2010).

These findings imply that the narrative of low-income and low-achievement that has been used to characterize Black Americans cannot necessarily be appropriated to African immigrants and their children. Although the barriers that first and even some second-generation immigrants Blacks are similar to their U.S.-born counterparts – at least in terms of the economic and racial hardships that they encounter – these students seem to somehow be able to successfully navigate the education system in the U.S. This is not an attempt to overgeneralize this very diverse population, since students who have an "African" identity may vary in several ways, including English language proficiency and generational status. To date, however, education researchers have not yet formulated a framework that articulates the pathways by which "Black" students as a whole earn Bachelor's degrees. Such a framework is necessary, and would certainly help to articulate how first, 1.5 and second-generation "Black" students are able to earn degrees in complex fields like the STEM disciplines.

The implications for these findings in the literature are numerous. First, it suggests that the oft-lamented achievement gap between White and Black students may be nonexistent or less stark for African immigrant populations (Condron, Tope, Steidl, & Freeman, 2013; Gaddis & Lauren, 2014; Hartney & Flavin, 2013). Second, it calls into question the tendency for scholars to include African-born children in the Black American student narrative. Rather than extol the virtues of young people who are achieving on par with – and even outperforming – many of their

White counterparts, most scholars have been fairly silent about this group of young scholars. At the same time, these findings reinforce the need for the U.S. government to better address the demographic profile of who is considered "Black." Without this shift in data collection and reporting at the federal level, scholars will be limited in the type and amount of student data to which they have access. By incorporating these recent demographic shifts into federal policies and practices, the educational research community can better understand the academic pathways of this diverse population.

Conclusion

In closing, the challenges facing URM STEM students, such as unwelcoming environments and weak academic preparation, have garnered considerable attention in scholarly circles (Figueroa et al., 2013; Museus et al., 2011; Perna et al., 2009). Yet, scholars have been relatively silent on the impact of distinct diversity issues within specific URM populations. For example, given the size of the Latino population in the U.S. and their projected growth, how will the recruitment and retention of Latino engineering students need to change strategically in the coming years? Additionally, given the diversity of the Black/African American student population, research should further explore which "Black" students begin their post-secondary careers at two-year versus four-year schools.

While there is no overarching structure that helps readers connect all of the factors that lead to student success in STEM, a framework that helps to position these elements into a broader paradigm for higher retention and graduation levels seems necessary. To be sure, focusing exclusively on high-achieving students, administrators, and institutions does not give voice to those URM STEM aspirants who may learn in a completely different context. It also does not necessarily consider the large number of URM non-traditional college students who

begin their post-secondary careers in community colleges. A recommendation might be to take a hybrid approach in the literature, which presents those established patterns that lead to better URM enrollment, retention, and graduation rates while acknowledging those challenges that continue to be pervasive for students in science and math-based majors.

Realizing that students having varied backgrounds and educational needs, further work is necessary to develop a mapping system for helping students become successful in STEM fields. What, for instance, should be the strategy for upper-middle class African American students who have strong familial networks but nonetheless find themselves isolated on campus? On the other hand, for the first-generation Eritrean college student who may struggle with language proficiency while having to adapt to a new country, the path forward can be very different. In sum, the research to date has addressed many topics but needs to link them in some cohesive manner to adjust to the needs of diverse URM STEM students.

Chapter Three: Theoretical Perspectives and Conceptual Framework

Drawing upon the emergent themes from the literature review in the previous chapter, I offer several perspectives and a single framework that collectively inform the way in which I proceeded in this study. The first perspective is a success-oriented lens that I use to describe Black students in STEM. This vantage point builds upon the work of Fries-Britt et al. (2010) and Maton and Hrabowski (2004), who exclusively study students of color who persist in and/or graduate with STEM degrees. As described in the previous chapter, comparative analyses have often positioned URMs below their White and Asian counterparts in terms of their achievement levels. I employ the success-oriented perspective in order to contribute to the reshaping of discussions around URMs. In choosing to implement this perspective, I build upon a scholarly tradition that purposefully focuses on academic success narratives. This lens counters a dominant theme in STEM educational literature that magnifies Black/White achievement gaps, academic underpreparedness, and other maladies in the education system (Condron, Tope, Steidl, & Freeman, 2013; Palmer, Maramba & Gasman, 2013; Figueroa, Hughes, B. & Hurtado, S. 2013). While these challenges are pervasive, they can, if not placed in proper context, further a deficit-oriented perspective that suggests Black inferiority in STEM disciplines. I maintain that a success-oriented perspective is necessary to offer counternarratives of high-achieving Black students.

I also draw from Cabrera, Burkum, and La Nasa's (2005) research in which they define multiple pathways to degree completion. Their work established that multiple factors contribute to one's ability to earn a Bachelor's degree, including pre-college factors (e.g., socioeconomic status, academic preparation, and post-secondary aspirations) and post-secondary factors (e.g., first type of institution attended, academic experiences, and grade point average). I have

considered some, but not all of these factors, in developing my own framework. In order to develop a framework for this study, I considered themes associated with successful student outcomes from the literature review. In sum, researchers found that the following factors positively impact URM STEM transfer students:

1. Academic Components:
    a. Positive faculty and staff support
    b. Strong academic preparation for college
    c. Smaller class sizes
    d. High math and reading levels
2. Social Components:
    a. Peer support and engagement
    b. Strong family support
3. Welcoming and Supportive Campus Climate (e.g., advising, mentoring, etc.)
4. Individual Factors:
    a. Self-determination
    b. High level of English language proficiency
    c. Middle to higher socioeconomic levels
    d. Positive perceptions of and early exposure to STEM careers

In addition to these factors, my framework considers the influence of being born in the U.S. or another country. Individuals born in the U.S. are referred to as native students for the purposes of this study; people born outside of the U.S. are referred to as non-native students. In fact, since this study explicitly and intentionally expands the notion of race from a U.S. context to one that looks more globally (specifically, exploring race through the lens of African-born

students living in the U.S.), perspectives that take students' cultural backgrounds into account are critical. Thus, I present several theoretical perspectives that inform the lens that I use in exploring students' racial identities in a global context. I maintain that a global perspective is necessary to understand both the experiences of Black transfer students who may have either been raised in a very "American" environment, as well as first, 1.5, and second generation Blacks.

One lens that informs my research is the cultural-historical perspective, which maintains that students are defined in large part by the culture and history that they bring with them to the classroom (Gutiérrez & Rogoff, 2003). Secondly, I reference Renn's (2008) work on biracial and multiracial student identity development to explore lenses through which American students with different "Black" identities have been depicted in the literature. I conclude with more global conceptualizations of "Blackness," including some that specifically have been appropriated to the histories of African-born Blacks. One concept that I highlight is the dual imbroglio theory, which argues that African immigrant identity in the U.S. is not based around a Euro-centric or American-contextualized Blackness or minority status, but rather is connected to one's country of origin and cultural heritage.

The cultural-historical perspective articulates a way of understanding students that looks at the history of certain cultural practices that are germane to a subgroup of people (Gutiérrez & Rogoff, 2003). Proponents of this perspective argue, however, against oversimplifying students to a mere checkbox based on a cultural identity, much as one would mark a student as either male or female. This caution is particularly important, according to Gutiérrez and Rogoff (2003), because it can lead to stereotyping students and assuming that they will, as a result of a certain classification, automatically think or behave in a certain manner. Instead, the researchers

suggest that the cultural-historical perspective can be employed when attempting to understand certain patterns that a subgroup may exhibit.

While this view has been appropriated for the use of Black and Latino Americans, as well as for comparing subgroups such as Mexican Americans, it does not appear to have been utilized in a multinational context for "Black" students. That is, it appears that the cultural-historical perspective has not yet been applied to distinguish between the patterns and practices of Black students from different countries. As such, it would be interesting to understand how this framework might be applied to different "Black" students who might have been born in the U.S. compared to those raised in different African countries. Gutiérrez and Rogoff (2003) work suggests that it is possible to use this framework to compare the actions of different URM student groups, perhaps by utilizing methods similar to those employed by the authors involving Latino students.

Renn's (2008) work on identity development is also applicable to my conceptual model. Renn argues that there are five categories that may depict how students with biracial or multiracial backgrounds may self-identify. Renn (2008) classifies these different themes as follows: 1) A student has a monoracial identity, so that s/he looks at himself/herself as a member of a single race; 2) A student negotiates multiple monoracial identities, which means that a student can see himself/herself as one or another race depending on the environment in which s/he happens to be; 3) The student possesses a multiracial identity, essentially meaning that the student may see himself or herself as part of a unique group made up of more than one race; 4) The student chooses not to classify himself or herself according to the concept of race at all; 5) A student may have a single racial identity, but the elements of his/her identity may change depending on the environment in which s/he may be at the time.

While the framework that Renn (2008) articulates is certainly applicable to the hyper-racial context of the U.S., its utility has not yet been demonstrated in contexts that have not introduced the idea of *race* to the majority of their citizenry. For example, Renn's multiple categories would not be applicable in countries like Ethiopia or Eritrea, where nearly all of its inhabitants do not see themselves as part of the larger "Black" or even "African" race but rather define themselves as uniquely "Habasha" (Habecker, 2012). Habecker's (2012) analysis points out that Europeans have viewed Ethiopians as having somewhat of a White identity, chiefly because they were the only Africans to quickly repel the advances of a European colonizing power. Kibour (2001) adds that when Ethiopians migrate to the U.S., becoming de facto "Blacks" can create feelings of depression among newly-arrived immigrants, who – if given the opportunity – might choose to be "White" rather than "Black." Both Habecker (2012) and Kibour's (2001) work suggest that defining African immigrant students as "Black," or even students whose parents have a strong African identity as such, may be problematic because it assumes that they have assimilated and adopted a Eurocentric definition of themselves. Moreover, Habecker (2012) points out that in African countries in which "Blacks" are not the minority, but rather the majority, they may struggle with being essentialized as part of a larger underrepresented group. These types of perspectives may prove valuable in understanding how non-native Blacks view themselves in U.S. higher education institutions.

Although a unifying framework for understanding the experiences of "Black" students from Africa in STEM has not yet been articulated, Kibour's (2001) *dual imbroglio* theory may be the most applicable for understanding their experiences. Kibour (2001) writes the following in articulating the idea that Black students from Africa identify themselves in ways that are consistent either with their country of origin or culture associated with their home country:

> The dual imbroglio theory contends that African immigrants' experience in the United States includes an additional dimension: within-group ethnic diversity. This dimension pertains to the diverse and distinct ethnic group affiliations and identities that exist within African nations. Consequently, the term African or Ethiopian is a generic label, which has a plethora of meanings in relation to the experience of the individual. The duality then lies in the coming together of two experiences. One side of the duality is the immigrants' bringing to the United States one's psychological and physical ties to their country and culture in addition to the complexities of within-group, intraethnic diversity. This partly also speaks not only to the struggles they have in maintaining their ties to their country and culture but also to their struggles to find brotherhood among subgroups of their brethren. On the other side of the duality lies the distress that comes with the acknowledgment of the complexities of being a Black person in the United States (i.e., a shift from a racial majority status in one's country of origin to being a minority in the United States). As such, this half of their experience is the triple quandary lived through the eyes of an immigrant. A permeable line that elucidates the interconnectedness and nonexclusiveness of experiencing the two realms separates these two experiences. (p. 49-50)

The dual imbroglio theory acknowledges the cultural richness that benefits African immigrants in their home countries and contrasts that with the strain of being labeled a Black person in the U.S. This theory suggests that there may be other ways in which Black students in STEM may be classified, or that at least they should be given the option of choosing classifications more consistent with their self-identities. Some scholars have even suggested that students from Anglophone African countries may have different educational experiences in their home

countries than those from Francophone countries, and as such create even more nuanced categories within the African student population (V. MacDonald, personal communication, April 19, 2015).

Finally, some theoretical perspectives that intentionally place a higher value on URM individual and social behavioral patterns undergird this research. Self-determination theory, for example, places an emphasis on one's inner motivations and aspirations. According to Deci et al. (1991), self-determination theory makes distinctions between behavior that an individual personally decides to engage in, and actions that external actors or agents initiate. Deci et al. draw from research on the "locus of causality," and posit that "when a behavior is self-determined, the person perceives that the locus of causality is internal to his or her self" (p. 327). The authors of the study illustrate that possessing a reasonable sense of self-determination is associated with better educational outcomes, including more positive feelings about school and higher achievement levels. Deci et al. also cite scholarship that suggests that when students have the option to choose their own particular discipline or coursework, they generally have stronger degrees of self-determination.

At the same time, Yosso's (2005) use of community cultural wealth provides a foundation on which to build research on URM students in STEM. According to Yosso, community cultural wealth acknowledges the ability of marginalized groups to collectively develop networks that lead to student success. Yosso asserts that this theoretical framework challenges the deficit-laden lens employed by some proponents of cultural and social capital theory. In Yosso's view, these proponents disregard URMs' abilities to succeed in hegemonic educational institutions, choosing instead to focus mainly on positive attributes of the White, dominant culture. Drawing from Critical Race Theory, Yosso challenges the mainstream, White

discourse about communities of color to instead highlight the strengths that URMs bring to the classroom. In a similar way, I apply this lens to my study of Black transfer students in undergraduate engineering programs.

Figure 1 at the conclusion of this chapter offers a visual representation of the conceptual model that I first developed for this study. Briefly, the left-most section of the first box lists the factors that researchers argue may lead "Black" children to consider STEM careers. The upper-left area includes factors that emerge from literature on Black students in a U.S. context, while the lower area attempts to explicate those components that encourage Black children from African countries to pursue STEM. The middle section of this first part of the graphic illustrates areas of overlap, or factors that may encourage both Black African and Black American students to consider future studies in STEM. While this model does not explicitly list all of the factors or perspectives articulated earlier in this section, it states those components that I initially believed were the most crucial to my research. The framework changed as it was informed by other scholars in the field and by the results of the study. I present a revised framework in the Analysis chapter.

These first two sections of the framework explore students' interest in STEM more broadly. I chose to focus on STEM disciplines (rather than engineering alone) in this portion of the framework because in my professional experience, students may decide to study engineering *after* early exposure to a wider array of scientific/technical majors. Additionally, I would expect that young children as late as middle school would be more likely to exhibit a general interest in math or science than a specific STEM career. Beyond high school, Figure 1 indicates that there are specific factors that will encourage some students to pursue engineering at a community college. I list factors based on my findings in the literature to date. Again, the figure

distinguishes between components that may influence native Black students to enroll in a community college for engineering and those that may influence non-native Black students to do so.

The next area of the framework depicts the factors that may facilitate transfer to four-year undergraduate engineering programs. The model does not assume that students will necessarily earn an Associate's degree en route to the Bachelor's degree. Several components are listed in this portion of the model, which are drawn in large part from the literature review. The last part of the framework illustrates the final part of this educational expedition, which is transfer from the community college to a four-year college.

In closing, this conceptual model intentionally depicts students moving from high school, to community college, and ultimately to four-year colleges/universities. This progression from left-to-right along the framework underscores the success-oriented lens described earlier. While completing this study, I do not explicitly explore the barriers that students may face, but rather focus on the themes that undergird persistence and eventual transfer. This is not to say that I exclude any discussion of academic barriers from this research. However, I situate these barriers as part of the pathways that students have taken toward their success in engineering disciplines.

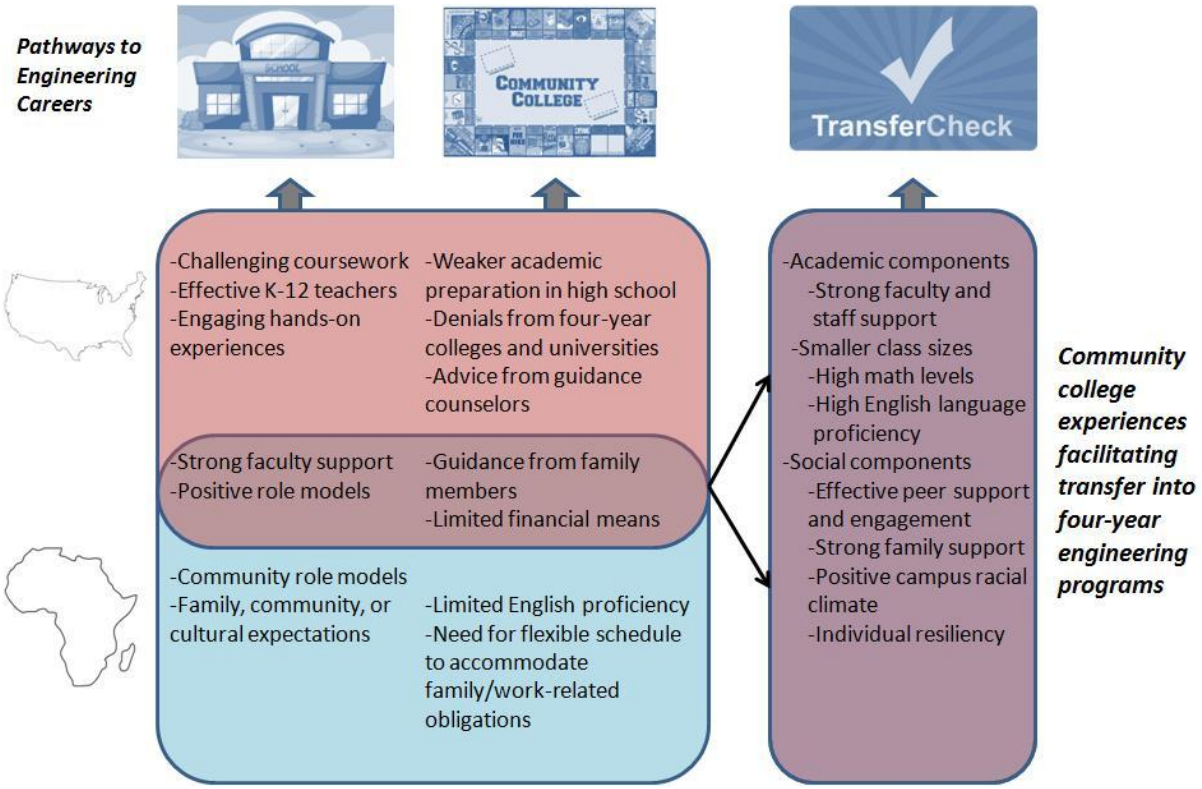

Figure 1. Conceptual Framework for Illustrating the Process Leading to Transfer for Black Engineering Students.

Chapter Four: Research Methods

Factors illuminating URM student pathways through higher education, especially in STEM disciplines, are often examined through large-scale quantitative studies (see, for example, Lord, Camacho, Layton, & Ohland, 2010; Lord, Camacho, Layton, Long, Ohland, & Wasburn, 2009; Sharpe & Swinton, 2012). I posit that qualitative methods allow for a thorough understanding of not only the factors that facilitate student transfer, but of the within-group differences of the students who undergo this process. Thus, this study employs qualitative methods to determine the full range of factors that facilitate student transfer. Through a more pinpointed examination of subgroups who fall under the large umbrella of "Black" students, this study also more fully reflects the new demography of the United States. Expanding the traditional Black/White paradigm to one that includes African immigrants, bi/multi-racial individuals (who have at least one "Black" parent), and people born throughout the African diaspora, creates a more robust portrait of this contemporary shift.

Qualitative Study Setting

The site for this study is Tech College of Engineering (pseudonym) a nationally competitive and highly ranked engineering college. Tech is one of several colleges at Landing University (pseudonym), which is a large, public, Research I university on the east coast. Approximately 12% of the nearly 4,200 undergraduates at Tech are URMs, and the vast majority of those URMs are Black students. The transfer population at Tech, however, is more racially diverse than the overall undergraduate engineering population: Approximately one out of every three transfer students is an underrepresented racial or ethnic minority, and about 50% of all URM transfers are Black. The percentage of women at Tech is approximately 25%, but the

percentage of women who transfer into engineering is less diverse at only about 15%. About two out of every ten Black transfer students is a woman.

All of the participants in the study transferred to Tech after first attending at least one semester of school at Eastern College (pseudonym). Eastern College (EC) is located in the same state as Tech College, and of all community colleges in the country, sends the highest number of engineering transfer students each year to Tech. Between 2009 and 2013, for example, it sent 476 students to Tech (Interim Dean, Joint meeting of EC and Tech College administrators, October 8, 2015). This is noteworthy considering the fact that the next highest number of engineering transfers from EC to another four-year university during that same time period was only 125. Moreover, currently 10% of the undergraduates at Tech attended EC at some point in their college careers. This suggests that EC's transfer rates to Tech are comparatively very high, and as such it is particularly compelling to be able to research Tech students who attended this community college. Conversely, this close relationship is also recognized as a possible limitation, given the strong alliance between the two institutions.

Based on data obtained in 2015, 1,482 students at EC currently identify engineering as their major (Interim Dean, Joint meeting of EC and Tech College administrators, October 8, 2015). This number is over twice the number of students who were declared engineering majors at EC in 2003, when the same figure was only 700. In fact, this figure is over triple the population of students who selected an engineering discipline in 1999, when there were only 454 such students at EC. Furthermore, the community college has set an ambitious goal of enrolling 2,000 engineering students by the year 2020. These enrollment numbers underscore EC's history of developing future engineers in partnership with four-year colleges and universities.

As of 2014, 36% of all EC engineering students were classified as Black, 7% were classified as Latino, and 15% were women (E. Thomas, personal communication, December 16, 2014). Among the Black engineering students, 55% were non-U.S. citizens. This implies that the vast majority of EC engineering transfers may bring "within-group ethnic diversity" from their home countries to their experiences in the U.S. (Kibour, 2001, p. 49). For example, compared to native Black engineering students who may not always pursue a two-year degree, those born in other countries will typically earn their Associate of Science (A.S.) degree prior to enrolling in a four-year college or university (Interim Dean, Joint meeting of EC and Tech College administrators, October 8, 2015). The advantage, according to a source who works directly with international students, is that possessing an A.S. degree prior to completing a Bachelor of Science degree allows them to be able to gain practical work experience earlier in their academic careers (Vice President and Provost, Joint meeting of EC and Tech College administrators, October 8, 2015).

EC is collectively composed of three campuses: 1) The Windsor campus, which opened in 1946; 2) The Barnesville campus, originating in 1965; and 3) The Harpersdale campus, established in 1970. According to an administrator at EC, in recent years the school has shifted its approach from having a "campus-based" emphasis in which each location operates independently of the others, to an approach that attempts to unify the three sites by discipline (Senior Vice President for Academic Affairs, Joint meeting of EC and Tech College administrators, October 8, 2015). For instance, all engineering programs and departments across the three campuses are overseen by a single dean, rather than having a different engineering dean at each campus. Another feature at EC is that many U.S. citizens and permanent residents are able to classes tuition-free because of the large number of merit and need-based scholarships

available. This of course does not include international students who are F-1 visa holders. Considering the large number of international students that EC classifies as non-citizens, it might be important in future studies to be able to disaggregate these students by citizenship type (asylee, refugee, etc.) to understand their financial needs.[6]

Despite efforts to establish certain baselines across all EC campuses, there are some notable differences. For instance, Windsor's infrastructure is outdated (Senior Vice President for Academic Affairs, Joint meeting of EC and Tech College administrators, October 8, 2015). The Barnesville location, by comparison, has updated resources, including state-of-the-art laboratories for STEM students. Distinct approaches to curricular and collaborative efforts have often limited the degree the three campuses' engineering programs operate in a unified manner. These distinctions are noteworthy, and represent an area previously understudied in community college research: Multi-campus differences within community colleges.

Although the importance of understanding the distinctions across campuses is not fundamental to my research with EC students, the interviews with the respondents in the study prompted me to want to learn more about the Windsor, Barnesville, and Harpersdale locations. Although I had already conducted two informational discussions with faculty and staff familiar with EC transfer, during a consultation with my advisor I determined that a third interview would be necessary to better grasp the distinguishing features of each campus. The following paragraphs provide the information that I was able to glean over the course of all three informational discussions.

According to an associate vice chancellor who helps oversee transfer student-related policies for the state in which Tech is located, Tech and EC have had one of the longest-standing

[6] The U.S. government refers to non-citizens as "aliens." However, in this study, I utilize the term non-U.S. citizens to be consistent with nomenclature employed by staff at EC.

articulation agreements in the state (Associate Vice Chancellor, personal communication, June 9, 2015). According to the associate vice chancellor, this agreement has helped to facilitate the transfer process for EC students (Associate Vice Chancellor, personal communication, June 9, 2015). When I asked her about the specific reasons that high numbers of Black students have been able to transfer from EC to Tech College of Engineering at Landing University, the associate vice chancellor responded that the county in which EC is located has a long-standing history of commitment to education. She pointed specifically to the K-12 public school system in that county, which has been nationally recognized as an academically high-performing district. Moreover, she was dismissive of the idea that some international students may have been educated outside of that county and indeed, outside of the U.S. In her view, regardless of where the students received their primary or secondary educations, there is an overall culture of educational excellence in that county which, according to her, will positively impact students.

While I do not disregard the notion that many students of color who were born in other countries can benefit from a county-wide culture in which education is prized, I noted that the associate vice chancellor seemed unaware of how students' national or cultural backgrounds might have impacted their educational trajectories. Her dismissal of the unique academic histories that students from other countries bring with them to the U.S. may have far-reaching implications. Foremost among these implications is that high-achieving Black students from other countries are likely being essentialized with native-Black American students by policymakers, therefore discouraging practitioners from considering significant differences between both groups. In order to shape the discourse around Black students in engineering, in STEM, and in higher education more broadly, a study of this nature can be impactful by helping to explain how different groups of Black students achieve depending on their cultural contexts.

Using my professional network as an engineering recruitment specialist at the University of Maryland, I met with Dr. Alan Roberts (pseudonym) and Mr. Scott Thomas (pseudonym). Dr. Roberts is an engineering and physics instructor who has been on the EC faculty for nearly fifty years. Mr. Thomas is a STEM internship coordinator at EC. Dr. Roberts and Mr. Thomas both advise engineering students. In fact, their combined efforts account for 90 to 95% of the engineering advising at one of the three EC campuses (A. Roberts & S. Thomas, personal communication, June 16, 2015).

I posed the same question to both EC representatives that I asked of the associate vice chancellor earlier. I asked them which factors have led to the high volume of Black engineering transfer students who move from EC to Tech College of Engineering at Landing University. Dr. Roberts explained that many first-generation students choose to attend EC because others from their home country previously attended the school (A. Roberts, personal communication, June 16, 2015). Others, according to him, attend EC because it is less expensive than four-year colleges and universities. The reduced financial burden in attending EC, along with the fact that students may not have been admitted to the first college/university of their choice, may lead both non-native and native students to choose to begin their postsecondary careers at EC.

According to Dr. Roberts, many Black first-generation students at EC foster positive relationships with native Black American students and help native students to feel a sense of racial and cultural pride (A. Roberts, personal communication, June 16, 2015). For all students, regardless of race/ethnicity, EC is also appealing because of the extent to which it supports students. Dr. Roberts explained that it has considerably more STEM/engineering staff than most other community colleges in the area. Both Dr. Roberts and Mr. Thomas stated that they are very diligent in advising students that in order to be successful in engineering, they will need to

prioritize their education in relationship to other pressing matters like employment. In fact, Dr Roberts pointed out that he advises students not to work full-time while also enrolled in school on a full-time basis. Moreover, the county in which EC is based has demonstrated its commitment to STEM through high levels of funding, including $75 million for a new STEM building. EC's high funding levels, which also support a larger STEM advising staff than on other community college campuses in the state, are connected to the high concentration of wealth in the county.

Dr. Roberts and Mr. Thomas do not look at EC as a community college where students rarely transition to four-year schools. Instead, they both see the school as a "transfer institution" (A. Roberts & E. Thomas, personal communication, June 16, 2015). They use this phrase to underscore the notion that faculty and staff empower students with the expectation that they will transfer. Furthermore, they believe that EC stands out from other community colleges that may not articulate this objective as clearly. Dr. Roberts commented that he also directs students to consider transferring to schools like the Massachusetts Institute of Technology and Georgia Institute of Technology while enrolled in EC. In fact, for years, Dr. Roberts encouraged students to consider schools like Georgia Tech instead of Tech College because he felt that Georgia Tech's engineering staff were more supportive to transfer students. However, Dr. Roberts explained that in recent years he has become much more comfortable with advising students to consider Tech because of his positive interactions with their college administrators. For this reason, he believes that the number of students who transfer to Tech has risen remarkably.

Dr. Roberts also explained that at EC, there is an overarching ethos that empowers engineering students to believe that they will be successful (A. Roberts, personal communication, June 16, 2015). He opined that students also benefit from advisors and other

staff who treat students with respect, maintain a high standard of educational quality and rigor, and look for ways to support students throughout their academic journeys. In both Dr. Roberts and Mr. Thomas' perspectives, the students at EC are motivated to be successful.

EC is known as the "Yale of the Boulevard."[7] Dr. Roberts asserted that this term was actually a "put-down" name leveled at the school by outsiders during its rise to prominence during the late 20th century (A. Roberts, personal communication, October 8, 2015). According to Dr. Roberts, these detractors "denigrat[ed]" EC because they felt that the school was becoming too ambitious. Dr. Roberts detailed an exhaustive history of the three campuses, revealing the evolution of this perception, particularly as it related to the Barnesville campus.

Initially established as part of the Eastern County Public Schools (ECPS) system in 1946, the initial home of Eastern Junior College (the first name of the school) was the Windsor campus. At this site, the college was viewed as the thirteenth and fourteenth grades for students who remained with ECPS after graduating from high school (A. Roberts, personal communication, October 8, 2015). However, from the onset, the county planned for EC students to spend only two years, and continue at a four-year college or university. In 1967, the Board of Trustees officially separated from ECPS and changed the name of the school to Eastern Community College. Over the course of the next few decades, the word "Community" was gradually removed from the name of the school and ultimately it began to be referred to as Eastern College. This may have had to do with the college establishing itself as a transfer institution – particularly at the Barnesville campus – rather than solely as a community college.

Dr. Roberts explained that when the Barnesville campus was founded in the mid-1960s, the school began making an ambitious effort there to recruit excellent instructors with Ph.D.s in

[7] The "Boulevard" referenced is a well-known commercial thoroughfare in the county. A number of high-performing businesses are located on or near the "Boulevard."

their respective fields (A. Roberts, personal communication, October 8, 2015). He opined that the Windsor site is the "younger brother" of Barnesville, despite the reality that the Windsor campus is actually older than the Barnesville campus. According to Dr. Roberts, faculty and staff at the Windsor school "resented" the growth of Barnesville and "stamped their feet" in frustration when the recognition of Barnesville began to increase. He stated that the Windsor location "became part of the problem" and not "part of the solution," effectively isolating itself from innovation and development taking place in Barnesville. He pointed to an example of an instructor named "Suzie" at the Windsor campus who taught a class outside of the sequence of courses taught at Barnesville, which ultimately precluded students who needed to move between campuses to continue their courses of study. Similarly, the Harpersdale campus decided "not to play with Barnesville," once again restricting meaningful interactions between faculty and staff at the different locations. Dr. Roberts has been based at the Barnesville location since his arrival there several decades ago, and he commented that he decided to limit his travel to the other sites because faculty and staff there have not been welcoming to him (A. Roberts, personal communication, October 8, 2015). He along with Mr. Thomas (also based at the Barnesville location) advise a high percentage of engineering students at EC-Barnesville.

Within the county, the Barnesville location is based in a region that is known for its high socioeconomic levels and expensive real estate. It also is in close proximity to government agencies that employ a large number of highly educated professionals. The Windsor campus is centered in a more of an urban district where educational, housing, and economic performance indicators are lower than in Barnesville. The Harpersdale campus is located in the exurbs of the county. The economic indicators for the geographic area in which it is situated are weaker than Barnesville, but notably stronger than Windsor.

Participants

Each participant in the study transferred from EC to Tech College of Engineering. Tech mandates that all incoming transfers have at least a 3.0 cumulative grade point average (GPA) from all of their previous courses. In addition, Tech requires students to complete prerequisite courses in mathematics, chemistry, and physics before being admitted to the college. If an EC student applies to Tech and has not yet completed these courses, s/he may be admitted to Landing University as a general studies major. After completing the aforementioned classes at Landing, the student can then transfer into Tech. Thus, there are two pathways by which students in this study may have enrolled in Tech: 1) The student could have already completed the prerequisite classes at EC and therefore transferred directly into Tech; 2) The student could have transferred into Landing University from EC, and after taking the required classes, transferred into Tech. Furthermore, participants all transferred to Tech between 2009 and 2014, either during a fall or spring semester. Each participant selected for this study also fulfilled the following criteria: 1) The student identified as Black/African American on his/her application to Landing University; 2) The student enrolled at EC prior to attending Landing University; 3) The student was at least 18 years of age at the time of the interview.

Working with the admissions office at Landing University, I obtained a list of Black students who transferred to Tech between 2009 and 2014. I then verified that participants met all three of the before-stated criteria. Then, I emailed letters to these students in order to invite them to participate in the study. Next, I began scheduling interviews with students who indicated an interest in participating in the study. Prior to conducting each interview, I informed each participant of the purposes, expectations, and risks of the study, and obtained written and verbal consent in accordance with Institutional Review Board requirements. All interviews took place

in an office in at the Clark School of Engineering at the University of Maryland. I completed all interviews between the summer and fall of 2015.

Data Collection and Analysis

At the beginning of each session, I asked the participant to complete a demographic questionnaire that required him/her to choose a first name pseudonym; I used this pseudonym for the purposes of recording and publishing his/her responses. Other portions of the questionnaire asked students about their current enrollment/graduation status. In the questionnaire, I also queried for information such as each student's, major, gender, race, and ethnicity. After discussions with another educational researcher, I elected not to have pre-populated race/ethnicity questions. Instead, I changed the questions of race and ethnicity to allow participants to choose their own racial and ethnic designations. In addition to questions about race/ethnicity, I posed further detailed questions that inquired about each participant's country of birth, age and date of birth, parents' country(-ies) of birth, and year in which s/he migrated to the U.S. (for those not born in the U.S.). Appendix A includes a full list of questions that I asked each participant.

The interview format that I first utilized was individual and semi-structured. According to Bogdan & Biklen (1992), this method allows the researcher to ask pre-determined questions while also delving more deeply into topics that may unexpectedly arise during the interview. I asked interviewees questions that included the following: 1) What kind of mathematics or science preparation did you receive as a child? 2) What inspired you to pursue an engineering major in college? Other questions explored the academic support systems that they were able to leverage before they transferred to Tech College. With the consent of the participants, I audio recorded all interviews. Appendix B provides the interview protocol and the full list of

questions that I prepared. I note that I received IRB approval for the interview protocol (see Appendix F for a copy of the University of Maryland IRB approval letter).

The purpose of each of these first-round interviews was to understand the factors that were the most salient in students' educational pathways from childhood through their transfer to Tech. I focused on topical issues such as respondents' K-12 and community college experiences, their family and peer networks (and the influence that these networks had on their pathways to engineering transfer), and their individual resilience. Additionally, I tried to determine the circumstances or individuals that influenced them to pursue engineering. I also asked interviewees about the reasons or events that led to their decision to initially attend a community college. Finally, I asked questions to understand what facilitated their transfer from EC to Tech. I asked how faculty and staff at both the sending and receiving institutions played a role in the transfer process, as well as how other groups or individuals (e.g., friends, mentors, family members) supported their transfer. Each individual interview lasted between approximately one and two hours.

After reviewing the responses to the first set of interviews, I noted and recorded emerging themes among both native and non-native students. I then created a list of questions for each subgroup and discussed them with a colleague who is also employed with the Clark School of Engineering. I scheduled a date to meet with each subgroup and, with my colleague, asked a series of questions related to the subthemes. The group interviews with native and non-native students each lasted approximately an hour and a half.

I recorded all interviews on a computer and then uploaded all recorded audio files of the interviews to Verbalink.com (a website that provides transcription services). After I received

each transcription, I sent it to each participant for his/her review, and for him/her to make corrections as necessary. This step provided the first validity check in the data collection.

Reflecting on the research topic, I looked at respondents' answers to the different interview questions and coded these answers based on themes that naturally evolved. I used manual coding processes in which I wrote emerging codes onto interview transcripts. Manual coding allowed me to have a better grasp of the data. Throughout the first coding phase, I wrote analytic memos to help me think deeply about the emerging themes that I noticed from the data. Drawing from Miles, Huberman, and Saldaña's (2013) work, analytic memos helped me "reflect on and write about how [I] personally related to the participants" and "reflect on and write about [my] code choices" (p.34-35). Furthermore, I met with my advisor and other committee members to discuss aloud and probe for patterns in the data. This provided another validity check in the data analysis.

In the next phase, I developed some broader categories that captured important but wide-ranging themes. Throughout this phase, I continued to write analytic memos to ensure that I maintained the richness of each individual's educational journey rather than homogenizing respondents. The analytic memos during this phase as well as discussions with my advisor and experienced researchers provided yet another validity check and helped me to properly situate my own biases (Lather, 1986).

According to Miles et al. (2013), deductive processes involve the use and application of codes that the researcher applies to the data based on his/her preconceptions. Inductive analytical processes, on the other hand, are much more concerned with themes that emerge unexpectedly or unpredictably from the data. In consideration of both approaches, I initially planned to first use a deductive protocol for coding data at the onset, and then follow that process

with an inductive procedure. However, my advisor encouraged me to code themes in a way that seemed natural, rather than limit myself to a particular procedure. I used a more general coding process for the duration of my work.

Limitations

Given the small number of expected participants, I note that this study is not necessarily generalizable to other contexts. However, I expect that this research might provide an opportunity for future work on transfer students in engineering. Follow-up studies may include a longitudinal study on a cohort of Tech students who transferred from EC; data collection could begin just before transfer occurs and continue until the cohort's expected graduation date at the receiving institution. A longitudinal study would also address the inability of the study to determine whether participants persist and graduate with engineering degrees. The capacity to establish whether students graduate might be of interest to other stakeholders who recruit graduating seniors, such as graduate schools and engineering firms.

Ethics

The research questionnaire, interview protocol, and all other procedures for data collection and analysis were reviewed by the University of Maryland Institutional Review Board (IRB). In the IRB application for research with human subjects, I noted that the only risk posed to study participants was the possibility that they might have to recall difficult memories that impacted their educational journeys. Besides this, there were no potential concerns associated with this study. Participants received a consent form that explained the nature of the study. In addition, respondents were informed that they had the option of withdrawing from the study at

any time of their choosing. In addition, I used pseudonyms for respondents' names and for the two schools described in this study to protect the identity of all participants.

Pilot Study

In the spring of 2014, I conducted a pilot study involving four engineering transfer students at Tech College of Engineering. Three of the four students were currently enrolled in Tech College of Engineering, and one was not taking classes due to financial challenges. Additionally, three of the students attended EC prior to enrolling in Tech, but one enrolled in a different community college. Although I invited women to participate in the study, all four respondents were men.

I met with each student for approximately 20 to 30 minutes. At the beginning of each meeting, I asked the participant to review and sign an IRB-approved consent form. Afterwards, I asked the participant to complete a brief questionnaire that was similar to the one provided as Appendix A. Next, I read an interview protocol, which – among other points – assured the student that he had the option of terminating the interview at any time. The protocol also asked whether he granted permission for me to record the interview.

The participants in the pilot study were somewhat similar. All four were men and three of the four were born outside of the U.S. This suggested that many URM students who enroll in Tech College may be either first- or second-generation students. Initial findings also indicated that whether students were raised in the U.S. or in another country, they largely credited their families for their success in engineering, mathematics, and science.

I presented findings from the pilot study at the 2014 annual meeting of the American Educational Research Association (AERA). Recognized scholars at the meeting suggested that the study only include students who attended the same community college (A. Rodriguez & L.

Espinoza, personal communication, April 30, 2014). According to fellow researchers, limiting participants to those from one community college would help to identify transfer trends associated with a single institution, rather than having to look at differences in transfer across multiple campuses. Because the other three respondents attended EC and because I was aware that this school sends the highest number of engineering transfers to Tech, I chose to only interview EC students after I conducted this pilot study.

Another change that I made as a result of the feedback during the annual AERA meeting was to focus exclusively on Black students (A. Rodriguez & L. Espinoza, personal communication, April 6, 2014). Among other points, scholars stated that the educational trajectories of Latino students are not necessarily the same as those of Black students (A. Rodriguez & L. Espinoza, personal communication, April 6, 2014). Because less research has been devoted to Black STEM transfers than to Latino STEM transfers, I determined that I could make a more significant contribution to the scholarly community by focusing on the former population.

Chapter Five: Results

Overview

The objective of this study is to understand the factors that positively influence the transfer of Black engineering students from two-year to four-year schools. Using the demographic questionnaires as well as the individual and group interviews that I described in Chapter Four, I attempted to answer two research questions: 1) What do Black undergraduates perceive as factors that facilitate community college student transfer to competitive engineering programs? 2) What are some of the within-group differences among Black students who transfer from community colleges to competitive engineering schools? After collecting and coding all of the data into major themes and subthemes, I then sorted the themes based on their relevance to the two research questions.

In the first section of this chapter, I provide a summary of participant profiles based on data that I obtained through the demographic questionnaires. Observations as well as data elicited from interviews also helped to inform the participant summary. In subsequent sections, I explore the emergent themes or categories that I identified through the individual and group interviews. I sorted the themes based first on the two research questions. Six themes emerged in response to the first research question concerning factors facilitating transfer. I present these themes in order of the significance that they seemed to have in helping students transfer, starting with the most salient: 1) *Community College Institutional Benefits and Supports*; 2) *Peer Supports and Social Networks*; 3) *A "Post-Racial" Lens*; 4) *Individual Factors for Success*; 5) *Family Support and Influence*; and finally 6) *Role Modeling and Altruism.* Within some of the categories, I discuss related subthemes that helped to develop a framework for the way in which

I conceptualized a particular theme. Appendix E: Analytic Memos on Subthemes provides an example of this process.

In *Community College Institutional Benefits and Supports*, I describe the formal structures – including classroom instruction and transfer advising – that interviewees reported they benefitted from while at EC. I then present *Peer Supports and Social Networks* as a theme that illustrates some of the informal support structures students reported that assisted them while they were enrolled at the community college. Next, I discuss the ways in which some participants used what I term a "*Post-Racial" Lens* to characterize racial climates both on and off-campus since enrolling at EC. This lens seemed to insulate the students from feeling the need to focus on prejudices that they may have encountered and freed them to focus on their academics.

These three themes collectively address a broad range of factors that positively impacted students immediately before they transferred to Tech College. The next theme that I present is a suite of components that I collectively refer to as *Individual Factors for Success*. These factors, such as academic interest and determination, undergirded the students throughout their educational journeys. I placed this theme after the first three because they overlapped, playing a role both at EC, as well as during participants' earlier school years. *Individual Factors for Success* provides a transition from a focus exclusively on participants' post-secondary school years, extending back to K-12 educational experiences.

The last two themes that emerged concerned foundational aspects of the students' lives. While these components may have not directly impacted their abilities to transfer, they were fundamental to how the students viewed their early childhoods. *Family Support and Influence* explores ways in which family members encouraged students' interests in STEM specifically, or

their academic achievements more generally. Finally, I introduce the last factor, *Role Modeling and Altruistic Behavior*, as another foundational aspect of interviewees' journeys. In this section, I examine the ways in which participants' interests in improving the lives of others was a driving force that empowered them in their own educational quests.

Despite some variation among the participants in the relative strength of the impact and significance of these themes to move through school and ultimately transfer (and expectedly not all participants' responses neatly fell into these six categories), consistency emerged across interviewees. The six themes that I have described were beneficial to the interviewees at different points of their educational journey. While some factors seemed to be more efficacious in helping them transfer directly from EC to Tech College, others were tied to their childhood and early exposure to STEM disciplines. I include these earlier aspects of participants' academic careers because of prior research that links college enrollment and retention to K-12 experiences (Cabrera et al., 2005).

Section One – Participant Summary

I interviewed four male and one female engineering undergraduates enrolled in Tech College, and one recent male graduate. All interviewees met the requirements of study participants outlined in Chapter Four, including the stipulation that they were previously enrolled in Eastern College. Table 1 below provides more information on all six participants. Three of the participants – Ben, Carter, and Goku – are native students. Native students are once again defined as students who were born and raised in the U.S. for their entire childhoods (see the Glossary for a full list of key terms utilized in the study). The other three participants – Maria, Oussou, and Titan – are non-native. For the purposes of this work, non-native students were

either born or raised in a sub-Saharan African country. A description of each participant follows the table.

Name[8]	Major	Gender	Race (self-identified)	Ethnicity (self-identified)	Year of Birth	Birth Order	Country of Birth	Mother's Highest Level of Education	Father's Highest Level of Education	Year of move to U.S.	Native or Non-Native	Generational Status
Ben	Chemical Engineering	Male	Mixed Race	Black/White	1994	Eldest of four siblings	U.S.	High School/GED	High School/GED	N/A	Native	Second
Carter	Materials Science and Engineering	Male	Multiracial	Black, plus more	1987	Second of three siblings	U.S.	Doctorate	Master's	N/A	Native	Third or higher[9]
Goku	Mechanical Engineering	Male	African American/Black	I have been told that I have African, Native American, and Caucasian ancestry	1992	Second of two siblings	U.S.	GED	Unknown	N/A	Native	Third or higher
Maria	Computer Engineering	Female	Black-African	Kenyan	1993	Fourth of five siblings	Kenya	Bachelor's	Master's	2003	Non-Native	1.5
Oussou	Civil Engineering	Male	Black	Zarma[10]	1994	Second of two siblings	Niger	Bachelor's	Master's	2011	Non-Native	First
Titan	Electrical Engineering	Male	Black/African American	African	1987	Eldest of five siblings	U.S.[11]	High School	None	2009[4]	Non-Native	First[12]

Table 1. Participant Summary

[8] The names that appear in this column are pseudonyms selected by the participants.
[9] A generational status of "third or higher" refers to a person whose parents were both born in the U.S. (U.S. Census, 2013c)
[10] Zarma refers to a tribe indigenous to Niger, as well as a small number of adjacent West African countries, including Burkina Faso and Nigeria (Zarma, 2016).
[11] Titan was born in the United States of America but moved to The Gambia, West Africa when he was three years old. He returned to the U.S. in 2009.
[12] Although Titan was born in the U.S., based on the definition of non-native, he is considered first-generation since he was raised in The Gambia.

Participant #1 – ***Ben: "My dad really did influence me to go into STEM."***

Ben was born in 1994 to immigrant parents and is classified as second generation because he was born in the U.S. His father migrated from Trinidad and Tobago, and his mother migrated from Finland. Ben, like all respondents, was given the opportunity to self-report his race and his ethnicity. He indicated that he was "Mixed Race" in his racial designation, and for ethnicity he wrote "Black/White." Ben reported on his demographic questionnaire that both of his parents have a high school education. He will most likely be the first in his immediate family to earn a Bachelor's degree because he is the oldest of his four siblings.

When he spoke about the development of his academic interests, Ben reported that his "dad really did influence [him] to go into STEM." He also said that he "just always really liked learning." He began his studies at EC as a declared computer science major prior to changing to engineering. Currently, he is in his second year at Tech College and a chemical engineering major.

Participant #2 – ***Carter: "Education…allows you, when somebody tells you 'no' to go out and find your 'yes.'"***

The second of three children, Carter was born in 1987 in the U.S. His mother, an African American, holds a doctoral degree and his father, who is White, has earned a Master's degree; both of his parents were also born in the U.S. When he indicated his race, he said that he is "Multiracial," and he stated that he was ethnically "Black, plus more." He seemed to draw inspiration for his academic journey from his parents, especially his mother. In his opinion, Carter's mother saw her own education "as a way out of the trajectory that had been planned for her." He says that she believes that "education allows you, when somebody tells you 'no' to go

out and find your 'yes.'" This sense of "agency," or the idea of being driven to achieve despite the challenges that one faces, seemed to be part of Carter's own ethos.

Carter's journey into STEM began "in the footsteps of an enrichment program that [his] sister was participating in with some science club." He also spoke on several occasions about how as a child he wanted to understand "how the world works" or the "world around him." A self-professed "tinkerer," he said that as a little boy he would try to repair his friends' broken toys. When he entered high school, he had the opportunity to intern with the National Aeronautics and Space Administration (NASA). Although he began the internship with plans to study meteorology, while there his interests shifted to materials science and engineering, his current major.

Participant #3 – *Goku: "I don't want to be a bad example for…the rest of my race."*

Goku was born in 1992 in the U.S. and identified his race as "African American/Black." In response to the question, "How do you identify in terms of your ethnicity?," he wrote "I have been told that I have African, Native American, and Caucasian ancestry." His mother, whose highest degree is a General Education Diploma (GED), raised him as a single parent. Goku says that he never met his father and so his father's level of education is not known. He has a half-brother who is approximately three years older than him. Growing up, Goku explained, was extremely challenging for him and his family; this led to poor performance in school. His family faced financial hardships and led a somewhat transient life from the time he was in third grade until his first year of high school; over the course of those years Goku's family moved five times.

Despite the difficulties that Goku encountered, he was intrigued by the science that he learned about through the media. He watched television programs like *Bill Nye the Science Guy*

and *The Magic School Bus,* and he would frequently view the Discovery Channel. When he eventually started "put[ting] a priority" on his education in high school, he "started doing really well in math." Goku entered EC with the intention of majoring in physics but changed his major to mechanical engineering after talking to a professor about his career goals. He found motivation in community college by meeting "acquaintances in courses" who "push[ed]" him to excel. Goku discussed the notion that he does not "want to be a bad example for…the rest of [his] race."

Participant #4 – ***Maria: "I just got used to really thinking…if I want to do something, I can do it."***

Born in Kenya, East Africa in 1993, Maria is the second youngest of five children. Her mother holds the equivalent of an Associate's degree and her father has a Master's degree. Concerning the question of race, she responded that she is "African American/Black." Ethnically, she said that she is "Kenyan." Maria moved to the U.S. in 2003 at the age of ten and is therefore considered a 1.5-generation student (see Glossary). Her mother's employer – the Embassy of Kenya – relocated her entire family that year.

When they moved to the U.S., Maria initially "struggled with math." It seemed as though she "had missed something" so Maria recalls that her mother said, "maybe we need to…hold you back." When she entered middle school, she struggled again with mathematics, but once more, her mother was a tremendous advocate for her. This time, her mother paid her instructor to help her over one summer. From that point on, Maria became a stronger, more self-assured student. Her confidence in mathematics was "reinforced" by the all-girls high school that she attended.

There, she "got used to really thinking…if I want to do something, I can do it." Maria attends Tech College and is currently pursuing Computer Engineering.

Participant #5 – ***Oussou: "I was just good at math"***

Oussou was born in Niger, West Africa in 1994 and is the younger of two children. His mother earned her Bachelor's degree and his father earned a Master's degree. When describing his racial identity, Oussou said only that he is "Black." To the question of ethnicity, however, he said that he is "Zarma," which is a tribe indigenous to Niger and a small number of neighboring countries. Although his father wanted him to attend college in France, he said that his mother preferred him to study in the U.S. Later, he explained that he had already come to the U.S. for a summer when he was still in grade school. Oussou eventually moved to the U.S. in 2009 and lived temporarily with a cousin who had also started her studies at EC.

When he talked about his early interest in and exposure to STEM, Oussou said that he was "good at math and physics." He added that "in [his] high school you can either choose to go for math and physics or biology or also you can take…French and all those English classes." Oussou selected the "math and physics" track in the school. When I asked him whether his proficiency in these subject areas was due more to an innate acumen or to the instruction that he received, he said he "[could not] really tell." He was more certain, however, about the idea that engineering for him represented a way to help "build" Niger. His plans after graduation are to join friends "back home" and improve the infrastructure through technology. He is currently pursuing an undergraduate degree in civil engineering at Tech College.

Participant #6 – *Titan: "Being in a math-science class, you're a genius and better than the others."*

Titan was born in the U.S. in 1987, but he moved to his parents' home country of The Gambia, West Africa when he was three years old. Because he spent nearly all of his childhood in The Gambia, I classified Titan as a non-native student. His mother has a high school education and he indicated that his father did not have a formal education. He is the oldest of five siblings, one of whom is currently pursuing an engineering degree in New York. Titan described his race as "Black/African American" and his ethnicity as "African."

Titan said that he "realized [he] was good at math" in the sixth grade when his mathematics teacher began to notice how often he asked questions in class. He also said that he began to "compete" with his friends to be the best in math and science. Titan said that one of the reasons that his friends were also drawn to these subjects was because "[they] had a stereotype [that] being in a math-science class, you're a genius and better than the others." His classes became increasingly difficult as he progressed to higher course levels. Despite the rigor, Titan persisted and eventually began his post-secondary education at EC. He studied electrical engineering and earned his Bachelor's degree from Tech College in May 2015.

Section Two – Factors that Facilitate Community College Student Transfer to Competitive Engineering Programs

A. Community college institutional benefits and supports

This part of the chapter explores the ways in which participants felt that the support structures at EC positively impacted them. Specifically, two subthemes reveal the role that EC played in facilitating transfer: 1) *In-class experiences* with challenging courses and engaging instructors and 2) *Mentoring and advising* received outside of the classroom.

1. In-class experiences. Native students spoke extensively about the challenging curriculum and excellence in teaching that they experienced at EC. Ben, for instance, felt that the school enhanced his existing STEM knowledge base. He added that he "learned a lot of science just really, really well" there. Ben also seemed to appreciate the ability to engage with professors in a smaller, more intimate environment than the ones that he has encountered at Tech College:

> The involvement of the teachers [at EC] is vastly different, so you go from 30 people and 1 teacher to 200 people and 1 teacher [at Tech], and so then, like I came here [to Tech] knowing physics and organic chemistry a lot better than the people who took physics and organic chemistry here [at Tech].

Carter similarly compared the instruction at EC to what he experienced when he moved to Tech, and added that "the instructors at EC were a lot more hands-on in terms of accessibility, certainly much more so, and it was expected that they would be more accessible to students." He also, appreciated the more meaningful interactions that he was able to have with professors at the community college. As an example, Carter discussed a particular chemistry class that he took at EC, which was being offered at the school for the very first time. As a smaller class, the professor was able to engage him using what education researchers might term a constructivist approach, in which students and instructors collectively create and understand concepts (Jonassen, 1994):

> [The professor] was like, it was the very first time it had been offered at that campus….He was like, 'We are going to boldly go into the unknown.' But it worked out. I had a lot of experiences that I felt were new to me and new to maybe the professor as well. They had taught it at Barnesville, but this was their first time teaching it here

> in this facility at [the Windsor] campus. They were less operating on habit and more conscious of the teaching style. I think that was beneficial. There was more a 'we're in this together; let's see how this works.' I appreciated that.

Carter remarked that he "was excited about every challenging course that came through [EC] because [the message was], 'This is something that you might not have been interested [in] even if you had come across it.'" Carter was also pleased with the experiences that he had with a particular physics professor, Dr. Paul Johnson (pseudonym). Through the course of this research I discovered that Dr. Johnson, an African American, served as a positive figure at EC. According to Carter, the experience that he had in Dr. Johnson's course was "fantastic, because he had a very unique teaching style, in that he would satisfy your curiosity, and he would ignite your curiosity to learn more."

Goku also reported positive interactions with Dr. Johnson, noting that the experience was a "kind of confidence booster." He explained that Dr. Johnson "cared" about him. Goku said that Dr. Johnson "[wanted] to see how you get to the answer, [he did not] want to see just the answer." He also played a very important role for Goku in helping visualize himself as a future STEM professional.

Overall, participants reported a positive impact from their in-class experiences at EC, particularly in STEM classes. Whereas Carter was hoping to satisfy his curiosity, Goku needed more confidence to believe that he could be successful. Ben appreciated the smaller environment and once at Tech he appreciated the strength of his academic preparation at EC. Although none of the non-native students spoke extensively about the pedagogical benefits of attending EC, I did not assume that this represented a major difference between them and their

non-native counterparts. The next subsection presents data from participants' experiences at EC outside of the classroom setting.

2. Mentoring and advising surfaced in the interviews as highly critical to their facility to enable transfer to Tech College. Both formal and informal mentoring and advising activities characterized the students' descriptions. Ben, for instance, commented positively about two programs in which he participated. The first was a program focused on research mentoring that the National Science Foundation funded. He learned about this program through a flier that he saw at EC. Ben stated that three or four instructors at EC with backgrounds that included biotechnology and mathematics facilitated the mentoring initiative. The program included lectures from faculty and hands-on experiences that included the modeling of cancer growth. There was also a scholarship component to the program, but Ben emphasized that he sought out support systems that not only "would give [him] money," but also "give [him] some information." Ben also participated in a program that focuses on entrepreneurship. After reading brochures about the opportunity, he decided to pursue it when the program director "approached [him at an EC event] and encouraged [him] to apply." The support provided by the program continues on to four-year schools, so Ben continued to be involved after he transferred to Tech College. He called this entrepreneurship program the "largest support system" that he encountered.

Ben opined that the culture at EC was heavily focused on transfer. He explained that since EC "is a two-year institution, [the administration] really [wants] people to transfer." Many of the degree programs at EC, Ben realized, are designed "so that they'll transfer to schools in the [state higher education system] very well." Describing the transfer advising that he received, he felt that the academic plan at EC was "almost perfectly laid out" for him. This is noteworthy

when considering that Ben arrived at EC as a computer science major. Ben was able to navigate his journey from one discipline to another without any reported complications.

Goku did not enter EC as an engineering major either, but instead was initially "adamant" about his plans to study physics. However, he had an enlightening conversation about his career ambitions with one of his physics professors. After he explained his goals, the professor responded:

> This isn't what you want…and she's like, 'This isn't the class you want to be taking if this is what you want to be doing.' And then I thought about that. I got a B in the course, and then I thought, maybe she's right. Maybe I should switch majors to something that's more geared towards actually being able to do stuff. So then I thought, who actually gets to build things besides mechanical engineers.

The professor's advice was crucial to helping Goku make the decision to pursue engineering rather than physics. She took time and guided him toward a new career path.

Goku interacted with other supportive staff at EC, including an academic advisor who proactively applied to a scholarship on his behalf. The advisor was engaged in his academic life, but also demonstrated a concern about his financial situation:

> I don't know how she did it, but [she] like applied a scholarship for me…I didn't even know about it until later on, and then someone e-mailed me and said, 'You should write her a thank you note or something like that.' It's like, I didn't even know that I was receiving this aid. So I think they did a very good job at giving scholarship information. I didn't start really applying to scholarships like on my own until after I realized that someone had [gone]went ahead and [done] that for me.

The mentoring and advising that these faculty and staff provided suggested that they cared about his academic, professional, and his financial well-being.

Dr. Roberts, the EC faculty member and engineering student advisor, also played a mentoring role for Carter and Oussou. Carter remembered that when they first met, Dr. Roberts affirmed Carter's progress and said, "You don't have anything to worry about in terms of GPA or transferring. You should be fine." When Oussou met with Dr. Roberts, he showed him schools throughout the country to which he could apply beyond only Tech College. For example, he recommended that Oussou consider other highly-ranked schools such as Texas A & M University.

Overall, both Carter and Oussou were very pleased with their experiences with advisors and mentors at EC. Oussou added that he would encourage other students like him from Francophone countries in Africa to go to EC before attending Tech if their English skills were not as strong. He felt that EC would be more beneficial to a student who needed to improve his/her English competency since "you can just go to the teacher because you have …less students."

Titan and Maria, who are from African countries as well, also lauded the support that they received at EC. As with Goku, Titan was grateful for his physics teacher who was "really amazing." He took additional courses with him and even "[had] conversations about what to pursue after graduating." He spoke about Dr. Roberts as well and appreciated the fact that he informed him what courses to take while preparing to transfer. Maria similarly noted that her formal advisors "knew what classes" to direct students to take in order to transfer.

B. Peer supports and social networks

All of the research participants explained that they benefitted from being part of peer support groups during community college. Peer groups tended to be both academic and social in nature, so a student may have worked with one set of classmates when studying Calculus, while s/he may have joined an entirely different group for an extra-curricular activity.

Maria spoke about having acquaintances that had already transferred to Tech College, and to whom she could look for advice before she moved to Tech. These informal advisors provided support structures that complemented the more formal advising that she received from staff at the community college. Her contacts, however, were not only those who had already transferred to Tech, but in fact she made "a lot of good friends…through her classes at EC." Maria studied and "[hung] out with" these friends, and she added that the individuals who comprised these groups all learned from each other. The fact that they spent time "hanging out" indicated that there was most likely a social dimension to the groups that they formed.

Like Maria, Titan credited his success in transferring to Tech College in part to "friends [who] helped him transfer." Titan expressed that the smaller class sizes at EC naturally led to building a rapport with a large portion of the engineering student population. He pointed out that in these more intimate classroom environments, "you just know somebody, you take a class with a couple of people, and then from there, you form your groups." Titan's comment suggests again that peer networks were often informal, and initiated by students as opposed to faculty or staff. He added that he "ended up living with [friends from EC] when he transferred…to [Tech], so they're all engineers so [they] motivated each other."

For Carter, who had been enrolled in an online curriculum throughout high school, EC "actually was a bit of a change in paradigm." He explained, however, that the adjustment "turned

out to be very beneficial" for him, "especially for some of the more difficult math courses like, say, Calculus II." He said that he was appreciative of anyone who he could find and study with at EC. Similar to Maria's reflections, Carter reported a feeling of camaraderie associated with his social networks, and they became more critical for him as courses became more challenging. In his experience, "study groups were very important for a lot of the harder classes. We actually spent a lot of time together studying, and the studying eventually turned into just meeting up and shooting the breeze – stuff like that." As with Maria, there was a social component to the groups with which he connected at EC.

Ben's peer networks at EC consisted more of organizations with formal structures. When he enrolled in college and joined the entrepreneurship program at EC, he found students who were "kind of going through the same thing" that he was experiencing on campus. In addition, Ben joined the engineering club. It was a student-run organization that, in his words, "helped [him] out forever." He was also part of the Student Senate, and in fact was the only participant who said that he held a leadership position in community college.

When he first started taking classes at EC, Goku admitted that he "just studied by [him]self." He implied that he did not join study groups for his early courses (mainly math classes) because he had relatively few challenges comprehending the material. When he transitioned to taking more engineering classes, however, he said that it became "harder to understand the concepts." For this reason, Goku said that he would "always study together" with other students in these more advanced courses.

Participants reported significant benefits from various types of peer support networks at EC. While most students formed more ad hoc study groups in order to pass rigorous STEM classes, one respondent joined structured student organizations through which he was able to

expand his academic and professional contacts. In some cases, the notion of a study group was new to participants, but they seemed to embrace the group and reported that these networks contributed to their success. In other instances, groups were dynamic, evolving from being solely academic in nature to eventually becoming socially-oriented as well.

C. Post-racial lens

This section explicates race-based challenges that the respondents discussed, but it describes how they became less focused on these challenges in their own educational journeys. To put it another way, this section provides evidence of racial challenges on a macro-level but also describes the individual perspectives that minimized the impact of these challenges. This "post-racial" perspective seemed to allow the students to focus more on their academic goals and less on prejudicial treatment that they might have encountered. In some cases, respondents actually said that they became more motivated to excel in school as a result of these obstacles. I have framed participants' responses in this way to underscore the idea that this work analyzes strategies for success, rather than barriers to academic achievement.

As an example, Maria, the only woman in the study, noticed that at times she was the "only Black girl…in class." However, she said that she found it "almost…empowering." She expressed this idea of empowerment by adding that she "just got used to really thinking that I can literally do-like, if I want to do something, I can do it." Oussou, the student from Niger, intimated that he encountered what may have been racism or xenophobia in an art class during his first semester at EC. He recalled that "at that time [he] spoke English" but "the accent was not like [the typical American] accent." Despite his efforts to perform well in the class, he said that he faced a challenge when he had to purchase materials from a different EC campus but did not have access to a car. The teacher, based on his narrative, offered few, if any, suggestions as

to how he could obtain the materials and he found the experience "frustrating." He implied that his teacher's inflexibility may have been because she was prejudiced toward students who spoke with non-American accents. Ultimately, he earned a "C" in the class despite his efforts. Generally speaking, however, he said that he was not treated differently because of his race/ethnicity and actually felt that "everyone is the same here." In fact, when I asked Oussou if he had encountered similar "frustrating" experiences in his STEM courses at EC, he responded no, everything was "amazing." From his vantage point:

> [Race and ethnicity] didn't really matter for me at all. Like for me everyone is the same so I don't really care. Unless the person shows me that there's a difference, then I just keep my distance from the person. But for me I think we're all the same so regardless of where you come from, your race…your ethnicity and everything.

Like Oussou, Titan could identify at least one instance that might have been classified as a microaggression. He recounted a situation shortly after he arrived in the U.S. involving a White woman who he happened to sit next to on a bus. According to Titan, when he sat next to her:

> She just looked at me and then stood up… but I didn't really care about it. I was like it's her own point of view so it won't affect me so it never affected me. It's just a story I just remember and laugh about it.

I did not interpret this statement to mean that the incident on the bus had a trivial impact upon Titan, but it suggested that he himself perceived it as being relatively insignificant. Apart from this occurrence, Titan did not allude to any other instances of prejudicial treatment since his return to the U.S.

During discussions with the non-native students, I discovered that all three of them had been involved in some way at EC with the African Students Association (ASA) on campus. Presumably, this organization's goal is to unite the broader African community of students on campus around cultural events and other on-campus activities. While they ostensibly appreciated the mission of ASA, they were not inclined to join it. When he explained his rationale for not joining ASA, Titan said:

> For me, I wanted something different. I wanted to do something different. I was like because I basically grew up in the same environment as most of them, so maybe it was like we have…similarities. I was like let me just try something different...I never attended events. I was like let me just shift.

Titan seemed to already have had a healthy awareness of his cultural background when he arrived at EC. For this reason, he did not appear to feel the need to develop an appreciation for his or other African cultures. Similarly, Maria indicated:

I wasn't like involved but I went to [ASA] events. I think it was – I mean, I didn't go just because I didn't have the time, but if I had time, I'd try to go to more things. They're just like a really good almost reminder just like glimpse of African culture so it's cool.

Maria appeared interested in being a part of ASA, but other time commitments precluded her from doing so.

Oussou was the most ardent in explaining his reasoning for not joining ASA. In his words:

I wasn't involved because I thought it was just a waste of time... I was [a] first year [student] so I was like, 'Why do I have to waste my time with this? They just come and they chat. I don't have time for that.'

The idea that he viewed the African Students Association as a "waste of time" suggests that Oussou may have been more focused on academic success or other commitments besides cultural immersion. He, like Titan and Maria, did not seem as engaged in extra-curricular activities as Ben, who joined different associations on campus. This suggested that they may have all been primarily focused on engineering and transferring to a four-year school.

Ben, like Maria, observed the underrepresentation of students of color in STEM courses, but the salience of the issue was not clear to him until he had been in EC for some time. He enrolled in a class in which he was required to report on the demographic composition of STEM courses that he was taking in college. The class also provided him an opportunity to reflect on the makeup of his high school science and mathematics classes:

> I was never concerned [about the racial/ethnic composition of students in high school] at the time. I probably never even actually noticed it at the time just because that was never really something I even thought about. Actually, so until I got into college and started becoming more aware of social issues like that, then I started realizing oh, wow, this is really unfortunate when things like that happen.

Ben was able to critique the disproportionate number of URM students in his classes both at EC and – somewhat retrospectively – at his high school. However, the levels of underrepresentation that he observed did not seem to personally affect him. Rather than offer specific examples of cases in which race limited his own personal journey in STEM, Ben saw his race from a macro-level. He recognized that he was one of a few students of color in STEM and only said that it was "really unfortunate" that there were not more URMs.

Similar to Ben, Goku said that he "wasn't…in classes looking for other people of color." However, he, too, began to take note of the underrepresentation of other Black students in his

math and science classes while he was at EC. Although he acknowledged the paucity of Black students in these courses, Goku said that:

I don't think [the fact that other Blacks were not in math and science classes with me] really impacted me. Like, I know in science courses, I would do really well…But I really wouldn't notice like any other – I wasn't' really thinking about hey, are there any other African Americans in here who are doing well as well? Like I didn't really think about it at the time. I was kind of like really only focused on myself.

Reflective of the detachment that others had when discussing the underrepresentation of URM students, Carter said that his being one of the few American students of color at EC "was more of an observation that didn't have an impact." Although he conceded that he might "have certain experiences…that may be different than [his] peers who happen to be a different skin color," Carter was reticent as to the issue of race in his own life. Instead of accepting pre-defined identities that society "placed upon [him]," he was more interested in "developing his own sense of identities." While recognizing his own diverse cultural background, he "sort of embraced the fact that [he is] more than just what [his] parents' heritage is."

In addition, Carter described himself as being "aligned with something more overarching" than race. He used as an example his experience with the National Society of Black Engineers (NSBE) on the Tech College campus. Although this experience occurred after he left EC and it therefore did not facilitate transfer, it provided insight into his personal views about racial affinity groups. When he attended a NSBE meeting, he recalled "that sense of familiarity was there, but there was much less emphasis on how does that experience inform your engineering career?" He said that he was more concerned with developing a "particular identity"

in engineering than developing one as a Black/African American person. To put it another way, Carter said this about his experience with NSBE:

> I felt that it was technically correct, like [society of Black engineers], yes. Here are engineers who are Black. It wasn't Black people who are focused on engineering. That's not necessarily a bad thing, but it was much more of a cultural-focused society rather than – I would say – an engineering-focused society. When I came to the university I went to find engineering societies because I had a cultural identity… I happen to be an African American so there is a default experience that kind of fades into the background where you say, 'people are following me around the store,' or whatever. I am usually the attention-catcher in a given situation. I am okay with that; it is part of my makeup. But at the same time, when I came to Tech I was like, 'Now that you've decided to pursue this whole engineering experience, I want mostly experiences focused around that.' When I attended those meetings, I was like, 'Okay, this is more of what I already know. So, if I have limited extracurricular time, maybe I'll find some more things that I haven't experienced.'

Carter seemed to have experienced his own forms of unfair treatment, such as having "people… [follow him] around the store." From Carter's perspective, though, he believed that it would be better for him to develop an identity focused primarily on engineering as opposed to one built around race or culture. He seemed to appreciate the importance of NSBE, but he was looking for something more technically focused in a student group. Interestingly, Carter's perspective about NSBE echoed non-native students' point of view about the African Students Association at EC. Both Carter and the non-native students viewed the respective organizations as more of racial or

cultural affinity groups than organizations that could directly assist them in their engineering career trajectories.

For the most part, participants were conscious of the impact of prejudice and/or the underrepresentation of URM students in STEM. However, the direct impact of discrimination or disproportionate numbers of students of color seemed only modest from their points of view. Interview data suggested that the participants did not generally feel negatively impacted by race/ethnic/cultural-based prejudices or disparities. Some participants even voiced their disinterest in organizations that were primarily racially or culturally-focused. Instead, they seemed to prefer to stay focused on becoming an engineer.

D. Individual factors for success

The first subsection below provides data that demonstrates ways in which students exemplified self-determination. Looking at characteristics like motivation, curiosity, and ambition, I explore how students expressed an inner drive to excel in science and math-based topics. In the second subsection, I explore other themes that emerged as individual factors, beginning with evidence of how some students seemed to lean more toward mathematics than science, while other students' inclinations were more toward science than mathematics. I conclude with a subsection on the relevance of competitiveness, and how some participants seemed to thrive as children by attempting to be the best performers among their peers.

1. Self-determination. The majority of the participants spoke either about their ambition to be highly successful or about their interest in learning. Rather than reporting that they only passed classes, students were more prone to talk about how they developed an interest in a specific subject area and chose engineering as a way to explore that area. In other instances, participants expounded on the idea that they had to learn to overcome academic and/or personal

challenges in order to persist in school. Respondents all seemed to have an inner drive to be successful regardless of external circumstances. In sum, they each possessed what prior research has defined as self-determination (Deci, Vallerand, Pelletier, & Ryan, 1991).

Carter explained that in order to understand the world around him, he developed an interest in STEM as a child. Using the books that his family provided for him, and from other enriching opportunities (e.g., trips to the library, visits to the museum), he was able to further cultivate this desire. He noted that his younger sister had the same opportunities that he was afforded, but her career and academic goals seemed to shift toward the arts. While his parents were "less encouraging" of his younger sister's interests, they afforded him the freedom to explore his curiosity about math and science. Carter suggested that his STEM interests came from a desire to understand the "world around him." He recounted his early fascination with STEM in this way:

> It was not something that was saying, 'Here let me expose you to this and then I'm going to kind of shepherd you along there.' I can't point to any single figure that was somebody that would push for curiosity or education in science in particular or math in particular. It was just me wanting to understand how the world works.

Early on in his life, Carter did not have direct exposure to the field of engineering, and in fact he admitted that "engineering popped up on [his] radar really late" in his youth. He said that as a child, the science that he learned in school was not nearly as intriguing as what he was able to learn on his own. It was not until he enrolled in EC that this changed. In Carter's words, when he began taking more advanced courses:

> It wasn't just, 'Memorize this list of plant parts.' It was more like, 'Here are the chemicals that go into a plant's cell. Here's what they do. This is the way energy's

converted.' I was like, 'Yeah, okay. It's starting to make sense.' So that was where I started to finally couple my curiosity with having that curiosity satisfied in education.

In addition, Carter frequently described himself as a "self-starter," and associated this term with the ability to maneuver successfully throughout his time at EC. In his opinion:

> Unless you are a self-starter and unless you are okay with navigating your own way and being secure in your own way, the cohort that you get in, say coming to a four-year institution where you're like, 'You're all freshmen; have a nice class.' That doesn't exist [in a community college]. You will have different people in every class…You have to be okay navigating that.

Carter was cognizant of the fact that the journey through community college can be different than the pathway of student whose entire post-secondary career is at a four-year college or university. In addition, he also explained that engineering could be "tough," and recalled a point at EC when he saw students dropping challenging STEM courses. He said that he would think to himself at those times, "I owe it to myself to at least keep going. And it's paid off." Rather than relinquish the goals that he established for himself, he indicated that he was determined to persist in EC's rigorous courses.

Because of the family challenges that he faced while growing up, Goku explained that he "didn't put a priority" on his formal education. His family frequently had to relocate, and he would feign a different personality at each elementary or middle school that he attended as a kind of coping mechanism. In his personal time outside of school, however, he developed a personal interest in science from watching the Discovery Channel and other similar educational programming. Although his academic performance improved in high school once his family circumstances began to stabilize, his grades were still not optimal. Goku's approach to and

interest in school shifted most dramatically, however, after he enrolled at EC. He remembered that "[his] interaction at EC was different, because then, I was trying my most. Like, I was doing the best that I could."

Goku, who was raised by a single parent and grew up as the younger of two boys, said that he did not want to be like his brother. His older brother had attended a four-year private institution in the southern part of the U.S., but unfortunately he "flunked out" of the school due to poor performance and still has not completed his Bachelor's degree. This had a major impact upon Goku, which he explained in the following way:

> So sometimes I think in order to contrast with [my brother], how bad he did in college, it kind of pushed me to do much better. So in terms of education, like he started out really well in elementary and high school he had high SAT scores but then when he went to college, it dropped off a lot. So that kind of pushed me to perform as well as I could in college so I wouldn't be as disappointing.

When he saw his brother "[flunk] out," Goku also made a conscious decision to start attending community college rather than a four-year college or university. He noted that he "didn't want to…leave home, and then flunk out of school."

Goku's sense of self-determination has extended to other areas of his academic experience at EC. When I inquired about how prepared he was for community college courses compared to his peers, he acknowledged that he did not have as strong of an academic preparation as some of them. However he stated that "he just knew that [he] had to do some work to catch up." He added that he developed a "philosophy of wherever the source of information is coming from, [he just tried] to find a way to get it, so that usually led [him] to a lot of videos on YouTube, trying to figure out concepts." Finally, Goku noted that while other

EC students complained about their teachers, ultimately success or failure in a classroom was "up to [the student], how much [s/he wants to] learn. Like, no one else can dictate how much you take from a class except you…you have to do the work." Goku appeared willing to take individual responsibility for his own academic performance in engineering and other classes at EC.

Similar to Goku, Ben's level of motivation and interest also seemed stronger than that of his siblings. According to Ben, who may be the first in his family to graduate from college:

> My sister [wanted] almost… none of [the math books that I had]. She was more of a person who didn't enjoy it at all and kind of…pushed back. And then my younger brothers, they weren't really as invested in it as I was.

Ben also said that he would find out more information about a topic "just by reading the book." He seemed to have an intrinsic motivation to learn more about different STEM subjects. Reflecting on his experiences in secondary school, Ben recalled:

> So ninth and tenth grade I felt like I could rely on teachers to tell me things. But by twelfth grade it was more like, 'Listen to the teachers and then look in the book because they have nice pictures,' everything is – like whatever the teacher tells you is like only a small amount of information *compared to what you can actually find for yourself* [italics mine]. So it kind of changed the way I viewed the classroom setting from like they're here to teach me or like I actually have to teach myself more than anything.

Ben became self-reliant as a high school student, realizing that he might have to find answers on his own. This self-reliance may have assisted him in other ways as his classes became more challenging in high school and in college.

Titan, Oussou, and Maria also expressed a sense of self-determination in a number of ways. Titan and Oussou, who grew up in West Africa, both spoke about their goals of attending a highly ranked engineering college. Besides Tech College, Titan said that he "did have other options – UPenn and Georgia Tech," but he ultimately came to Tech because his friends were also coming to this institution. Oussou was even more transparent in acknowledging that he was previously considering only highly ranked schools like Texas A&M and Stanford Universities. Maria admitted that part of the reason that she came to Tech was because her family was in close proximity, but the other reason that she chose this school over other programs was because of the impressive status of the university.

Offering advice to future community college students, Oussou felt that it is imperative that prospective transfer students "stay…really determined" and "know what brought [them] here." Titan likewise spoke about the importance of hard work, and reflected on his education in The Gambia in which he was only one of three students who remained enrolled in a challenging Calculus class. He noted that "most of [the students] ended up dropping" and so by the end of the class, only Titan and two other students remained. He continued to be persistent when he enrolled in EC and when he completed his studies there, he said that he "finish[ed] high." Moreover, the success that he experienced at EC reinforced Titan's determination and ultimately "kept [him] going." In Maria's own words, "When [she] put the effort in to something," it made her "want to do more." On more than one occasion Maria emphasized that "things aren't going to be given to you." She valued the importance of "tak[ing] responsibility" and "mak[ing] a way for yourself."

Self-determination appears to be a broad, but appropriate, term to describe the various attributes that I have outlined in this subsection. For participants in this study, self-determination

encompassed their personal interests in STEM as well as the strong work ethic that they needed in order to persist in rigorous courses. Furthermore, some participants demonstrated this quality by the educational goals that they established for themselves. Evidence showed that students all seemed to possess an inner desire to be successful, which ultimately assisted them in the years leading up to transfer.

2. Mathematics versus science interests. Another theme that emerged during the individual interviews was the preponderance of the participants who spoke about having an interest in mathematics rather than science, particularly as children. This was a valuable finding because it highlighted the specific STEM subject that seemed the most interesting to participants as children. Furthermore, understanding whether math or science was more influential to the respondents eventually informed the revision of the conceptual framework that I developed for this study. Each of the non-native students suggested that mathematics seemed to have a greater influence upon them in their youth than did science, and two of the three native students that I met with indicated the same. Maria, whose mother arranged for her instructor to tutor her, had an overall positive reflection about mathematics. However, she was more neutral when it came to her classroom experiences with science. She recalled:

> I found [math] challenging, but, like, solving it was gratifying…so I would need to study. It's not like it came easy, but it was – I think the process, that was a little more interesting than, like, for example, history or English or other languages. But as far as sciences, … I think I was more focused on math when I was younger and that kind of put me towards… [the] engineering track.

When I asked Oussou about the factors that inspired his interest in math and science, he responded twice that he "was good at math." His background in Calculus I from his education in Niger was so strong that his math teacher at EC "would just tell [him] not to talk in class." He said that Calculus II was "easy too" and that he did "pretty well." Additionally, he stated during the interview that his secondary education leaned heavily toward physics, and noted that when he arrived at EC he found the physics to be "easy." However, Oussou admitted that chemistry was "hard," ostensibly because he did not have as strong of a background and/or interest in that subject matter as he did with mathematics and physics.

Similarly, Titan also had early exposure to basic and advanced math concepts while growing up in The Gambia. Like the other interviewees, I asked him about the factors that inspired his early interests in mathematics or science. He pointed out:

> During elementary school, middle school, I was interested in math. It was a broad math, just a general math, and then it was really algebra…and then in middle school, I was exposed to more in-depth math, and in high school, I was exposed to calculus, and then in high school, I took physics, chemistry, and biology, but I didn't like biology.

As with Maria, Titan drew a distinction between mathematics and the life sciences. He later pointed out that "biology…was so bad, so I already knew that I was [going to] go into engineering." By contrast, he stated on more than one occasion that he was "good at math" and that he would "sit next to his teacher's desk… [and] ask a lot of questions."

Goku, also spoke much more about his background and interests in mathematics than science. As early as elementary school, he noted that "math always came easier." He tended to earn lower grades in mathematics courses, but indicated that his performance had less to do with

understanding the content in the classes and more to do with personal challenges that his family faced. Later, I asked Goku about his interest in mathematics versus science as he was growing up, and he responded:

> It was math more than science. I didn't really start doing science courses until like high school. Because in the middle school, we didn't do much physics. Or in elementary school. But we still had like the basic core math. And I was really good at the math.

Although he later noted that he took honors science courses in high school, Goku never indicated that he was "good at" science in the way that he spoke about mathematics.

Ben's responses to the math-versus-science question seemed to be two-fold. On one hand, he had more experience with mathematics than with science early on in life. He seemed to believe that his narrative was not uncommon and commented, "of course elementary school was more math and science, because I don't think science was really around." Rather than talk more about science, he tended to talk about the support that his father provided him in cultivating his engagement with mathematics. His father reportedly "pushed [him] to read this book that he had gotten on very basic concepts in mathematics and geometry. And so [he] kind of excelled at math in those early elementary years."

On the other hand, there was a notable shift in Ben's interests in high school because he had an "amazing" chemistry teacher who "influenced" him. He contrasted his chemistry teacher with his physics instructor who was "all right" and his mathematics instructors who "weren't that great." He fondly recalled:

> I would go to [my chemistry teacher] during the lunchtime hours and then we would occasionally just chat about different things in chemistry that she knew about that she

> doesn't talk about in class because obviously you just have to pass the standardized test, so they really don't have to tell you much more than that…so just chemistry felt like a very, very different experience. It also felt like we were solving actual problems that someone might be interested in.

In that same response, he opined that chemistry has more practical usefulness than mathematics, adding that "you don't actually gain any real knowledge for [math]."

Perhaps even more than Ben and certainly more than other respondents, Carter appears to have always been intrigued by the sciences. In order to understand "how the world works," he indicated that science - more than mathematics - helped him to achieve this goal. Carter read books on "various scientific topics like *Gravity is a Mystery* or *Tornado Warning* or *Hurricane Watch* or *The Solar System.*" From Carter's perspective, these books had a major impact upon him because he was learning "facts about the world that you might not know."

Whereas the majority of the other respondents seemed to take pleasure in learning about mathematics, Carter, who interned with NASA, had a very different reflection. He appeared to have a strong predilection for science rather than mathematics. Carter spoke openly about how this dichotomy played out in childhood:

> I knew that math wasn't something that I particularly enjoyed, but I knew I needed to learn it eventually to understand more about the world. Science was something that came very easily to me, because most of the material I'd ever covered, I had read about before. So when they came to the unit about planets, I could take the test basically as soon as it came up. They came to the unit about geology, well I had already read tons of books about volcanoes and all this other

> kind of stuff…[I] had to read this chapter in the book, even though [it was] something [I] already [knew].

Carter correlated the success in science that he had *inside the classroom* to the experiences that he had *outside the classroom.* His account deviated from Ben's, whose in-school experiences with his chemistry teacher helped create his penchant for science.

Students in the study seemed to have always been drawn to either mathematics or science. Their affinity for either subject matter predated their interest in or awareness of engineering. Based on the data that the interviewees provided, their ability to transfer to Tech may not have been possible without their strong science or mathematics background. However, childhood experiences both in and out of school seemed to determine whether a student became more interested in science as opposed to math (or vice versa). Furthermore, a framework for developing Black engineering transfer students might need to account for undergraduates who may be more drawn to one subject than another.

3. Competitiveness. Through individual and group interviews, I observed that three of the six participants indicated that competition with other students helped inspire them to excel in STEM. Reflecting on his experiences in The Gambia, Titan talked about the importance of competition in his academic career. He made a general statement that "[Africans] have this mentality that hard work pays off, being competitive." Titan, whose parents did not attend college, referenced his father's competitive nature, asserting:

> My dad is competitive and he likes to brag, so he likes being the first person, the very first person who has a child in the school. For example, my high school, I was the first one among his family to attend that school.

Here, Titan connected the notion of being competitive with the habit of his family "bragging." By becoming the first to attend the particular high school that Titan enrolled in, not only was his father proud of Titan, but he had an opportunity to boast about his son's accomplishments.

Ben's father seemed to also foster a competitive spirit in his son. Beyond simply doing well in mathematics, he wanted his son to be among the best in his school. Although he lacked personal experience navigating the journey from secondary school to college, Ben's father promoted importance of excelling beyond one's peers. Ben, also a first-generation college student, stated that while he was growing up:

> There weren't really conversations that much about my future, but it was more like…go learn your times tables and then recite all of them up to 12 or something. And kind of stuff like that. Just making sure that I knew what I was doing and practiced things like that all of the time. Just not really because I needed to, but just for the sake of getting ahead of the other students.

Ben's father believed that if his son could perform better than his peers, he could excel in school.

Goku, who neither came from a highly educated family, nor had well-resourced parents, seemed the most interested in competing with peers. Referencing his secondary school years, he said that he "would get competitive with other students to see who could get the highest grades." Although he acknowledged that competition served him well, he alluded to its negative aspects:

> [Competition could be] a bad thing because you would look at people differently, like if someone gets lower than you consistently on something, sometimes you think like, okay, yeah, I'm smarter than them, or something like that, and usually it affects how you interact with them in conversations or if you want to become their lab partner or something like that.

Beyond his individual performance, being one of the top performers was something that Goku internalized as something that he should do as an African American. In his own words:

> I always felt like African Americans weren't expected to excel in academics, and it was kind of expected. So I kind of liked to be an outlier, just like to stick it in people's faces. Like yeah, I can be smart as well...I feel like that kind of pushed me to be better in academics, because I felt like some – most of the time, people expect me not to be as good in academics.

Goku viewed competition as a means of proving that he was a good "example for…the rest of [his] race."

Competition was a salient issue for Ben, Titan, and Goku. Each student embraced competitiveness as a means of moving ahead of classmates. Some spoke about being "better" than their peers even prior to EC. Competition seemed to undergird their studies and most likely motivated them as they planned to transfer to a four-year school.

E. Family support and influence

During the interviews, I asked students about the roles that their families played in their lives prior to and even during their time in community college. In nearly every case, interviewees indicated that the roles that their parents, siblings, and even extended family members had was generally a positive one. In this section, I discuss the various ways in which participants' families supported them. I begin by exploring the significance of high family academic expectations. Next, I talk about the exposure that respondents had to various forms of capital, including social and cultural capital; I explain how these components positively influenced students' engineering trajectories. Afterwards, I discuss the import of specific family members in students' lives, such as a particular parent, sibling, or extended relative.

1. High family expectations. A consistent theme that I observed in conversations with the participants was the idea that their family members – particularly parents – expected these students to perform at a high level. Ben, whose parents both immigrated to the U.S. as young adults, spoke about having to live up to the hopes and ambitions that his family held for him. Ben commented:

> Personally, I'm a first generation student. So that kind of placed a significant amount of expectation on me, just solely because both of my parents were immigrants, so them coming here for the opportunity kind of made it such that I was the one who had to get the opportunity in the end.

Similar to Ben, Titan was a first-generation college student. Although his parents are still in The Gambia, Titan said that he had to "work hard and get something done" in order to satisfy his father. Titan added that his father even called him at night just to see how he was doing with his classes. He explained this tendency by stating that his "father has bragging rights, so failure is not an option" for him.

As may also be the case with Ben, Titan's younger siblings "don't feel that much pressure [as him] but still they do know that they have to succeed." Titan's statement suggested that as the eldest, the expectations that he has to live up to may be higher than those placed upon his younger brothers and sisters. Titan also spoke about other students that he knew of whose families have similar hopes and aspirations for them. He remarked that, "My close friends, some of them are first generation, and even if they're not first generation, they are the first in their family to pursue engineering, so they don't want to…fail."

Unlike Ben and Titan, Oussou will not be the first in his family to earn a college degree. However, his narrative suggested that he still carries some of the weight of fulfilling high

academic expectations. Oussou echoed some of the same "bragging" – type sentiments as Titan, admitting that:

[My father] likes [my siblings and I] to do our school [work]…I hear my friends saying when he comes to their house talking to their friends like, '[My son] did this. He's good at school…' And my mom also she wants me to…even go to grad school because…she went to school. She went all the way to university. Even my dad he did so.

Oussou understood that because his parents attended college, they expected the same of him. Maria was likewise born in Kenya to educated parents and appreciates the value that her family places upon academic achievement. She explained that, "In my family [academic achievement] is just expected. Like, you go to school…you get a good job." Maria also remarked that her parents and even her "extended family" have set "high expectations" for all of their children. Similar to other respondents, Carter's family strongly encouraged him to excel in his studies, but not necessarily to choose a STEM discipline. His mother, who helped facilitate his education at home, was especially vocal about what she required of him:

She was like, 'I taught classes, and I taught grad level classes, and…if I gave Ds to my students, you could bet you're not going to submit this if it's in this kind of shape'…She didn't have unrealistic standards. But she did push [me and my siblings].

Carter's mother valued the education that he received, which influenced her decision to teach him using a home-school curriculum offered by a local educational campus. He added that his mother felt that it was best to enroll him in these classes because she "felt that the local caliber of educational resources wasn't that great." She also believed that Carter would receive a better education if she instructed him herself; in his words, she wanted more of an "emphasis on critical thinking" than most of the other schools provided.

Nearly every student in this research expressed a belief that their families wanted them to achieve at high levels. For some students, the pressure to achieve seemed strongest when they were in grade school. Other participants felt the need to be successful in college, and understood that parents wanted them to earn a four-year degree. Families' high expectations ultimately pushed the students in the study to want to do well at all levels of school, including leading up to transfer.

2. Forms of capital. Most students in the study were able to take advantage of special opportunities because of the financial resources or capital that their families possessed. In other cases, parents inadvertently leveraged a form of cultural or social capital in order to help improve their children's experiences in school. According to Bourdieu (1986), cultural capital has to do with the ability to obtain certain advantages in society as a result of one's non-financial resources or qualifications. Benefits afforded to possessors of exceptionally high cultural capital may often be a superior education. Examples of cultural capital relevant to this study might include how to access a highly specialized secondary school program, or opportunities to visit museums or science laboratories.

Social capital, as defined by Bourdieu, "is the aggregate of the actual or potential resources which are linked to a possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition" (p. 88). In other words, Bourdieu explains, "membership in a group" of a particularly high status may be accompanied by access to opportunities not necessarily available to the general public. In the case of the six interviewees, relevant types of social capital could be membership in a robotics or mathematics club, or access to family members with strong backgrounds in STEM.

This subsection illustrates the different forms of capital from which participants in the study benefitted prior to enrolling at EC. In particular, it focuses on resources and/or early STEM exposure gained as a result of financial, cultural, and social capital. Although forms of capital can theoretically be accessed without relying on one's family, I thought it was appropriate to include this subsection in the discussion on family support. I made this determination after it became apparent during the interviews that students were only able to leverage their various forms of capital with the support of parents or other family members.

Carter seemed to benefit the most from early exposure and multiple forms of capital, and spoke freely about the capital that his parents were able to garner through their own struggles. He explained that his parents were outliers in their respective communities. For instance, he said that his father "was expected to…inherit the farm and do farm-based activities" in his Midwestern hometown. Against his parents' advice, his father joined the Peace Corps and travelled abroad to Cameroon, West Africa. There, he met his wife and Carter's mother, who holds a doctoral degree and was on a Fulbright fellowship at the time. His believes that his mother was "confident in her potential" and challenged the norms of what was expected for an African American woman:

> She was never one to take 'no' for an answer. There are a lot of people – she grew up during the Civil Rights movement –in education who are thinking, 'You shouldn't be here,' or 'The fact that you're here is too soon. It should have happened more naturally. Why are you in this space? Why are you asking these questions?...Why are you here?...Did you even earn this position?' All that kind of stuff… I think that is one of the reasons why her scrutiny of the local education system turned out to be as extensive as it was.

Her "scrutiny" led her to begin home-schooling Carter using "correspondence courses" through a private school from the time that he was in the first grade. Being highly educated herself and a former college/university professor, she was dissatisfied with the education that the local school system would provide him. He stated:

> I think the line in the sand for [my mother] was when she was checking out preschool programs. And over the summer, one of the instructions they had was, 'We've given them a sort of introduction for reading, but we want to make sure they're proficient by the time they come back for the fall.' And she was like, 'Wait, that's your job. What are you doing?' So she felt that the local caliber of educational resources wasn't great.

During this same time period, Carter began to be exposed to resources like "picture books about investigating the world" covering broad scientific topics from gravity, to the solar system, and even to natural disasters like hurricanes. He also walked in "the footsteps of an enrichment program that [his] sister was participating in with some science club." Aside from that, Carter's childhood included hands-on interactions with an aquarium in the home, "clear globes with electronic components inside," and frequent visits to local museums. In addition, he noted that as a boy he would regularly travel to the public library, and check out and read the maximum number of books allowed for patrons.

Similar to his primary school years, Carter's mother seemed to employ her cultural capital when she identified a high school curriculum offered through the University of Nebraska High School (part of the University of Nebraska). She thought that this school would benefit her son more than the standard secondary curriculum in the county. According to Carter:

[My mother] heard about [the University of Nebraska High School], I believe, online. And she did some vetting of it, because there's a number of…types of high school things that you can do. Most of the homeschoolers that I think were doing stuff around that time were saying, 'You can do this particular curriculum and then get your GED and then go to college.' But she was like, 'You can get your GED, or you could go to an official high school that's basically college, and get a high school diploma.'

Along with the exceptional educational opportunities that Carter received, his parents allowed him the freedom to explore multiple career paths. He commented:

> There was emphasis from my parents about encouraging general curiosity. So while I gravitated toward books about discovering the world around you, at the same time there was also books about the human body or art and art history. So there was a broad selection of books to choose from. I just happened to focus on the ones that interested me the most.

Finally, Carter explained that he had a "family friend" who worked for the National Aeronautics and Space Administration (NASA). This friend helped Carter obtain an internship with NASA that ultimately redirected his career pathway. Although he commenced his internship planning to study meteorology, at NASA he found that "meteorology is sitting in front of a supercomputer, waiting for your latest simulation to compile." This was something that he quickly determined that he did not want to do as a career, and in the process he discovered a passion for materials science and engineering (his current major). His access to this friend and the internship that he participated in at NASA represents a type of social capital that Carter was able to engage. Without this connection it is uncertain whether he would have worked for NASA at that time and been able to learn about engineering.

Reflecting on their childhoods in Kenya, Niger, and The Gambia, respectively, Maria, Oussou, and Titan also seemed to benefit from their parents' cultural capital. I learned from interviews that none of them attended a public school during their primary or secondary school years. Instead, they attended private, sometimes very selective, educational institutions. Maria stated that she attended Catholic schools both in Kenya and after moving to the U.S. When I asked her what prompted her parents to send her to a Catholic school in Kenya, Maria responded:

> They just heard it was a good school…it was a private school so like, usually…the state schools…didn't have exams at the end, like the students didn't do as well and so my parents wanted [me and my siblings] to [excel]. And also, my dad was a professor at the University of Nairobi, so he just knew where to send us.

Once her family moved to the U.S., she continued to benefit from various forms of capital. When she spoke about her first challenges with mathematics after her family moved to the U.S., Maria remembered:

> Math started out as a challenge, it was hard for me to get into and understand. But once I had a summer that I really felt like I was like getting behind so I just took one of teachers offered to help me during my summer, and so during that summer I really…put in the time and I found that like all I needed was the time. And the next semester flew by, it was like a breeze and I think it was the extra time I gave it.

When I asked questions about how she was able to receive help from her teacher over the summer, Maria stated that her mother actually paid her teacher to tutor her. This indicated that

her family had the economic means to be able to support the additional instruction that she received. It also appeared that Maria's mother was confident enough in her own status or "capital" to approach the school about ways in which to support her daughter.

Like Maria, both Oussou and Titan had the privilege of accessing multiple forms of capital as a result of the resources that their parents' were able to access. Oussou was also fortunate enough to have a private tutor while he grew up in Niger. Additionally, he was able to attend highly selective Turkish and Korean-sponsored secondary institutions in Niger. He credited private schooling for his strong STEM background, adding that "it made a great difference because…in public school they didn't have materials…and also sometimes the teachers [did not] come to class." Similarly, Titan noted that attending a private British school in The Gambia "made a difference for [him]. In [his case there were] more materials and teachers [were] required to teach." Both Oussou and Titan acknowledged that private schools in their home countries provided them access to educational materials that they may not have had in government-sponsored schools. Like private schools in the U.S., however, attending these schools is a privilege granted only to those who have the financial means to do so. The participants received these relatively exclusive educational privileges as a result of their families' financial capital.

While the previous four interviewees had opportunities to attend private schools, Ben received his formal education in his local public schools. He mentioned that while he had the chance to enroll in a magnet program at a competitive secondary school, he chose to attend his zone school "because it was pretty good and near my neighborhood." Born to parents who were not familiar with American public schools and who lacked a college education themselves, Ben had fewer resources upon which to rely. However, his father used the cultural capital that he had

available to him to provide Ben with a "book on very basic concepts in mathematics." Using this book and the existing knowledge that his father had about the importance of mathematics, he strongly encouraged Ben to excel in math as a child. Ben's father seemed to want the best for his son particularly because his father "lacked an education and really wanted to be sure that [Ben] got [his] education." Ben was able to utilize the cultural capital that his father possessed in order to enhance his fundamental understanding and appreciation of mathematics.

As a result of his mother's financial challenges, Goku's mother could not offer him some of the kinds of opportunities that most of the other students described. His life story was quite turbulent through middle school. He acknowledged:

> After third grade when I switched schools, that's when we…got evicted from the house we were in. So we kind of had – started having some family problems. So I didn't really focus on school that much. We actually moved, and started living in a hotel while I was still at this new school, and then later on we moved...So then I went to a whole different school…It definitely was kind of an up and down rough period. Challenging for my mother.

Despite these obstacles, he credited his mother for being more responsive to his needs when he became vocal about his academic concerns around the beginning of high school. When he realized that "moving around a lot was hurting [him] in how [he] was growing up," Goku asked his mother if they could "stay in one place in high school." Goku's mother found a means to keep the family stable, which led to his improved academic performance in high school. He said that he "started doing really well in [his] math classes" and showed significant improvement compared to his "bad" performance as a younger child. Furthermore, Goku explained that his mother is now able to provide him "money for books and [pay] for [his] housing."

The six students demonstrated that their families possessed multiple forms of capital. While some seemed to possess financial, social, and cultural capital, others may not have had access to all three types of resources. Social capital was also more limited to one or two students among the respondents. For instance, other students did not necessarily have personal contacts that would allow entrée into venues like NASA. However, each student in the study had at least one family member that employed his/her existing cultural capital to assist him/her in school.

3. Support from key family members. Each participant had a specific family member who played a prominent role in his/her life. For instance, in some cases a mother may have been the more active of a student's two parents, while in other cases a father had the more visible role. In other instances, an interviewee may have received support from an extended relative, such as a cousin. In this section, I explore the ways in which specific family members were engaged in the lives of the participants. Looking at the ways in which they provided their support, I unpack how these family members were impactful in helping to shape a trajectory that culminated in transfer.

Titan's father's expectations not only motivated him as a child, but even as an adult Titan felt driven to achieve in order to please him. Titan connected his father's lack of an education to the goals that he set for him. According to Titan, "my dad didn't go to school so he wanted his kids to go to school…and have a good education." When I asked him about the role that his mother played in his life, Titan compared his parents by saying "my mother played a role just in terms of advising him and just telling [my siblings and me] how to go about [our education], but she wasn't more of the bragging style." Even when talking about his mother's level of education, Titan redirected the conversation back to his father, stating for example that:

On my mom's side she went up to high school and then…her brothers all went all the way up to universities and have like good jobs. So my dad will use them as a reference but then at the same time he'll be like push, push, push us to do [well]. Just he likes bragging rights. 'My son did this. My son did that.'

From Titan's perspective, his mother did not have as direct an influence as his father. However, his father may have exerted more pressure on Titan because he was effectively living vicariously through him. His father may have felt insecure about his own lack of an education compared to Titan's mother and uncles, so he felt the need to "push Titan."

Similar to Titan, Ben's father was dedicated to helping his son to achieve at a high level. Ben's father also mirrored Titan's father in that although he lacks a college education, he promoted the importance of STEM. Ben recalled his father's belief that success in STEM translates to better opportunities in life:

> My dad really did influence me to go into STEM because he knew that – like he was a dishwasher when he first came here [to the U.S.]. Then he became like a factory worker before he got laid off. And so he kind of saw that – like he's trying to raise a family and he's working these jobs. And almost no matter what, he feels like he couldn't get ahead.
>
> So he felt that if you have an education, if you have a job in STEM, you'll get paid well.

Ben also spoke on more than one occasion about the supplemental mathematics book that his father "pushed" him to read as a child. He explained that after receiving the book from his father and working through the exercises included in the text:

> I kind of excelled at math in those early elementary years… [My father] kind of knew that if you get into that [level of math] at an early age you'd be more likely to be interested in that as you go along.

His father stayed at home with him on occasion during his early childhood, and Ben even noted an instance when he spent more time with his father when he was "laid off." During times with his father, he might be asked to "recite something" or take a quiz that his father administered at home. Ben's father even limited his son's "free time," and he frequently required Ben to "go learn some math from the book" when he was not occupied with his homework. Eventually, Ben explained that he became "conditioned" to the idea that his father might ask him to demonstrate his aptitude in mathematics at any given point, so he developed a habit of continuously improving his math skills on a more voluntary basis.

Similar to Titan, Ben almost exclusively spoke about his father as opposed to his mother. When Ben spoke about his mother, he drew a sharp contrast between the messages about education that she gave him compared to those that his father provided. He explained:

> My dad is very future-oriented. So he would say okay, what's important is that what you're doing now will prepare yourself for ten years in the future. Because ten years from now you want to be better off. And then my mother is kind of more like in the moment.

Ben's father's tendency to be goal-oriented – and perhaps his mother's inclination for being more "in the moment" – was, in Ben's own words, borne out of their experiences in their home countries. He compared his father who was "very, very poor" in Trinidad and Tobago with his mother who did not encounter the same struggles growing up in Finland. The poverty that his father encountered in his youth as well as the challenges that he faced as a young man in the U.S. was a catalyst for motivating Ben to strive for excellence in school. Like Titan, his father's ambitions for his son evolved because of the educational experiences that he did not have himself.

Maria's mother , whose job relocated her from Kenya to the U.S., was crucial to helping Maria overcome challenges that she encountered in mathematics. She was willing to "hold [Maria] back" in fifth grade to ensure that her daughter had a stronger grasp of the material that she was responsible for learning. Her mother also talked to her middle school mathematics teacher about tutoring Maria during the summer. Additionally, as an employee of the Kenyan embassy, Maria's mother was able to have all of her children's k-12 tuition paid by the Kenyan government when they moved to the U.S. When she spoke to Maria about where she would enroll, "it was kind of a no-brainer" that she would attend a rigorous Catholic school.

When I queried Maria about the difference between her two parents, she acknowledged that her father had a role in supporting her in school. However, her mother's role seemed to be particularly salient for her once her family moved to the U.S. According to Maria:

> I mean, both my mom and dad are home and everything, but my mom was like – like her approach to education is kind of like it's like, you know, just get an education. You'll be good for life. So like her story, I mean, she kind of like built herself up and was able to work in government and eventually brought us all here through her job so, I mean, for her – I mean my dad, too, but her more.

The idea that her mother "built herself up and was able to work in government" may imply that, like Ben, the parent that appeared to have to work extremely hard seemed to transfer that same work ethic to his/her children. This does not diminish the efforts that her father made, but from Maria's point of view, her mother's own motivation was critical in being able to inspire Maria to succeed.

While some of the participants seemed to benefit from the involvement of a particular parent, Oussou's narrative neither emphasized his father nor his mother. When he discussed the

decision process that eventually led him to Eastern College, Oussou stated his parents were both vocal about their opinions. He said that while his father preferred for him to study in France, his mother's choice was the U.S. Ultimately, he indicated that it was because of the advice that another relative gave him that he decided to study in the U.S.:

> I…spent one semester not doing anything after my [secondary] school so – and then my cousin's husband was like, 'Just come here [to the U.S.]. We have a school here.' I didn't know it was Eastern College. I thought it was a university because I didn't know about community colleges and all that. [My cousin's husband] came to see me, to visit me when I came and he was like, 'You're going to community college. You're not going to university.'…My cousin's husband, he did engineering over there at EC so he is the one who did the paperwork and all that.

Oussou was able to leverage the knowledge and experience of an extended family member who was already located in the African diaspora. This family member took a very similar educational pathway in his own postsecondary career, beginning his studies at EC before transferring to a four-year school. He showed Oussou how to follow this same pathway. Oussou found support by engaging with a broader family network in order to help establish himself in the U.S.

Carter was raised in a two-parent household and both of his parents earned advanced degrees. His parents moved to the region in which EC and Tech College are located after growing up in the Midwest. Carter believes that they relocated because they wanted to live in a more progressive part of the U.S. He described it this way:

> [The move to this area] was less that the jobs were here and more that it was a happening place that didn't have anybody saying, 'no.' It was an area full of high achievers who would want their kids and everybody else to do well. Both of my parents had been so

> surrounded growing up with people saying, 'You're going to do this, not that,' people limiting them, telling them, 'This is what your trajectory in life is going to be,' that they didn't want to live in an area where it was that deterministic.

Despite his parents' shared interest in wanting "their kids…to do well," Carter almost exclusively focused his narrative on the academic foundation that his mother provided for him. When I asked him later about the attention that he placed on his mother versus his father in the responses that he provided, he said that that "my mother was initially much more concerned with the quality of education and how important that is to future trajectories. My dad's initial attitude was more along the lines of 'school is school.'" Although he said that his parents eventually found themselves on the "same page regarding the importance of education," he opines that his mother had the greater effect on his formative educational years.

In addition to the schools that his mother identified, Carter said that she "had an entire bookshelf filled with Plato and various writings about this ideal society versus that ideal society…she was very, very heavily critical thinking based." When it came to overseeing the work that he did at home, Carter explained that she was less interested in him simply completing homework assignments. To the contrary, he said that she would monitor his progress and ensure that his work met her expectations.

Aside from ensuring that he was held to what he termed "high [academic] standards," Carter's mother was an exemplar of tenacity and this seemed to have a striking impact upon him as a young person. Carter remarked that "she was never one to take 'no' for an answer." Although he did not explicitly discuss her race, he alluded to her identity as an African American woman who was not readily accepted in the academic and professional "spaces" that she entered. Perhaps because of the struggles that she encountered, he added:

> My mom always placed a heavy emphasis on education, the importance of education, and the importance of education in giving you agency. It wasn't just you need to go to school, stay in school, stay in school. It was more like education is what allows you, when somebody tells you 'no' to go out and find your 'yes.'

Goku, who arguably had the most turbulent childhood among the respondents, indicated that his mother was a constant figure in his life. When he told her that "moving around…was a detriment" to his education, Goku said that his mother "noticed it as well." She subsequently kept Goku in one home for the duration of his high school career. He also noted that she has helped him stay motivated since he enrolled in college. In his words, "she thinks [that I should] focus on school and [she'll] focus on supporting [me] financially."

Participants in the study benefitted from having key family members who supported them at critical points in their lives. While some relatives helped them to develop a greater understanding of mathematics in early childhood, others were more important during the college selection process. Still other family members helped establish the value of academic achievement, whether students were taking STEM courses or other classes. The salience of these relatives to the participants varied depending on what stage they were in along their journey toward transferring.

F. Role modeling and altruistic behavior

Each participant appeared to find some fulfillment in reaching out and supporting others. In some cases, these individuals were younger family members to whom participants served as role models. In other instances, respondents ascribed to the idea of helping others in a particular peer group, such as other students on campus. One particular student was somewhat impassioned with the thought of being an example for other Black students on campus. The role modeling

and altruistic behavior that they described during interviews were catalysts that inspired them academically and personally en route to transferring. The idea of giving back seemed to provide an impetus for them to be even more successful while they were enrolled at EC.

Ben, Titan, and Maria all spoke about their position in the family with respect to younger brothers and/or sisters. Both Ben and Titan are the eldest, and both internalized their positions with the responsibility for being a positive role model to their siblings. Ben hoped that his younger sister and brothers would be "more inclined to pursue something in STEM just because [he was] kind of hoping… they [would] follow in [his] footsteps." Titan had already helped facilitate the pursuit of a STEM degree for his brother, who is also studying engineering. As mentor to his brother, Titan talked about having to temporarily stop focusing on his own schoolwork in order to give his brother some assistance on an assignment. Last, Maria said that when one has "younger siblings" like she does, "people kind of look up to you." Ben, Titan, and Maria all appeared to want the best for their younger siblings, and their responses suggested that they embraced the importance of being a role model. Their comments did not imply that they felt any familial pressure to help, but rather that they were happy to be a positive example.

Carter said that he enjoyed helping other students in college. The notion of supporting his peers provided him with a strong sense of fulfillment. In his words, "there are very few things in a college experience that give you [as much] perspective as helping somebody else...It helps keep your problems in perspective." He said that when he encountered other students in college who were working through difficult situations, he thought:

> Let me reframe, let me get out of my head and into their head. Let me get out of my problems and think about somebody else's problems. That has really been efficient, especially when you've got engineering on your brain.

Assisting other students has both helped Carter to temporarily disconnect from his own academic challenges while also providing him a sense of fulfillment on campus.

Oussou, similar to Carter, looked outside his immediate family to identify groups that may be able to benefit from his education. He explained that he chose engineering in part because he saw that in his home country (Niger), people are working to improve the existing infrastructure. Oussou believes that civil engineering will allow him to join the coalition that is already at work there. He pointed out that he even has "some friends that are doing civil engineering [like him] and…after we graduate we [will] go back home and have a project all together."

Goku was less focused on specific groups (i.e., relatives, college students, or other communities) than he was on being a role model in a broader racialized context. He said that he "felt like African Americans weren't expected to excel in academics." He also admitted that he would feel "disappointed" when "African students around [him]" at EC would perform poorly in their classes. Goku further stated:

> I don't want to be a bad example for…the rest of my race. So I feel like maybe I have to be a good representative. So I would feel like – sometimes, I don't want to say put up a front, but I would try to act as smart as I could, try to put up the best representation as I could to people outside the race who were part of any of the study groups I would form.

Goku believed that it was crucial that other (non-Black) audiences viewed him in a positive light.

Returning to Ben briefly, he – like Goku – hoped that his life would be an inspiration for other students of color. While he wanted to be a role model to his siblings, he also was greatly concerned about the paltry numbers of Blacks in his specific engineering discipline. He related

the point at which he realized that the number of Black students in chemical engineering was disproportionately low:

> So [my identity] kind of has motivated me in that I looked at the statistics a way long time ago and I saw that I think like the amount of Black chemical engineers is like three percent, which is kind of ridiculous. So I feel like that has motivated me personally to be like, okay, I'm going to be the one to help it get to four percent or five percent, and then hopefully we'll go from there. But yeah, I suppose some people would look at that and be like oh wow, I don't want to be in that community of a culture that's not – where my culture doesn't exist there. But for me personally, I just kind of want to be helping get more African American people into these higher-paying jobs. So that's kind of like a motivational factor.

Ben's awareness of the underrepresentation of African Americans has been "motivational." Rather than viewing the challenge as insurmountable, he understands that he can help to increase the total percentage of African American chemical engineers.

Overall, while their motivations and target audiences may have differed, for all respondents the ability to engage in altruistic activities was a salient theme. Students believed it was important to be able to provide support and/or positive examples to others with whom they worked. This belief acted as a motivational force that encouraged them to want to be successful in engineering.

Conclusion

School, home, and social settings provided a foundation for many of the factors that led to the transfer process. Elements of students' personal and academic lives supplied them with tools to help them navigate their educational pathways. Based on the interview data, without an

involved parent or mentor, it is uncertain whether the respondents would have been able to eventually transfer. In addition, faculty and staff that they encountered during their primary, secondary, and/or post-secondary school years reinforced the idea that they could be successful. In some cases, faculty and staff provided the proper advising to ensure that the process leading up to transfer was smooth.

While these factors were crucial, the internal components that propelled each participant from his/her early childhood were also significant. In several cases the participant was the only member of his/her immediate family to pursue engineering. Moreover, the students' responses to challenges in life differed at times from their siblings. Their actions suggested that they were self-determined throughout their academic journeys.

Section Three – Within-group Differences Among Black Engineering Transfer Students

The next part of this chapter reviews themes that emerged in response to the second research question, "What are some of the within-group differences among Black students who transfer from community colleges to competitive engineering schools?" The differences that I examine are specifically related to those between native students who were born and raised in the U.S. and non-native students who lived in a sub-Saharan African country during at least part of their childhood (see Glossary for the definition of "sub-Saharan"). I focus on these differences as opposed to other distinctions, such as the level of parental education or grades participants earned in community college. While these other types of differences are important factors to consider – and indeed I queried respondents in the demographic questionnaire – I looked for distinctions that would not be as apparent from government or campus records. Furthermore, these types of records would not necessarily help me understand how native and non-native students differed. Explicating the differences between Black African and Black American

undergraduates help to better articulate the unique academic pathways of URM subgroups. The findings also justify the importance of avoiding the tendency in STEM education research to homogenize Black students.

In this part of the chapter, I again present themes based on their overall bearing upon the study. To emphasize and underscore the differences between native and non-native students, I begin by examining the ways in which all students fundamentally view themselves. I entitle this section *Racial, Ethnic, and Cultural Identity*. The distinctions that I present help to frame the ways that I reveal other aspects of students' narratives.

The next section, *Peer Supports and Social Networks*, illuminates experiences with other students at EC that seemed to have a significant influence upon interviewees. The third section of the paper, titled *K-12 Educational Experiences*, examines how non-native interviewees described the rigor in their home country's schools, and I compare these narratives with those of students who were educated in American schools. I conclude by once again looking at the importance of *Role Models* in science and engineering. Whereas in an earlier section (*Role Models and Altruistic Behavior*) I illustrate how some participants served as role models to *others*, in this section I look at the ways in which participants report that they benefitted from their *own* role models in STEM.

A. Racial, ethnic, and cultural identity

I received various responses when I queried the participants about their self-described racial identities. These identities appeared first in Table 1, which is provided again in this chapter as Table 2. As to the question of race, two of the native students – Ben and Carter – said that they were "mixed race" and "multiracial," respectively. Goku was the only native student who indicated that he was "Black" or "African American" in his response. All three non-native

students, however, included the word "Black" in their answers. (See Glossary for definitions of the terms "Black" and "African American" for the purposes of this study).

Answers to the question of ethnicity varied as well. Ben, Carter, and Goku said that they were ethnically "Black/White," "Black, plus more," and a combination of "African, Native American, and Caucasian," respectively. However, Maria, Oussou, and Titan viewed their ethnicities as "Kenyan," "Zarma," and "African" respectively. Whereas non-native students saw themselves as "Black" in a *racial* context, the majority of native students discussed their "Black"-ness in *ethnic* terms. Non-native students saw their ethnicities through perspectives that emphasized their "African"-ness rather than their "Black"-ness.

Native students generally were both accepting and aware of their identities as African Americans. However, they expressed their acceptance of their racial identities in different ways. For Ben, whose father was born in Trinidad and Tobago and whose mother is from Finland, overt conversations at home concerning race while he was growing up seemed to be limited. As a child, Ben recalled:

> Since my mom is white, blonde hair, blue eyes, and then my dad is from the Caribbean, which is Black, I don't think there was really anything for them to talk about [regarding race]. So my dad did occasionally mention things like – I suppose he would mention things like institutional racism every once in a while, but never out of a certain context. And to me, I never thought that they were huge things until I started watching the news.

Name[13]	Major	Gender	Race (self-identified)	Ethnicity (self-identified)	Year of Birth	Birth Order	Country of Birth	Mother's Highest Level of Education	Father's Highest Level of Education	Year of move to U.S.	Native or Non-Native	Generational Status
Ben	Chemical Engineering	Male	Mixed Race	Black/White	1994	Eldest of four siblings	U.S.	High School/GED	High School/GED	N/A	Native	Second
Carter	Materials Science and Engineering	Male	Multiracial	Black, plus more	1987	Second of three siblings	U.S.	Doctorate	Master's	N/A	Native	Third or higher[14]
Goku	Mechanical Engineering	Male	African American/Black	I have been told that I have African, Native American, and Caucasian ancestry	1992	Second of two siblings	U.S.	GED	Unknown	N/A	Native	Third or higher
Maria	Computer Engineering	Female	Black-African	Kenyan	1993	Fourth of five siblings	Kenya	Bachelor's	Master's	2003	Non-Native	1.5
Oussou	Civil Engineering	Male	Black	Zarma[15]	1994	Second of two siblings	Niger	Bachelor's	Master's	2011	Non-Native	First
Titan	Electrical Engineering	Male	Black/African American	African	1987	Eldest of five siblings	U.S.[16]	High School	None	2009[4]	Non-Native	First[17]

Table 2. Participant Summary

[13] The names that appear in this column are pseudonyms selected by the participants.
[14] A generational status of "third or higher" refers to a person whose parents were both born in the U.S. (U.S. Census, 2013c)
[15] Zarma refers to a tribe indigenous to Niger, as well as a small number of adjacent West African countries, including Burkina Faso and Nigeria (Zarma, 2016).
[16] Titan was born in the United States of America but moved to The Gambia, West Africa when he was three years old. He returned to the U.S. in 2009.
[17] Although Titan was born in the U.S. based on the definition of non-native he is considered first-generation since he was raised in The Gambia.

> and reading things in these past few years. So then it was kind of just like I have a white parent and I have a Black parent, so everything is fine.

Despite the lack of discussions at home about race and the idea that "everything [was] fine" as a child, Ben admitted that he has "become more conscious of it as time has gone on." In addition to the class assignment in which he became alarmed by the paucity of African Americans in chemical engineering, he recounted a research internship in which he was the only Black person present. He began to feel that, "I shouldn't be the only Black person here. Like, we make up 13% of the population. There should be at least 13% of this group being Black." Moreover, although he reported being "Mixed Race" in the questionnaire, he referred to himself as Black during this part of the interview. This suggested that Ben's self-identity may change when he is engaged in certain conversations about race.

Although he could not specifically point to any non-Black family members, Goku, who did not grow up with his father, explained that he self-identified with "a mix of different ethnicities." He stated that "I have African, African American, Native American, and I even think some Caucasian ancestry." As was the case with Ben, he viewed himself through different racial lenses and did not necessarily want to be limited to a singular identity. However, he felt strongly about the fact that there were certain generalizations about what he was and was not capable of doing. These stereotypes caused him to want to work harder, as he pointed out:

> I thought that, in general, it was like a common generalization that there aren't a lot of Black scientists or there aren't a lot of Black engineers. I kind of thought it was like generalized that usually, Black people were good at athletic things. That's what my experience has been like when I was growing up, before even going to – before going to [EC], that people assumed that you're good at something because you're Black. Like they

> assume you're supposed to be good at football. And they're like, 'Are you fast, [Goku]?' I was like, 'Am I supposed to be fast? I mean, I don't know," so I do think that sometimes, there's the assumption that, because of what race you are, you're not supposed to have certain skills. And one of those things that I kind of thought before going to EC was that all people thought that sometimes Black people weren't as smart because they were more athletic, so sometimes, I felt that that meant that I had to like prove myself because I was Black. I have to show that I'm smart on purpose.

Goku said that he would be "disappointed" in himself, in other African Americans, as well as in African students when they did not perform well at EC. He saw both African Americans and non-native students as a "reflection" of himself and would want to tell them "come on, you can do better than that." His statements about both "African Americans" and "African" students implied that he associated with multiple groups at EC. Goku identified with students broadly classified as Black, including those born in the U.S. as well as those born in African countries.

Whereas Goku and Ben expressed concern about negative stereotyping and the underrepresentation of Blacks in engineering, Carter was – as stated earlier – more reticent about discussing larger, more global issues affecting people of color. He did acknowledged, however, his own racial identity. Restating a quote from a prior section, Carter, who is "Multiracial," noted:

> I happen to be an African American so there is a default experience that kind of fades into the background where you say, 'people are following me around the store,' or whatever. I am usually the attention-catcher in a given situation. I am okay with that; it is part of my makeup.

Carter's narrative mirrored Ben's in some ways. In certain discussions they both referred to themselves as Black or African Americans, despite using other self-identifiers in the questionnaire. Additionally, Carter and Ben each identified with some of the challenges associated with being Black Americans. Nonetheless, I noted that each student felt empowered to live with these challenges. The idea, for example, that Carter felt "okay" with being the "attention-catcher" suggested that he had developed his own coping mechanisms for dealing with prejudicial treatment.

Unlike Ben, Goku, and Carter, non-native students were more concerned with the significance of culture than race. For them, their identities as it related to their non-American cultures were more salient than any racialized identities that they had developed since moving to the U.S. As an example, although Maria moved to the U.S. earlier in life and attended American secondary schools, she said that administrators should stay "open minded to all the cultural meanings of things like how people learn." She also opined about "how [Black Africans] are raised…different" from Black Americans.

Similarly, Titan spoke about the significance of cultural identity. Like Maria, he was less focused on his perceived identity as a Black student in the U.S. than he was on the cultural differences that international students bring to campuses. Regarding students like himself, who migrated from sub-Saharan African, he said the following:

> The entire upbringing that we have is different from the upbringing that some people have... For example, the upbringing of a single parent will be different from an upbringing of someone with two parents and the upbringing of someone who grew up in like in Africa will be different from someone who grew up in the United States.

Whereas native students were concerned about racial challenges that they faced in the U.S., Oussou was more focused on the obstacles that fellow Nigeriens are facing. He talked about working with friends who plan to "go back home [to Niger]" and help improve the infrastructure. He did not seem to primarily view himself as a Black American, but instead perceived his identity through the lens of his home country.

Native students perceived that there were certain negative stereotypes and other challenges to overcome as a Black American. Although they did not indicate that these barriers posed insurmountable obstacles, they did not completely divorce themselves from their existence. Non-native students, on the other hand, subordinated their racial identities in the U.S. to their national and cultural identities as Africans.

B. Peer supports and social networks

Respondents from both demographic groups all appeared to benefit from being a part of peer support groups at EC. However, the groups seemed to vary depending on whether respondents were native or non-native students. Interviewees who were raised in the U.S. tended to view some social networks as heterogeneous spaces for discussion where anyone – regardless of race or ethnicity – might be present. Goku put it this way: "[College]…is a…melting pot of people. I find that like, in engineering, especially, the people who understand it are so happy to explain it, because they're so excited that they understand it."

Ben remarked similarly, adding, "everybody goes through the same struggle." He implied that engineering is so arduous that students – despite factors that might separate them – unite when they have to solve difficult challenges in class. Carter felt that since engineering at EC was "new to everybody" and "everybody [was] having a hard time," most students decided to

just “focus on it.” Rather than aligning himself with a racial/ethnic affinity group, Carter, too, had a “melting pot” of friends. He remarked:

> Two of the…longest-lasting contacts or friends that I’ve had from EC have been very diverse. One is a son of German immigrants, and the other is a daughter of Nigerian immigrants, so it's – it was very much a multicultural experience. And the study groups that we formed were based on necessity, and those students who felt that, ‘Wow, I really don't understand this.’

By comparison, the idea of a “melting pot” of peers was much less apparent during interviews with non-native students. As an example, Titan and Oussou – who are from largely Francophone countries – said that their friends tend to be French speakers. Oussou, in fact, implied that one of the benefits of attending EC was that there were many students who spoke French as their primary language. The feedback that Titan and Oussou provided suggested that subgroups of Africans at EC may form their own networks built around common native languages. This feedback echoed Maria’s experience at EC with somewhat impenetrable circles of Ethiopian students. She spoke about a “language barrier” between Ethiopian students and students from other African countries. This is most likely because unlike Kenya, The Gambia, and Niger, which recognize English or French as at least one of the country’s official languages, Ethiopia’s major tongues are non-European and are classified as Semitic, Cushitic, Omotic, or Nilotic (Getachew, A. & Derib, A., 2008).

Even when they did not discuss language, the non-native students still seemed drawn to socialize and study with other African students. For example, although Maria was not heavily involved in the African Students Association (ASA) at EC, she said that she attended several of their events:

> I did go to a lot of things [sponsored by the African Students Association]…and…the community built there is…motivational in the sense that…they're all kind of working hard towards like maybe transferring to…the business school and engineering school. I think structures like that are really helpful.

Compared to her involvement with largely non-native student groups, Maria admitted that she was much less engaged with African Americans at EC. In her words, "I've had a couple of African American friends…but not too many. Like most of my friends are African just because…how we're raised is different." Maria felt that she had more in common with her African friends than her African American colleagues, and believes that African Americans were "raised…different[ly]" from her.

Oussou likewise acknowledged that he spent more time at EC with classmates from Africa. He said that he saw "more Africans than African Americans in [his] engineering classes[es]." As was the case with Maria, he could only recall being around African American students as the exception rather than the rule. Oussou provided one such example as follows:

> I'll say I only had one African American friend and he's the only one I had like as a friend. The rest would just be in class and like just interact but besides class we wouldn't even talk. I think he was the only one. The rest were just Africans, Middle Eastern[ers].

Titan appeared at first to be slightly more intentional with his selection of diverse friends. Like the native students, he assumed that everyone – regardless of race or ethnicity – around him had a shared goal of being successful in their classes. In his words, "I did step out and [had] some friends that [were] African Americans and also Caucasians…It has helped because we are all in the same category. We are all doing engineering and we know how hard engineering is."

I realized that Titan's "stepping out" was less common than I initially thought, especially when I considered some of his other statements. He, too, acknowledged that he "was more associated with Africans in general." Titan conceded that "there were a lot of African Americans [at EC] but…I didn't involve myself [as much] with Black Americans that were born and raised here." His tone did not suggest disdain for or intentional avoidance of Black Americans, but he still seemed to find more Black Africans with which to associate.

By contrast, two of the native students reported having some very meaningful interactions with Black students from Africa. Ben noted that he "hung out with a lot of the African kids and enjoyed their culture for a while, so that was kind of cool." He went on to say that at EC, he would regularly see African American students associating with students from Africa. Ben offered a counterpoint to non-native student narratives, inferring that there was more cross-cultural exchange taking place and even a cultural appreciation for the diversity that African-born students brought to EC. This type of interaction was less common among other student populations; Ben explained, "It would likely not be like Caucasian Americans hanging out with African Americans or Hispanic Americans." Ben's comment implied that Black Americans may have been intentional about their choices of friends and study groups at EC. He indicated that native students chose to interact with Black Africans rather than other racial/ethnic groups. This was noteworthy considering the fact that Black Africans did not express the same sentiments regarding Black Americans.

Goku also said that he "hung out" with more of the African students. He suggested that the reason that he interacted with more Africans than African Americans was mainly the result of the demographics of his courses:

> In Eastern College, it did seem kind of like I [hung] out with more of the African students. Because it was really more African students. I didn't really see a lot of African American students. You could tell that they were like – their parents or they were from a different country. They still had strong – like American accents. Like they didn't sound like they were from a different country, but you could tell that their parents were. So I feel like they congregated around me, sort of. Like I didn't go out in search of friends, but it kind of just organically happened that way.

Similar to non-native students, Goku did not intentionally search for non-native friends. It was a more of an "organic" process for him, as it was for Maria, Titan, and Oussou.

Non-native students recalled having peer groups at EC that were largely comprised of African students. In most cases, they associated more often with these other students than with Blacks who were raised in the U.S. Native students also noted the comparatively large numbers of African-born students, and reported that they, too, regularly interacted with them. Whereas non-native students were not compelled to form diverse groups, the opposite seemed to hold true for their native counterparts. The relatively high volume of non-native Blacks seemed to encourage Black Americans to develop more heterogeneous peer networks.

C. K-12 educational experiences.

One unexpected finding that emerged was that native and non-native students had very distinct experiences in primary and secondary school. This section explores the multiple ways in which their early years of formal education differed through two principal themes, *Public versus Private Education* and *R*igor of Curriculum and Emphasis on Testing.

1. Public versus private education. Both Ben and Goku, who were born and raised in the U.S., attended public schools exclusively. They appeared to enroll in residentially zoned

schools close to their homes. Carter, as stated earlier, took correspondence courses through the eighth grade. From ninth through twelfth grade, he enrolled in the University of Nebraska (online) High School. By contrast, all non-native students attended private schools. Titan, for example, attended a British private school in The Gambia that was affiliated with the Cambridge Institute (Cambridge Institute, 2012). According to the Institute's website, it "is a private educational center specialized in language training, mainly English, Spanish, French and German." The other goal of the organization is to prepare students to take an international examination required to earn the International General Certificate of Secondary Education (IGCSE). Titan attended one of the increasing numbers of private secondary school in The Gambia that have designed curricula to align with IGCSE curriculum standards (U.S. Department of State, 2016). Titan added that his instructors in The Gambia were mandated to meet higher expectations than those required of public school teachers:

> In our case in private [school] more materials [are necessary] and teachers are required to attend and teach. They have a curriculum and they have to follow [it] and then at the end of the year they have to make sure that they've completed [the] curriculum. While in public schools some teachers might get away with not finishing the curriculum…they are more lenient than the private schools.

Titan also explained that class sizes could be smaller in private schools, particularly as students began to take electives in high school. As an example, he stated that his smallest class was his Calculus course, in which only three students (including him) were enrolled.

Oussou attended three different schools in Niger, all of which were private. Similar to Titan, he attended middle and high schools with an international emphasis. He described his primary and secondary school education as follows:

> When I was in elementary school I attended a national school. It was a private national school so I started from first grade to sixth grade…And then when I got to middle school I went to a Turkish school. There I spent four or five years and I did the entire middle school there and then the first year of high school at the Turkish school and then I transferred to [a] Korean school for the rest of my high school classes.

Like Titan, Oussou noticed that private schools that he attended differed from the region's public schools. From his recollection, public schools sometimes "didn't have…access to materials, and also sometimes the teachers [did not] come to class."

In the same way, Maria, who attended a Catholic school in Kenya until the fifth grade, observed that in parochial schools the classes "tend[ed] to be smaller. The teachers are maybe more…involved so they're better." She also attended Catholic schools in the U.S. when her family relocated, and reported that she was "encouraged" by teachers and guest speakers who would give inspirational speeches to students. Maria recalled fondly that students in her school were both "free to ask questions" and that the questions that were posed "were well received."

Carter was the only native student who did not receive his formal education through public schools in his local county. Unlike Ben and Goku, his mother homeschooled him using correspondence courses and online classes throughout grade school. By comparison, all three non-native students enrolled in private schools. In the next section, I describe how students in the study felt about the rigor of the curricula that these schools provided.

2. Rigor of curriculum and emphasis on testing. With regard to the rigor of their curricula, participants who grew up in the U.S. had mostly different experiences from their non-native counterparts. After enjoying math as a young child, Ben commented, "In middle school I shifted away from math probably because at that point I didn't have anything to supplement me."

He added, "My [middle school] teachers probably weren't the best." Retrospectively, Ben was also critical of the mathematics instruction that he received as he took more advanced classes in high school:

> I personally – this is just an opinion – feel like the math teaching right now isn't as great as it could be. Likely because of the whole standardization issue. Personally I feel like what they're doing is saying okay, kids, learn how to solve this problem. But you'll never learn why you had to solve the problem. And so of course everyone can just solve some precalculus problem, but when the teacher never tells you why and you still pass the standardized tests, you kind of don't really gain anything for it. So that was kind of the downfall of the [high school] mathematics professors I always had.

Compared to his mathematics teachers, however, he was pleased with the science education that he received. According to Ben:

> My [high school] chemistry professor was amazing. And my physics professor was all right. So I feel like the chemistry professor really helped me out and influenced me. That's probably why I ended up choosing chemical engineering in the end.

Similarly, Goku was relatively unimpressed with the rigor of mathematics instruction that he received. Commenting about his first high school he said, "I think the [math] teacher was…afraid of the students. He would try to project, but he was very soft spoken, and most of the time everyone in class wasn't listening anyways. So that wasn't very good preparation." Goku moved to a second high school during ninth grade, but still was unimpressed with some of the mathematics instruction. He said that he did not think that his mathematics classes were particularly challenging, and said "that's why [he] think[s] [he] wasn't in any upper level math

courses." Goku added that the classes provided "basic stuff that [he] needed," but reiterated that they were not "high level math courses."

Compared to Ben and Goku, Carter's primary and secondary school curricula were quite demanding. While enrolled in the correspondence courses at the school that he first attended, he explained that he "knew that memorizing a list of facts would get [him] nowhere." He added, "Having that sort of pushing in critical thinking early, pushed me to go further in high school and definitely helped me to do well in university courses as well." Carter also pointed out that his mother was a critical part of his early education. As an example, he said:

> In the writing process, she would usually apply her critical thinking standards to whatever essay [my siblings and I] were writing. So…there's this one book that we always had to write about …And she would say, 'What themes are you interested in illustrating?'

Overall, Carter found the correspondence courses (and his mother's facilitation of them) "highly rigorous." He seemed grateful that the courses prepared him for studies in high school and in college.

Interestingly though, Carter seemed to appreciate the correspondence courses mainly for enhancing his writing and critical reading skills. He learned to be a strong writer – including how to be "very neat in his handwriting" – as a result of the requirements set by both by the school and by his mother. However, his earlier courses did little to spur his curiosity about science and "how the world works." This seemed to change when he began taking classes through the University of Nebraska High School:

> It wasn't until I got to Physics that I finally got to some of the stuff that I hadn't covered yet. So I already knew Newton's laws, but I didn't know some of the ways to apply Newton's laws before...So designing your own rocket and saying, 'you know, here's an

> equation where this is changing here, and this is changing in this dimension, and then you also have a mass change here' - finally being given the tools and sort of the facts around that, the considerations around that to kind of say, 'Ah. I've always been fascinated by this, and now I finally have the tools to fully see that system play out.' And I was excited about that. I really enjoyed the Physics. And I went back to the Chemistry with a new found passion. And I was like, 'Hm. Okay. Before, I learned about acids and bases and all that kind of stuff. But now, I know that the reason why all these acids and bases work is because the periodic table has different electron configurations as you go across. And based on that, you can examine why this has this particular property, why this element has this property.'

Although Carter's interest in the sciences existed for many years, his educational experiences in the correspondence courses did not complement his enthusiasm for the sciences in any significant way. It was only through his online high school education that he began to see connections between the standard curriculum and his informal scientific inquiries. Overall, he found the University of Nebraska High School classes to be "challenging and stimulating, and it kind of pushed [him] forward."

Native students had a diverse set of experiences in school. Ben and Goku were disinterested in some classes but found others to be more appealing to them. They attributed some of their disinterest to the ways that teachers facilitated the classes. Perhaps because of the capital that his family acquired, Carter was able to have a very privileged education. By contrast, each non-native student had the resources to attend more selective schools. The schools that Titan and Maria attended prepared them to take national British exams. Oussou, on the other

hand, took courses that prepared him for national French exams. By attending these schools, their math and science experiences may have differed from those of Ben and Goku.

Titan commented that his classes were "really hard" in The Gambia. He remarked taking courses that "prepared [him] really [well] because [he] had more opportunities…and then [he] took international exams, which [he] passed real[ly] [well]." Whereas Ben and Goku did not feel very challenged or motivated by some of the classes that they took, Titan felt a sense of pressure to do well. This pressure even differed from the enthralled sense that Carter had once he began to see real-world connections in his courses. That is, while Carter was motivated by his own scientific inquiries, Titan was motivated by a compulsion to perform well in his examinations:

> Well, the final exam that I took in high school was through the British, Cambridge, and basically you had to study really hard, really to pass. And then I think you don't want to waste money if you fail, some parents would be like, 'You basically wasted money for no reason' and they'll always use you as a scapegoat in the family and then they're like, 'So basically you and such went to the same class. You guys have the same resources at home. How come he passed and you failed?' So that's something that's instilled in your mind.

Titan felt obliged to do well in his exams, and because the purpose of his curriculum was to help him pass the IGCSE, he worked hard to succeed in his courses. Perhaps because of the rigor of his high school courses, Titan later said that "mathematics…was not bad [at EC] because I…took the classes [in The Gambia]. I already took precalculus and had a little bit idea of Calculus I and Calculus II, so it wasn't bad."

Oussou also took classes in Niger that prepared him for national examinations. His school based their evaluations on the French testing system, which scores students on a 20-point

scale. The French educational system requires that students take and pass national exams at three points in their academic careers (D. Noubiap, personal communication, January 1, 2016). The first test occurs at the end of elementary school, the second test takes place prior to the beginning of ninth grade, while the final exam occurs at the end of twelfth grade before students graduate from high school. In order to move to the next level or to graduate from high school, students must pass each of these examinations. According to one source, a score ranging from 14 to 15.9 on the exam corresponds with high honors, while a 12 to 13.9 on the exam indicates that a student has passed the exam with general honors (Campus France, 2016). A score of 10 to 11.9 is a "passing" score.

At Oussou's Turkish school, his score of 17 out of 20 placed him at the top of his class. Afterwards he attended a "selective" Korean-sponsored school that he called "the best school in the country." He found the material at the Korean school to be very challenging. Oussou recalled, "The exams [were] hard" and the "programs [were] really intensive." Similar to Titan, Oussou's background in mathematics was so superior that he found his EC Calculus I to be a review of material that he already knew.

Maria, who attended grade schools both in Kenya and in the U.S., felt that in Kenya "the curriculum expects a lot." She contrasted the Kenyan educational structure to the American system by stating that, "I think the U.S. leans more towards, like kind of formulas versus concepts." Maria implied that Kenyan schools seem to prize more of a fundamental knowledge of information disseminated in class, while American schools tend to encourage a formulaic, memory-based approach to solving problems. She stated the following:

> [In Kenya] they expect that you master everything that you see and you can remember. Versus here [in the U.S.], I think it's, like, can you, like, not memorize, but can you just

> understand this concept, get tested at it, and then, you know, you're not going to need to apply it in your later courses, or it's integrated, but it's never really, you know, tested again.

As with Oussou and Titan, Maria's remarks also underscored the importance of international examinations in her home country. She noted that while a test like the SAT carries a great deal of weight in the U.S., she added that "even to pass high school [in Kenya] a student would need to take [and successfully complete] the country's required examination."

Whether native students attended public schools or private schools, they did not describe their experiences as did non-native participants. Native students described interactions in individual classes or with specific teachers. Non-native students, by comparison, spoke more globally about the rigor of the schools and connected the curricula to the importance of passing national exams. The differences in their reflections highlighted the ways in which Black Africans and Black Americans may have very distinct K-12 experiences.

D. Role models

Most students in the study mentioned someone from their personal or academic lives who influenced them en route to transferring to Tech College. However, during the interviews I realized that the person(s) who fulfilled this position varied. In the case of the all of the non-native students, one or more family members fulfilled this role. For the majority of native students, however, the people who served as examples were not family members, but rather contacts with whom they were acquainted as a result of either school or non-familial relationships. Participants' relationships with role models (i.e., whether they were family members or other types of contacts) did not appear to depend on families' income or educational levels.

Titan, a first generation college student, explained that both his uncle and cousin have technical backgrounds in telecommunications. He elaborated on their respective tenures in this field:

> I guess my uncle did… [telecommunications]…since I was a little child, so he liked it, and my cousin just started. [My cousin] just gave me advice and what to do, so I guess that just also shaped my mind on doing this.

Titan not only had telecommunications professionals in his family, but received first-hand information on how to prepare for a career in that industry.[18]

Maria also has a cousin who is an engineer and has a brother who "was really into computers" as a child. In her words, engineering/computer technology "looked hard" but she felt that she "would want to do that when [she] grew up." She also has a sister who had started her post-secondary studies at EC before transferring to four-year nursing program. In both Oussou's and Maria's narratives, not only was there a STEM professional in their extended family, but each had at least one relative who attended EC early in his/her collegiate career.

Oussou received support through his extended family in the U.S. when he moved here from Niger. Two cousins who lived in the U.S. encouraged him to attend EC; one of these two cousins is an engineer who also attended Tech College. Oussou said that this cousin, who also first attended EC himself, "did the paperwork" necessary for Oussou to register for community college classes. His comment implied that he was able to leverage role models who were part of his international family network. A relative in the U.S. served as a role model for Oussou when he moved from Niger to this country.

[18] Telecommunications is a sub-discipline of electrical engineering. Recall that Titan majored in electrical engineering in college.

Of the three native students, only Ben has a family member who has a STEM background. Although his father did not attain a college degree, Ben said that after living in the U.S. for some time his father began working with computers. Rather than attend formal schooling, his father, "got some books himself and then taught himself how to set up and run computer networks. And so then from there now he is…a network administrator…So now he has a white-collar job [and]…he's come very far." His father's interest in technology impacted Ben in a positive way. Ben said that because his father was trying to "better himself," Ben "ended up getting this book from him that just taught [him] how to write web-based programs in HTML." Ben received exposure not only to computer programming from his father, but also to the value of working hard in order to be successful.

Although Carter arguably had more social and cultural capital than any student in the study, he did not have any familial STEM role models. However, he recalled a "family friend" who worked for the National Aeronautics and Space Administration (NASA). Carter elaborated on the impact of this individual in great detail:

> He had been running an internship program for people who were at Eastern College already. And because we knew him, he was all like, 'Well technically you're still in high school, but why not tag along?' And I was like, 'Okay, that sounds great.'… [and] I was heavily interested in science…Most of what they did at [that NASA site involved] earth-facing satellites. So they're talking about weather, they're talking about heating and cooling, their instrumentation satellites focused on earth. So [when he heard about] my interest in meteorology, he was all like, 'Oh, okay. Well we have this transmitter that picks up satellite feeds directly. You should come and tag along.'

Although he originally went to NASA planning on becoming a meteorologist, he explained that the internship actually dissuaded him from pursuing that career path. Instead, he became enthralled with NASA's work in materials science, and is now a student in the materials science and engineering program at Tech College.

Goku did not mention having a relative or even a "friend" who was a STEM professional. However, he spoke highly of Dr. Paul Johnson, the physics professor about whom both he and Carter spoke favorably. Aside from teaching him the required course material, Goku commented that Dr. Johnson was an inspirational figure:

> I really remember at EC, my physics professor, Paul Johnson, because he's a Black person as well…he was a physics teacher… it was kind of a confidence booster. And at EC, we can have more personal relationships with the instructors, because there [are] less students, and with Paul, I took him for all three of my physics courses, so I got to spend a lot of time with him. So it was encouraging, because he would tell us about his experiences when he was growing up.

More than any other instructor – and indeed any other person in his life – Goku seemed most positively influenced by his interactions with Dr. Johnson.

Each of the interviewees had a role model who exposed him/her to STEM professions. However, non-native students differed from native students in two significant ways: 1) Non-native students' had relatives – in their immediate family and/or their extended family – who had science or math backgrounds; 2) At least one of the relatives that non-native students referred to not only a STEM professional, but specifically was an engineer. Notwithstanding, the relationships that native students leveraged with non-familial role models were likewise

advantageous. Ben, Goku, and Carter were each able to identify a person who guided them along their journey to pursuing engineering.

Conclusion

Participants who spent their childhood in the U.S. had markedly different views of their racial identities than those who grew up in African countries. These identities appeared to influence the peer networks to which students belonged. Native students tended to belong to more diverse social groups than their non-native counterparts. Respondents differed also in their K-12 academic backgrounds. Students who attended private schools in sub-Saharan Africa seemed more likely to talk about demanding curricula. On the other hand, participants who attended American schools were more drawn to courses that they found enjoyable. Finally, although each had a role model in the STEM fields, these mentors were familial in the case of Black Africans but mostly non-familial among Black Americans.

Table 3 below provides a visual representation of the major within-group differences that emerged during the findings. Rather than diminishing one subgroup and praising another, this table carefully communicates differences between the Black engineering transfer students in this study. In the areas of identity and peer networks, it demonstrates the degree to which Black Africans and Black Americans may view race and culture in different ways. The table also presents important differences in the K-12 schooling experiences of native and non-native Blacks. It furthermore challenges research that suggests that Black students tend to enroll in underperforming schools. Even in the case of Black Americans, who (besides Carter) did attend private schools, the table highlights the positive attributes of public schools that may produce future engineers. Finally, Table 4 reaffirms the importance of engaging STEM role models, both for students who have family relationships and for those that leverage other connections. Using

this as a tool, scholars may be better able to conceptualize the multiple pathways that culminate in the same successful outcome.

Theme	Non-Native Black Students	Native Black Students
Racial, ethnic, and cultural identity	African-based identity frequently connected to country of origin. Minimizes the significance or consequence of being perceived as a Black American/African American.	U.S.- contextualized view of race. View of being Black Americans is connected to historical context of race. Places more emphasis on the significance or consequence of being perceived as a Black American/African American.
Peer supports and social networks	Connections with more Black African students. Fewer relationships with Black American/African American students.	Peer support groups are diverse. Relationships fostered with students from different countries, ethnicities, etc.
K-12 educational experiences	Private school instruction frequently leading to exams sponsored by former colonizing authorities (i.e., England or France).	Generally public school instruction. Exposure to challenging and engaging STEM content is possible, but not necessarily guaranteed.
Role models	Familial examples of professionals in a STEM discipline.	Mostly non-familial connections leading to STEM exposure.

Table 3. Summary of Within-Group Differences Among Research Participants.

Chapter Six: Analysis

Overview

In this chapter, I revisit the findings from this very limited study, situate them alongside extant scholarship, and discuss their significance. I explore themes from Chapter Five, and how they converge with or diverge from available scholarly literature. Using information gleaned from the Literature Review, as well as education research with which I have more recently become familiar, I evaluate the data. I also draw inferences based on my own evaluations of the data, offering perspectives on the findings that are particularly salient for my analysis. After revisiting the results that emerged in response to the first research question, I use a similar approach to explore the data that Research Question #2 generated.

The last final section of this chapter revisits the conceptual framework that Chapter Three introduced. Drawing from the findings and analyses presented in this chapter, I also offer a revised framework. This newer visual representation accounts for the factors that this study determined to facilitate transfer to Tech College. It also recognizes the within-group differences between the non-native and native Black students that I interviewed. Although this study included a relatively small number of participants, this framework may better inform research on URM student pathways to college.

Section One – Research Question #1: What do Black undergraduates perceive as factors that facilitate community college student transfer to competitive engineering programs?

A. Community college institutional benefits and supports

Interviewees described a culture at EC that encouraged transfer. Their reflections echoed those of Dr. Roberts and Mr. Thomas, who referred to the school as a chiefly "transfer

institution" (S. Roberts & E. Thomas, personal communication, June 16, 2015). The campus supported students by offering a curriculum that challenged them, professors with whom they worked closely, and staff who provided valuable information. Participants in the study seemed supported, rather than deterred, in their goal of eventually transferring to a four-year institution. Advisors provided them information that they needed on to transfer, and several respondents particularly remarked about how informative Dr. Roberts was when they met with him. In fact, comments from participants about their experiences as EC were almost always positive. Findings suggest that EC has created a *structure for success,* which some community colleges promote through mentoring and other student support services (Palmer et al., 2013). This structure seemed to result in an ethos or culture that encouraged transfer.

This is an important finding when considering research on the constraints that some community colleges have placed on student progress. Early research by Clark (1960) described the "cooling out" practices that community colleges employed to redirect students' aspirations; Clark found that the two-year schools encouraged their enrollees to consider vocational programs instead of four-year colleges and universities. Brint and Karabel (1989) similarly argued that community colleges helped reproduce social class stratification. In a follow-up to this study, Brint (2003) noted that "the circumstances of community college have, in several respects, changed for the worse" (p. 16). Brint found that, among other maladies, student attrition rates continued to be dismal. In another publication, Labaree (1990) wrote that the original purpose of community colleges was to "block mobility" to bachelor's degree-granting institutions (p. 231). He found that these schools tended to create an anti-academic culture of "attenuated" student "upward mobility" (p. 230-231). To what extent this culture has evolved over the last fifty years is beyond the scope of this work. However, it seems clear – based on student narratives – that

EC seems to champion "upward mobility." EC appears to have created a culture in which students are both expected and encouraged to transfer. This study offers a counternarrative to the depiction of American two-year schools as largely inhibitors of progress.

1. In-class experiences. HBCUs often emphasize teaching over research (Hurtado et al., 2010); this emphasis, according to their research, can prove beneficial to Black STEM students. Scholars have seldom reported the same positive outcomes about Black engineering undergraduates in community colleges, but the experiences that participants had at EC coincided with those of HBCU students. For example, Ben explained that he learned "a lot of science just really, really well," and Carter was "excited about every challenging course that came though." One may also recall the chemistry professor that told Carter that the two of them were "going to go boldly into the unknown." Each of these narratives suggested that EC values excellence in pedagogy.

Ben and Carter also appreciated the smaller, more intimate environment at EC. Ben noted that EC instructors were "accessib[le]" and had smaller student-to-teacher ratios than he encountered at Tech College. Carter's quote from the previous paragraph referred to a course in which it was just "[him] and the professor." The appreciation that the two students had for the smaller class sizes reflected findings by Palmer et al. (2013), who determined that when students of color are enrolled in smaller STEM classes, they tend to perform at higher levels. Hagedorn and Purnamasari (2012) likewise discovered that larger student to faculty ratios can lead to academic challenges for URM students in STEM.

When I further analyzed the interview data, I noted that most of the praise for EC's curriculum and pedagogy came from native students. Of the non-natives, only Titan seemed to appreciate these elements of EC's courses, commenting that he had a physics teacher there who

was “really amazing.” Although I did not originally perceive within-group differences in how respondents reflected about their experiences, these findings suggested that native and non-native Black students may be served in different ways by EC. This coincided with Conway’s (2010) work, which determined that native students needed more mathematics assistance than those who were born outside of the country. On one hand, the Blacks educated in the U.S. expressed appreciation for the “challenging” STEM courses that schools like EC offer. Their non-native counterparts, particularly Titan and Oussou, appeared almost over-prepared for the mathematics that they encountered at EC. Those educated overseas, however, may have benefitted from other advantages that EC provided. One such advantage may have been access to professors who understood the nuanced differences between groups of Black students. Dr. Roberts, for example, noted the large number of Cameroonian and Ethiopian students that attended the college. During my interview with him, he also recounted how French-speaking African students mentored an African American student on campus. Instructors like Dr. Roberts may have used more culturally relevant pedagogies in this case, which Ladson-Billings (1995) suggests can create greater opportunities for student success.

Whether students were native or non-native, all appeared to benefit from a strong sense of self-efficacy as they took classes at EC. Bandura (1977) explained that self-efficacy has to do with a person’s confidence that s/he is able to achieve a given outcome. In academic contexts, Zajacova, Lynch, and Espenshade (2005) found a strong association with higher levels of self-efficacy and stronger academic performance. Barrios (1997) specifically studied community colleges and found that students who received training on self-efficacy were more likely to perform well in their classes.

Students appeared to express a sense of self-efficacy in different ways. A number of students talked about "confidence" that they gained as a result of taking EC classes. Others suggested that their prior mathematics background gave them a strong foundation to do well in community college. For example, Goku admitted that "for [his] high school grades, [he] didn't feel confident." However, when he found that he "could complete coursework and get good grades in the classes…that helped [him] transfer." Ben pointed out that he "was actually quite confident" in his ability to do well in his chemistry classes at EC, particularly because he had already performed well in earlier computer science courses. Carter added that:

> I would say the first semesters that I was at EC were very crucial to building… confidence. Before I came to EC, I didn't have a sense of confidence about that sort of stuff that was backed up by what I would term internal evidence.

Carter seemed to appreciate the EC classes because they validated ideas that he already had about science concepts. Because he was exposed to opportunities like visits to the museum, Carter may have been looking for answers to specific questions that he developed as a child. EC's ability to answer to some of these questions underscores the quality education that it may offer to precocious students like Carter.

Oussou's and Titan's knowledge base in mathematics seemed to provide them with an assurance that they could be successful. Oussou said that as a result of his training in Niger, he "did pretty well in the [calculus classes]" at EC; eventually he even became a mathematics tutor on campus. Titan reflected on his experiences in The Gambia in which he was "the only guy in the [math] course that he took." His performance at EC in mathematics – in which he also excelled – was connected to the confidence that he brought with him from his secondary school classes.

By suggesting that the native and non-native Blacks in this study attended community colleges for different reasons, I do not wish to imply that U.S.-educated Blacks are inferior to their counterparts from African countries. Data that I presented in Chapter Five, in fact, demonstrated that both Ben and Goku had an early affinity for mathematics; even Carter stated that in high school he earned "straight As" in math courses. However, it is noteworthy that Oussou and Titan in particular seem to confirm Conway's (2010) findings about international students' strong mathematics backgrounds. Educational experiences in their home countries seemed to translate into exceptional mathematics performance at EC. Their narratives challenge existing positions that suggest URM community college students often have weaker mathematics backgrounds and do not perform well in two-year schools (Dowd, 2012) .

In STEM education research on two- and four-year schools, education researchers have treated URM and low-income students as a monolithic group (Dowd, 2012; Malcom, 2010). After suggesting that URMs as a whole are economically challenged, they extend this correlation by suggesting that URMs often have weaker mathematics preparation in secondary school. Furthermore, they contend that low-income, URM students with weaker math preparation often have a less impressive performance when they encounter mathematics in college. The students in this work offer a counterpoint to these existing findings. First of all, among the six students, only Goku alluded to having personal financial challenges. The majority of the participants took advantage of various forms of capital, such as the opportunity to attend private schools and early exposure to scientific inquiry. Finally, all of the students reported that they performed well in mathematics in secondary school, even if they had to overcome some obstacles before they began to excel.

2. Mentoring and advising. Students benefitted from the fact that the staff and faculty at EC were willing to provide academic and career-related guidance. The research program that Ben participated in allowed him to work directly with professors on campus. His experience confirmed prior findings that URM students who engage in on-campus research with STEM faculty are more likely to persist in science or math-based majors (Figueroa et al., 2013; Griffin et al., 2010; Hurtado et al., 2010; Palmer et al., 2013). Goku had an advisor apply to a scholarship "on his behalf," which underscored the importance of supportive advising staff for students of color in STEM majors (Figueroa et al., 2013; Griffin et al., 2010; Maton & Hrabowski, 2004; Museus et al., 2011; Palmer & DuBord, 2013).

Goku had a number of other positive interactions with faculty and staff and EC that reflected themes that other scholars have observed. For instance, he spoke about the physics instructor who advised him to consider engineering instead of physics. This finding was intriguing because my expectation was that EC advisors' roles would be more limited. I mainly expected them to focus on obligations like informing students of required courses. Goku's experience indicated that advising at a community college may have a broader definition than what practitioners and/or scholars may expect.

Instructors like this physics professor, as well as others such as Dr. Johnson and Dr. Roberts, reinforced the importance of less formal advising relationships. These faculty mentors did not meet with participants on a regular basis while they were at EC, but their impact seemed to be nonetheless very strong. Prior research has explored the idea of these less formal relationships and has similarly found their effect on students of color to be significant (Figueroa et al., 2013; Griffin, Perez II, Holmes & Mayo, 2010; Hurtado, Newman, Tran & Chang, 2010; Palmer, Maramba, & Gasman, 2013). Dr. Johnson's interaction with Goku, which he described

as a "confidence booster," emphasized the role that faculty of color in particular can play in the lives of URM STEM students (Griffin et al., 2010; Griffith, 2010; Hurtado et al., 2010). The co-existence of Black instructors like Dr. Johnson and White instructors such as Dr. Roberts suggested that regardless of their racial/ethnic group, supportive faculty are important for success in STEM. However, Goku, who does not have a relationship with his father, found personal inspiration in Dr. Johnson's life story. The connection that he made with Dr. Johnson implies that professors of color may be in a unique position to mentor URM students. Whether faculty of color can provide more extensive support that their White/Asian counterparts is uncertain, and is a question that the Literature Review for this study poses as well. However, this research suggests that a diverse group of instructors can be impactful.

The results also reinforce findings that advisors and mentors can play an important role in creating a welcoming culture on college campuses (Museus et al., 2011; Palmer & DuBord, 2013). They also highlight the contrast between the more strained environments on four-year college campuses and the friendlier cultures at many two-year schools. Although the purpose of this study was not to contrast two and four-year schools, Ben alluded to the strain at Tech College and compared it to his experience at EC. He remarked that the "involvement of teachers [was] vastly different" at each school, and that EC provided a more caring environment. Ben's narrative coincided with Hagedorn and Purnamasari's (2012) work, in which they found two-year schools to be more inclusive and supportive of students.

I was able to make reasonably facile connections between the data that I collected and relevant scholarship on the topic. Ultimately, the findings supported scholars' findings that positive interactions with faculty and staff can help to facilitate transfer (Dowd, 2012; Hagedorn

et al., 2010). The data also suggest that the positive faculty-student interchanges at EC coincide with other encouraging findings about community colleges.

Finally, I noted that the interview data did not allude to any support that Tech College offered the participants. Respondents spoke almost exclusively of faculty and staff at the Eastern College, rather than at the four-year school. This finding suggests that students in the study may have felt a strong sense of connectedness to EC. Professors and advisors like Dr. Roberts and Mr. Thomas may have made all of the information available to students that they needed to know in order to transfer. This may have made it unnecessary for interviewees to seek out information on their own Tech College or any other outside resources. While faculty and staff at EC were well-informed, this does not imply that Tech College did not play important roles. For example, EC may have worked with Tech to develop articulation agreements or review EC courses to verify transferability. However, this research focused on students' perceptions of factors that enabled transfer. As such, collaborative efforts between the two schools and other support that Tech offered may have been less visible to the respondents.

B. Peer supports and social networks.

The findings of the study demonstrated that each of the six interviewees benefitted from being a part of peer groups at EC. These groups appeared to support the interviewees as they prepared to transfer. In this section, I unpack the demographic composition of the participants' peer networks, as well as the structures by which these networks existed (e.g., informal vs. formal structures).

Maria's narrative included a recounting of the peers that she not only studied with, but also with whom she developed closer relationships. She explained that she "hung out" with these colleagues, suggesting that these social networks were somewhat informal. Titan, Oussou,

and Carter similarly built camaraderie with students in their classes. Their narratives echoed Figueroa et al.'s (2013) findings that URMs in STEM benefit from positive, less structured relationships with other students. Their ability to form interdependent connections with classmates in their courses also echoed Treisman's (1992) results on his study of Calculus students. In Treisman's research, Chinese students who formed support groups and spent extensive time together outperformed Black students in the same class; Treisman found that Black students tended to work alone. Unlike Treisman, however, this work moves away from the scholarly tradition of portraying Blacks who underperform relative to their Asian counterparts. Instead, the results demonstrate that URMs, too, can progress in rigorous STEM courses by developing peer networks.

While informal peer groups helped other respondents, Ben's account of his EC experiences confirmed the value of more structured student organizations. One of the three native students, he was the most engaged in formal groups of all the students interviewed for the study. He joined the Student Senate and the Engineering Club, was involved in an undergraduate research program, and also participated in an entrepreneurship organization. Ben's narrative mirrored Hurtado et al.'s (2010) findings that joining associations on campus can be beneficial to URM students in STEM majors. Similar to other students in the study, Ben said that he remained in contact with students that he met through some of his associations even after transferring; for instance, he remarked that the entrepreneurship program support extended to Tech College. In the same way, Rios-Aguilar and Deil-Amen's (2012) research examined the ability of social networks of Hispanic students to continue beyond college and into more professional arenas. Respondents' comments in this study reveal that Black peer groups can also demonstrate this long-term connectedness.

The results of the study highlight the importance of Black engineering peer groups in two-year college settings. However, most of the literature on this subject looks at URMs enrolled in four-year schools. By contrast, these findings highlight the significance of peer networks on community college campuses. In addition, while research on other racial/ethnic peer groups is valuable, these results suggest that scholars should closely consider the effectiveness of Black peer networks.

C. Post-racial lens

The notion of a "post-racial" student perspective that minimizes racial prejudice seems to run counter to well-established ideas. Recent scholars have bemoaned, for instance, the idea of a "color-blind" approach to higher education. They contend that such an approach disregards subtle vestiges of racism in colleges and universities (see, for example, Harper, Patton, & Wooden, 2009 and Smith, Allen, & Danley, 2007). In a broader way, the post-racial perspective may also appear to challenge Critical Race Theory (CRT), which has long maintained that White racist power structures subjugate people of color (Delgado & Stefancic, 1993; Dixson & Rousseau, 2005; Ladson-Billings & Tate IV, 1995).

To the contrary, the post-racial lens, as I have described it, does not intentionally give short shrift to CRT. It does, however, contextualize race amid a host of other factors that impact community college engineering students. Rather than solely emphasize prejudicial treatment or students' responses to inequities in STEM, the post-racial lens opines that other factors complicate the exclusivity of a race-based focus. As Younger (2009) found, "transfer [from community college] trumps race" (p. 97). For students like Titan, who only "laugh[ed] about" societal biases, it was not that racism was nonexistent, but that he did not perceive it as limiting his academic pursuits at EC.

Interviewees' decisions to not fully engage in the African Students Association (ASA) or the National Society of Black Engineers underscored the idea of these students' post-racial perspectives. The importance of being successful in engineering and the need to transfer "trumped" the need – in the students' opinions – to become active in these associations. However, when analyzing students' reflections, I observed key differences in the degree to which they wanted to be involved in these affinity groups. Oussou, who moved from Niger to the U.S. as an adult, felt that membership in ASA was a "waste of time." Alternatively, Maria, the student who came to the U.S. from Kenya as a child, attended several ASA meetings. Unlike Oussou, she thought that ASA was a "reminder…of [her] African culture." Her remark, juxtaposed with her identity as 1.5 generation participant, confirmed Awokoya's (2012) assertion that 1.5 generation students often struggle with retaining a cultural identity. The ASA may have reaffirmed Maria's cultural heritage while she prepared to transfer.

Although race and culture are not terms that I use interchangeably in this study, it may be more appropriate in some instances to use the term "post-cultural" instead of "post-racial." Just as native students did not focus extensively on their racial identities, students educated in Africa were not very prone to talk their cultural or ethnic backgrounds. All students, regardless of the country in which they resided in their formative years, saw neither race nor culture as particularly critical in their ability to transfer to Tech College. They did not seem to believe that their race or culture played a major role – either as a factor that enabled them or deterred them – in their ability to transfer to Tech College.

D. Individual factors for success

In this section, I revisit themes that highlighted the ways in which participants were intrinsically motivated and prepared for transfer to Tech College. The results suggested that

these factors worked in tandem with the support that they received from external agents, including faculty/staff, peers, and family members. Here, I analyze the subthemes through scholarly literature.

1. Self determination. Students in the study tended to articulate perspectives that converged with Deci et al.'s (1991) definition of self-determination theory, which I presented first in Chapter Three. Their narratives also suggest that self-determination may manifest and function in different ways along a student's academic trajectory, depending on the circumstances that s/he may encounter. The fact, for instance, that Carter's parents allowed him to explore different interests supported one of Deci et al.'s claims; his narrative reflected the authors' position that freedom of choice leads to improved educational outcomes. However, Carter's argument that "enthusiasm is not enough," implied that self-determination must work in conjunction with other student performance factors. His sentiment echoed findings from Figueroa et al.'s (2013) research, which found that URM STEM students must be motivated to seek additional support when necessary.

In general, responses that I classified as related to self-determination fit within Deci et al.'s (1991) conceptualization of this term. Students in the study were interested in STEM in general and in engineering in particular, and these interests grew out of their own motivations. External agents like supportive teachers or peer networks most likely supplemented these interests, but they could not act as a substitute for them.

2. Mathematics versus science interests. Most respondents in the study indicated that they were interested more in mathematics than science, with two exceptions. Although Ben said that when he was a child he had a book on "basic concepts in mathematics and geometry," he became more impassioned about chemistry in high school. Carter seemed to appreciate science

in order to understand the "world around him." These findings coincide with Eshach and Fried's (2005) research on the value of teaching science at an early age. Their work supports the idea of an early science education (grades K-2) for multiple reasons, including the notion that young children are naturally inquisitive about nature. Eshach and Fried (2005) also posited that "early exposure to scientific phenomena leads to better understanding of scientific concepts studied later in a formal way" (p. 315).

However, Carter and Ben's narratives diverged somewhat from the pathways to science that Eshach and Fried (2005) recommend. While Carter had a curiosity about "how the world works," his experiences with science outside – rather than inside – of the classroom piqued his interest as a young child, As an example, he commented that his "first early experiences with…science were in the footsteps of an enrichment program that [his] sister was participating in with some science club." He explained that he "didn't feel excited in an educational context…until later" in high school. Similarly, Ben's interest in the sciences did not develop until he took a course with an "amazing" high school chemistry teacher. In sum, Carter and Ben's fascination with science did not originate with early classroom exposure. Instead, it was not until their secondary high school years that they began to enjoy the science education that they received. This does not suggest that championing an engaging science education in elementary school is ill-advised. However, it may imply that modern science education is disconnected from the ideals that Eshach and Fried advocate. In existing educational systems, students like Carter and Ben may not find scientific topics to be of interest until much later in grade school.

Analysis of recent K-12 education literature may offer some insight as to why most respondents indicated a preference for mathematics as opposed to science. The last ten to fifteen

years have seen an increased focus on standards-based curricula in the U.S.; these curricula often test students' mathematics and English proficiency levels (Echevarria, Short, & Powers, 2006). Simultaneously, the time devoted to science instruction has decreased (Blank, 2012). This may explain why Goku seemed to be especially conscious of how his aptitude and performance in mathematics progressed throughout his K-12 years. Even Maria, who did not move to the U.S. until she was in fifth grade, did not articulate having any concern with math until she moved to this country. Indeed, many students who are in college now attended grade school during the years in which standards-based programs, part of the No Child Left Behind guidelines, were mandated (Hamilton, Stecher, Marsh, McCombs, & Robyn, 2007). The urgency to meet proficiency standards may have created an unintended shift toward emphasizing mathematics, a high-stakes test subject, at the expense of a quality science education.

While the reasons that students like Goku and Maria preferred mathematics over science may be understandable, scholars have written little about the emphasis on specific K-12 STEM subjects in sub-Saharan African countries. One may deduce, however, from Titan and Oussou's statements that some countries may provide different "tracks" for students. Oussou's placement in the "math and physics" track as opposed to one focused on the life sciences, for instance, may explain why he was more interested in math. In addition, Titan's remark that "biology…was so bad" for him can clarify why he remarked more about Calculus than scientific disciplines. The research on students educated throughout Africa may benefit from explicating the reasons that some students choose mathematics over science.

While researchers continue to magnify the importance of improving access to a quality STEM education, they have placed more attention on some disciplines than others. K-12 education research readily promotes the "M" in STEM, for instance, but the "T" receives short

shrift (Cavanagh, 2008). In parallel fashion, education policymakers and resultantly, teachers and students, have enlarged their emphasis on the "M" as well. Although mathematics is important, this study questions the lack of focus on an early quality education that exposes students to science. Furthermore, this study illuminates the need for more research on the different STEM tracks that students may take in African countries. For instance, Pomerantz, Ng, and Wang (2008) review education research literature that compares American students to their East Asian counterparts; however, few – if any – studies have explored what American students can learn from high achievers raised in sub-Saharan Africa.

3. Competitiveness. The idea of competitiveness was a recurring theme in the study. More than one participant expressed that s/he felt compelled to be the best among his/her peers. Titan, Ben, and Goku all commented about how important it was to exceed their peers' achievement levels. Fathers in particular contributed to fostering a competitive spirit in Titan and Ben. Focusing more on the idea of "bragging," Titan said that his father wanted him to be "the first one in his family to attend" a particular school. In discussions with Ben, he remarked that his father wanted him to "get ahead of the other students" in his courses. Goku added that he wanted to "get the highest grades" in his classes. These participants seemed to have competitive tendencies both at EC and even while they were in grade school.

I was surprised that competitiveness emerged as a subtheme because of prior research on how Black students often learn. In her early work on children's learning styles, Hale-Benson (1986) posits that African American children benefit from being allowed to work in groups. In their research on classrooms in sub-Saharan Africa, Clegg and Afitska (2011) similarly note that teachers may foster "affective and social bonds between themselves…and within the class as a community" (p. 67). These scholars add that in these classrooms, pupils may be required to

"take initiatives, listen, respond, argue, and present and defend positions" (p. 67). Consistent with the literature, I did not expect that students in the study would have competed against each other; instead, I assumed that they would most likely have worked *with* each other both in school. This finding also seemed to run counter to evidence that these respondents took advantage of study groups at EC. They may have understood the need to work alongside other students, but also felt an inner drive to, as Goku said, "be better in academics."

It is possible, however, that competition may not have functioned alone in motivating these students to transfer. Educational research scholars have also written about stereotype threat, or the idea that minoritized populations can underperform when they become anxious about the possibility of fulfilling negative stereotypes (Steele & Aronson, 1995). Stereotype threat creates mental and emotional stressors that can prevent URMs from performing well in school. Interview data revealed that Goku may have been concerned about how others would perceive him or other Black classmates. However, Goku used the threat of being essentialized to make him want to "rise" to the "level" of other students.

Although stereotype threat in and of itself may be a deterrent to underrepresented students, it did not appear to factor into the respondents' achievement levels at EC. The results of this study further suggest that competition may have mitigated the chance for stereotype threat. That is, although scholars may point to the potential for victims of stereotype threat to perform poorly, responses students like Goku offer a different narrative. By embracing competition amid an environment that may have perpetuated stereotype threat, he was able to use this potential to his advantage. Furthermore, it is possible that the large diverse population at EC minimizes negative stereotypes about Black students, thereby allowing for healthier competition among those who enroll. Research on how competition diminishes the effects of

stereotype threat for URM STEM community college students may be beneficial in future research.

In closing, parents' educational levels may have also impact students' perceived need to compete. It is noteworthy that neither Maria, Oussou, nor Carter – who at least had one parent that earned a Bachelor's degree – made any reference to competition. Indeed, the three students who spoke the most about competition – Ben, Titan, and Goku – were all first-generation college students. Yet, first-generation participants' remarks suggest that competition served an additive – rather than subtractive – role for community college engineering students. This suggests that parents' educational levels may in fact play a modest role in influencing students' desires to be competitive.

E. Family support and influence

Scholars have explored the roles that family members play for URM STEM students (Griffin et al., 2010; Museus et al., 2010). The findings of this study likewise demonstrated a positive association between supportive family members and respondents' ability to advance academically. However, the large degree to which relatives in this study were engaged was unexpected.

1. High family expectations. Nearly every student in the study perceived that his/her family expected them to excel academically. Families did not encourage the participants to become engineers specifically, but rather seemed to want them to generally do well in all of their classes. While these relatives did not necessarily express these expectations overtly, respondents appeared to understand how important it was for them to succeed.

As previously noted, Ben is not only the child of immigrants, but also may be the first in his family to earn a four-year degree. According to Ben, his father wants him to "go so much

further than he ever could." Ben's remarks reinforce findings about immigrant parents' hopes for their children's educational careers; parents who have not been able to attend college themselves tend to transfer these hopes onto their children (Roubeni, De Haene, Keatley, Shah, & Rasmussen, 2015). Titan, like Ben, is also a first-generation college student, and talked about his father having "bragging rights" when he did well in school; he even called Titan from the Gambia periodically while he was in college to see how he was doing in his courses. Ben and Titan's fathers' may live somewhat vicariously through their sons, attributing their sons' successes to their own achievement as fathers. This reflects research by Flowers III (2015), which demonstrates that Black male engineering undergraduates may be motivated to succeed if they are the first in their families to earn a Bachelor's degree.

Scholars have often pointed to data that shows negative associations between first-generation college students and their retention rates. Fike and Fike (2008), for example, found that students were less likely to persist in community college if their parents had not earned a college degree. In this research, however, the level of engagement of parents adds a dimension frequently reserved for K-12 studies. Narratives of high family expectations here extend prior research on primary and secondary school parental engagement to students' post-secondary years. Epstein (2001), for example, offers multiple ways in which K-12 teachers and administrators are able to engage parents to promote shared achievement goals. Kim's (2009) study explores minority parent involvement in particular, and looks at obstacles that preclude parents from fully partnering with teachers. As with this work, Kim's research moves away from a deficit-laden view of parents to a perspective that positions families of color in an appropriate cultural context. Once again, Ben and Titan both remarked that their fathers strongly promoted education and resultantly, created an expectation that academic excellence was

required. Although they did not spend time with their sons in the classrooms, they provided exhortations to perform at high levels and – in Ben's case – even a supplemental mathematics book.

Both non-native as well as native students expressed that their families expected them to do very well in school. Although the study included only six participants, it offers a perspective that differs from that of some scholars. As one illustration, Kao and Tienda (1995) found that non-native prospective college students tended to have higher academic aspirations than their native counterparts. While Kao and Tienda (1995) did not necessarily look at the impact of family, data from this study suggests that strong family support can create a common baseline for all students. In other words, where family encouragement is strong, both for native and non-native students, aspirations may tend to be similar. This seemed true both of the four students who resided with their families – Ben, Carter, Maria, and Goku – as well as those who lived separate from them. Titan's remarks about his father's phone calls, as an example, implied that father continued to be active even after he moved to the U.S. Data from this study attempts to reframe families of community college students, who often appear as distractions in the literature; researchers note that URM students often lose focus when they have to provide financial and other means of support to their relatives (Fike & Fike, 2008; Harris & Harper, 2008; Kim, Sax, Lee, & Hagedorn, 2010). Family members in this work were, by contrast, able to offer a stable foundation upon which the participants were able to build their academic careers.

While the respondents' undergraduate goals mirrored each other, Oussou explained that his parents also wanted him to earn a graduate degree. Perhaps because this was what was expected of him, he said that he planned to go to graduate school after earning his Bachelor's

degree. Oussou's comment coincides with prior work that documents the large numbers of highly educated Black African immigrants in the U.S., many of whom hold advanced degrees (Migration Policy Institute, 2012; National Center for Education Statistics, 2010; Reed & Andrzejewski, 2010). These immigrants hold a higher percentage of advanced degrees than the overall U.S. population (American Immigration Council, 2012).

Oussou's post-baccalaureate aspiration also seems to reflect Fries-Britt, Mwangi, and Peralta's (2014a, 2014b) assertion that non-native Black students desire to succeed is often connected to their parents' goals for their lives. Furthermore, this remark demonstrates that family expectations may do more than motivate non-native Black students to transfer from community colleges into four-year schools. In reality, the goals that they set for these students may inspire students as they begin to make post-baccalaureate plans. Interestingly, Oussou's father has a Master's degree while his mother has only an undergraduate degree. Although it is unclear from his answers, behavioral science research suggests that his father (rather than his mother) may have influenced his academic plans. Pizzorno, Benozzo, Fina, Sabato, and Scopesi (2014) explored father-son dyads in the context of career aspirations. The authors found that sons may feel a "paternal mandate" to "replicate their fathers' occupational positions" (p. 428). Although their work focused more on vocationally-centered goals than academically-centered ones, they found the relationships between fathers and their sons to be more influential than between mothers and their sons.

The high expectations that families maintained for undergraduates in this study seemed to motivate them academically. Rather than overwhelm them, the hopes and aspirations that relatives had led to positive results. Students used the high standards to which their families held them as a catalyst for doing well in grade school and in community college. Although studies on

URM community college STEM students have mostly not explored the role of family expectations, data from this study implies that this may be an important factor to consider. Black community college students may be more prone to transfer to four year engineering schools when their families have established high expectations.

2. Exposure and forms of capital. Scholars that appropriate social justice frameworks have generally rejected theories of capital as hegemonic. As an example, Hinton (2015) contends that that the "proliferation of capital" in social science research has "accelerated" in recent decades (p. 300). She argues that in doing this, researchers have often framed communities of color in inferior and unflattering ways. According to Hinton, theories that employ financial capital inevitably have "winners and losers" (p. 302). Even "metaphorical capital" like social and cultural capital, according to Hinton, is inherently unjust. In response to these frameworks, scholars like Yosso (2005) have promoted the use of more egalitarian perspectives, such as community cultural wealth. Community cultural wealth acknowledges the ability of marginalized groups to collectively develop networks that lead to student success. Oussou's family demonstrated this ability through the ways in which family in Niger worked with relatives in the U.S. to help ensure his successful transition.

While arguments against financial and metaphorical capital hold true for low-income groups and some communities of color, most of the respondents' were still able to leverage these forms of capital. Their ability to access these resources suggested that communities of color and educationally disenfranchised populations are not a monolithic group. Carter, whose African American mother holds a doctoral degree, benefitted from the resources that she was able to provide him. Her ability to scrutinize local schools and expose him to more rigorous curricula suggests that she was able to employ her own cultural capital. Moreover, by drawing on her

knowledge base as a post-secondary educator, she placed Carter in an excellent academic position. Carter also was the one respondent who had participated in an internship, but it is noteworthy that his experience came as a result of a "family friend." Once again, Carter's family was able to leverage social capital in order to provide an impactful opportunity for him. His narrative challenges assumptions that URMs lack the capital to leverage resources mainly available to White families.

Through my own research, I learned that there is a high cost to enroll in the schools that Carter attended through twelfth grade. Currently, the annual cost to enroll in the school that offered his correspondence courses can range from approximately $15,000 to $20,000. In addition, the online University of Nebraska High School, in which he enrolled starting in ninth grade, offers classes at a rate of $200 to $400 per credit for out-of-state students (http://highschool.nebraska.edu/Admissions/Tuition-and-Fees.aspx). His parents' ability to enroll Carter in both of these schools suggests that they may have had a comparatively high level of financial capital in addition to their cultural capital. Thus, for this small study it may not be prudent to reject the use of traditional theories of capital to describe the educational experiences of URMs. Indeed, the resources that Carter's family accrued fit within established conventions, including Bourdieu's (1986) foundational work on social and cultural capital.

The non-native students in the study seemed to have parents who were able to leverage their own forms of capital in order to provide them with educational benefits. Maria and Titan both attended private schools throughout their childhoods. Oussou attended private high schools in The Gambia, and added that he had an opportunity to visit Turkey at one point. After completing his studies at a Turkish school, Oussou remarked that he was admitted to a Korean

school that he described as “the best school in the country.” Oussou, along with Maria, also benefitted from having private tutors.

The resources that these non-native students’ families were to obtain implied that they possessed at least a modest level of financial capital. Parents were able to assist students in two important ways: 1) Parents paid for students’ private education; 2) When necessary, parents supported students by paying for private tutors. These findings may imply that for an African student to be successful both in his/her home country and in the U.S., private schools and tutoring can be helpful. Data also highlight the rigor of curricula designed to help students pass rigorous British and French examinations; the math and science skills that are necessary to show proficiency on these tests may be transferable to American two and four-year schools.

Additionally, it is plausible that non-native students took advantage of even more resources, such as migrating cultural capital. This concept, introduced by Erel (2010), suggests that the skills that migrants bring from their countries of origin provide new “modes of validation” (p. 642). Erel opines that “migrants whose institutional cultural capital is transnationally validated can use it for professional and geographic mobility” (p. 648). This form of capital also seems to support Mwangi’s (2014) research on non-native Blacks. Her work looked at Blacks born in other countries who often attend top-tier schools like Harvard University; Mwangi determined that these students frequently attended private schools in their home countries and came from two-parent households. Migrating social capital may therefore help to explain how parents of non-natives provided their children with private educations that prepared them for future college success. It may also work in tandem with other financial capital to support students before, during, and after their transition to the U.S. For instance, migrating social capital and financial capital may help describe how students like Oussou are able to obtain

their F-1 visas and connect with family members who are already living in the U.S. Considering the financial costs associated with obtaining these visas and relocating, one may infer that these families possessed at least modest resources.

While Ben's and Goku's parents did not possess all of the various forms of capital that assisted the previous four students, there were other factors that played a significant role. The book that Ben's father provided helped him develop an early adeptness for mathematics. In addition, he provided Ben with the knowledge that "if you do a lot of math, you'll get a good job in STEM." Goku's mother was able to obtain resources that allowed him to have a more stable life once he moved into high school. Across the continuum of URM students, this suggests that it may not be necessary that families have substantial levels of social, cultural, financial, and other forms of capital. Instead, it may be that having just one or two of these components is critical to helping students transfer to engineering colleges and universities.

3. Support from a key family member. Each student in the study benefitted from the support that a key family member provided. Through an interrogation of some of the literature on parent-child relationships, I was able to better interpret the results that I presented for this subtheme in the prior chapter. I also relied on a broader synthesis of studies that explore relationships with non-parental extended family members. This synthesis allowed for a more meaningful understanding of the comments that Oussou, who was guided by other relatives in the U.S., provided during his interviews.

Titan frequently talked about his father, mentioning on more than one occasion that his father liked to "brag" about him. However, he also commented that his father called him from The Gambia just to see how he was performing in the U.S., and commented to the pressure that he felt as the eldest child. Rather than deter Titan from being successful, however, Titan seemed

to understand and accept the expectations that his father placed upon him. The results of this study align somewhat with Tan and Goldberg's (2009) study of parent-child dyads, which looked at the effectiveness of some father-child interactions around school performance. Tan and Goldberg (2009) added that mother-son relationships tend to be more effective predictors of academic success, but Titan's narrative did not support that position. Even when the father is not college educated himself, Flowers III (2015) suggests that parents like Titan's father can be great sources of encouragement.

Ben, who is also a first-generation college student, also seemed to be more influenced by his father than by his mother to be successful. The father-son dyad that he enjoys may again underscore Tan and Goldberg's findings about effective fathers who are heavily engaged with their sons' school performance. Like Titan, Ben benefitted from a healthy relationship with the parent with whom he shared a common gender identity. Furthermore, although he referred to his race as "Black/White," his father's racial identity may also have influenced his perspectives about race. As an example, he commented that the paltry number of Black chemical engineering students in his courses was "kind of ridiculous." Although Ben did not reveal how his father classified his own race, he stated that his father migrated from Trinidad and Tobago, a West Indian country that is part of the African diaspora. Bratter and Heard (2009) similarly suggest that biracial students may become more closely associated with the parent who plays a more active role in their academic endeavors. Ben's awareness of the underrepresentation of URMs may have to do with his close connection to his Black/West Indian father.

Carter's narrative, unlike Ben's and Titan's, did not reinforce the father-son dyad. Instead, Carter indicated that his mother was much more involved in his childhood education. The opportunities that his mother provided him supported Tan and Goldberg's (2009) work on

mother-son relationships and their ability to shape educational pathways; his mother was more engaged than his father regarding his education. However, he diverged from his mother's identity as an African American by asserting that he was more interested in "developing his own sense of identities." Carter was hesitant to discuss the challenges caused by historical racism and desired to be "more than just what [his] parents' heritage is." His ostensible disconnectedness to his mother's race offers another dimension to Bratter and Heard's (2009) findings. While the authors of that study suggest that biracial children may develop stronger bonds with the parent who is more involved – and adopt that parent's racial identity – this research offers a different perspective. Biracial students like Carter may be less willing to adopt that racial identity when the involved parent is of a different gender. In other words, if Bratter and Heard's findings hold true for this study, Carter may have been more willing to embrace a Black identity if his father was the more engaged parent.

Maria's assumed relationship with her mother emphasized the importance of the mother-daughter dyad in academic preparation. Her mother's willingness to find and pay for a tutor may have been pivotal to her decision to ultimately enroll in a STEM major. By allowing Maria more time to establish a strong mathematical foundation, her mother may have allowed her confidence in mathematics to increase. According to Casad, Hale, and Wachs (2015), mothers with lowered math anxiety are likely to have daughters who also have lowered math anxiety. Although Maria did not indicate that her mother was nervous about understanding mathematics herself, she suggested that her mother was concerned about her daughter's performance and was willing to "hold [Maria] back." Her mother's willingness to potentially "hold" her "back" and to eventually hire a tutor translated into positive outcomes for her daughter. Maria ultimately became much stronger in her mathematical performance as a result of her mother's intervention.

An extension of Rios-Aguilar and Deil-Amen's (2012) work on *funds of knowledge* may also inform this research. In their study, they examined they ways in which parents of Hispanic/Latino students influence educational outcomes. Building on well-established research like that of Moll, Amanti, Neff, and Gonzalez (1992), Rios-Aguilar and Deil-Amen determined that family involvement may manifest itself differently for URM students (compared to their White counterparts). The scholars posited that success in American classrooms is based on a White paradigm, in which parents are visible and work alongside both teachers and students. Similar the Hispanic/Latino parents in prior studies, the parents of many of these students did not appear to use White normative parenting practices. Nonetheless, their capacity to support the participants was clear despite the non-normative parental practices that they employed.

While Maria, Carter, Ben, and Titan had the privilege of having a parent who was greatly involved, Oussou spoke more about his cousins' support. These relatives helped him when he arrived in the U.S. and encouraged him to enroll in Eastern College. Oussou benefitted from the fact that these cousins had enrolled in EC themselves, and that one of his cousins is also an engineer. This finding suggests that family members who are already in a receiving country can help extended kin who arrive from other parts of the world. Mwangi's (2015) metasynthesis on international Black students likewise suggests that family and community members in the U.S. can provide "familial" support to newly arrived immigrants. According to Mwangi, this support can also translate into providing advice to new immigrants in their college choice decisions. Oussou's feedback highlighted the importance of extended kin in shaping a trajectory that leads to transfer.

Key family members varied in terms of their relationship to the students in this research and in terms of their own academic backgrounds. While some members provided advice that

they had learned through their own academic experiences, others promoted educational opportunities that they never received themselves. Some participants also shared more in common than other participants, such as a common gender or other identity. The degree to which one participant's relationship may have been stronger or more effective than another's is beyond the scope of this study. However, the feedback that they each provided supports prior research on the significance of having involved family members. This limited study suggests that family members are important to students who will eventually transfer to four-year engineering schools.

F. Role modeling and altruistic behavior

Each respondent stressed the importance of being a role model for younger siblings, or of general service to the broader community. For Titan and Ben, who were the eldest siblings in their respective families, the idea of being an example for younger brothers or sisters motivated them while they were enrolled in EC. Although Maria was not the eldest, she, too, felt that it was valuable to be a role model to younger children in the family. Carter, on the other hand, looked at the larger sphere of students in college. He believed that it was important to "get out of [his] own head" to provide assistance to his peers. Oussou and Goku were perhaps the most broad in the ways that they verbalized their altruistic behavior. Oussou wanted to eventually return to his home country of Niger and help improve its infrastructure. Goku felt that his success would help end negative stereotypes of black underperformance "in academics."

Scholars have well established that URM STEM students are highly motivated to provide service while enrolled in college. Other scholars have highlighted the importance of this component as a means of encouraging students of color to persist in these majors (Figueroa et al., 2013; Hurtado et al., 2010; Maton & Hrabowski, 2004). Stebleton (2007) notes that "African

immigrant students may be compelled to select social or altruistic occupations that allow them to contribute to their families and communities" (p. 296). Findings from this study complement this prior work by pointing to its relevance in community college environments. Whereas most publications focus on the importance of social relevance for students in four-year schools, this study explores a different context; it suggests that when engineering is connected to a broader, service-oriented purpose, community college students may be encouraged to persist in STEM classes.

Conclusion

The findings associated with the first research question largely converge with extant literature on URM STEM students. Data from this study that highlight the importance of supportive faculty/staff and peer groups, for instance, coincide with other qualitative research on students of color in STEM majors. The factors outlined in this part of the chapter extend these prior works to explore an under-researched population: Black engineering transfer students.

Although this analysis extends research that uses success-oriented frameworks, it acknowledges that Black students have heretofore not always been the subject of these works. As an example, this study looks at research on effective Chinese and Hispanic social networks and appropriates them to a population of Black studies. In referencing these other studies, I simultaneously acknowledge the dearth of research on strong Black peer networks.

In a global sense, this research underscores the need for more scholars to research trends that lead to success for Black students. Post-secondary education literature is rife with studies on substandard performance of Black and other URM students (Beasley & Fisher, 2012; Keels, 2013; Swain, 2006). In community college contexts, scholars have framed URM and low-income students as a nearly monolithic group. While these works have highlighted a dire need to

address achievement gaps and a lack of access to a quality education, they do not offer a balanced perspective. Contributions such as this study potentially deter consumers of scholarly literature from the erroneous assumption that most – if not all – Black/URM STEM students are underachieving relative to White/Asian students. It also repositions community college students, staff, and faculty in a more favorable way than often depicted.

Section Two – Research Question #2: What are the Within-Group Differences among Black Students who Transfer from Community Colleges to Competitive Engineering Schools?

While sources like the U.S. Census and post-secondary education literature frequently present Blacks as a monolithic group, the native and non-native students in this research differed in several ways. First, they fundamentally viewed themselves through different lenses. Native students were more prone to discuss their racial identity while non-natives seemed to be more cognizant of their cultural or national identities. Non-native students expressed these cultural distinctions through the peer groups with which they associated. In the first two sections that follow this introduction, I interrogate the extant literature as to how it has recognized these racial/cultural and peer group distinctions.

Another difference in the narratives that the students provided was that non-native students had very different educational experiences than those that most scholars have considered in their works. In the third portion of this chapter, I revisit the data that I provide in the Results chapter on K-12 experiences. This section attempts to illustrate these different experiences and situates them alongside a new but very important body of higher education literature. Finally, the last section of this analysis examines the differences in role models to which sub-groups of students had access. Once again, this section suggests areas of convergence with and divergence from the literature on role models.

A. Racial, ethnic, and cultural identity

Students differed in the ways in which they acknowledged their identities as people of color. The native students' responses to topics of racial identity were not always consistent. For example, while Ben, who said that he is "Mixed Race," said that race was not a major topic at home, he became more conscious of the underrepresentation of Blacks in his EC classes. Goku viewed his ethnicity as a combination of "African, Native American, and Caucasian ancestry." However, he felt that it was a very important to be a good "example" to "the rest of [his] race," particularly at EC. Carter alluded to being racially profiled when he talked about being an "attention-catcher" in different public settings. However, he explained that he hoped to develop an identity focused more on the engineering profession than on race.

These comments coincide with Renn's (2008) multiple identity framework, which posits that Black students may adopt different identities depending on the context in which they find themselves. Each of the native students seemed to accept society's definition of them as Black students, but were unwilling to accept this definition exclusively. For Ben and Goku, their "Blackness" may have been more salient at school than at home. However, Carter seemed less prone to consider his Black identity at school, but spoke more freely about his mother's involvement in the Civil Rights movement as an African American woman. These comments suggested that each student's need to identify as Black at EC may have been different. For Carter, it may be that he understood from his mother what being Black meant, particularly in a historical context; he may have preferred to view race in a limited historical context than to include making it part of his primary identity.

Non-native students spoke more about their cultural or ethnic identities as children raised in an African context. Compared to the native students, they almost never mentioned the subject

of race. Titan was dismissive of the one time in which he felt treated unfairly in the U.S. because he was Black, saying that he just "laugh[ed] about it." Oussou similarly seemed to be unconcerned about an EC teacher who he suggested treated him differently, and focused on the overall positive experiences that he had at the school. Maria added that "color…[does not] determine what you're able to do."

In addition to speaking about "color," however, Maria also spoke about being the "only Black *girl* in class" at EC. She made this statement in response to a question that I asked about the impact of *race* in her post-secondary career. By doing so, Maria introduced the concept of gender into her interview and therefore, her experiences as a woman of color. Her statement may reflect other scholars' work on the theme of intersectionality, which attempts to conceptualize gender in relationship to other identities, such as race and ethnicity (Shields, 2008).

Reed and Andrzejewski (2010) acknowledge "tensions" as "African immigrants struggle to be recognized as not just 'African American' or 'black'" (p. 1). In an article that addressed identity amongst Black students, Mwangi (2014) similarly asserted that non-native Blacks may view race as less crucial than their national or cultural identities. Maria, Titan, and Oussou's comments also echo Fries-Britt, Mwangi, and Peralta's (2014b) findings on undergraduates who pursue physics degrees. Non-native Black students that they interviewed saw their identities through a cultural lens that was connected to their home countries. Fries-Britt et al. posit that Black students from other countries may eventually adapt to a U.S. – racialized context. However, they add that their awareness of their de facto Black American identities may take a period of time to fully realize. This suggests that among Black Africans in this study, their identities may evolve in the years that follow their time at Eastern College.

As Renn (2008) posits, the environment in which students learn may also influence the degree and the pace at which they are able to adapt. In a setting like EC, which has a large Black international student population, the need to adjust to highly-racialized environment may be less urgent. Students like the non-natives in this study may have been insulated from some of the challenges that other Blacks in the U.S. face because they are, in effect, the majority Black population. A future study that queries non-native students about race after transferring to Tech College might provide different insights into how they view their Blackness. Furthermore, a longitudinal study that explores the evolution of racial identity – from post-secondary school to the engineering workforce – might also demonstrate the shifting significance of race.

This analysis affirms assertions in the literature, which include the idea that non-native Blacks may tend to retain their national identities after moving to the U.S. (Habecker, 2012). Native Blacks, as Renn (2008) argues, may emphasize the importance of being a Black American differently, depending on the environment. This study also suggests that interviewees' perceptions of themselves may have controlled for the degree to which they were willing to interact with students who had been raised in different environments. In the following section, I look at peer groups once more and examine the literature on Black student social engagement. This section draws distinctions between native and non-native students' peer networks, and offers findings from prior work that help to situate these distinctions.

B. Peer supports and social networks

While all students in the study participated in peer groups, the demographic composition of these groups varied. Native students tended to see engineering at EC as a "melting pot," where anyone was welcome. Non-natives, instead, engaged more with peers who also had

migrated to the U.S. In this section, I examine literature on these different socialization patterns, offering suggestions that might explain why these differences may have existed.

Native and non-native students together reflected a tension that the literature highlights. While some scholars describe the benefits to URM students who work with diverse peer groups (regardless of race/ethnicity), other researchers suggest that it is more advantageous for URMs to work with other students of color (Fries-Britt, Younger, & Hall, 2010). This study may offer insight as to why this tension exists. Because native students were the minority Black population in engineering, it may have been to their advantage to view the campus as a melting pot and be willing to engage with different peers. A more restrictive approach to working with their colleagues may have effectively limited the number of students with whom they could partner. Non-native students comprised a larger percentage of the engineering/STEM population at EC, and therefore did not have to consider the possibility of working with a diverse group of classmates.

Despite non-native students' tendency to study with other Black immigrants, they did not seem to be intentional about their choices of peer networks. That is, they did not appear to purposefully choose to not work with African American students. Their peer network at EC seemed to evolve naturally rather than out of a pre-arranged plan for social grouping. Interestingly, Fries-Britt et al. (2014b) found that non-native Black physics students sometimes preferred to work with native students. This may be because the racial and ethnic composition at their research site encouraged non-natives to engage more with native students. EC once again represents an interesting case study because of the large international student population at the school. Whereas Black Africans in other studies may have been a smaller percentage of the engineering or STEM population, in this case they represented the majority of students in these

disciplines. In addition, EC is located near one of the ten most populous American cities in regard to the number of African immigrants. In similar research sites, such as campuses in the New York or Philadelphia area, non-native Black students may also feel less pressure to engage with a diverse group of peers (Reed & Andrzejewski, 2010).

A small number of studies imply that efforts to foster positive peer relationships between native and non-native Blacks have been challenging. Fries-Britt et al. (2014) explain that some non-native students in their study experienced difficulty when attempting to integrate into American social settings. Awokoya (2012) similarly noted that African American students could be less accepting of Black immigrants. With these research efforts as a backdrop to this study, Carter, Goku, and Ben provide a counter-story to these prior works; they seemed more willing to interact and form positive relationships with non-native students at EC. Ben, for instance, felt that the various African cultures that he encountered at the school were "kind of cool."

Finally, because Black African students are the majority-Black population at EC, they took advantage of situations that other scholars have problematized. For example, Oussou and Titan both implied that they appreciated having classmates who were native French speakers. Oussou later added that a school like EC could assist students whose English skills may need improvement. This offers a different perspective than that of Hagedorn et al. (2010), who note that English language challenges can preclude community college students from being able to transfer. In a sense, the advantage that Oussou had of associating with other French-speakers at EC may have counteracted the potential negative implications of being less proficient in English.

Black American students' peer networks looked and – to some degree – functioned in different ways than the non-native students' networks. Ben, Goku, and Carter looked to peer networks at EC as a means to help them through their coursework. As Ben put it, "everybody

goes through the same struggle." Non-native students, however, found students with whom they could share a common history as immigrants. Although these groupings seemed to evolve naturally, this preceding analysis may help to explain how and why different groups of Black community college students develop peer networks.

C. K-12 educational experiences

The majority of this section examines differences in the academic training that participants received. However, prior to analyzing the native and non-native student experiences, I first suggest that this limited study offers a more overarching contribution to STEM education literature. Rather than reframe past narratives of Black student underachievement in science and math courses, this work provides evidence of schools that trained students to excel in these subjects. It also undergirds prior studies that emphasize the importance of pre-college preparation for URM STEM students (Dowd, 2012; Figueroa et al., 2013; Museus et al., 2011; Palmer & DuBord, 2013). Additionally, whereas K-12 STEM literature often focuses on public schooling, this research redirects attention to the role of private schools. To date, a small number of scholars have recognized the tendency for non-native Black students to have been educated in private schools in their home countries (see, for example, Mwangi, 2014). However, this study illustrates how private schools may specifically help to produce future Black engineers, particularly from sub-Saharan African countries.

In at least some instances, the native respondents indicated that their K-12 educational experiences were unfulfilling. After enjoying arithmetic as a child, Ben felt that his mathematics teacher in high school was "not that great." Goku also complained about his mathematics instructor in high school. He recalled that that the teacher might have been "afraid of the students" and that he did not receive "very good preparation" in that class. This feedback may

suggest at first that Ben and Goku received a sub-standard STEM education, especially in high school. This notion is consistent with Burrell, Fleming, Fredericks, and Moore's (2015) finding that, compared to West Indian or West/Central African students, African American students may be academically underprepared for college.

Despite these early high school experiences, however, Ben and Goku also had encounters that encouraged them along their academic journeys. Ben later said that his chemistry teacher was "amazing," and added that his physics teacher was "all right" as well. Goku moved to a different high school in the middle of ninth grade, and once he arrived there he "started doing really well in [his] math classes." These incidents suggest that even a few positive classroom experiences may diminish the impact of K-12 school events that might otherwise deter students from pursuing STEM careers.

Carter's trajectory from correspondence courses to the online high school curriculum, and eventually to community college, was unique among participants in the study. It offered insight into an online learning context that few – if any –STEM education scholars have explored. The degree to which schools like the ones that he attended may contribute to an engineering pipeline is unknown. However, it is important to note that Carter's mother – and not his schools alone – played a major role in developing his K-12 pathway. While taking these classes, Carter's mother "push[ed]" him and "emphasiz[ed] critical thinking." This suggests that the engineering education pipeline for URM students can include highly educated and engaged parents. Once again, rather than solely emphasize low-income, under-educated, and disengaged parents, this study offers a different perspective: Parents of URM students can take on numerous roles to supplement, or even replace, traditional K-12 classrooms. On the other hand, students whose

parents sent them to private schools in Africa had different reflections about their academic preparation.

Maria, Titan, and Oussou differed from the native students in that they all attended private schools. In Niger, where Oussou was raised, attending private schools is fairly common. Approximately 30% of primary school students attend a private school in Niger, compared with just 7-8% in the U.S (The World Bank, 2016). The percentage of students who attend private schools is less than 5% in The Gambia, where Titan lived as a child. Kenya, where Maria was born, does not report these numbers.

Maria had the opportunity in the U.S. to attend an all-girls Catholic school. As a high school student, she benefitted from having teachers who "said you could do anything you wanted to do." Her experiences in high school were consistent with other studies that emphasize the importance of exposing girls to STEM careers, removing gender stereotypes, and promoting girls' self esteem in these disciplines (Burke, 2007; Tan, Calabrese Barton, Kang, & O'Neil, 2013). Whether in secondary school or in college, all girl/women academic spaces encourage young women to pursue traditionally male-dominated fields, including those within the STEM professions (Rosenthal, London, Levy, & Lobel, 2011; Weinberg, 2007). Research shows that young women in these programs often report a higher sense of belonging as they pursue these majors (Rosenthal, London, Levy, & Lobel, 2011). Whereas most of these studies omit the intersection of race in their scope, Maria's narrative adds to the knowledge base of how to develop future *Black* female engineers.

Additionally, Oussou and Titan took courses that they described as being very challenging. Their comments suggested that their schools prepared them well for the math that they encountered at EC. Oussou and Titan's narratives challenge the idea that URM students are

less prepared for the rigors of STEM in college and that they attend less rigorous high schools (Figueroa et al., 2013; Palmer, Maramba & Gasman, 2013). These results echo Fries-Britt et al.'s (2014) findings about non-native students who are exempt from some advanced mathematics and physics classes when they arrive in the U.S. Oussou and Titan's K-12 experiences provide more insight into STEM education in Africa; they suggest that schools in sub-Saharan Africa with a strong math and science emphasis may be able to produce future engineers. Furthermore, they illuminate a missing element of community college research: Scholars have mostly not yet considered how prepared two-year schools are for the enrollment of highly educated Black immigrants. Practitioners, too, may be underprepared to support this group of students.

Finally, in an era in which scholars have criticized high-stakes testing for marginalizing students of color, Oussou and Titan's experiences offer a different perspective (Heilig, Vasquez, Darling-Hammond, 2008; McNeil, 2005; Walpole, McDonough, Bauer, Gibson, Kanyi, & Toliver, 2005). They were each enrolled in selective schools that required students to pass a series of tests, but also placed onus on teachers to be present and engaged. For reasons that are not yet known, they were able to succeed in high school, passing British and French exams that were most likely quite difficult. It may not necessarily be that high-stakes testing is inherently unjust, but that its implementation is problematic in hegemonic societies like the U.S.; in schools and communities of color that are often under-resourced, these scholars often portray students as victims. Oussou and Titan's narratives suggest, however, that in different contexts students of color can succeed at high levels on national exams. Their narratives further imply that the preparation that they receive for these exams may lead to future success in STEM disciplines.

D. Role models

Both native and non-native students benefitted from having role models who inspired them academically. For native students the role models were mostly non-family members. Among the non-native participants, however, there was an immediate or extended family member who filled this role. In Titan and Maria's narratives, there were at least two relatives who had a STEM background.

Scholars have given relatively short shrift to the notion of STEM role models for URMs. By comparison, the need to provide inspirational figures to young women – as opposed to URMs – appears with much greater frequency (Blickenstaff, 2005; Dowd, 2012; Stout, Dasgupta, Hunsinger & McManus, 2011). Whereas researchers discuss the value of introducing URMs to scientists and engineers, the idea is framed as more of a goal for the future. There has been little evidence that these connections are occurring at the present time. Such approaches devalue the crucial strides that many engineers and scientists of color have already taken.

While this study included a small sample of students, they each had access to other Black STEM professionals. Goku, for instance, enjoyed the experience of being able to talk to Dr. Johnson, who was a Black physics professor at EC. His relationship with Dr. Johnson supports prior work that professors can often "connect with students of color in deep and meaningful ways" (Griffin et al., 2010, p. 06). Moreover, Goku's connection with him implies that a professor may serve more than one purpose, depending on the student with whom s/he works. Goku appreciated the fact that he "cared" about him and acted as a "mentor."

Carter found support through a "family friend" who helped him obtain his NASA internship. This "friend" was not an engineer himself, but was able to help Carter learn about materials science. While other students did not have internships, Carter's familial social capital

enabled him to have an impactful experience learning about a new career. His narrative demonstrates the ways in which social capital can empower students who may not have traditional role models in their own families; while Carter did not have any scientists or engineers who acted as role models, family resources allowed him to meet STEM professionals.

` Ben's comments implied that his father, who is an information technology professional, helped foster an interest in math and computer programming. Despite his father's non-traditional pathway that included other careers earlier in life, Ben internalized the importance of computer programming and initially chose to major in it at EC. Rather than further concretize the impression that Black, first-generation college typically receive less career exposure, Ben's feedback rejects this dominant discourse. Instead, it demonstrates that Blacks can benefit from mentors who can provide them with an awareness of STEM opportunities early on in life. Furthermore, Ben's father's own narrative as an immigrant who grew up "very, very poor" acted as an additional catalyst for Ben to "get a job in STEM." Literature should consider the idea of a parent-role model duality, in which a mother or father is also the means by which a child learns about a career in STEM.

The non-native students in the study expressed that they have relatives who have a science and/or mathematics-based background. Maria spoke of her sister who studied nursing at EC, while Titan and Oussou said that they have cousins and/or uncles who have technical backgrounds. Their narratives demonstrate that inspirational STEM figures may be part of more immigrant families than scholars have noted. Considering the impressive numbers of highly educated African immigrants in the U.S. – many of whom study careers in the sciences – this is not especially surprising (Capps, McCabe, & Fix, 2012; Reed & Andrzejewski, 2010).

However, this finding reinforces the need for scholars to recognize the remarkable intellectual capacities of this under-researched population.

In conclusion, native and non-native students alike referred to role models that promoted STEM in general and, in some cases, engineering in particular. Carter and Goku did not have established STEM professionals in their families, but they leveraged the resources that they had available to them to engage other role models. Ben provided a unique example of a non-traditional STEM professional (i.e., his father) who did not have the same educational experiences from which he benefitted. Despite his lack of a formal education, the example that his father provided to Ben seemed to be very influential. The mentoring that his father provided further emphasizes a broader definition of *role model* as "a person you respect, follow look up to, or want to be like" (Bricheno & Thornton, 2007, p. 4). Besides college-educated STEM professionals, future Black engineers may have a more diverse set of role models from which they draw inspiration.

Non-native students could each refer to at least one person in their families with a science or engineering background. They were able to name at least one STEM professional in their families to whom they looked for advice as they began their engineering studies. Rather than contradict the examples that native students provided, their descriptions once again enhance what scholars may understand about role models.

Conclusion

A portrait of the differences between Black African and Black American students emerged in this limited study. Rather than encourage a perspective that lauds the success of one subgroup at the expense of another, it seeks to expand the base of knowledge pertaining to both native and non-native students. The analysis draws from research on high-performing URMs in

an attempt to elevate success-oriented scholarship on Black students. Simultaneously, it offers several critiques of studies that primarily portray both U.S.-born and immigrant Blacks in unfavorable ways.

While much of the analysis draws from research on Black students, it also seeks to contribute to evolving discussions around more diverse student populations. For instance, it complements Ryu's (2010) research in which she examined college-going patterns of Hispanic subgroups of students. In her work, she looked at specific populations of students, including students of Mexican, Colombian, and Cuban decent. It also builds upon dissertation studies that have explored the predilection many non-native Black students have for STEM degrees (Gebre, 2007; Hailu, 2012; Kagume, 2010). Moreover, given the rapid increase in the number of Black African immigrants, this study provides deeper insight into an under-researched subgroup: Black African community college engineering students. At the same time, it acknowledges the increase in biracial or multiracial students, who some scholars have homogenized with other Blacks (Jackson & Samuels, 2011). By disaggregating these oft-essentialized populations, this study may further explicate the unique attributes of Black subgroups.

Section Three – Conceptual Framework

Overview

In Chapter Three, I presented an initial conceptual framework for this study. This framework guided the way in which I developed questionnaires and interview questions during the data collection phase. The success-oriented perspective assisted me in the development of a visual representation, which appears again as Figure 2 below (Fries-Britt et al., 2010, Maton & Hrabowski, 2004). Using this perspective assisted me with identifying components that lead to

transfer and other academic successes. It also served as a safeguard from more deficit-laden points of view that negatively frame URMs.

Cabrera et al.'s (2005) research that defines multiple pathways to degree completion was critical to this study as well. After reviewing the pathways through the framework that Cabrera et al. (2005) these scholars present, I was better able to visually illustrate the transition from K-12 schools, to community colleges, and ultimately to four-year engineering colleges/universities. Using some of the components that Cabrera et al. identified in their model, I explored how factors like family support and peer engagement might facilitate transfer. Furthermore, this work served as a foundation on which to build as I looked at different pathways that both native and non-natives students might take. Rather than essentialize students, Cabrera et al.'s framework allowed for a more nuanced representation of diverse student populations.

Finally, the conceptual framework for this research relied on several perspectives or theories in order to respond to the second research question. The cultural-historical perspective helped frame the lens through which I viewed students' ethnic differences (Guitierrez & Rogoff, 2003).

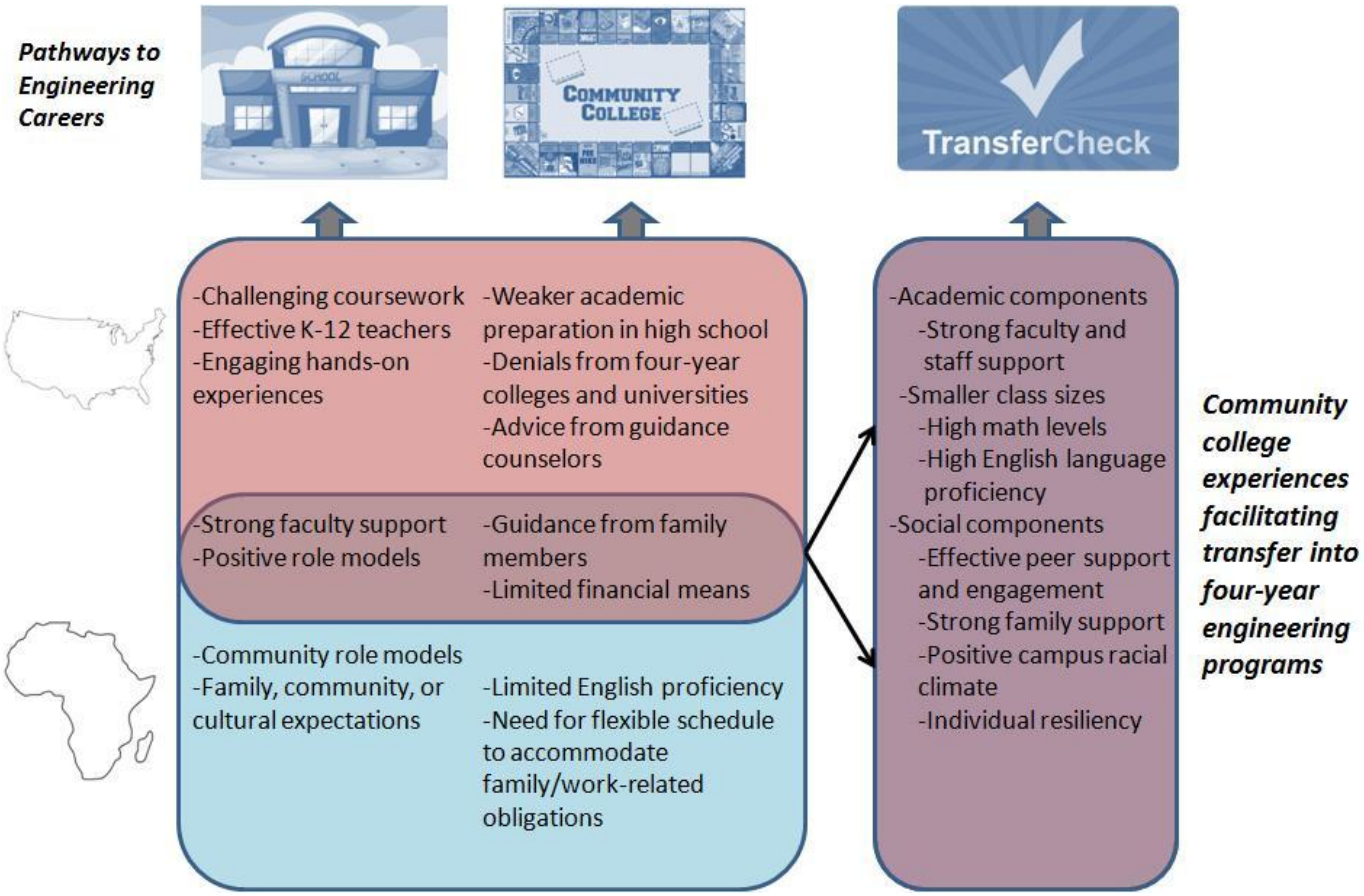

Figure 2. Original Conceptual Framework

I also relied on Renn's (2008) identity development model to conceptualize experiences of students like Ben and Carter, who identify with more than one race. Although this research was more designed to draw distinctions between native and non-native students, Renn's work allowed for recognition of subtle distinctions among the three native participants.

Revised conceptual framework

Figure 3 below provides the revised conceptual framework, informed by the results and analysis of data. As with the original visual representation, it illustrates a process that commences during K-12 schooling and then continues as students enroll in community college. The culmination is the point of transfer, when students move from two-year to four-year

engineering programs. Four notable differences exist between the original and revised frameworks.

First, during Black students' primary and secondary school years, the individual components that undergird their STEM trajectories are virtually identical for students raised in either the U.S. or sub-Saharan Africa. For example, all participants in the study demonstrated self-determination in their early academic endeavors. Second, the framework shows that family plays an important role both for native and non-native students. The original framework did not account for individual factors that may lead to an interest in STEM, and it only considered the impact of family for students educated overseas. In this newer conceptualization, the capacity of Black American families to empower children confronts long-held depictions that victimize or marginalize African American parents.

Third, the newer visual representation also shows some key differences between Black African and Black American students during their K-12 years. The most salient distinction is while students who emigrate from African countries may have attended private schools, most American Blacks attended public schools. Included in African-educated private schools is a

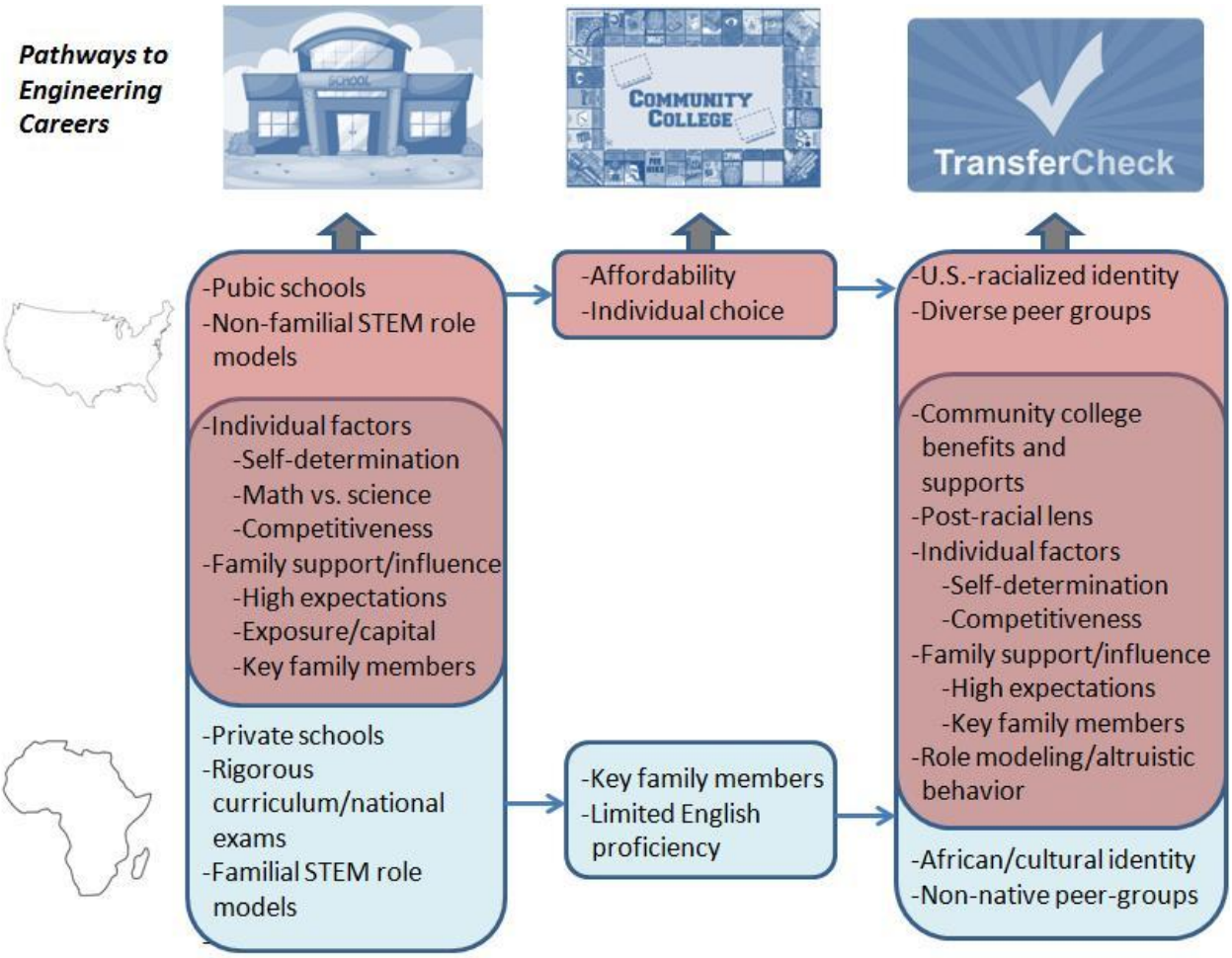

Figure 3. Revised Conceptual Framework

curriculum that is highly rigorous and directed toward helping students pass national examinations. Compared to the original framework, which postulated that an American curriculum would have greater rigor than one based in Africa, this new framework differs in an important way. It underscores the strong academic preparation that some Black non-natives bring with them to the U.S. and at the same time challenges prior notions of African inferiority. Following this distinction, students differ in the STEM role models with whom they may engage. Among non-native students, all STEM role models were family members. Native students, on

the other hand, mostly had STEM role models with whom they are acquainted through school or other networks.

Fourth, whereas the initial framework hypothesized several reasons that Black students might enroll in community college, almost none of those assumptions held true in this research. Among those that reappeared in the revised conceptualization, undergraduates' limited English proficiency emerged as a factor that might lead Black African students to choose two-year schools. Advice from family members also appeared as a component that could lead Black undergraduates to choose community colleges. However, in the earlier version I assumed that family members would encourage both native and non-native students to choose these schools. However, only relatives of Black Africans served this role; American-educated respondents did not seem to include family members in their post-secondary career plans.

Instead, native students seem to choose community colleges based on personal choice or affordability. Goku expressed the idea of choice when he said that he chose EC because he wanted to "contrast" with his older brother. Both Ben and Carter spoke to the financial considerations that they made in choosing EC. Ben commented, "One of the biggest reasons I also went to [EC] was because of money." Similarly, Carter remarked that, "I am operating on a limited budget [and] I am trying not to rack up a huge student loan…that is one of the reasons why I chose Eastern College."

Several factors, including a few that appeared in the original framework, emerged as components that enabled students to transfer. Among those that I listed in both conceptualizations were community college benefits and support (originally labeled "Academic components"), family support, and peer groups. However, in the initial framework I did not assume that the composition of peer groups would vary from Black African to Black American

students. Instead, the data revealed that although various social networks were important, native Blacks tended to choose more diverse groupings than their non-native counterparts.

In addition to the factors that appeared in the initial framework, three others emerged in the process of completing this study. The first was the salience of identity. Native students tend to move through the community college with an understanding of themselves as Black Americans. Black Africans tend to view their national or cultural backgrounds ahead of their de facto identities as Black Americans or African Americans. However, both native and non-native students alike seem to feel that race or culture is subordinate to their engineering aspirations. Participants were more prone to choose to focus on their coursework or on professional development at EC than they were on their identity as a student of color. Finally, a component that both subgroups of students addressed was the importance of being altruistic or a role model for others.

In closing, the revised conceptual framework describes a process that facilitates transfer for Black African and Black American engineering students. Informed by the results of this study, it illustrates common factors that support *all* Black students – regardless of their country of origin – as well as components that are unique to subgroups. This framework responds to a changing Black population, a renewed emphasis on graduating more community college graduates, and a call for the U.S. to produce more engineers. While its application may not be generalizable for all URM populations, it may provide a blueprint for a more diverse engineering workforce.

Chapter Seven: Implications for Practice and Future Studies

Overview

This concluding chapter offers several implications for policymakers and other practitioners in colleges and universities based on the study's research. The implications primarily address the current state of higher education and its preparedness for the growing Black African engineering undergraduate population. In the sections that follow, I acknowledge the limitations of the study to some of these implications, and finally offer directions for future studies. These topics will continue to build the body of research on Black engineering students enrolled in post-secondary institutions, and can extend this study into new arenas.

Limitations

Similar to other qualitative studies, one limitation of this work is its generalizability (Huberman & Miles, 2002). Eastern College and Tech College enjoy a strong partnership, and as a result hundreds of diverse engineering students have transferred over the last decade. However, based on available data, Tech enrolls far fewer students from other local community colleges. It is therefore uncertain to what degree this study is replicable with other two-year institutions that send students to Tech. Furthermore, the sample size used in this research is small, and therefore it is not known whether similar results would emerge in a larger work.

A related limitation is the extent to which other research sites like EC exist in the U.S. EC is a compelling case study because it enrolls a large population of Black engineering students from both sub-Saharan Africa and the U.S. It is unknown whether many other two-year schools with similar demographic compositions exist. However, Reed and Andrzejewski's (2010) findings suggest that there are other areas of the country in which post-secondary institutions are

seeing increasing numbers of non-native Blacks. These cities include Los Angeles, Houston, and Chicago. In *Future Studies*, I discuss possible opportunities to engage schools in these cities in similar studies.

Additionally, this study did not account for the role of gender. While Maria alluded to her perspective as a woman of color in a male-dominated field (she commented about being the "only Black girl…in class") the methods did not allow for a greater explication of Maria's experiences. Moreover, although it acknowledged literature on 1.5 generation students like Ben, the findings did not account for generational status. Lastly, although the research included Black students from other countries, it did not involve undergraduates who emigrate from other parts of the African diaspora, including the West Indies.

Finally, although this work recognizes some distinguishing features of the three EC campuses, it does not explore distinct experiences that participants had at these sites. In Chapter Four, I contextualize the Windsor, Barnesville, and Harpersdale campus in geographic, economic, and other terms. However, in the findings I did not explore the degree to which any of the locations may have had their own unique cultures. In *Future Studies*, I suggest ways in which to further explicate distinctions that may impact prospective engineering transfers at different EC campuses.

Implications for Practice

Multicultural Engineering Program (MEP) support is already available to universities and technical companies interested in increasing diversity (Anderson-Rowland, 2011). One organization that is dedicated to increasing the participation of URMs is the National Association of Multicultural Engineering Program Advocates (Anderson-Rowland, 2011). Other associations include the National Action Council for Minorities in Engineering (NACME) and

the National Society of Black Engineers (NSBE). These organizations bring attention to the underrepresentation of Blacks in engineering, while also sharing best practices with their stakeholders for graduating more undergraduates of color. (Anderson-Rowland, 2011).

While these programs are valuable and important to the mission of recruiting and retaining Black engineering undergraduates, they may unintentionally exclude some students of color. On one hand, students like Carter may self-select out of participating in organizations like NSBE because, as he said, there is more of a "cultural-focus" than an "engineering-focus." If other students feel similarly, it may suggest that NSBE itself is not meeting the needs of some Black undergraduates. Whereas some students may believe that their racial identity is as important for them as their engineering identity, others may feel that race is less of a salient factor.

Indeed, the racial context in engineering has changed, and it may be that a reevaluation of program mission and goals is warranted. Around the time that NSBE was established at Purdue University in 1971, four out of five Black engineering freshmen on that campus either changed their major or completely dropped out of school (NSBE, 2016). As racism has become more covert and engineering retention of Blacks has increased somewhat, programs like NSBE may not resonate with some undergraduates (Coates, 2008; Knight, Carlson, & Sullivan, 2007). This certainly does diminish the importance of MEPs, but it may suggest that leaders should consider revisiting the focus of these organizations. In other words, if students like Carter desire to have an organization for "Black people who are focused on engineering," then the fundamental mission of the MEP may need to change. If this is not possible, or the rationale for keeping a "cultural-focus" outweighs the benefits of an organizational re-branding, a new type of MEP

may emerge alongside these more established societies. This will allow Black students the option of choosing the *type* of MEP with which they need to engage.

The new type of MEP may not only be beneficial to students who share Carter's perspective. Considering the minimal engagement that Maria, Titan, and Oussou had with the African Students Association, they may be less inclined to join NSBE if they view it primarily as another cultural group. It is also possible that if they perceive MEPs as primarily supportive of Black *Americans*, they may feel less welcome in what seems like an unfamiliar space. Juxtaposing the context of EC with a four-year school that may not appreciate the nuance of engaging both native and non-native Blacks, transfer students may feel less connected when they transition.

Findings from this study have immediate implications for the growing Black African populations in metropolitan areas throughout the country. Because of the growing Black African population in cities like Los Angeles, Houston, and Chicago, results from this work can be the foundation for new faculty and staff training on cultural diversity (Reed & Andrzejewski, 2010). MEP leaders and other campus administrators must be educated on the shifting Black demographic in their colleges. Faculty like Dr. Roberts, who have become keenly aware that the Black engineering population has evolved at EC, are in a key position to use these and other results to help other schools developing greater cultural awareness.

At a minimum, advising staff can introduce new surveys that not only query students for their race, but also ask about country of birth and fluency in other languages. These surveys can be completely optional and should be framed in such a way that they do not make students feel uncomfortable. If the Black student population changes in similar ways in other STEM departments (e.g., biochemistry and computer science), engineering advisors can share lessons

learned with colleagues from across campus. Additionally, this data can help inform STEM teacher training programs in colleges of education. Although lessons learned may be derived from experiences in colleges and universities, future K-12 teachers will benefit from understanding how to better recognize and support diverse Black students in their classrooms.

Researchers and practitioners should not assume that an emphasis on Black Africans will threaten program support for Black Americans. To the contrary, interactions between native and non-native Blacks at EC suggest that a cross-cultural exchange between and among Black engineering undergraduates is possible. As students from other countries learn about successful Black American engineers, they may be more prone to develop friendships with native Blacks. At the same time, students who identify as African Americans may be pleased to discover the numerous technological advances led by Blacks throughout sub-Saharan Africa. Study-abroad experiences to African countries and related student exchange programs can foster a sense of Pan-Africanism in engineering. Engineering deans and other leaders should make an effort to recruit Black American engineering undergraduates in two and four-year schools for these opportunities. They should also provide these students with a greater cultural awareness in order to eliminate any negative stereotypes about Africa prior to these exchanges. MEP administrators, too, should also embrace the full African diaspora of Black engineers, and hire staff to reflect this within-group diversity. By demonstrating openness to new cultures, administrators can act as role models for *all* of the students that they support.

Future Studies

This study reinforces the necessity of supporting community college students through engaging faculty and staff at the sending institution. Eastern College, furthermore, emerged as a site that assisted Black engineering students through both in-class experiences and out-of-the-

class mentoring and advising. Scholars and practitioners have an opportunity to look for ways in which to replicate the EC model throughout the country, particularly in schools with large Black African and Black American populations. Future studies on campuses with similar student demographics can demonstrate whether or not this model is replicable. If similar findings emerge at other two-year schools, the data will underscore the need to place a greater emphasis on understanding within-group differences among Black engineering students who transfer. Simultaneously, as research outcomes become more visible, faculty and staff may be more likely to integrate new support programs to assist prospective transfer students.

Because the historical context of each EC campus is unique, research that builds on this work can explicate any differences in student experiences across the three locations. Whether or to what degree advisors provide unique forms of support for prospective engineering students at the Windsor, Barnesville, or Harpersdale campus may have other implications. In particular, it would be interesting to consider whether enrollment on one EC campus leads to higher rates of transfer than on other campuses. Given Dr. Roberts' comments about the strength of the Barnesville location, related studies can explore the degree to which other locations have developed their own unique support structures.

From a broader perspective, a number of research questions can motivate other future studies. For instance, *To what extent do community college faculty and staff support transfer for Black engineering students?* Related to this question may be inquiries about how student social capital influences their engagement with professors and advisors. An example of such a research question might be, *To what extent do Black engineering students' relationships with two-year campus professors and advisors influence their ability to transfer?* Additionally, several findings involving specific participants in this study can undergird new investigations.

Several of Maria's comments suggest that gender should be a consideration in related studies. As an example, she was the only student to remark that she "struggled with math." While other respondents may have encountered their own difficulties in school, she was the only participant to explicitly make this statement. This is not to suggest that other interviewees did not encounter this challenge, but her acknowledgement of challenges in mathematics is intriguing. An investigation related to this observation might consider the following research question: *To what degree are Black women in engineering degree programs more or less likely to talk about requesting help in mathematics?* Findings from this study may inform how women who eventually enroll in male-dominated disciplines seek out assistance in middle or high school. Correspondingly, scholars can determine whether Black women who sought math assistance in K-12 schools are more likely to outperform their counterparts in college who do not mention requesting help.

Maria is also distinct in that of the three non-native students, she was the only participant to continue living with her immediate family after entering EC. Related studies can attempt to determine whether Black African students' gender influences their decisions to remain near their parents. If students like Maria have additional roles and responsibilities with younger siblings or older family members, then they may be more likely to stay at home. This tendency may not only exist among African engineering women undergraduates, but among non-native women in multiple STEM disciplines.

Although this work attempted to disaggregate Black American and Black African engineering transfers, further distinctions may exist even within each subgroup. As gender-related roles and expectations may create somewhat separate pathways to transfer for African women, so may components like social and cultural capital. Findings from this study revealed

that Carter differed from Ben and Goku in terms of the opportunities and resources that he was able to leverage. Carter also was unique in that he was the only student in the study who was homeschooled. Future studies may explore how homeschooled children in the U.S. are being prepared for careers in STEM. Furthermore, Ben was the only native student – and indeed the only student overall – who was involved in campus leadership activities at EC. McClenney, Marti, and Adkins (2006) have established how community college students who are engaged in on-campus activities tend to persist in school. Their research suggests that engineering community college students may be more likely to transfer if they are involved in organizations or activities such as those in which Ben participated.

In addition, Weerts, Cabrera, and Mejías (2014) articulated four types of student engagement categories that scholars can appropriate to the participants in this study. First, Super Engagers, as Weerts et al. classify them, join groups on campus dedicated to altruistic activities (e.g., mentoring young children) as well as social justice. Apolitical Engagers, by contrast, are interested in findings ways to give back to society but avoid involvement in groups that have a social justice component. Ben may fit this typology considering the number of non-political groups with which he was affiliated.

Weerts et al. (2014) also describe Social-Cultural Engagers, who may be interested in the arts or activities that promote racial/ethnic diversity. Students who participate in the National Society of Black Engineers or the African Students Association may fall into this category. Finally, Weerts et al. discuss Non-Engagers, who tend not to join any types of organizations. Most interviewees' comments about their experiences suggest that they were Non-Engagers at EC. However, because each participant was able to transfer to Tech, future studies may investigate how Non-Engagers in engineering majors succeed despite a lack of on-campus

involvement. It is possible that the study groups that respondents formed created informal networks that replaced the need for involvement in preexisting associations. Despite not being recognized organizations, findings reveal that these networks were effective and helped facilitate transfer.

Moreover, the rich data that this small study produced underscores the value of qualitative research on URM engineering students. Findings that emerged from this study would typically not be available in quantitative research, which generally explores relatively few dimensions of student diversity. Rather than detract from quantitative research, however, this work attempts to complement it by offering new factors that scholars can consider in future investigations. Research that utilizes quantifiable surveys, for instance, can query Black engineering students for information that typically does not appear on these instruments. For instance, surveys can ask each student whether s/he attended a public or private school, his/her country of birth, as well as his/her year of arrival to the U.S. (if s/he was born outside of the U.S.). Scholars can use this information to determine whether the factors that emerged from this work are statistically significant in research using larger sample sizes.

Other quantifiable data points are students' GPAs, which can be analyzed over the course of their tenures at EC. Although Tech only requires students to have a 3.0 GPA and to have completed three prerequisite courses, participants' transcripts can provide greater context for understanding their academic experiences. For instance, if a student earned a 2.5 GPA in his/her first year but eventually began earning more As and Bs as s/he progressed at EC, this may suggest that s/he may have improved his/her study skills over time. In addition, an improvement may imply that the student developed a greater relationship with an academic advisor in subsequent years. Furthermore, a review of students' transcripts may reveal that some EC

students had to develop certain mathematical proficiencies prior to enrolling in Tech. As an example, a participant may have enrolled in a college algebra or precalculus course prior to beginning advanced courses in calculus. Such a review of transcripts may provide further examples of a student's self-determination, particularly when s/he initially was required to take more introductory courses. Moreover, scholars have previously correlated success in mathematics in community college to their rates of transfer, and have also determined that students' mathematical abilities determine their future success in engineering studies. It would therefore be informative to better understand the academic trajectories of prospective engineering transfer students, particularly as it relates to their mathematical backgrounds.

Finally, a longitudinal study of Black students may be an outcome of this work. Future studies can monitor student progress at multiple stages of their academic pathways toward engineering degree completion. Results from this dissertation emphasize the importance of supporting students in primary and secondary school, and of continuing that support in two and four-year institutions. One recommendation for obtaining longitudinal data would be to explore the academic progressions of cohorts of Black students, both in the U.S. and throughout sub-Saharan Africa. This may further assist with articulating components that lead to successful outcomes along all stages of the engineering pipeline.

Appendix A: Participant Questionnaire

1. Pseudonym (First Name). Please choose a name by which you will be identified in this study. This should not be your actual first name.
   _____Pseudonym
2. Are you a current student?
   a. If **yes**, what is your projected graduation semester?
      ____August 2015
      ____December 2015
      ____May 2016
      ____August 2016
      ____December 2016
      ____May 2017
      ____August 2017
      ____December 2017
      Other? Please indicate: _____
   b. If **no**, please list the semester in which you graduated (e.g., May 2011, December 2011, etc.).
      ____May 2011
      ____August 2011
      ____December 2011
      ____May 2012
      ____August 2012
      ____December 2012
      ____May 2013
      ____August 2013
      ____December 2013
      ____May 2014
      ____August 2014
      ____December 2014
      ____May 2015
      Other? Please indicate: _____
   c. If you are no longer a student in Tech College and have not graduated from the College of Engineering, please check "Not Applicable" below.
      ____Not Applicable. **PLEASE STOP HERE AND RETURN THIS FORM TO THE PRINCIPAL INVESTIGATOR (BRUK BERHANE)**
3. Please list your current major or the major that you studied while a student at Tech College.
   ____Aerospace Engineering
   ____Bioengineering
   ____Chemical/Biomolecular Engineering
   ____Civil/Environmental Engineering
   ____Computer Engineering
   ____Electrical Engineering
   ____Fire Protection Engineering
   ____Materials Science & Engineering
   ____Mechanical Engineering
4. Please indicate your gender.
   ____Female
   ____Male

5. What is the highest level of education your mother attained?

6. What is the highest level of education your father attained?

7. Are you or will you be the first in your family to graduate with a Bachelor of Science degree in engineering?
    a. ____Yes
    b. ____No
8. Please list the previous college(s) that you attended, including those outside of the U.S., starting with the most recent college in which you were enrolled. Please also include the years that you attended each school. An example is provided below:
   EXAMPLE: Name of School: University of Michigan Year(s) Enrolled: 2010-2014

   Name of School:_____ Year(s) Enrolled:_____

   Name of School:_____ Year(s) Enrolled:_____

   Name of School:_____ Year(s) Enrolled:_____

9. What was your cumulative grade point average (GPA) at the community college from which you transferred to Tech College?:_____
10. Please list your date of birth in the following format (MM/DD/YYYY).
    _____
11. Where do you currently live? (Please list the city and state)._____
12. Please list the country in which you were born.
    Country of Birth: _____
    If are Puerto Rican and were born on the island, please indicate when you moved to the mainland U.S.: _____
13. If you were born outside of the United States, please indicate your age when you moved to the U.S.
    Age:_____
14. Please list any other countries in which you lived prior to moving to the U.S., starting with the most recent country and the age you were when you moved to/from that country:
    EXAMPLE:
        COUNTRY: <u>Tanzania</u>
            Age when you moved to that country: <u>22</u>
            Age when you moved from that country: <u>25</u>
        a. Country:_____
            i. Age when you moved to that country:_____
            ii. Age when you moved from that country:_____
        b. Country:_____
            i. Age when you moved to that country:_____
            ii. Age when you moved from that country:_____
        c. Country:_____

i. Age when you moved to that country:_____
ii. Age when you moved from that country:_____

Please use the reverse side of this page if you require additional space

15. Please list the country(-ies) in which your parents were born:
    Mother: _____/Father:_____

16. How do you identify in terms of your race?
    _____

17. How do you identify in terms of your ethnicity?
    _____

If needed.

Appendix B: Individual Interview Protocol

Thank you very much for agreeing to participate in this study, which explores the factors that help students of color transfer from community colleges to the Tech College of Engineering (pseudonym). As I mentioned, this interview is part of my dissertation research project in the Minority and Urban Education Program at the University of Maryland. I am interested in understanding which factors played a role in the successful transfer of underrepresented minorities from community colleges like the one you attended, as well as the academic experiences that you had leading up to your pursuit of an engineering career in college. There are no direct benefits to participants. However, possible benefits include a contribution to research on engineering education and on minority college students. Your participation is voluntary and you can terminate your participation at any time.

The interview will last between thirty and sixty minutes and will focus on the experiences that impacted your decision to pursue an engineering career, as well as the support that you received in order to become academically prepared. You will be asked questions both about the supports that you received in high school as well as in college, and you will also have the opportunity to reflect upon challenges that you have faced while and prior to pursuing your engineering degree. For example, one question asks, "How well do you feel your previous institution prepared you for Tech College?" Another example of a question is, "What supports systems did you have in place prior to your transfer from your previous institution to Tech College?"

Any potential loss of confidentiality will be minimized by storing data in a secure location, i.e., investigators' computers. In addition, your name will not be identified or linked to the data at any time unless you give your express consent to reveal these identities. The data you provide through your responses will not be shared with your employer. Only the principal investigator will have access to the participants' names. If you decide to stop taking part in the study, if you have questions, concerns, or complaints, please contact me, Bruk Berhane (Principal Investigator), by telephone (301-405-0287/office; 301-655-2806/cellular) or e-mail (bberhane@umd.edu). If you have questions about your rights as a research participant or wish to report a research-related injury, please contact the Institutional Review Board Office at the University of Maryland, by e-mail (irb@umd.eu) or telephone (301-405-0678). This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.

Do you agree to participate? [If yes, continue. If no, stop.]

The interview will last between thirty and sixty minutes, and I would like to ask your permission to record this interview for accuracy. The recording will only be available to me, and your identity will be kept confidential. Your identity will not be revealed in any report. Instead, a pseudonym (i.e., false name) of your choice will be used in any references that are made to you. If your words are included in the results, any identifying information will be removed.

Do you agree for me to record this interview? [If yes, then turn on the recorder. If no, do not record the interview.]

Let us start with the questions.

Part I: Childhood and School-Based Experiences Prior to College

In the first part of this interview, I am going to ask you about your childhood and early school experiences. I want to understand how these experiences impacted your interest or abilities in math and science. I also want to understand how these early experiences specifically motivated you to pursue an engineering degree later on in your life.

1. Tell me about your early childhood. What kind of school(s) did you first attend as a young child? What kind of mathematics or science preparation did you receive?

2. What role, if any, did your family and friends play in your educational experience as a young child? What role, if any, did they play in your decision to pursue an interest in mathematics, science, or even engineering?

3. Talk a bit more about the different schools that you attended. Was the sequence designed as elementary, middle/junior, and then high school? Or was designed to follow a sequence beginning with primary and then secondary school? What grades were covered in those schools?

4. What was the process required to transition from one school to the next, and how was it determined that you would attend a particular primary or secondary school?

5. Did you have a particular interest in science or mathematics early on? If so, tell me about that interest and what inspired it?

6. *If the respondent was educated outside of the U.S. prior to college, ask the following:* Was there a particular educational tradition in your home country? French, Ethiopian, etc.? If so, how – if at all – might that have impacted you in terms of your educational trajectory in general or STEM trajectory in particular (either in the US or in your home country)?

If the respondent was educated in U.S. schools prior to college, ask the following: Was there a particular educational program during your high school years, such as AP, Honors, IB, or dual enrollment? If so, how – if at all – might that have impacted you in terms of your STEM trajectory?

If the respondent was educated both outside of the U.S. and in the U.S. prior to college, ask the following: Compare and contrast the educational experience that you had in your home country (or others in which you were educated prior to moving to the U.S.) to the education that you had when you moved to the U.S. What was similar? What was different? What stood out to you as particularly impactful? How did these experiences shape your educational trajectory and STEM trajectory, if at all?

7. How hard were the classes in which you were enrolled while in each primary or secondary school that you attended? In particular, how hard was the math and science preparation that you received in primary or secondary school?

8. How did you end up in the courses/track that you took in school? Was there a particular exam that you took, an application required, etc.?

9. At any point, were you part of a racial or ethnic minority group in school prior to college? If so, were you the only Black student or one of a few Black students? If so, how did that shape your perspective about education and how did that impact you as a student? How did that impact you in your STEM courses?

10. What out-of-the classroom experiences encouraged you to pursue an engineering degree?

11. What inspired you to pursue an engineering major in college? What experiences did you have prior to college that encouraged you to consider engineering?

12. What other motivation (academic or otherwise) did you have for pursuing an engineering degree?

13. What preparation for engineering study did you receive prior to college?

<BATHROOM/SNACK BREAK>

Part II: College Experiences

At this point, I am going to begin asking you questions about your college experiences, and how those experiences impacted your educational trajectory.

14. If you attended any other colleges besides Eastern College and Tech College, why did you attend those schools? How long did you stay at those schools and what was the process like in transitioning from one school to another?

15. Why did you choose to attend community college? Why did you decide to attend Eastern College?

16. Where did you choose to live during college while you attended Eastern College? Why did you choose to live there?

17. If your family lives in the U.S., where does your family live? Do you know why your family chose to live there? If yes, please explain why they may have chosen to do so if you know why.

18. How well do you feel that Eastern College prepared you for Tech College? If you attended any other institutions, how well do you feel these other institutions prepared you for Tech College? Please talk about how your previous institution helped you in terms of the following:

    a. Scholarships/Financial Aid
    b. Transfer Advising
    c. General Academic Advising

19. What support systems did you have in place prior to your transfer from your previous institution to Tech College (e.g., peer mentors, college advisors, etc.)?

20. What role, if any, has your family played in your college experiences thus far?

21. What role, if any, have your friends played in your college experiences thus far?

<BREAK>

Part III: Identity Development and Educational Impact

In this next set of questions, I want to understand how your identity may have played a role in your decision to pursue an engineering major. When I talk about identity, please think about how you see yourself (in terms of race, country of origin, parents' country of origin, gender, culture, family, etc.). Also, please think about how your identity may change or remain the same depending on what environment you may find yourself.

22. How has your cultural, ethnic, racial, family, or social identity impacted your education? *If participant was born or raised outside of the U.S.*, talk about your identity in your country of birth, your identity in the U.S., and your identity in other countries in which you have lived?[19]

23. What particular values are especially important to members of your family? *If participant was born or raised outside of the U.S.*, what particular values are important to your immediate community in the U.S., versus those who reside in your native country?[20]

24. How has your self-identity changed in the different countries or communities in which you have lived, if at all? How has/have that/those identity/-ies impacted your educational experiences, if at all?

25. How has your identity changed, if at all, since deciding to pursue engineering? How has that changed before and after your time in college? For example, do you see yourself more aligned culturally or socially with members of your home country, native language, Black Americans, other Americans, students in general, etc.?

[19] As a prompt, the interviewer should be sure to give examples as to how he himself identifies and how his identity has impacted his own education.

[20] Again, interviewer should give examples of values that might be important, such as work ethic, study skills, and adherence to a particular set of religious/moral beliefs.

26. Do you identify or have you identified with any particular groups or communities on campus? Do you identify with any particular groups or communities off campus? If so, please explain whether those groups are the same or, if they are different, how they differ?

27. Is there a particular group or community with which you have spent the most time (e.g., studying, socializing, etc.) as a student? If so, which group/community has that been? If not, what different groups and communities have you engaged with at different times?[21]

28. How has your engagement with the different groups and communities that we have discussed impacted your educational trajectory in engineering?

Part IV: Final Reflections

For the final set of questions, I would like for you to take a final reflection on your educational journey thus far. Please think specifically about your experiences in college.

29. If you could have changed your experience when preparing to transfer to Tech College, what things would you have done differently?

30. Overall, what has your journey toward an engineering degree been like thus far? What experiences really stand out as being impactful?

31. What other structures or programs at Tech College or Eastern College might have helped you?

32. These are all of my questions. Is there anything else you would like to add about your factors that enabled you to successfully transfer to Tech College, or is there anything that we have discussed about which you would like to elaborate?

Last, if I have any questions regarding your answers, could I contact you in the future?

[21] For instance, the National Society of Black Engineers or the African Students Association.

Thank you very much for your time and for sharing your experiences. I greatly appreciate it.

Appendix C: Group Interview Questions for Native Students

1. Some of you seemed to emphasize points in your life when it was clear that your math/science abilities or interest levels seemed to be stronger, or at least just as strong, as your English/Composition abilities/interest. How common was it for others in your peer group to see math/science as more attractive than other subject areas?
2. For all or most of you, you did not have a family member or immediate role model in life that drove you to look at STEM. Some of you mentioned that your desire for STEM more or less came from within yourself and because of what you saw on TV or read in books. Did you ever notice a difference between you and the other EC students, in terms of the STEM role models you were exposed to? If so, what was that difference like for you? How did you deal with it?
3. You all talked about being confident – to some degree – in math or science despite not having immediate role models around who were professionals in STEM fields. To what do you attribute that confidence?
4. Goku and Carter, neither of you spent your whole time in school (K-12) in the local county public school system, a system that is known for its stellar schools. Yet, you have been successful. While at Eastern College, did you have experiences with students who were educated in that school system? If so, what were those experiences like? What did you have in common with those students? What was different?
5. For all of you one STEM area seemed to attract you over others early on. For you, Carter, it was more science and less mathematics. For you, Goku and Ben, it was more mathematics and less science. Can you speak more about why was there more of a leaning to one area over another?
6. We have heard from some interviewees that the numbers of US-born students of color at EC is small, compared to those from overseas like Africa, Asia, or Latin America. How did it feel being one of only a few American students of color at EC?
7. Were you ever more conscious of your racial/ethnic identity prior to enrolling at Tech College? If so, talk about what led to that consciousness at that point. For instance, was it a happy time, an event involving racism, etc.?
8. Compare and contrast the experiences that you had with instructors and staff at EC with those prior to enrolling to EC. How significant or helpful were the faculty and staff that you encountered at EC, and how did they compare to the faculty and staff that you encountered in your educational experiences during your earlier years in school?
9. Goku and Carter, you both talked about the influence of siblings, friends, or classmates. Overall, to what extent were you influenced by peer pressure prior to attending Tech College? (The influence could have been positive or negative).

10. To what extent were your parents involved with your schools? Directly, indirectly? Did they attend school meetings or chat w/teachers online? Why so?

11. Did you ever consider applying to other schools besides Tech College? To private schools? To HBCUs, etc.?

12. Compare and contrast the different campuses on which you studied. Carter, you said that Barnesville did not have a great deal of support for transfer students, but you also talked about the support from Dr. Roberts. Compare and contrast the support that Dr. Roberts gave you with your overall transferring advising experiences at Barnesville and Windsor. Goku—same for you. Compare and contrast Barnesville experiences w/experiences at Harpersdale, and mention if you interacted with Dr. Roberts. Ben, in your case, you studied entirely at the Harpersdale campus, so how did your experience there compare to what you heard from others who attended the Barnesville or Windsor campuses?

13. What is the best take-away that we can have from this study from each of you? What do you think is most important for us to know as we work with more diverse engineering students from EC, particularly those born in the US?

Appendix D: Group Interview Questions for Non-Native Students

1. What was unique about the students at Eastern College (EC)? How were/are the students different from those at Tech College or other schools that you attended?

2. How do you think other EC-engineering students would describe the preparation that they received?

3. Between the three of you, you have had experiences at all three EC campuses (Windsor, Barnesville, and Harpersdale). I would like for you to talk about the differences between the three campuses, as well as how they were similar.

4. Each of you explained that your decision to attend EC was either because of finances or because you were advised by a family member. Looking back on that decision, how would you advise students interested in engineering, particularly those from your home country? Would you advise that they also attend EC? Why would you advise them to do that? If not, why would you advise them to make a different decision?

5. Each of you attended non-public schools in your home countries. Reflecting on your educational journey, how significant was the fact that you attended a private school rather than a public school?

6. Some of you indicated that Tech College was a better choice for transfer than other four year schools—in terms of finances at least. Did you consider attending Historically Black Colleges and Universities like Morgan State University or Howard University for engineering? (*note that Howard Univ. often gives scholarships to high performing students*)? If so, why did you choose Tech College?

7. Although you came from two-parent households, each of you seemed to have one particular parent that influenced you in terms of your educational journey. For one or more of you it was your father, while in another case, it may have been your mother. Please talk about why you were influenced – in terms of your education – by the particular parent that supported you.

8. For all of you, you mentioned that your identity as a Black or African/Kenyan/Nigerien/Gambian student was not the most significant factor in your ability to transfer. If anywhere, where did your racial, cultural, or ethnic identity played a major role in your educational journey up the time you transferred from EC?

9. If you can think about your most difficult classes at EC or the most challenging period before you came to Tech College, what kept you motivated? What was the reason you pursued engineering even when it was difficult?

10. What is the best take-away that we can have from this study from each of you? What do you think is most important for us to know as we work with more Black African engineering students from EC?

Appendix E: Analytic Memos on Subthemes

Saturday, January 23, 2016

Of the three categories, the one that seemed the most salient for all respondents was Family Support and Influence. All of the interviewees spoke at length of the influence of an immediate or extended family member who was especially impactful in helping him/her to be successful. Initially there were seven separate subthemes that I developed, which were as follows:

1) General Family Support and Influence;
2) Mother's Influence more than Father's Influence
3) Father's Influence more than Mother's Influence
4) Freedom to Explore
5) High Family/Cultural Expectations
6) Family/Cultural Connectedness in the U.S.
7) Cultural Capital and Financial Resources

I accumulated a total of 55 quotes across these seven family-related subthemes; the subthemes were not ranked in any particular order. However, as I reviewed the interview data I determined that it would be better to collapse some of these sub-themes into somewhat more general sub-themes. I chose to do this in cases in which I collected a larger body of data for one sub-theme than for another sub-theme that contained somewhat similar information. For instance, although I initially separated sub-themes 2, 3, and 6 above, I noted that a section just on students' mothers or just their fathers would be limited in its breadth. This was particularly concerning since not every student spoke about his/her mother, nor did each student speak specifically about his/her father. Alternatively, I realized that each student had at least one family member – even if it was an extended family member – from whom s/he received support. I therefore elected to develop a broader sub-theme called Support from key family members in order to describe all of the different relatives who positively impacted the lives of the students. I also removed General family and support as a sub-theme because most of the data that I placed under this heading could be placed in one of the other parts of the Family Support and Influence section of the chapter.

I kept High family/cultural expectations as a separate sub-theme because the responses that I categorized under this heading were rich and distinct enough to be presented separate from the other sub-themes. As for the remaining sub-themes – Freedom to Explore and Cultural Capital and Financial Resources - I first chose to move Freedom to Explore under the heading of this second sub-theme because I realized that only one student spoke about having parents or older family members actively encourage children to consider a myriad of career paths. This participant's ability to "explore" appeared to be linked to his parents' own knowledge base and professional/social network. In other words, the ability to explore existed only because of the capital that parents possessed. After I combined these two sub-themes, I initially used the name Exposure and Cultural/Social Capital. However, I eventually began using the heading Exposure and Forms of Capital for this sub-section because I realized that financial capital – in addition to social and cultural capital – played a major role in the types of opportunities from which many of these students benefited. After Family Support and Influence, I ranked Peer Supports and Social Networks second in its importance to students and to their ability to be able to transfer.

Appendix F: IRB Approval Letter

UNIVERSITY OF MARYLAND
INSTITUTIONAL REVIEW BOARD

1204 Marie Mount Hall
College Park, MD 20742-5125
TEL 301.405.4212
FAX 301.314.1475
irb@umd.edu
www.umresearch.umd.edu/IRB

DATE:	March 2, 2015
TO:	Bruk Berhane
FROM:	University of Maryland College Park (UMCP) IRB
PROJECT TITLE:	[556601-3] Readying the Engineering Pipeline: A study of the factors that best predict community college student transition to competitive engineering programs among underrepresented minorities
REFERENCE #:	
SUBMISSION TYPE:	Continuing Review/Progress Report
ACTION:	APPROVED
APPROVAL DATE:	March 2, 2015
EXPIRATION DATE:	March 13, 2016
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # *6 & 7*

Thank you for your submission of Continuing Review/Progress Report materials for this project. The University of Maryland College Park (UMCP) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

Prior to submission to the IRB Office, this project received scientific review from the departmental IRB Liaison.

This submission has received Expedited Review based on the applicable federal regulations.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Unless a consent waiver or alteration has been approved, Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of March 13, 2016.

Please note that all research records must be retained for a minimum of seven years after the completion of the project.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Maryland College Park (UMCP) IRB's records.

Glossary

1.5-generation: A reference to a person born in another country, but who migrated to the U.S. before the age of 10 (Ellis & Goodwin-White, 2006).

African American: A reference to a student who was born in the U.S. and who has at least one parent whose ancestry can be traced to the forced migration of Africans to the Americas through the institution of slavery.

Black: A term used to describe students born both in sub-Saharan African countries and those born throughout the modern African diaspora (Mwangi, 2014).

Competitive engineering program: A reference to a highly ranked engineering school. For this study, I consider a college of engineering competitive if it has been included in the *U.S. News and World Report's* list of its top 25 engineering programs for undergraduates at least one year since 2010.

First-generation: A reference to a person born in another country and who lived in that country until adulthood; s/he moved to the U.S. as an adult (Thomas, 2011).

Native: A term used to describe a person who was born in the U.S.

Non-native: A term used to describe a person who was born in sub-Saharan Africa and who moved to the U.S., either as a child or as an adult.

Post-racial: For the purposes of this work, this term refers to the perspective that the issue or the challenge of racism is not personally problematic. In this perspective, racial challenges, such as discrimination, are subordinate to other academic obstacles (e.g., challenging math or science classes).

Second-generation: A reference to a person born in the U.S., whose parents both emigrated to the U.S. as first-generation adults (Thomas, 2011).

Sub-Saharan: A reference to the continental portion of Africa that is located south of the Sahara desert.

Vertical transfer: A term used to describe transfer from a two-year college to a four-year college or university (Ignash & Townsend, 2000).

.

Bibliography

Aderemi, H. O., Hassan, O. M., Siyanbola, W. O., & Taiwo, K. (2013). Trends in enrollment, graduation and staffing of science and technology education in Nigeria tertiary institutions: A gender participation perspective. *Educational Research and Reviews*, *8*(21), 2011-2020.

Akkari, A. (2004). Education in the Middle East and North Africa: The current situation and future challenges. *International Education Journal*, *5*(2), 144-153.

Akyeampong, E. K. (2006). Race, identity and citizenship in Black Africa: The case of the Lebanese in Ghana. *Africa-London-International African Institute 76*(3), 297-323.

American Immigration Council (2012). African immigrants in America: A demographic overview. Retrieved March 9, 2016 from http://immigrationpolicy.org/just-facts/african-immigrants-america-demographic-overview

Anderson-Rowland, M. R. (2011). WEPAN, NAMEPA, and underrepresented student organizations: We need to help each other. *Women in Engineering ProActive Network*.

Andrade, M. S. (2006). International students in English-speaking universities Adjustment factors. *Journal of Research in International Education, 5*(2), 131-154.

Aud, S., Fox, M.A., & Kewal-Ramani, A. (2010). *Status and trends in the education of racial and ethnic groups* (NCES-2010-015). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Awokoya, J. T. (2012). Identity constructions and negotiations among 1.5-and second-generation Nigerians: The impact of family, school, and peer contexts. *Harvard Educational Review*, *82*(2), 255-281.

Bailey, T., Jenkins, D., & Leinbach, T. (2005). *What we know about community college low-income and minority student outcomes: Descriptive statistics from national surveys*. New York, NY: Community College Research Center.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.

Barrios, A. A. (1997). *The Magic of the Mind (MOM) program for decreasing school dropout* (Publication No: 405436): U.S. Department of Education: Educational Resources Information Center.

Beasley, M. A., & Fischer, M. J. (2012). Why they leave: The impact of stereotype threat on the attrition of women and minorities from science, math and engineering majors. *Social Psychology of Education, 15*(4), 427-448.

Blank, R. K. (2012). *What is the impact of decline in science instructional time in elementary school?* Washington, D.C.: Noyce Foundation.

Blickenstaff, J. (2005). Women and science careers: leaky pipeline or gender filter? *Gender and Education, 17*(4), 369-386.

Bogdan, R.C. & Biklen, S.K. (1992). *Qualitative Research for Education (2nd ed.).* Boston: Allyn and Bacon.

Bourdieu, P. (1986). The forms of capital. *Cultural theory: An anthology*. New York, NY: Greenwood.

Bratter, J., & Heard, H. E. (2009). Mother's, father's, or both? Parental gender and parent-child interactions in the racial classification of adolescents. *Sociological Forum, 24*(3), 658-688). Blackwell Publishing Ltd.

Brawner, C. E., Camacho, M. M., Lord, S. M., Long, R. A., & Ohland, M. O. (2012). Women in industrial engineering: stereotypes, persistence, and perspectives. *Journal of Engineering Educatio*n, *101*(2), 288-318.

Bricheno, P., & Thornton, M. (2007). Role model, hero or champion? Children's views concerning role models. *Educational research*, *49*(4), 383-396.

Brint, S. (2003). Few remaining dreams: Community colleges since 1985.*The ANNALS of the American Academy of Political and Social Science*, *586*(1), 16-37.

Brint, S., & Karabel, J. (1989). *The diverted dream: Community colleges and the promise of educational opportunity in America, 1900-1985.* New York: Oxford University Press.

Brus, C. P. (2006). Seeking balance in graduate school: A realistic expectation or a dangerous dilemma? *New Directions for Student Services*, *2006*(115), 31-45.

Burke, R. J. (2007). 1. Women and minorities in STEM: a primer. *Women and minorities in science, technology, engineering, and mathematics: Upping the numbers*. Northampton, MA: Edward Elgar Publishing.

Burke, R. J., & Mattis, M. C. (Eds.). (2007). *Women and minorities in science, technology, engineering, and mathematics: Upping the numbers*. Northampton, MA: Edward Elgar Publishing.

Burrell, J. J., Fleming, L., Fredericks, A. C., & Moore, I. (2015). Domestic and international student matters: The college experiences of black males majoring in engineering at an HBCU. *Journal of Negro Education*, *84*(1), 40-55.

Bybee, R. W. (2013). *The case for STEM education: Challenges and opportunities*. Arlington, VA: National Science Teachers Association.

Cabrera, A. F., Burkum, K. R. & La Nasa, S. M. (2005). Pathways to a four year degree: Determinants of transfer and degree completion. In A. Seidman (Ed.). *College student retention: A formula for student success* (pp. 155-209). Washington, D.C.: American Council on Education.

Calvert, K. (2015, January 20). Obama: Community college should be 'as free and universal in America as high school.' *Public Broadcasting Service.* Retrieved March 19, 2015 from http://www.pbs.org/newshour/rundown/community-college-tuition-top-theme-state-union-speech/

Cambridge Institute (2012). About us. Retrieved February 2, 2016 from http://www.cambridgeinstitute.net/en/elinstituto-english/quienes-somos-ingles

Campus France (2016). What is the French Baccalauréat? Retrieved February 2, 2016 from http://www.canada.campusfrance.org/en/report/what-french-baccalaure

Capps, R., McCabe, K., & Fix, M. (2012). *Diverse streams: African migration to the United States.* Washington, D.C.: Migration Policy Institute.

Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, *44*(8), 1187-1218.

Carnevale, A.P., Smith, N., & Melton, M (2011). *Science, Technology, Engineering, and Mathematics.* Washington, D.C.: Georgetown University.

Casad, B. J., Hale, P., & Wachs, F. L. (2015). Parent-child math anxiety and math-gender stereotypes predict adolescents' math education outcomes. *Frontiers in Psychology*, *6*(1597), 1-21.

Cavanagh, S., & Trotter, A. (2008). Where's the 'T' in STEM? *Education Week*, *27*(30), 17-19.

Ceci, S. J., Williams, W. M., & Barnett, S. M. (2009). Women's underrepresentation in science: Sociocultural and biological considerations. *Psychological Bulletin*, *135*(2), 218-261.

Chang, M. J., Eagan, M. K., Lin, M. H., & Hurtado, S. (2011). Considering the impact of racial stigmas and science identity: Persistence among biomedical and behavioral science aspirants. *The Journal of Higher Education*, *82*(5), 564-596.

Chubin, D. E., May, G. S., & Babco, E. L. (2005). Diversifying the engineering workforce. *Journal of Engineering Education*, *94*(1), 73-86.

Clark, B. (1960). The "cooling-out" function in higher education. *American Journal of Sociology*, *65*, 569-576.

Clegg, J., & Afitska, O. (2011). Teaching and learning in two languages in African classrooms. *Comparative Education*, *47*(1), 61-77.

Coates, R. D. (2008). Covert racism in the USA and globally. *Sociology Compass*, *2*(1), 208-231.

Cole, D., & Espinoza, A. (2008). Examining the academic success of Latino students in science technology engineering and mathematics (STEM) majors. *Journal of College Student Development*, *49*(4), 285-300.

College Board (n.d.). Types of colleges: The basics. Retrieved April 22, 2015 from https://bigfuture.collegeboard.org/find-colleges/college-101/types-of-colleges-the-basics

Committee on the Impact of the Changing Economy on the Education System, National Research Council, Center for Education, Division of Behavioral and Social Sciences and Education (2002). *The Knowledge Economy and Postsecondary Education: Report of a Workshop*. Washington, D.C.: National Academies Press.

Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, National Academy of Sciences, National Academy of

Engineering, & Institute of Medicine (U.S.). (2007). *Rising above the gathering storm: Energizing and employing America for a brighter economic future*. Washington, D.C.: National Academies Press.

Condron, D. J., Tope, D., Steidl, C. R., & Freeman, K. J. (2013). Racial segregation and the Black/White achievement gap, 1992 to 2009. *The Sociological Quarterly*, *54*(1), 130-157.

Conway, K. M. (2010). Educational aspirations in an urban community college: Differences between immigrant and native student groups. *Community College Review*, *37*(3), 209-242.

Cress, C. M. (2008). Creating inclusive learning communities: the role of student–faculty relationships in mitigating negative campus climate. *Learning Inquiry*, *2*(2), 95-111.

Crisp, G., Nora, A., & Taggart, A. (2009). Student characteristics, pre-college, college, and environmental factors as predictors of majoring in and earning a STEM degree: An analysis of students attending a Hispanic serving institution. *American Educational Research Journal*, *46*(4), 924-942.

Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *Educational psychologist*, *26*(3-4), 325-346.

DeCuir, J. T., & Dixson, A. D. (2004). "So when it comes out, they aren't that surprised that it is there": Using critical race theory as a tool of analysis of race and racism in education. *Educational Researcher*, *33*(5), 26-31.

Dee, T. S. (2005). A teacher like me: Does race, ethnicity, or gender matter? *American Economic Review*, *95*(2), 158-165.

Delgado, R., & Stefancic, J. (1993). Critical race theory: An annotated bibliography. *Virginia Law Review, 79*(2), 461-516.

Dixson, A. D., & Rousseau, C. K. (2005). And we are still not saved: Critical race theory in education ten years later. *Race ethnicity and education, 8*(1), 7-27.

Dowd, A. C. (2012). Developing supportive STEM community college to four-year college and university transfer ecosystems. *Community Colleges in the Evolving STEM Education Landscape: Summary of a Summit*, 107-134.

Downs, C. (2010). Increasing equity and compensating historically academically disadvantaged students at a tertiary level: Benefits of a Science Foundation Programme as a way of access. *Teaching in Higher Education, 15*(1), 97-107.

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology, 92*(6), 1087-1101.

Echevarria, J., Short, D., & Powers, K. (2006). School reform and standards-based education: A model for English-language learners. *The Journal of Educational Research, 99*(4), 195-211.

Ellis, M., & Goodwin-White, J. (2006). 1.5 Generation Internal Migration in the U.S.: Dispersion from States of Immigration? *International Migration Review, 40*(4), 899-926.

Ennis, S.R., Ríos-Vargas, M., Albert, N.G. (2011). *The Hispanic population* (Publication No.: C2010BR-04). Washington, D.C.: U.S. Census.

Epstein, J. L. (2001). *School, family, and community partnerships: Preparing educators and improving schools*. Boulder, CO: Westview Press.

Erel, U. (2010). Migrating cultural capital: Bourdieu in migration studies. *Sociology*, *44*(4), 642-660.

Eshach, H., & Fried, M. N. (2005). Should science be taught in early childhood? *Journal of Science Education and Technology*, *14*(3), 315-336.

Espino, M. M. (2014). Exploring the role of community cultural wealth in graduate school access and persistence for Mexican American PhDs. *American Journal of Education*, *120*(4), 545-574.

Espinosa, L. L. (2011). Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence. *Harvard Educational Review*, *81*(2), 209-240.

Fike, D. S., & Fike, R. (2008). Predictors of first-year student retention in the community college. *Community College Review*, *36*(2), 68-88.

Figueroa, T., Hughes, B., & Hurtado, S. (2013). Supporting future scientists: Predicting minority student participation in the STEM opportunity structure in higher education. Paper presented at the National Association for Research in Science Teaching, Rio Grande, PR. http://heri.ucla.edu/nih/downloads/NARST2013-Predicting-Minority-StudentParticipation-in-STEM.pdf

Flowers III, A. M. (2015). The family factor: The establishment of positive academic identity for black males engineering majors. *Western Journal of Black Studies*, *39*(1), 64-74.

Fries-Britt, S., George Mwangi, C. A., & Peralta, A. M. (2014a). Learning race in a US Context: An emergent framework on the perceptions of race among foreign-born students of color. *Journal of Diversity in Higher Education*, *7*(1), 1-13.

Fries-Britt, S., Mwangi, C. A. G., & Peralta, A. M. (2014b). The acculturation experiences of foreign-born students of color in physics. *Journal of Student Affairs Research and Practice*, *51*(4), 459-471.

Fries-Britt, S. L., Younger, T. K., & Hall, W. D. (2010). Lessons from high-achieving students of color in physics. *New Directions for Institutional Research*, *2010*(148), 75-83.

Gaddis, S. M., & Lauren, D. L. (2014). School accountability and the Black–White test score gap. *Social Science Research*, *44*, 15-31.

Gebre, D. Z. (2008). *Perceptions of African immigrant students regarding the factors leading to persistence in ESL classes in a community college "education is my mother and father"* (Order No. 3300351). Available from ProQuest Dissertations & Theses Full Text. (304471416). Retrieved from http://search.proquest.com/docview/304471416?accountid=14696

Getachew, A., & Derib, A. (2008). Language policy in Ethiopia: History and current trends. *Ethiopian journal of education and sciences*, *2*(1), 37-62.

Gibbons, M. (2005). Women in engineering. *American Society of Engineering Education Prism*, *15*(2), 20-21.

Griffin, K. A., Pérez, D., Holmes, A. P., & Mayo, C. E. (2010). Investing in the future: The importance of faculty mentoring in the development of students of color in STEM. *New Directions for Institutional Research*, *2010*(148), 95-103.

Griffith, A. L. (2010). Persistence of women and minorities in STEM field majors: Is it the school that matters? *Economics of Education Review*, *29*(6), 911-922.

Gutiérrez, K. D., & Rogoff, B. (2003). Cultural ways of learning: Individual traits or repertoires of practice. *Educational Researcher*, *32*(5), 19-25.

Habecker, S. (2012). Not black, but Habasha: Ethiopian and Eritrean immigrants in American society. *Ethnic and Racial Studies*, *35*(7), 1200-1219.

Hagedorn, L. S., Cabrera, A., & Prather, G. (2010). The community college transfer calculator: Identifying the course-taking patterns that predict transfer. *Journal of College Student Retention: Research, Theory and Practice*, *12*(1), 105-130.

Hagedorn, L. S., Moon, H. S., Cypers, S., Maxwell, W. E., & Lester, J. (2006). Transfer between community colleges and 4-year colleges: The all-American game. *Community College Journal of Research and Practice*, *30*(3), 223-242.

Hagedorn, L. S., & Purnamasari, A. V. (2012). A realistic look at STEM and the role of community colleges. *Community College Review*, doi:0091552112443701.

Hailu, T. E. (2012). *Adaptation and academic adjustment of first generation immigrant students from the horn of Africa to higher education learning in the United States* (Order No. 3555118). Available from ProQuest Dissertations & Theses Full Text. (1318643379). Retrieved from http://search.proquest.com/docview/1318643379?accountid=14696

Hale-Benson, J. (1986). *Black children: Their roots and their culture (rev. ed.)*.Baltimore, MD: John Hopkins University.

Hall, R. M., & Sandler, B. R. (1982). *The classroom climate: A chilly one for women?* (Report No. ED215628). Washington, DC: Association of American Colleges.

Hamilton, L. S., Stecher, B. M., Marsh, J. A., McCombs, J. S., & Robyn, A. (2007). *Standards-based accountability under No Child Left Behind: Experiences of teachers and administrators in three states*. Arlington, VA: Rand Corporation.

Handel, S. J. (2011). *Improving student transfer from community colleges to four-year institutions: The perspectives of leaders from baccalaureate-granting institutions.* New York, NY: College Board.

Hargreaves, J. R., Bonell, C. P., Boler, T., Boccia, D., Birdthistle, I., Fletcher, A., Pronyk, P, & Glynn, J.R. (2008). Systematic review exploring time trends in the association between educational attainment and risk of HIV infection in sub-Saharan Africa. *Aids*, *22*(3), 403-414.

Harmon, N. (2012). *The role of minority-serving institutions in national college completion goals.* Washington, D.C.: Institute for Higher Education Policy.

Harper, S. (2010). In his name: Rigor and relevance in research on African American males in education. *Journal of African American Males in Education, 1*(1), 1-6.

Harper, S. R., Patton, L. D., & Wooden, O. S. (2009). Access and equity for African American students in higher education: A critical race historical analysis of policy efforts. *The Journal of Higher Education*, *80*(4), 389-414.

Harris, F., & Harper, S. R. (2008). Masculinities go to community college: Understanding male identity socialization and gender role conflict. *New Directions for Community Colleges*, *2008*(142), 25-35.

Hartney, M. T., & Flavin, P. (2014). The political foundations of the Black–White education achievement gap. *American Politics Research*, doi: 1532673X13482967.

Heilig, J. V., & Darling-Hammond, L. (2008). Accountability Texas-style: The progress and learning of urban minority students in a high-stakes testing context. *Educational Evaluation and Policy Analysis*, *30*(2), 75-110.

Hill, C., Corbett, C., & St Rose, A. (2010). *Why so few? Women in science, technology, engineering, and mathematics*. Washington, D.C.: American Association of University Women.

Hinton, K. A. (2015). Should we use a capital framework to understand culture? Applying cultural capital to communities of color. *Equity & Excellence in Education*, *48*(2), 299-319.

Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *Status, prospects, and an agenda for research.* Washington, DC: National Academies Press.

Huberman, M., & Miles, M. B. (2002). *The qualitative researcher's companion*. Sage.

Hurtado, S., Newman, C. B., Tran, M. C., & Chang, M. J. (2010). Improving the rate of success for underrepresented racial minorities in STEM fields: Insights from a national project. *New Directions for Institutional Research, 2010*(148), 5-15.

Ignash, J. M., & Townsend, B. K. (2000). Evaluating state-level articulation agreement according to good practice. *Community College Review*, *28*(3), 1-21.

Jackson, K. F., & Samuels, G. M. (2011). Multiracial competence in social work: Recommendations for culturally attuned work with multiracial people. *Social Work*, *56*(3), 235-245.

Johnson, D. R. (2012). Campus racial climate perceptions and overall sense of belonging among racially diverse women in STEM Majors. *Journal of College Student Development*, *53*(2), 336-346.

Jonassen, D. H. (1994). Thinking technology: Toward a constructivist design model. *Educational technology*, *34*(4), 34-37.

Kagume, D. W. (2010). *A multiple case study of social cognitive influences on career choice in science, mathematics and technology among Kenyan women* (Order No. 3414597). Available from ProQuest Dissertations & Theses Full Text. (621241667). Retrieved from http://search.proquest.com/docview/621241667?accountid=14696

Kao, G. & Tienda, M. (1995). Optimism and achievement: The educational performance of immigrant youth. *Social Science Quarterly, 76,* 1-19.

Keels, M. (2013). Getting them enrolled is only half the battle: College success as a function of race or ethnicity, gender, and class. *American Journal of Orthopsychiatry*, *83*(2), 310-322. doi: 10.1111/ajop.12033.

Knight, D. W., Carlson, L. E., & Sullivan, J. F. (2007, June). Improving engineering student retention through hands-on, team based, first-year design projects. In *Proceedings of the International Conference on Research in Engineering Education*. Honolulu, HI.

Kibour, Y. (2001). Ethiopian immigrants' racial identity attitudes and depression symptomatology: An exploratory study. *Cultural Diversity and Ethnic Minority Psychology*, *7*(1), 47-58.

Kim, Y. (2009). Minority parental involvement and school barriers: Moving the focus away from deficiencies of parents. *Educational Research Review*, *4*, 80-102.

Kim, K. A., Sax, L. J., Lee, J. J., & Hagedorn, L. S. (2010). Redefining nontraditional students: Exploring the self-perceptions of community college students. *Community College Journal of Research and Practice, 34*(5), 402-422.

Klasen, S., & Lamanna, F. (2003). *The impact of gender inequality in education and employment on economic growth in the Middle East and North Africa*. Washington, D.C.: World Bank.

Labaree, D. F. (1990). From comprehensive high school to community college: Politics, markets, and the evolution of educational opportunity. *Research in sociology of education and socialization*, *9*, 203-240.

Ladson-Billings, G., & Tate IV, W. (1995). Toward a critical race theory of education. *The Teachers College Record*, *97*(1), 47-68.

Ladson-Billings, G. (1997). It doesn't add up: African American students' mathematics. *Journal for Research In Mathematics Education*, *28*(6), 697-708.

Larson, P. (2012, July 18). President Obama announces new plan to create STEM master Teaching Corps. *Office of Science and Technology Policy.* Retrieved November 29, 2014 from http://www.whitehouse.gov/blog/2012/07/18/president-obama-announces-new-plan-create-stem-master-teaching-corps

Lather, P. (1986). Issues of validity in openly ideological research: Between a rock and a soft place. *Interchange*, *17*(4), 63-84.

Lincoln, Y. S. (1995). Emerging criteria for quality in qualitative and interpretive research. *Qualitative inquiry*, *1*(3), 275-289.

Lord, S. M., Camacho, M. M., Layton, R. A., & Ohland, M. W. (2010, April). Who enrolls in electrical engineering? A quantitative analysis of U.S.A. student trajectories. *IEEE EDUCON Education Engineering 2010*. Madrid, Spain: Institute of Electrical and Electronics Engineers.

Lord, S. M., Camacho, M. M., Layton, R. A., Long, R. A., Ohland, M. W., & Wasburn, M. H. (2009). Who's persisting in engineering? A comparative analysis of female and male Asian, Black, Hispanic, Native American, and White students. *Journal of Women and Minorities in Science and Engineering*, *15*(2), 167-190.

MacDonald, V., & Carrillo J.F. (2010). The United Status of Latinos. In E. Murillo Jr., S.A. Villenas, R.T. Galván, J.S. Muñoz, C. Martínez, & M. Machado-Casas (Eds.), *Handbook of Latinos and education: Theory, research, and practice* (pp. 3-26). New York, NY: Routledge.

Malcom, L. E. (2010). Charting the pathways to STEM for Latina/o students: The role of community colleges. *New Directions for Institutional Research*, *2010*(148), 29-40.

Maton, K. I., & Hrabowski III, F. A. (2004). Increasing the number of African American PhDs in the sciences and engineering: A strengths-based approach. *American Psychologist, 59*(6), 547-556.

McClenney, K, Marti, C.N., & Adkins, C. (2006). *Student engagement and student outcomes: Key findings from CCSSE validation research.* Austin, TX: Community College Leadership Program-The University of Texas at Austin.

McNeil, L. M. (2005). Faking equity: High-stakes testing and the education of Latino youth. In A. Valenzuela (Ed.), *Leaving children behind: How "Texas-style" accountability fails Latino youth* (pp. 57–111). New York: State University of New York Press.

Mellow, G. O., & Heelan, C. M. (2014). *Minding the dream: The process and practice of the American community college*. Lanham, MD: Rowman & Littlefield.

Michaelowa, K. (2001). Primary education quality in Francophone Sub-Saharan Africa: Determinants of learning achievement and efficiency considerations. *World Development, 29*(10), 1699-1716.

Miles, M. B., Huberman, A. M., & Saldaña, J. (2013). *Qualitative data analysis: A methods sourcebook.* Los Angeles, CA: SAGE Publications, Inc.

Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory into Practice*, *31*(2), 132-141.

Morgan, S. L., & Mehta, J. D. (2004). Beyond the laboratory: Evaluating the survey evidence for the disidentification explanation of Black-White differences in achievement. *Sociology of Education*, *77*(1), 82-101.

Morse, R. (2014, September 8). Best undergraduate engineering programs methodology. *U.S. News and World Report.* Retrieved December 1, 2014, from http://www.usnews.com/education/best-colleges/articles/2014/09/08/best-undergraduate-engineering-programs-methodology

Museus, S. D., Palmer, R. T., Davis, R. J., & Maramba, D. (2011). *Racial and ethnic minority student success in STEM education: ASHE higher education report*. New York, NY: John Wiley & Sons.

Mwangi, C. A. G. (2014). Complicating blackness: Black immigrants & racial positioning in U.S. higher education. *Journal of Critical Thought and Praxis*, *3*(2), 1-27.

Mwangi, C. A. G. (2015). (Re) Examining the role of family and community in college access and choice: A metasynthesis. *The Review of Higher Education*, *39*(1), 123-151.

National Association for College Admission Counseling. (2015). *Community college: A viable option.* Arlington, VA: National Association for College Admission Counseling.

National Center for Education Statistics. (2012). *2011-12 National Postsecondary Student Aid Study* (NPSAS:12). Washington, DC: U.S. Department of Education.

National Science Board (2014). *Science and engineering indicators 2014 digest*. Retrieved November 29, 2014, from http://www.nsf.gov/statistics/seind14/index.cfm/digest/stem.htm

National Society of Black Engineers (2016). NSBE history. Best undergraduate engineering programs methodology. Retrieved December 1, 2014, from http://www.nsbe.org/About-Us/NSBE-History.aspx#.VuT20n0rJhE

Ohland, M. W., Brawner, C. E., Camacho, M. M., Layton, R. A., Long, R. A., Lord, S. M., & Wasburn, M. H. (2011). Race, gender, and measures of success in engineering education. *Journal of Engineering Education*, *100*(2), 225-252.

Ong, M., Wright, C., Espinosa, L. L., & Orfield, G. (2011). Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics. *Harvard Educational Review*, *81*(2), 172-209.

Palmer, C. A. (2000). Defining and studying the modern African diaspora. *The Journal of Negro History*, *85*(1/2), 27-32.

Palmer, R. T., & DuBord, Z. M. (2013). Achieving success. In Palmer, R.T. & Wood, J.L. (Eds.), *Community colleges and STEM: Examining underrepresented racial and ethnic minorities* (pp. 193-208). New York, NY: Routledge.

Palmer, R. T., Maramba, D. C., & Gasman, M. (Eds.). (2013). *Fostering success of Ethnic and Racial Minorities in STEM*. New York, NY: Routledge.

Palmer, R. T., & Wood, J. L. (Eds.). (2013). *Community colleges and STEM: Examining underrepresented racial and ethnic minorities*. New York, NY: Routledge.

Perez, P. A., & McDonough, P. M. (2008). Understanding Latina and Latino college choice: A social capital and chain migration analysis. *Journal of Hispanic higher education*, *7*(3),

249-265.

Perna, L. W. (2000). Differences in the decision to attend college among African Americans, Hispanics, and Whites. *Journal of Higher Education*, *71*(2), 117-141.

Perna, L., Lundy-Wagner, V., Drezner, N. D., Gasman, M., Yoon, S., Bose, E., & Gary, S. (2009). The contribution of HBCUs to the preparation of African American women for STEM careers: A case study. *Research in Higher Education*, *50*(1), 1-23.

Pizzorno, M. C., Benozzo, A., Fina, A., Sabato, S., & Scopesi, M. (2014). Parent–child career construction: A narrative study from a gender perspective. *Journal of Vocational Behavior*, *84*(3), 420-430.

Pomerantz, E. M., Ng, F. F., & Wang, Q. (2008). Culture, parenting, and motivation: The case of East Asia and the United States. *Advances in motivation and achievement: Social Psychological Perspectives*, *15*, 209-240.

Powers, M. H. (1994). *Factors that influence the educational attainment levels of women students at the University of Malawi, Africa* (Order No. 9518520). Available from ProQuest Dissertations & Theses Full Text. (304113000). Retrieved from http://search.proquest.com/docview/304113000?accountid=14696

Prewitt, A., Daily, S. B., & Eugene, W. (2007). Minority retention and success in engineering: Diversifying the pipeline through the development of social capital. In *Proceedings of the 2007 ASEE Annual Conference* (pp. 24-28).

Pronin, E., Steele, C. M., & Ross, L. (2004). Identity bifurcation in response to stereotype threat: Women and mathematics. *Journal of Experimental Social Psychology*, *40*(2), 152-168.

Reed, H.E., & Andrzejewski, C.S. (2010). The new wave of African immigrants in the United States: *2010 Population Association of America Annual Meeting*: Dallas, TX: Princeton University.

Renn, K. A. (2008). Research on biracial and multiracial identity development: Overview and synthesis. *New Directions for Student Services, 123*, 13-21.

Reyes, M. E. (2011). Unique challenges for women of color in STEM transferring from community colleges to universities. *Harvard Educational Review, 81*(2), 241-263.

Rios-Aguilar, C., & Deil-Amen, R. (2012). Beyond getting in and fitting in: An examination of social networks and professionally relevant social capital among Latina/o university students. *Journal of Hispanic Higher Education, 11*(2), 179-196.

Rosenthal, L., London, B., Levy, S. R., & Lobel, M. (2011). The roles of perceived identity compatibility and social support for women in a single-sex STEM program at a co-educational university. *Sex Roles, 65*(9-10), 725-736.

Roubeni, S., De Haene, L., Keatley, E., Shah, N., & Rasmussen, A. (2015). "If we can't do it, our children will do it one day": A qualitative study of West African immigrant parents' losses and educational aspirations for their children. *American Educational Research Journal, 52*(2), 275-305. doi: 10.3102/0002831215574576

Ryu, M. (2010). *Minorities in higher education: Twenty-fourth status report*. Washington, D.C.: American Council on Education.

Sharpe, R. V., & Swinton, O. H. (2012). Beyond anecdotes: A quantitative examination of Black women in academe. *The Review of Black Political Economy, 39*(3), 341-352.

Shields, S. A. (2008). Gender: An intersectionality perspective. *Sex Roles, 59*(5), 301-311.

Smith, W. A., Allen, W. R., & Danley, L. L. (2007). "Assume the position...You fit the description": Psychosocial experiences and racial battle fatigue among African American male college students. *American Behavioral Scientist*, *51*(4), 551-578.

Staudinger, J. (2006). A brief guide to engineering majors. *Engineers Dedicated to a Better Tomorrow*. Retrieved March 12, 2016 from http://www.dedicatedengineers.org/Resources/Engineering_Disciplines_Handout.pdf

Stebleton, M. J. (2007). Career counseling with African immigrant college students: Theoretical approaches and implications for practice. *The Career Development Quarterly*, *55*(4), 290-312.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of personality and social psychology*,*69*(5), 797-811.

Stout, J. G., Dasgupta, N., Hunsinger, M., & McManus, M. A. (2011). STEMing the tide: Using ingroup experts to inoculate women's self-concept in science, technology, engineering, and mathematics (STEM). *Journal of Personality and Social Psychology*, *100*(2), 255-270.

Strayhorn, T. L. (2009, October). Work in progress-Academic and social barriers to Black and Latino male collegians in engineering. In *Proceedings of the 39th IEEE International Conference on Frontiers in Education Conference* (pp. 1246-1248). New York, NY: IEEE Press.

Swain, C. M. (2006). An inside look at education and poverty. *Academic Questions*, *19*(2), 47-53.

Tan, E., Calabrese-Barton, A., Kang, H., & O'Neil, T. (2013). Desiring a career in STEM-related fields: How middle school girls articulate and negotiate identities-in-practice. *Journal of Research in Science Teaching, 50*(10), 1143-1179.

Tan, E. T., & Goldberg, W. A. (2009). Parental school involvement in relation to children's grades and adaptation to school. *Journal of Applied Developmental Psychology*, *30*(4), 442-453.

The World Bank (2016). *Percentage of enrollment in primary education in private institutions*. Retrieved March 9, 2016 from http://data.worldbank.org/indicator/SE.PRM.PRIV.ZS

Thomas, K. J. (2009). Parental characteristics and the schooling progress of the children of immigrant and U.S.-born blacks. *Demography, 46*(3), 513-534.

Thomas, K. J. (2011). Familial influences on poverty among young children in black immigrant, US-born black, and nonblack immigrant families. *Demography, 48*(2), 437-460.

Tierney, W.G. & Clemens, R.F. (2011). In J.C. Smart & M.B. Paulsen (Eds.), *Higher education: Handbook of theory and research* (pp. 57-83). Netherlands: Springer.

Torres, V. (2004). Familial influences on the identity development of Latino first-year students. *Journal of College Student Development, 45*(4), 457-469.

Townsend, B. K. (1999). *Understanding the Impact of Reverse Transfer Students on Community Colleges. New Directions for Community Colleges, Number 106*. Jossey-Bass Inc., Publishers, 350 Sansome Street, San Francisco, CA 94104-1342.

Treisman, U. (1992). Studying students studying calculus: A look at the lives of minority mathematics students in college. *The College Mathematics Journal*, *23*(5), 362-372.

Tsui, L. (2007). Effective strategies to increase diversity in STEM fields: A review of the research literature. *The Journal of Negro Education*, *76*(4), 555-581.

Tulshyan, R. (2010, March 2). Top 10 college majors for women. Retrieved November 29, 2014 from http://www.forbes.com/2010/03/02/top-10-college-majors-women-forbes-woman-leadership-education.html

Turner, C. S. V., & Myers, S. L., Jr. (2000). *Faculty of color in academe: Bittersweet success*, Needham Heights, MA: Allyn & Bacon.

U.S. Census (2013a, July 25). About Hispanic origin. Retrieved December 1, 2014, from http://www.census.gov/topics/population/hispanic-origin/about.html

U.S. Census (2013b, July 8). Race. Retrieved December 1, 2014, from http://www.census.gov/topics/population/race/about.html

U.S. Census (2013c, June 19). About foreign-born population. Retrieved January 29, 2016, from https://www.census.gov/topics/population/foreign-born/about.html

U.S. Congress. (2014). House approves four committee bills. Retrieved November 29, 2014, from http://science.house.gov/press-release/house-approves-four-committee-bills

U.S. Department of State (2016). Educational system of The Gambia. *Embassy of the United States.* Retrieved March 9, 2016 from http://banjul.usembassy.gov/news/education/educational-system-of-the-gambia.html

University of Maryland (2015). Report: UG Retention and Graduation Rates (2005 Cohort and Later). In *Institutional, Research, Planning, and Assessment.* Retrieved from http://www.irpa.umd.edu

Walpole, M., McDonough, P. M., Bauer, C. J., Gibson, C., Kanyi, K., & Toliver, R. (2005). This test is unfair: Urban African American and Latino high school students' perceptions of standardized college admission tests. *Urban Education*, *40*(3), 321-349.

Weerts, D. J., Cabrera, A. F., & Mejías, P. P. (2014). Uncovering categories of civically engaged college students: A latent class analysis. *The Review of Higher Education*, *37*(2), 141-168.

Weinberg, J. B., Pettibone, J. C., Thomas, S. L., Stephen, M. L., & Stein, C. (2007, June). The impact of robot projects on girls' attitudes toward science and engineering. *Workshop on Research in Robots for Education*. Atlanta, GA: Georgia Institute of Technology.

White, B. W. (1996). Talk about school: Education and the colonial project in French and British Africa (1860-1960). *Comparative Education*, *32*(1), 9-26.

White House (2009). The American graduation initiative. Retrieved April 21, 2015, from https://www.whitehouse.gov/the_press_office/Excerpts-of-the-Presidents-remarks-in-Warren-Michigan-and-fact-sheet-on-the-American-Graduation-Initiative

White House (2015). Building American skills through community colleges. *The White House.* Retrieved February 8, 2015 from http://www.whitehouse.gov/issues/education/higher-education/building-american-skills-through-community-colleges

Wladis, C., Hachey, A. C., & Conway, K. M. (2015). The representation of minority, female, and non-traditional STEM majors in the online environment at community colleges: A nationally representative study. *Community College Review*, *43*(1), 89-114. doi:10.1177/0091552114555904.

Wood, J. L. (2010). African American males in the community college: Towards a model of academic success. Unpublished Doctoral Dissertation. Tempe, AZ: Arizona State University.

Wood, J. L. (2014). Examining academic variables affecting the persistence and attainment of black male collegians: a focus on academic performance and integration in the two-year college. *Race Ethnicity and Education*, *17*(5), 601-622.

Younger, T.K. (2009). *The case for degree completion: African American transfer students at a traditionally White institution.* Available from ProQuest Dissertations & Theses Full Text. Retrieved from http://drum.lib.umd.edu/bitstream/handle/1903/9944/Younger_umd_0117E_10905.pdf?sequence=1&isAllowed=y

Yosso, T. J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race Ethnicity and Education*, *8*(1), 69-91.

Zaffos, J. (2013). Power of place. *Tribal College Journal of American Indian Higher Education*, *24*(3), 17-20.

Zajacova, A., Lynch, S. M., & Espenshade, T. J. (2005). Self-efficacy, stress, and academic success in college. *Research in higher education*, *46*(6), 677-706.

Zarma. (2016). In *Encyclopedia Britannica*. Retrieved January 29, 2016 from http://www.britannica.com/topic/Zarma.