DISSERTATION

RELATION OF OUT-OF-SCHOOLTIME PROGRAM PARTICIPATION TO [STEM] ACADEMIC OUTCOMES FOR UNDERREPRESENTED YOUTH

Submitted by

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In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Fall 2016

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ABSTRACT

RELATION OF OUT-OF-SCHOOLTIME PROGRAM PARTICIPATION TO [STEM] ACADEMIC OUTCOMES FOR UNDERREPRESENTED YOUTH

This is the primary abstract to my three-part dissertation research project. This publication includes two introductory chapters that provide background information and the theoretical framing for the research. I prepared chapters 3, 4, and 5 as independent research publications; therefore, some of the introductory content of each is summative and yet repetitive of the chapters that precede it. In the final, sixth chapter, I describe how the three research studies relate to each other and contribute to the research worlds of youth development and out-of-schooltime programming, specifically as related to identity development, college readiness, and exposure to science, technology, engineering, and mathematics (STEM) fields.

The research in study 1 supports other findings that out-of-schooltime programs provide support for youth of color. I collected data through focus groups of program participants and alumni to understand the participants' experiences in the program. The study results show the amount of community cultural wealth (CCW) that youth of color developed through participation in the out-of-schooltime program. The research also emphasizes the role of the program location in the development of CCW. I use a critical-race-theory (CRT) lens through which to frame the analyses for this portion of the research. I present the data through a composite counternarrative told through the program participants' voices. Findings reveal that the participants experienced a great deal of CCW, which seemed to assist them during college. I include examples of the six forms of CCW the participants gained from the program. The study concludes with suggestions for practice and future research. This research is part of a larger project intended to provide a basis for increased understanding into how out-of-schooltime programs support underrepresented youth.

In the second study, I investigate the factors that seem shared among participants who graduate with 4-year degrees and among those who do not. I use qualitative and quantitative survey data to gather information from alumni youth participants. I analyze the data using a CCW and bioecology framework to understand the strengths of the community throughout the college-readiness process. Findings reveal that participants who academically successful are supported from many different venues. Additionally, these participants need opportunities to shine and show pride in their academics and STEM accomplishments. Those participants who pursued STEM fields indicated they were engaged in fun STEM activities at a young age and received positive recognition in a STEM area. This research supports the need for youth programs that create an inclusive community and values each person's role and contributions. This study closes with suggestions for practice.

For the final study of this three-part research project, I investigated the ways in which amount of experienced discrimination and level of identity awareness influenced participants' academic and STEM outcomes. I used the same qualitative and quantitative survey tool as in the prior study, and the same population of youth program alumni. I analyzed the data using a three-part framework, including CCW, CRT, and bioecology. I used bioecology in the survey design, as is evident in the survey asking about many components of participants' lives. I used CRT to identify instances of discrimination, and to reframe my perspective to be that of my participants instead of my own. I used CCW to identify strengths the participants employed to overcome discrimination and other obstacles. Findings reveal that participants experienced increasing discrimination for multiple identities at each of the escalating levels (individual, institutional, societal, and civilizational). Additionally, the nonSTEM-persistent participants experience more high-level awareness and discrimination for their identities compared to the STEM-persistent group. In many cases, participants who had experienced more discrimination had higher academic aspirations. This research builds on the growing knowledge base related to the experiences and effects of institutional racism on underrepresented youth.

Keywords: Bioecology; critical race theory; counternarrative; community cultural wealth; ecological learning; youth of color; underrepresented youth; out-of-schooltime programs

ACKNOWLEDGMENTS

Most of those who know me personally, know that my dissertation journey was not always easy; however, many people helped me move beyond the obstacles. My mother has been an essential asset for me in finishing this research. She has been a consistent thought and research partner throughout all of the analysis and writing stages. My partner Arden has supported me emotionally and in my writing endeavors, editing my work and providing his perspective on my research findings and presentation. My best friend and sister, Brooke, supported me emotionally and technically through providing me with meals and care packages and editing my many pages of writing to find minute typos and inconsistencies. I also appreciate the rest of my family and friends for always supporting me and encouraging me to continue reaching for my dream of being a doctor.

I appreciate my Education Programs Family, particularly Judy, Mickael, and Touri. In this family, I include a large group of people, representing over 600 people who have been touched by the programs as staff members, participants, or both. I could not have done this research or developed my current perspectives if not for my experiences there and all of the individuals who have contributed their personalities and hearts to making the program a welcoming and transformative environment.

Last but not least, I am forever grateful to some faculty members from Colorado State University, all of whom have provided emotional and technical support. Gene Gloeckner supported me since my first year of the graduate program. He is the primary reason I continue beyond my first year of my doctoral program. My primary advisor, Antonette Aragon took me under her wing as an advisee when she was already pushed to the limits and has developed my

critical perspectives greatly over the past few years. My co-advisor, David MacPhee provided immense support for me in developing a complete and robust study. David also agreed to assist me during a time when he was reducing his workload. My committee members, Jackie Pela-Shuster and Shelley Haddock have provided support in bringing fresh perspectives with focuses on career development and youth development. Lastly, I enlisted Sharon Hamm to edit my research, who provided me with significant feedback on formatting guidelines, writing style and clarity. I deeply appreciate the diverse feedback I have received to make this a multidisciplinary dissertation. I hope that this product brings pride to others, just as it does for me.

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CHAPTER 1: INTRODUCTION

I probably knew from the first day of college biology class that I did not fit in with the science crowd. Although I earned my bachelor's degree in biology, I struggled through the classes. I refused to accept the signs that I may not be suited to be a doctor according to the US standards. Looking back, I am not sure why I felt unsuccessful in this task. The possibilities are endless: being a woman, having trouble with memorization, not learning well from lectures, or not feeling supported in my degree choice.

Instead of pursuing medicine, I became an educator and a mentor. I spent most of my time working with an out-of-schooltime science, technology, engineering, and math (STEM) college-readiness program that provided supplemental education for low-income and first-generation high-school students. This program helps students learn about and see the interesting aspects of STEM. The goal of the program is to increase the numbers of students of color who attend college and major in a STEM field. I have witnessed many students fall in love with STEM as a result of their involvement in the college-readiness program. They continue to declare a STEM major for the first 2 years of college, but graduate as a nonSTEM major. This outcome is a problem. The United States needs a method to address the unequal representation of graduates in STEM fields.

Throughout this dissertation research, I have strived to capture some of the complex reasons that underrepresented youth pursue STEM fields less frequently than White and Asian, middle- and high-income students do. To capture this complexity, I have elected to do an alternative dissertation, which typically includes three related research studies. My chapters are as follows:

- Chapter 1: I introduce the terms used throughout this paper. Then I paint a picture of the educational history in the United States that has led to the demographic disparities in STEM fields. I share statistics that demonstrate the disparities. Then I discuss influencing factors that promote and demote the STEM diversity.
- Chapter 2: This chapter begins with a summary of the purpose of the study and the study diagram. Through the diagram, I introduce the 3-part theoretical framework: community cultural wealth (CCW), critical race theory (CRT), and bioecology. CCW identifies different types of capital that exist in communities of color. This theory highlights the strengths of communities (Yosso, 2005). CRT illuminates the importance of a person's identity, specifically one's race, and in general how people's identities influence their experiences. A fundamental component of CRT is that the experiences of White people are not normative and not representative of everyone's experiences (Solórzano & Yosso, 2002). Bioecology describes the contextual influences on human development, using the process-person-context-time model (Bronfenbrenner & Morris, 2006). This model has numerous influences and acts as a reminder of factors for one to consider for a full understanding of contextual influences. Last, I introduce details about the three studies that I conducted for my dissertation.
- Chapter 3: In this chapter, I present my first study, in which I investigated how participants experienced community cultural wealth during their time in an out-of-schooltime program. I found that the participants experienced a great deal of community cultural wealth, which seemed to assist them during college. I completed this qualitative study for my preliminary exam and have since updated it to submit to *Race, Ethnicity and*

Education. This peer-reviewed journal is fitting because supports using critical studies and informing educational practices, particularly for students of color.

- Chapter 4: According to the research data included in Chapter 3, study participants most often valued the component of the community bond established between STEM program participants and staff. Therefore, in this second study I wanted to learn how and by whom the community is built for program participants. Components that contributed to my understanding of the community included the experiences participants had during the program and the skills they felt they had learned as a result of participation. I base this study on a mixed-methods research design and used a qualitative and quantitative survey. I plan to submit this study to *Afterschool Matters Journal*, a national, peer-reviewed journal dedicated to improving professionalism in afterschool programs and to influencing youth-developmental policy.
- Chapter 5: Through this final study, I sought to determine the existence of a relationship between experienced discrimination and personal identity, and academic outcomes. I used the same mixed-methods survey as I used for the study in Chapter 4. Through chapters 4 and 5, I convey my efforts to understand the alumni-identified program components that related to participants' academic achievement levels. I plan to submit this paper to *Journal of Praxis in Multicultural Education*, a peer-reviewed journal targeted to formal K-through-16 educators that strive to bring new light to the meaning of praxis.
- Chapter 6: In this chapter, I synthesize my findings from all three studies to identify and develop the major benefits of program participation. I also present suggestions to increase

the success rates of program graduates. Finally, I suggest other efforts to continue reducing disparities in STEM fields.

For the remainder of Chapter 1, I provide the background information and definitions that inform my work. Please continue reading with an open mind to understand the unheard voices that I expose through my research. Allow yourself to consider this research as you engage with others in educational settings and mentoring interactions.

Definitions and Terms

This research includes terms that individuals use in everyday life. To ensure that all readers understand how I use the terms, I provide definitions and a diagram of their context within the research (Figure 1.1). The problem my research addresses is the underrepresentation of certain populations within STEM majors. I define STEM majors and an overview of the target population, and some of the major factors that relate to those who persist to careers in STEM fields. Because I gathered the data from participants and alumni of an out-of-schooltime program, I provide a broad definition of the purpose and guidelines for out-of-schooltime programs. I also provide additional definitions of more specialized terms in later chapters. Following the definitions, I unpack the depth of the problem in the Background Information section by introducing the related concepts and history. I also introduce factors that influence the severity of the problem and recommendations to address the problem. Last, I describe the program that set the stage for my research and my interest in this underrepresentation in STEM majors.

The Problem

- Underrepresentation of certain populations in STEM majors
  - Definition of *STEM majors*
  - Definition of an *underrepresented* population

The Target Population

- Identification of underrepresented populations
  - People of Color (specifically *Black* and *Latin@* for this research)
  - *Low-income* individuals

Research Setting

- *Out-of-schooltime program*

Figure 1.1. Outline of the problem of underrepresentation in STEM, the target population, and the research setting, as related to the definitions of terms.

STEM Majors

As previously noted, STEM stands for *science, technology, engineering, and mathematics.* The US government developed a list of college majors, which they defined as STEM majors (ICE, 2012), which include all aspects of science, technology, engineering, and mathematics. Some majors may be surprising because they do not immediately come to mind when one thinks of STEM (e.g., educational research, robotics, architecture, occupational safety, and psychology). Jenkins (2003) has defined STEM education as a teaching methodology that incorporates the skills necessary for students to succeed in STEM. The US Department of Education (ED) has developed the Common Core State Standards based on the needs of the United States’ future workforce to have a better skill set than the current workforce. These skills include problem solving and knowing when to try a different approach (National Governors

Association, 2008). STEM education also includes the application of learning to real-world contexts that integrate various aspects of the community.

Underrepresented

The word *underrepresented* is widely used by professionals in the education fields. The US Department of Education (2011) defines the word as “Proportionate representation as measured by degree recipients, that is less than the proportionate representation in the general population” [section (b), para. 34]. The National Center for Education Statistics provides a detailed description, including individuals from any of the following categories in the underrepresented and underserved populations: people of color, first-generation college bound, low income, Generation 1.5 (those who have foreign-born parents and have attended schools in their native countries and the United States), online learners, and attendees of for-profit institutions (Rendón, 2006).

The National Science Foundation (NSF, 2008) defines *underrepresented* as including Alaska Natives, Native Americans, Blacks or African Americans, Latin@s,[1] Native Hawaiians and other Pacific Islanders, and persons with disabilities. NSF also notes that different fields of STEM may have different underrepresented groups. Otherwise stated, NSF does not have a general definition of the word *underrepresented*, but instead defines it according to the context, taking into consideration the groups who are underrepresented in each unique context (A. Cooper, personal communication, December 10, 2012). For this research, the term *underrepresented* includes females, individuals with disabilities, first-generation college-bound individuals, low-income families, and individuals who racially identify as Alaska Native, Native

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[1] Throughout this research, I use Latin@ because it includes all individuals with Spanish, Native American, and Latin American origins. Additionally, the @ symbol is gender inclusive.

American, Black or African American, Latin@, Native Hawaiian, other Pacific Islander, or mixed race.

Identity

In American society, we have multiple ways to categorize ourselves. These categories help us identify how others are different from or similar to ourselves. Within each category, one identity typically serves as the dominant identity, and society marginalizes or oppresses all of the other identities within the category. Table 1.1 shows some of the most common identity categories, and the identities within each category (adapted from a gender and sexuality section of the Intergroup Dialogue Program at the University of Massachusetts, Amherst in Spring 2005).

Table 1.1

Examples of Social-Identity Categories

Social-identity category	Examples of identities within each category
Race	**White**, Black, Latin@, Asian/Pacific Islander, Native American, Biracial, Multiracial
Socioeconomic class	**Owning class**, middle class, working class, poor
Sexual orientation	**Heterosexual**, Bisexual, Lesbian, Gay, Queer, Questioning
Religion/spiritual affiliation	**Christian**, Jewish, Muslim, Bahai'I, Agnostic, Atheist
Gender	**Man**, Woman, Transgender, Queer

Note: Bold font indicate dominant identities.

People of Color

This term is a designation for people who identify as Black, Latin@, Asian/Pacific Islander, Native American, Biracial, Multiracial. This includes all individuals in the United States who experience racism to varying levels. Please do not confuse this with the term *colored people*. This is offensive in that it defines people by the nonWhiteness of their skin and it was used in the 1950's to support the separate-but-equal policies. I use *people of color* as opposed to other terms including *minorities* or *nonWhite people* because the other terms often imply inferiority to the alternative (referring to White people). Specifically, when one references minorities, the alternative would be the majority or dominant. The English language and American culture support the concept that more is better, which implies that minorities are less than majorities. Further, nonWhite is the absence of Whiteness; speaking of the absence of something is implicitly negative regarding that which is lacking.

Latin@

Throughout the paper, I use the term *Latin@,* although some related research uses other terms, including *Hispanic* and *Chican@.* The word *Latin@* is inclusive of those who have mixed Spanish and Native American origins, and those who are recent emigrants from Latin American countries (Espino, Leal, & Meier, 2008). The @ symbol represents both female and male individuals.

Black

Throughout the paper, I use the term, *Black*. Although the research uses *African American* and *Black,* I do not find *African American* as inclusive of all of the different national origins of *Black* people, specifically Caribbean Americans.

Low Income

Those persons who live below the 150% federally determined poverty line (2015 Poverty Guidelines, 2015). The US government uses the 150% poverty guideline as a requirement for acceptance into the TRiO programs (Federal TRiO Programs, 2015). The 185% poverty guideline determines whether students receive reduced lunch prices (USDA, 2014). Table 1.2 shows the poverty guidelines for 2015. For this research, I considered any participants who were eligible for free or reduced lunch as low income.

The US government determines poverty guidelines by multiplying the household income from the previous year by the rate of inflation. This calculation provides the baseline value for a single-person household. The added dollar amount per person is calculated by adjusting for inflation the income levels for households of from one to eight people. Then, the differences between those values are determined and averaged. The resulting number serves as the dollar amount added for each additional person in the household (Computations for the 2014 Annual Update, 2014).

Table 1.2

2015 United States Federal Poverty Guidelines (48 Contiguous States and District of Columbia)

Number of persons in family/household	Annual income poverty guideline	150% poverty level guideline	185% poverty level guideline
1	$11,770	$17,655	$21,590
2	$15,930	$23,895	$29,101
3	$20,090	$30,135	$36,612
4	$24,250	$36,375	$44,123

Note. For families of more than four people, add $4,060, $6,240, or $7,511 respectively for each additional person.

Out-of-Schooltime Program

This term refers to programs that are designed for young people to attend before school, after school, on the weekends, or during school breaks. Through these programs, young people learn important skills and build connections with like-minded peers and adults. The programs typically provide enriching educational activities for youth, teach life skills, and build a community outside of the school context (Dabney et al., 2011; Elmoghrabi, 2012). The Institute of Education Sciences presented five recommendations for out-of-schooltime programs: (a) align program curriculum with academic curriculum; (b) find methods to maximize student involvement and attendance; (c) address for small-group and individual needs; (d) develop engaging learning opportunities; and (e) consistently evaluate the program and program outcomes to improve the program quality (Beckett et al., 2009).

Dosage. The dosage of program participation is the number of program services in which participants engage. In the program of interest, participants have a range of dosages. A participant with minimum dosage attended one to two events, as opposed to the highest dosage, of participants engaging in summer programming and academic year programming for their four years of high school.

Background Information

Each identity of underrepresented individuals plays a role in the individual's academic achievement level. Researchers have identified poverty as the greatest risk factor for educational failure and dropping out of school. For each year children live in poverty, the likelihood of falling behind their expected grade levels increases by 2%. Similarly, a child whose family lives in poverty for 10 years is 20 times more likely to do poorly in school than a child who is poor for only a year (Bernard, 1991). In turn, one finds a high concentration of impoverished youth in need of greater academic support and services.

Disparities in academic achievement associated with specific life factors can also be attributed to the level of education and family income of the student's guardian. Looking at admissions rates alone, data from the Expanded College and Beyond database shows that the percent of students accepted into college in 1995 steadily increased from 34% to 43% as family income increased (Bowen, Kurzeil, & Tobin, 2005). The persisting gap between student enrollment rates in postsecondary degree programs, when subdivided by family income, further demonstrates this relationship. The gap between low- and high-income student enrollments decreased from 41% in 1972 to 25% in 2008, but it persists (National Center for Education Statistics, 2010). Similarly, the percentage of college admissions increased from 35% to 42% as parental education levels increase from no high-school degree to doctorate-level degree (Bowen et al., 2005).

For more than 40 years, there has been a consistent gap in high-school diplomas earned by low-income students versus high-income students, and Black and Latin@ students versus White students. Despite overall decreases in dropout rates among all students, in 2008, 9% of low-income students compared to 2% of high-income students dropped out, and 19% of Latino students and 11% of Black students dropped out compared to 5% of White students (Chapman, Laird, & KewalRamani, 2010). There is also a consistent difference between the percent of degrees various ethnicities and races have earned. Specifically, in 1972, 35% of Latin@ students dropped out of high school, compared to 22% of Black students and only 12% of White students. These significant gaps persisted in 2008, with 19% of Latin@ students, 11% of Black students, and 5% of White students dropping out (Chapman et al., 2010). Although the gaps have decreased, a problem clearly still exists regarding high-school graduation rates for students from ethnic/racial-minority and low socioeconomic-status (SES) backgrounds.

Additionally, extreme barriers in college enrollment exist for first-generation, college-bound students. For example, a report by the National Center for Educational Statistics (2001) indicated that only 54% of first-generation, college-bound students pursue college, compared to 82% of high school graduates whose parents held a bachelor's degree or higher. Otherwise stated, the gap between first-generation, college-bound students and those with parents who have a bachelor's degree or higher remained significant between 1992 and 2008, with a low of 25% difference in 2006 and a high of 46% difference in 1995 (National Center for Education Statistics, 2010).

Educational History in the United States

Formal schooling in the United States for White, upper-class boys began in the mid-1600s in Massachusetts. Slowly, more states in the Northeast began to open schools to teach children religion and the laws of the Commonwealth (Sass, 2014). In 1787, the first school for girls opened in Pennsylvania. Soon after, in the early 1800s, schools opened for children who had learning disabilities and those who were blind and deaf. Slaves received minimal education, particularly once many Southern states passed laws that prohibited teaching slaves to read or write (the first law of this kind passed in 1830; Goldin, 1999). In contrast, 200 years after schools had begun for White boys, the first school for African Americans opened in 1837 in Pennsylvania (Sass, 2014). Regardless of prohibition laws, however, Black communities in the North and South developed unofficial methods to teach reading and writing (Anderson, 1988). The first Morrill Act (1862) granted government land to states to use for colleges. This Act was followed by the second Morrill Act (1890), which provided comprehensive support for the colleges and led to the establishment of 16 Historically Black Colleges and Universities (Goldin, 1999; Nelson & Weinbaum, 2006; Sass, 2014). By the end of the 1800s, the responsibility for education had shifted from parents to the government, and by 1913, all White children had to be enrolled in school (Clare Boothe Luce Policy Institute, n.d.).

Also by the turn of the century, government officials established a clear separation of church and state as a response to the increased number of immigrants with different religious beliefs (Goldin & Katz, 2003). However, the government did not integrate any people of color into the schools for White children. Government officials sent Native American and Mexican children to boarding schools, where they were taught “proper” American culture (Sass, 2014). Black children learned in their own segregated schools, as the Plessey vs. Ferguson case (1896;

Goldin & Katz, 2003) supported. By the 1920s, the Native American boarding schools had primarily closed down. In 1931, the Alvarez vs. the Board of Trustees of the Lemon Grove (CA) School District became the first desegregation court case in the United States (Sass, 2014). A number of other court cases followed, including Brown vs. Board of Education of Topeka (1954), which made segregation illegal in the United States (Sass, 2014). Figure 1.2 details some of the major events that followed for specific groups of people living in the United States. During the 1960s and 1970s, educational disparities between White middle- and upper-class children, and children of color and low-income children reduced significantly (Wells, 2014). Federal laws and educational approaches addressed specific identities. However, as the United States began to take on the color-blind approach of today, educational disparities began to widen once again (Wells, 2014). In particular, after the passage of the No Child Left Behind law in 2001, disparities increased again because the element of cultural competence was lacking in the standardized tests used (Morris, 2009; Racial Justice, n.d.). These tests do not accurately reflect the intelligence or ability of students of color or low-income students. Additionally, the school grading systems provide schools with a reputation based on their standardized tests scores and ignore the community benefits of the schools. The recent school closures and educational budget cutbacks have largely influenced low-income areas (Sass, 2014). School-choice programs represent another example of color-blind policy (e.g., charter schools, vouchers, and outside-district busing). These programs have benefited White, low-income families more than low-income families of color because White families possess increased access to transportation and cultural capital (Wells, 2014).

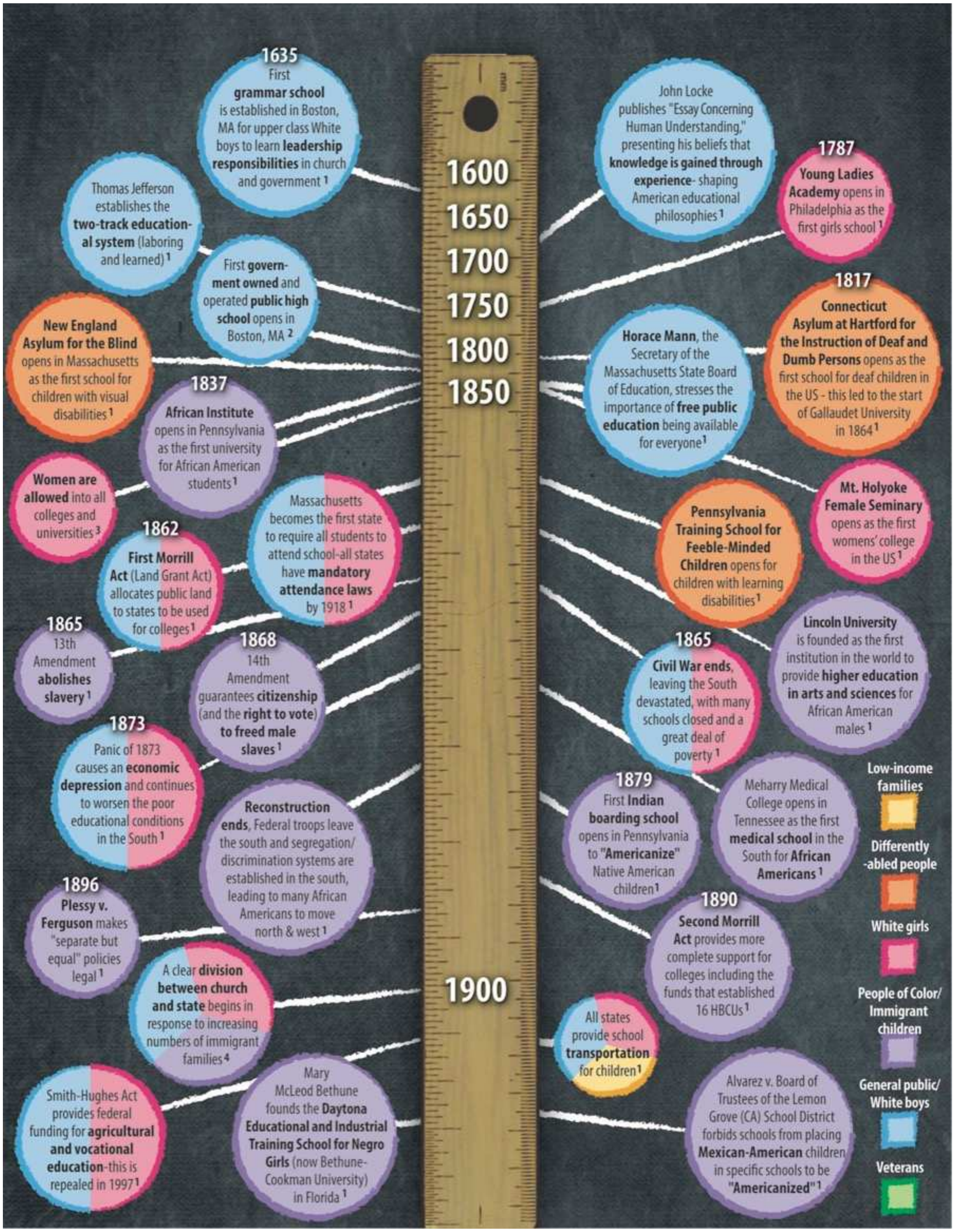
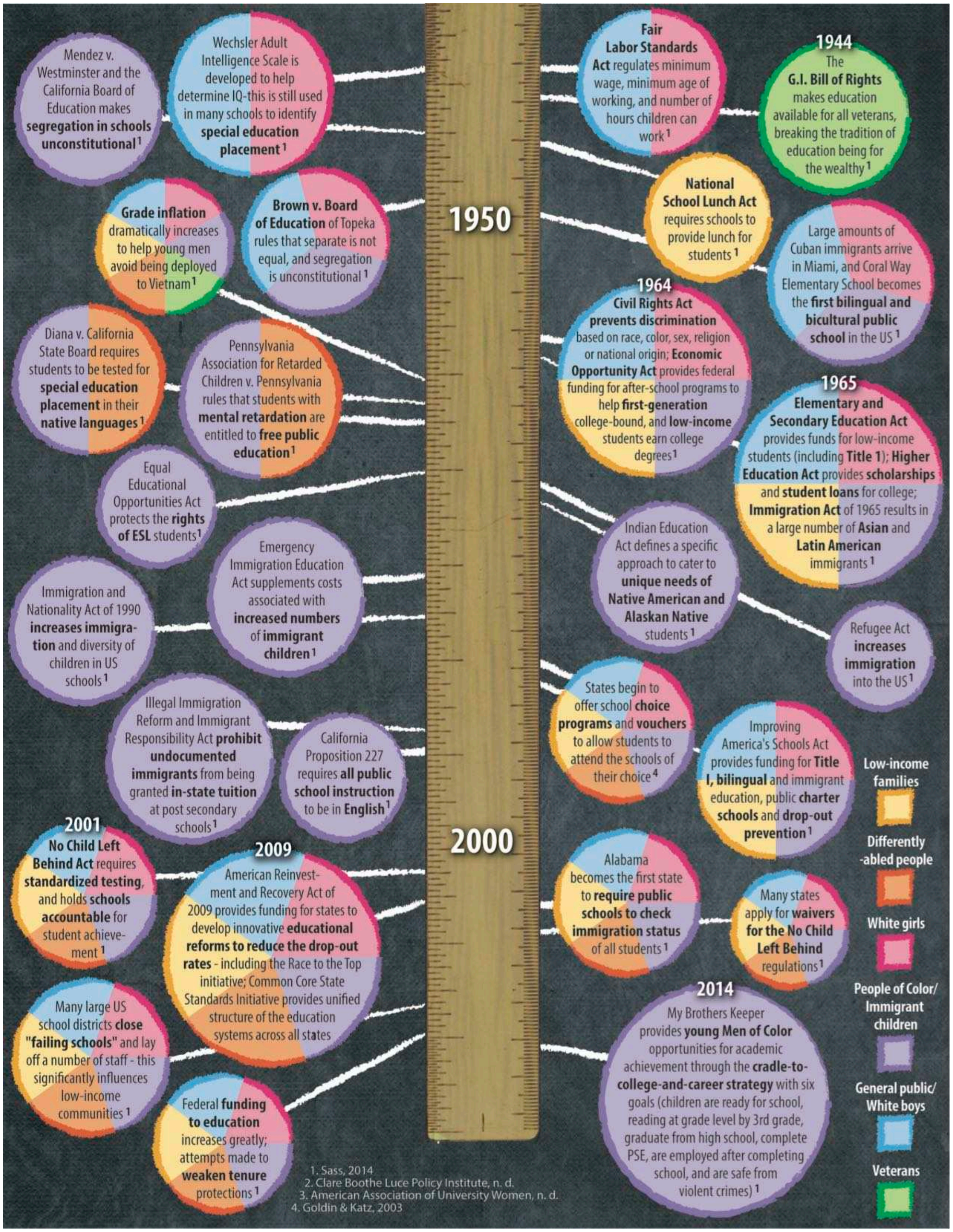

1600
1650
1700
1750
1800
1850
1900
1635 First grammar school is established in Boston, MA for upper class White boys to learn leadership responsibilities in church and government 1
Thomas Jefferson establishes the two-track educational system (laboring and learned) 1
First government owned and operated public high school opens in Boston, MA 2
New England Asylum for the Blind opens in Massachusetts as the first school for children with visual disabilities 1
1837 African Institute opens in Pennsylvania as the first university for African American students 1
Women are allowed into all colleges and universities 3
1862 First Morrill Act (Land Grant Act) allocates public land to states to be used for colleges 1
Massachusetts becomes the first state to require all students to attend school-all states have mandatory attendance laws by 1918 1
1865 13th Amendment abolishes slavery 1
1868 14th Amendment guarantees citizenship (and the right to vote) to freed male slaves 1
1873 Panic of 1873 causes an economic depression and continues to worsen the poor educational conditions in the South 1
Reconstruction ends, Federal troops leave the south and segregation/discrimination systems are established in the south, leading to many African Americans to move north & west 1
1896 Plessy v. Ferguson makes "separate but equal" policies legal 1
A clear division between church and state begins in response to increasing numbers of immigrant families 4
Smith-Hughes Act provides federal funding for agricultural and vocational education-this is repealed in 1997 1
Mary McLeod Bethune founds the Daytona Educational and Industrial Training School for Negro Girls (now Bethune-Cookman University) in Florida 1
John Locke publishes "Essay Concerning Human Understanding," presenting his beliefs that knowledge is gained through experience- shaping American educational philosophies 1
1787 Young Ladies Academy opens in Philadelphia as the first girls school 1
1817 Connecticut Asylum at Hartford for the Instruction of Deaf and Dumb Persons opens as the first school for deaf children in the US - this led to the start of Gallaudet University in 1864 1
Horace Mann, the Secretary of the Massachusetts State Board of Education, stresses the importance of free public education being available for everyone 1
Mt. Holyoke Female Seminary opens as the first womens' college in the US 1
Pennsylvania Training School for Feeble-Minded Children opens for children with learning disabilities 1
Lincoln University is founded as the first institution in the world to provide higher education in arts and sciences for African American males 1
1865 Civil War ends, leaving the South devastated, with many schools closed and a great deal of poverty 1
1879 First Indian boarding school opens in Pennsylvania to "Americanize" Native American children 1
Meharry Medical College opens in Tennessee as the first medical school in the South for African Americans 1
1890 Second Morrill Act provides more complete support for colleges including the funds that established 16 HBCUs 1
All states provide school transportation for children 1
Alvarez v. Board of Trustees of the Lemon Grove (CA) School District forbids schools from placing Mexican-American children in specific schools to be "Americanized" 1
Low-income families
Differently -abled people
White girls
People of Color/ Immigrant children
General public/ White boys
Veterans

Figure 1.2. Infographic of significant events influencing the educational history in the United States separated by influenced groups of people (created by Lily Donelson, 2014).



Mendez v. Westminster and the California Board of Education makes **segregation in schools unconstitutional**[1]

Wechsler Adult Intelligence Scale is developed to help determine IQ-this is still used in many schools to identify **special education placement**[1]

Fair **Labor Standards Act** regulates minimum wage, minimum age of working, and number of hours children can work[1]

1944 The **G.I. Bill of Rights** makes education available for all veterans, breaking the tradition of education being for the wealthy[1]

Grade inflation dramatically increases to help young men avoid being deployed to Vietnam[1]

Brown v. Board of Education of Topeka rules that separate is not equal, and segregation is unconstitutional[1]

National School Lunch Act requires schools to provide lunch for students[1]

Large amounts of Cuban immigrants arrive in Miami, and Coral Way Elementary School becomes the **first bilingual and bicultural public school** in the US[1]

1964 **Civil Rights Act prevents discrimination** based on race, color, sex, religion or national origin; **Economic Opportunity Act** provides federal funding for after-school programs to help **first-generation** college-bound, and **low-income** students earn college degrees[1]

Diana v. California State Board requires students to be tested for **special education placement** in their **native languages**[1]

Pennsylvania Association for Retarded Children v. Pennsylvania rules that students with **mental retardation** are entitled to **free public education**[1]

1965 **Elementary and Secondary Education Act** provides funds for low-income students (including **Title 1**); **Higher Education Act** provides **scholarships** and **student loans** for college; **Immigration Act** of 1965 results in a large number of **Asian** and **Latin American** immigrants[1]

Equal Educational Opportunities Act protects the **rights of ESL** students[1]

Indian Education Act defines a specific approach to cater to **unique needs of Native American and Alaskan Native** students[1]

Emergency Immigration Education Act supplements costs associated with **increased numbers** of **immigrant children**[1]

Immigration and Nationality Act of 1990 **increases immigration** and diversity of children in US schools[1]

Refugee Act **increases immigration** into the US[1]

States begin to offer school **choice programs** and **vouchers** to allow students to attend the schools of their choice[4]

Illegal Immigration Reform and Immigrant Responsibility Act **prohibit undocumented immigrants** from being granted **in-state tuition** at post secondary schools[1]

California Proposition 227 requires **all public school instruction** to be in **English**[1]

Improving America's Schools Act provides funding for **Title I, bilingual** and immigrant education, public **charter schools** and **drop-out prevention**[1]

2001 **No Child Left Behind Act** requires **standardized testing**, and holds **schools accountable** for student achievement[1]

2009 American Reinvestment and Recovery Act of 2009 provides funding for states to develop innovative **educational reforms to reduce the drop-out rates** - including the Race to the Top initiative; Common Core State Standards Initiative provides unified structure of the education systems across all states

Alabama becomes the first state to **require public schools to check immigration status** of all students[1]

Many states apply for **waivers for the No Child Left Behind** regulations[1]

Many large US school districts **close "failing schools"** and lay off a number of staff - this significantly influences low-income communities[1]

2014 My Brothers Keeper provides **young Men of Color** opportunities for academic achievement through the **cradle-to-college-and-career strategy** with six goals (children are ready for school, reading at grade level by 3rd grade, graduate from high school, complete PSE, are employed after completing school, and are safe from violent crimes)[1]

Federal **funding to education** increases greatly; attempts made to **weaken tenure** protections[1]

Low-income families 🟨

Differently-abled people 🟧

White girls 🟥

People of Color/ Immigrant children 🟪

General public/ White boys 🟦

Veterans 🟩

1. Sass, 2014
2. Clare Boothe Luce Policy Institute, n. d.
3. American Association of University Women, n. d.
4. Goldin & Katz, 2003

Figure 1.2 (continued). Infographic of significant events influencing the educational history in the United States separated by influenced groups of people (created by Lily Donelson, 2014, see Appendix A for email correspondence of approval for publication).

President Obama has initiated two noteworthy programs to try to address the growing educational disparities: Race to the Top, and My Brother's Keeper. Race to the Top has provided large grant funds to selected states that have initiated innovative ways to reduce the education gaps and improve student outcomes. Although final outcomes of the Race to the Top initiative have not yet, the preliminary findings seem positive. To date, three main findings are that (a) a large percent of the lowest-performing schools in awarded states are no longer classified as "lowest performing"; (b) four states have fully implemented educator-evaluation systems, and the other states are progressing toward full implementation; and (c) all state administrators have redefined the standards to reflect career and college-readiness skills (Miller & Hanna, 2014).

The My Brother's Keeper initiative supports mentoring programs specifically geared to support young men of color and children. The program has six milestones that encompass educational, environmental, physical, and emotional health (My Brother's Keeper, n.d.). This program premiered in August of 2014, so to date, there are no results to report; however, the program has created movement in community leaders and young people to create positive outcomes for the future generations. Overall, researcher struggle to conduct comparative research on the effects of mentoring programs because of the range of program activities, duration, dosage, and structure.

Demographic Trends in STEM Fields in the United States

To keep up with other countries' technological developments, the United States should increase the representation of underrepresented populations in the STEM disciplines. Doing this will better help to address the demands of the growing US workforce and provide a more diverse perspective in the STEM fields (STEM: Education for Global Leadership, 2015). Because of discrepancies in school resources and opportunities for learning, Black, Latin@, and Native

American students starting as early as fourth grade achieve far below White and Asian students (Aud, Fox, & KewalRamani, 2010). These disparities grow as students graduate from high school and enter college (George & Malcom, 2011; see Appendix B). These data reveal major disparities in all of the STEM degrees earned, and even more broadly in doctoral degrees awarded. Although I do not expect that all ethnic groups will have an equal percentage of degrees awarded to them, these numbers should mirror the demographic profile of the United States in 2011: 78.1% White, 13.1% Black, 16.7% Latin@, 5.0% Asian, and 1.4% American Indian/Alaskan Native/Native Hawaiian (United States Census, 2011).

When one considers the intersectionality (the combined effect of multiple forms or systems of oppression) of ethnic and gender identities, researchers found larger gaps than when one considers only one identity. Hill, Corbett, and St. Rose (2010) found that Black men and women and Latino men earned more degrees in computer sciences when compared to American Indian/Alaskan Native men and women and to Latina and American Indian/Alaskan Native women. Additionally, Black and Latino men earned more degrees in engineering when compared to other groups. Many factors contribute to persisting inequalities between the academic achievements of underrepresented groups and the dominant population.

Perceptions of STEM

At least to some extent, individuals base their career choices on their perceptions or stereotypes they have of the STEM disciplines. Historically, science fields have been associated with White men (Beardslee & O’Dowd, 1961; Chambers, 1983; Mead & Metraux, 1957), and these perceptions persist regardless of the increasing diversity in the STEM fields (Huges, 2002; Thomas, Henley, & Snell, 2006). Further supporting this stereotype, young women typically do not see STEM as applicable to their futures (Lent et al., 2005), and they do not have many role models in STEM fields (McCrea, 2010). Additionally, the public views many STEM classes as more difficult than classes in the humanities (McCrea, 2010), a perspective that deters students who perceive STEM abilities as inherent (rather than learned). Nassar-McMillan, Wyer, Oliver-Hoyo, and Schneider (2011) presented preliminary findings from a study by the NSF, that people of color are less likely than White people to believe in equal opportunities in STEM fields. The study also found that women are more likely than men to state that educational and professional opportunities should be equal. In another study focusing on environmental studies, researchers compared White students and students of color majoring in science (124 White, 37 students of color). The researchers found that, compared to white students, students of color perceived greater barriers and had less interest in pursuing environmental studies (Quimby, Seyala, and Wolfson, 2007).

Both positive and negative experiences lead to opportunity. According to the Happenstance Learning Theory, human behavior depends on lived experiences (both planned and unplanned; Krumboltz, 2009). Applying this concept to STEM fields, positive STEM life experiences often lead to retention in STEM professions. At the same time, negative STEM life experiences would then inform STEM retention concerns. Leviene, González, Cole, Fuhrman, and Le Floch (2007) developed and validated a model of 123 critical incidents in life to describe the STEM career pathway from middle school through graduate school.

Research supports increased positive STEM exposure to correlate with positive STEM perceptions. For example, Christensen, Knezek, and Tyler-Wood (2014) found that high-school students who participated in a STEM academy had more positive perceptions of STEM compared to students who did not attend the STEM academy. The particular STEM academy provided eleventh- and twelfth-grade high-school students an opportunity to participate in a residential college experience. During this experience, the students completed their last 2 years of high school and their first 2 years of college. Christensen et al. (2014) found that, compared to male participants, female high-school participants showed less-positive perceptions of math, technology, and engineering as academic fields. However, female participants felt more positive than male participants about STEM careers . In the same study, a second finding regarding racial and ethnic differences in perceptions of STEM was that Black participants reported the highest affinity for science, and American Indians had the highest affinity for mathematics when compared with other ethnic/racial groups (Christensen et al., 2014). These findings allign with other findings indicating that, at the beginning of their first years of college, more women of color than White women intend to major in a STEM degree program (NSF, 2011; Smyth & McArdle, 2004).

Much research documents factors that contribute to female students' decisions to pursue STEM fields. The factors include STEM perceptions, mother's level of education, parental expectations, and having a parent who works in a STEM discipline (e.g., Hanson, 2009; Huang, Taddese, Walter, & Peng, 2000; Leslie, McClure, & Oaxaca, 1998). These findings support the view that academic professionals, formal educators, and informal educators need to understand what hinders the underrepresented groups from persisting in STEM careers. Researchers on this topic have identified a number of influential factors that reflect students' lack of the following: relationships with faculty and department, a sense of belonging, role models, faculty support, and overall support (Johnson, 2011). In a review of three books regarding why women chose to leave STEM majors in college, Pfatteicher (1999) found that the prevailing reason to leave was based on the relationships women had in their academic departments. Other factors related to students' persistence in STEM fields include SAT math scores, high-school math grades, parents' level of education and employment in a STEM field, anticipation to pursue a STEM graduate degree, and presence of a sense of belonging (Huang et al., 2000; Leslie et al., 1998; Smyth & McArdle, 2004).

Researchers and society often investigate these factors through a deficit lens, or the "culture of poverty" model, which therefore portrays the underrepresented groups as lacking compared to those who succeed in STEM fields. From the deficit perspective, these differences in values result in a cascade of actions and behaviors that support the disparities. Furthermore, this perspective, based on the assumption that communities of color prioritize the wrong tenant and have low aspirations, amplifies conflicting values (Solorzano, 1992). This outcome, in turn, results in low expectations for students of color and low achievement outcomes (Ford & Grantham, 2003). The deficit lens focuses on the differences between people and does not address the systemic guidelines that govern the field's culture. Therefore, the underrepresented individuals in STEM may be treated differently, receive fewer opportunities for new experiences, and attend schools with minimal resources (Solorzano, 1992). The deficit model addresses the surface-level differences between the racial and ethnic groups in the United States, However, the model does not address the reasons the disparities persist or the initial sociopolitical context that led to the formation of the disparities (Gorski, 2010). Policies at all levels—from government to organizational guidelines—also influence experiences within STEM fields. These systemic factors have greatly contributed to the sense of belonging that people may feel or not feel as members of the field.

Successful people in the field tend to have a sense of belonging. Compared to White women and men, women of color specifically often have a lower sense of belonging and feel excluded from the STEM academic environment (Johnson, 2007; Malone & Barabino, 2009;

Ong, 2005; Tate & Linn, 2005). Negative perceptions of STEM are predictive of a decreased sense of belonging and desire to pursue STEM disciplines (Good, Rattan, & Dweck, 2012). Women of color may also have trouble persisting in STEM fields because of gender and racial discrimination. Discrimination results in the society perceiving women of color in the least positive way, of publicly viewed groups in the STEM fields. The term *double blind,* coined by Malcom, Hall, and Brown (1976), described this concept of having two or more marginalized identities. The results of some research on this concept show that variables predicting STEM persistence differ depending upon identity (i.e., gender, ethnic identity, and first-generation college bound; MacPhee, Farro, Canetto, 2013).

STEM Identity Among People of Color

For this section, I have combined the research on identity formation in all areas of STEM to develop an explanation of STEM identity (as opposed to the science, mathematics, or engineering identities more commonly found in the research). Identities are salient and constructed based on each person's experiences, how the person interacts with the setting, and the other individuals present. These factors include the active and passive roles that individuals play, the unspoken messages relayed by the physical setting, and the individuals present (Jackson & Seiler, 2013). Even those who exist in the same settings may develop different identities because of their past experiences and the way each perceives and internalizes the experience. In fact, each related experience accumulates to change an individual's overall STEM perception (Jackson & Seiler, 2013). People develop their STEM identities based on these complex environmental factors and experiences.

The STEM identity incorporates the meanings of experiences for individuals and the society's structures or systems (Carlone & Johnson, 2007). Based on this concept, Carlone and

Johnson (2007) developed a model that helps us to conceptualize the concept of science identity. In their model, three factors overlap competence, recognition, and performance. The individual's personal identity (race, gender, SES, religion, ability, native language, etc.) influence all three factors. Additionally, one's STEM identity depends on what the individual sees oneself doing that relates to STEM in the future (Aschbacher, Li, & Roth, 2009). Someone with a strong science identity, for instance, would be one who has performed well, has demonstrated competence in a subject, and has been recognized by others in the field for accomplishments.

Any number of internal or external factors can undermine the STEM identity. Some potential internal obstacles may include a lack of confidence to perform or personal identities that differ from those expected in the STEM setting (Carlone & Johnson, 2007). In contrast, internal factors that may strengthen one's STEM identity include having the ability to change adversities or external factors into positive forces of motivation. For example, Carlone and Johnson (2007) found that two of 15 women of color (a Black woman and a Native American woman) earned doctorate-level degrees in STEM by reframing others' doubt into motivation to do better than others expected of them.

The major external component of STEM identity is receiving recognition from professional peers. Professional peer support comes in many different forms, including personal support, STEM role models, tutoring, exposure to STEM, mentoring (Aschbacher et al., 2009), and strong STEM capital (Archer, DeWitt, & Willis, 2013). STEM capital includes knowing those who work in STEM fields, having positive opportunities and experiences related to STEM, and knowing how the STEM fields work (Archer et al., 2013). A number of studies have investigated the presence of institutional and unconscious racism, particularly in science fields, which largely shapes the amount and kind of recognition people of color receive in professional

STEM settings (e.g., Carlone & Johnson, 2007). For example, Aschbacher et al. (2009) found that Asian participants perceived a great deal of support from teachers and administrators; however, Black and Latin@ students felt as though educators had low expectations of them. Although many researchers have studied the different amount and kind of attention people of color compared to white individuals receive in STEM, minimal research has been conducted regarding the effects of reduced professional attention to people of color in STEM settings.

Recommendations to Reduce the Gaps in STEM Fields

Researchers have proposed many remedies to address these disparities in the STEM fields. The suggestions directly related to education include improved STEM education at the K-through-12 level and supplemental STEM instruction programs (out-of-schooltime, summer, and informal STEM education). There is also a need for mentoring programs and role modeling, and student research experiences in STEM fields. Last, policy changes and improved data collection on student progress in STEM could also contribute to this effort (Moore & Shulock, 2010; Tyson, Lee, & Hanson, 2007).

The NSF and the US Department of Education both allocated significant funding for agencies addressing the unequal representation of minority groups and women in the STEM fields. The NSF developed a framework intended to provide action items associated with broadening participation in STEM (NSF, 2008). This framework has guided the development of grants including the Broadening Participation in Computing (BPC), Alliances for Broadening Participation in STEM (ABP), and Centers of Research Excellence in Science and Technology (CREST) programs. The US Department of Education also has a number of grants geared toward helping underrepresented groups in STEM and education overall. One example, the TRiO programs support individuals from low-income backgrounds who are the first generation college bound in their families, and those with disabilities. Initially, there were three programs, hence the name TRiO; however, now there are seven different types of TRiO programs: Educational Opportunity Centers, McNair Scholars, Student Support Services, TRiO Staff Training, Upward Bound, Upward Bound Math & Science, and Veteran Upward Bound. Many other efforts are being conducted nationwide; however, this research focuses on the TRiO programs, specifically an Upward Bound Math & Science program. To a significant degree, the success of the TRiO programs is based on the mentoring approach these programs use.

Influences of Mentoring on Underrepresented Youth

Research supports positive changes in mentees' self-esteem, social skills, sense of belonging (Karcher, 2005), ethnic identity, and educational achievement (Fruiht & Wray-Lake, 2013; Hurd, Sanchez, Zimmerman, & Caldwell, 2012) while students engage in mentoring programs. Research has shown mentoring to increase academic achievement, regardless of socio-economic status, parental support, peer influence, or school resources (Erickson, McDonald, & Elder, 2009).

The need for out-of-school-time mentoring programs for underrepresented youth has been supported by evidence for cross-time continuity resulting from consistent environmental and social (including family) contexts (Hanlon, Simon, O'Grady, Carswell, & Callaman, 2009). Mentoring can help to increase self-efficacy, making it a protective mechanism for academic achievements and increase the resiliency of underrepresented youth (Rutter, 1990). This is particularly true in urban Black youth who have a disproportionally high association with communities of low socio-economic status (Hanlon et al., 2009). During after-school hours, youth program participants have the opportunity to learn professional behaviors, engage in academic enrichment or prosocial activities, live new experiences, provide and receive social support, and build peer relationships with others who strive to set and attain goals (Roth & Brooks-Gunn, 1998). Alternatively, youth may participate in nonstructured safe activities (dance club, poetry club, informal peer mentoring, supervising younger family members or neighbors, etc.) or risky behaviors. Hence, structured out-of-school-time programs have the opportunity to provide positive experiences for youth, and to reduce exposure to risky experiences.

Additionally, students who engage in adult-let, after-school programs that expose them to different activities tend to feel more empowered and able to avoid engaging in risk behaviors with their peers (Erickson et al., 2009; Hanlon et al., 2009). Students who feel empowered to use the benefits of community organizations such as businesses or community colleges more frequently achieve higher academic success than those who did not (Rios, 2010). Structured after-school mentoring programs can provide this sense of empowerment to youth and aid them in their academic success.

The characteristics of a mentoring program largely influence participants' outcomes. For a mentoring program to be successful, it should be multiyear and build on academic and personal strengths of the participants while aiding them in avoiding risk behaviors (e.g., Erickson et al., 2009; Roth & Brooks-Gunn, 1998). Erickson et al. (2009) supported this method, with findings that the level of knowledge regarding avoidance of risk behaviors and academic achievement increased due to participation in a structured after-school Brotherhood program. The program consisted of curriculum based on the American School Counselor Association Standards, empowerment theory, and the Nguzo Saba (seven Afro-centric principles that encourage self-confidence and teamwork). This study successfully assessed the needs of the community, and created goals and activities to help increase academic achievement and feelings of empowerment in the students.

Participants who appreciate and see value in school tend to have more academic success. Program staff can bolster the value of academics through creating academic support systems, increasing academic resources available to the youth, and/or encouraging participation in school activities. Black, Grenard, Sussman, and Rhrbach (2010) examined one such program, which assessed school attachment as a mediator between increased academic achievement and mentoring relationships at school. This study qualitatively demonstrated how the level of school attachment mediated the relationship between natural mentoring and the prevalence of risk behaviors in adolescents. Their findings showed that through increased school attachment, involvement in extracurricular activities, and the presence of a caring adult mentor, students were less likely to engage in risk behaviors, developed a higher level of empowerment, and achieved higher academic success.

When acknowledging the ways that mentoring programs may contribute to the academic accomplishments of underrepresented youth, one must consider the supports and the abilities that mentors help build in a child’s life. Mentoring is often a means for developing the character and the competencies that underrepresented youth need to successfully transition into adulthood (Roth & Brooks-Gunn, 1998). As Thompson and Kelly-Vance (2001) pointed out, mentors provide the extra individual attention that underrepresented youth need to navigate societal systems and act as a positive role model to help reduce academic risk factors. Youth who might not otherwise have the support or skills to navigate school successfully, and achieve academically, gain such resources through mentoring relationships and the programs to which they belong.

Specific components beneficial to underrepresented youth and their academic achievement have to do with the support and navigational skills participants gain through mentoring and its programming. Often, underrepresented youth populations lack the skills necessary to navigate academic systems, given the current racist academic structures in the United States. Through a mentoring program, youth can build social supports and feel safe through self-development. By having social supports, youth can gain great psychological benefits that build their confidence in school, strengthen their academic abilities, and provide them with access and knowledge regarding attainment of academic success (Hurd et al., 2012). The presence of a mentor increased positive long-term educational success. This association was mediated by improved self-perceptions of academic success and increased racial identity (Hurd et al., 2012).

Description of the Out-of-Schooltime Program

The out-of-schooltime program of focus is located in the southeastern United States, near the beach. This program strives to increase underrepresented youths' enrollment in postsecondary degree programs (specifically in STEM fields) through mentoring, workshops on life skills, career opportunities, STEM-focused classes, field trips, and college-readiness activities. The program staff serves as a liaison between the school system, the youth participant, and the guardian. Staff and peers mentor participants in a formal, multiyear, goal-oriented, group-mentoring approach.

The STEM classes during the 6-week summer have a marine-science focus, with a different theme each week (i.e., marine ecology, marine biology, marine geology, meteorology, oceanography, and marine resource management). The county school district reviews the curriculum each year and awards participants credit for an integrated science class. During the school year, program staff selects STEM-class topics based on the participants' and mentors' interests. Examples of class topics include robotics, bridge construction, nutrition, human anatomy, the science of cooking, math tricks, computer animation, and ecological restoration. Participants also have the opportunity to attend college and career fairs to encourage conversation and reflection of future planning for participants. I summarize the program structure and activities in Table 1.3.

Table 1.3

Activities Included in Academic-Year and Summer Components of the Out-of-Schooltime Program

Academic year (28 Saturdays)	Summer (6 weeks, 5 days/week)
Science Saturday academy	30-day intensive marine-science program
College preparation classes	Overnight trip
College tours (day and overnight trips)	Mentoring
Career fairs	2 days/week of beach exploratory learning
Tutoring	Weekly STEM-related field trips on Fridays
STEM-related field trips	Project-based learning
Mentoring	Team building
Team building	School credit for participation
Family nights	Research symposium

The grant regulations structure the recruitment efforts because the US Department of Education TRiO Programs is the primary source of funding. The program staff recruits participants from Title I schools. Most participants begin the program the summer before their first year of high school and continue in the program throughout their 4 years of high school. Grant regulations require for two-thirds of the participants to be both low income and first-generation college bound. The program serves roughly 50 participants at all times.

During the mentoring sessions, mentors guide participants through a process of self-learning and learning how their identities influence their interactions with and experiences in the outside world. Additionally, the participants learn about the identities that give them privilege and how to use those privileges as the basis for alliances with others. The program's culture is diverse in many ways and encourages self-learning opportunities and new experiences.

Racism

Race is a socially constructed concept that leads to people categorizing each other into a hierarchy. Leaders created racial categories based on physical characteristics, not biological or genetic factors (Tatum, 1997). Many educated, uneducated, people of color and White people confuse race with ethnicity, which is determined based on cultural factors (language, ceremonial practices, shared customs or country of origin; Tatum, 1997). North American children learn about the factors that influence categorization early on in life. An abundance of research supports that children as young as 3 years of age have images of what certain groups of people should look like (e.g., Byrnes & Kiger, 1992). For example, in 2010, CNN found that children still stereotyped personality characteristics with what they thought people should look like (Billante & Hadad, 2010).

This concept and the resulting actions/behaviors encourage people to treat others based on misconceptions. What one is told and what one is not told as a child can commonly lead to these misconceptions (Tatum, 1997). For example, if one grows up never having read a novel written by a Latin@ person or heard about a wealthy Black business person, one may assume that Latin@s do not write books, and Black people are not wealthy business people. These kinds of cultural messages can lead everyone to have deep-set prejudices that influence daily behaviors. Although one may not intend to act in a prejudicial way, one cannot help it because of constant exposure to misinformation about others and the common segregation that persists within communities (Tatum, 1997).

Why do people continue to share misinformation and exist in fairly segregated communities? The partial answer may be because individuals prefer to be surrounded by those who look like them. However, even for those who do not desire this lifestyle, the segregation persists as a result of inherent racism in the systems and policies that govern the country. Racism has a number of definitions:

- *Prejudice:* This word is often used interchangeably with *racist*; however, I see a distinction. Prejudice is an individual action, while racism is a ruling ideology that has a larger influence than an individual action.
- *A system of advantage based on race* (Wellman, 1977): By this definition, racism is a part of the systems that govern the society. That means that racism is ingrained in every aspect of the community.
- *Racism = Prejudice + Power:* This is a common definition among social activists.

Although the term is accurate, many people do not understand or relate to this definition. Typically, people do not see themselves as prejudiced or powerful because one of the most insulting things for most people is to be called prejudiced, and there is always someone more powerful than them.

For this research, I use Wellman's definition of racism because it encompasses the idea that racism influences all people—of color and White—on a daily basis. Additionally, I believe this factor is essential in understanding the causes of the large disparities in the demographics of people working in STEM fields.

Over the years, racism has changed forms. It has become less overt than it was before the Civil Rights era; however, it prevails in the American society through the policies and systems for schooling, getting loans, and healthcare treatments, for example (Tatum, 1997). The nation's policy changes since the Civil Rights era have helped to make services such as education and healthcare accessible for all; however, the quality and the applicability of the services differ significantly between communities of color and White communities (Zamudio, Russell, Rios, &

Dridgeman, 2011). In fact, racism also influences underrepresented populations' abilities to form strong STEM identities and persist in STEM fields because it prevents people of color from developing strong social support from professional peers (Carlone & Johnson, 2007).

The colorblind approach to concerns related to racism leads to changes in racism's appearance. With this mentality, people think that people of color should not be treated differently and commonly conclude that "I will treat them how I like to be treated." This perspective concerns to those who advocate for social justice because it does not value the individuality of each person. Additionally, it reverts to the *Whiteness as normal* ideology, which further endorses White practices as the norm. Some people take the color-blind ideology to a higher level, believing that racism no longer exists in the United States. This ideology (postracialism) developed from the idea that the North American people have made significant progress regarding racism in the United States, and it is no longer necessary to develop race-based solutions or policies (Cho, 2009). Given the complexity of the concept of racism, I divide this section into parts to ease understanding of how racism overtly plays a role in each aspect of our lives, regardless of our racial identities. The subsections of the content on racism cover racism in schools, White privilege, racism today, costs of racism, intersectionality, and stereotype threat.

Racism in schools. Many people believe that US school systems create a fair environment in which all children have an equal opportunity to succeed as long as they try their hardest. This is the concept of *meritocracy*: People's ability and personal characteristics determine their own success because the United States is a fair society in which people work the same amount for each degree, regardless of their identities. Many educational activists do not agree with this concept, however, because it disregards the perspective that school systems may have been created without consideration for or knowledge of the diversity of students.

What are the differences in quality in the education that students of color often receive compared to White students? When students of color enter a classroom, they do not engage with texts or content that accurately represents their histories or places strong values on their cultures (Zamudio et al., 2011). Teachers and school staff rarely greet students of color with expectations to attend college. Primarily, teachers greet students of color with (often) unconscious judgments of the students based on their identities before the teachers get to know them (Tatum, 2003). Consistently for the past 30 years, research has found that, regardless of teachers' races or their inclinations about racism, they often have many biases that inadvertently emerge through their interactions with students (e.g., Eberhardt & Fiske, 1998; Lawrence, 1987; Sparks, 2015). Unless individuals actively fight racism, biases emerge through (what are considered to be) normal daily behaviors.

I have also seen racism in the US schools with my own two eyes. As a White child, I attended some of the highest-ranking schools in my hometown. College was never a discussion; teachers assumed I would go. I never considered going into the military or working right after high school. Until the age of 22, I was a student. So I went through high school, attended college, and began teaching in an inner-city school. When I taught there, my school was 98% Black and 85% of students qualified for free or reduced lunch. The differences between the schools I attended and the school I taught in astonished me. Some examples will help to clarify my point.

As a student I recall absent teachers leaving a carefully crafted lesson plan to be executed by one of five professionals (who had full teaching certificates or graduate degrees in the topic). As a student, substitute days were a bit less strenuous but overall similar to typical days when the teacher was present. When I became a teacher and a coworker missed works, the school administration asked the other teachers to cover the missing teacher's classes. I taught high-school science and covered many history, English, Spanish, and math classes during my short time teaching. When I confronted administration about my concern about my inability to teach the students two quite different topics at once, not having a lesson plan, or not having enough desks to seat all of the students, the administrator told me not to worry about instruction—just make sure the students stayed in the classroom and behaved in case a district administrator visited.

A second example relates to standardized testing. I attended a private school before the era of No Child Left Behind. I did not have to undergo standardized testing that determined my ability to advance to the next grade. Instead, I regularly met with a college advisor who knew my name and interests. In contrast, as a teacher, I administered the state tests to my students; after they finished with their exams, the administration herded them into the auditorium to hear presentations on joining the military and taking the Armed Services Vocational Aptitude Battery (ASVAB) standardized test to see the military positions for which the students were eligible. Joining the military right after high school was not a conversation at my high school.

Once these students join the workforce, racism persists. Racism is a factor that influences the underrepresented population's ability to form strong STEM identities and to persist in STEM fields because it prevents people of color from developing strong social support from professional peers (Carlone & Johnson, 2007). Racism persists in US society, at least partially, because racism is a governing system that benefits the White community, and the White community does not understand how racism also is hurting its community (Zamudio et al., 2011).

White privilege. *White privilege* describes the benefits that White people gain from living in an inherently racist community. This privilege shows its face in many different forms, including White people being associated with their individual personality traits, as opposed to their personal behaviors representing the whole White community (Tatum, 1997). At the same time, the same behavior of a Native American person would be indicative of a behavior common amongst Native Americans. For example, if a White person is tardy to a meeting, one may think, "Oh, that Sara, she is always running late!" whereas if a Native American person arrives late to a meeting, one may think, "Well, she is Native American; you know *they* are always late to things." White privilege is the ability to be seen as an individual and not a representative of all people who share a particular identity.

I see many concrete examples of White privilege in people's daily lives. Some of these scenarios are clearly White privilege, and others seem to be good luck. The examples of good luck for White individual(s) are often simultaneously examples of bad luck for people of color. Some examples of White privilege from my own life that also are supported by research follow.

My life examples:

- I can enter a store with confidence that the store clerk will not follow me.
- I can easily find people in the media who look like me.
- I am fairly certain that, if I have an interaction with law enforcement, they will not arrest, hurt, or mistreat me.
- I can find hair products and a stylist who can work with my hair anywhere I go in the United States.
- I inherited land.

- I lived in one home, which my mother inherited from her parents, for the majority of my life.
- I had a credit card in high school so I could begin to build my credit score.
- I can buy nude-colored undergarments or bandages that actually match my skin color.

Some research-supported examples:

- People of color are overrepresented in special-education programs (Blanchett, 2006), low-income communities, prisons, populations who receive governmental assistance (US Census, 2011), residences in inner-city or environmentally dangerous areas (Pulido, 2010), and unemployment data.
- There is an underrepresentation of people of color with advanced degrees, working in STEM fields (NSF, 2008), working as high-level managers/leaders (Powell & Butterfield, 1997), owning homes (Fernald, 2015), living in suburban areas (Pulido, 2010), and employed or visible in media (Baynes, 2003).
- People of color experience shorter lifespans, worse quality of life, and more preventable chronic diseases compared to White people (Thomas, Quinn, Butler, Fryer, & Garza, 2011).
- The value of homes in neighborhoods where predominantly people of color live has decreased significantly more than that value in neighborhoods where predominantly White people live (Coates, 2014; Fernald, 2015).
- In the early 20th century, White men or government officials often robbed people of color who owned land or property without cause or consequences for the robbers (Coates, 2014).

- Legal processes of the home-mortgage market restricted Black people from getting home loans from 1930 to 1960 (Coates, 2014).

The research associates the examples above with discrimination based on race. Because I am White, I have not experienced many of these forms of discrimination. I can credit some of my life stresses to nonethnic discrimination. However, I would venture to say that I have not earned many of the good fortunes in my life.

It is important to remember that these are examples and they do not define all of the possible ways in which White people experience privilege. This list may also include some examples that not every White person experiences. In saying that, I want to emphasize that most White people learn that racism is a specific set of actions directed toward an individual. In reality, these examples of White privilege show how the systems that run the country are inherently racist. Therefore, if you are a White person reading this, you may think that you have not experienced these privileges. Although it may be true that you have not experienced all of these examples, it may also be that you *have* experienced the examples but have been unaware of the benefits you have received from the governing systems. I encourage you to continue living life as you normally would, taking note of any potential ways in which you might be treated differently than a person of color in the same situation.

Racism, post-civil rights era. Although racism has greatly changed since the civil rights era, it persists in the modern-day United States. The participants in this study had experienced racism in their educational histories. They also were targets of racism in everyday life, which may have influenced their life paths. Figure 1.3 shows the relationships of some of the many different forms of racism, each of which fit into one or more of four categories, as described by Scheurich and Young (1997): civilizational, societal, institutional, and individual. *Civilizational racism* refers to the assumptions humans make based on the White-lived experience. Through this mentality, society defines the White experience as the so-called normal and expected experience for all individuals. The next level, *societal racism,* develops through the norms within a specific society that represents the White experience. *Institutional racism* is the practice of standard procedures within a system or organization that favor the White community. Last, *individual racism* includes overt and covert racism. White individuals exhibit *overt racism* (also referenced *old-fashioned*) when they openly do or say something that damages a person of color. White individuals show *covert* (*modern*) racism when they do something privately that hurts a person of color, but blame the action on something else (for example, not hiring someone because the person does not have reliable transportation).

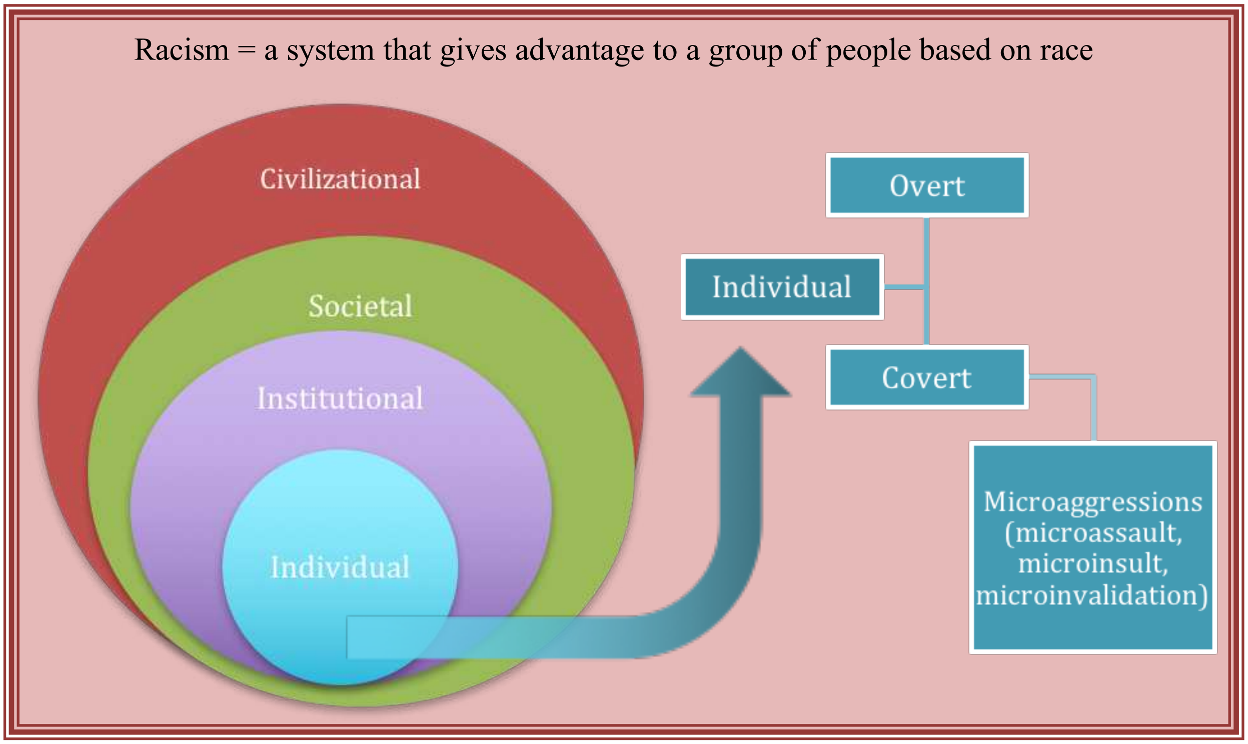

Racism = a system that gives advantage to a group of people based on race
Civilizational
Societal
Institutional
Individual
Overt
Individual
Covert
Microaggressions (microassault, microinsult, microinvalidation)

Figure 1.3. *The many forms of racism, from large scale, on a civilizational level, down in scale to the individual level. The individual level then is subdivided into the other forms as specified.*

An example of covert racism is microaggressions, brief insults toward people of color.. Sue et.al categorized microaggressions into microassault, microinvalidation, and microinsult (2007). *Microassault* is an intentional use of offensive words or behaviors to hurt someone. *Microinvalidation* is when the word choice or presented perspective excludes a person of color. *Microinsult* is communication that is insensitive to people of color or implies people of color are less skilled (Sue et al., 2007). CRT and counternarratives provide a common framework through which to explore all of the forms of racism. Briefly, CRT encourages data interpretation from the marginalized group's perspective. Counternarratives present the participants' experiences through their own voices.

Costs of racism. There are obvious costs of racism for communities of color; however, White communities also experience costs. In fact, the costs of racism come in many forms, including psychological, economic, and daily-life costs. Picture yourself in a conversation with others, and each time you express a comment or idea, they ignore your comment. How does that make you feel? People of color experience that feeling regularly because of being denied the opportunity to share their ideas (Turner, 2015). The White perspective rules the United States. For example, the majority of US school systems teach children the so-called normal or White perspectives and do not provide a multicultural approach to the nation's history (even though many different groups of people influenced the development of the United States; Kivel, 2002). Most Americans have a skewed outlook on life, that the White way of doing things is the normal way. Such a view leads to White people being oblivious to the perspectives of people of color, and their motivations or reasons for doing things; it also reduces White people's ability to relate to people of color. This issue does not translate into the same problem for people of color because the White mentality dominates American society so that people of color often have a clear understanding of the White perspective (resistance, 2009). This often makes it challenging for White people to understand the presences of racism in the systems as opposed to how many people define racism (individual acts of racism towards others).

Researchers have begun testing the psychological costs of racism using the Perceived Costs of Racism to White Scale (PCRW; Spanierman & Heppner, 2004). This scale identifies five different types of psychological costs that White people may have from racism (see Table 1.4). Living in any context in which one regularly experiences fear and guilt is not an ideal situation. Also, these psychological costs largely influence people's daily interactions and relationships with others because of disagreements or tensions related to racism (Kivel, 2002).

Table 1.4

The Five Categories of Psychological Costs of Racism

	Empathy for people of color	White guilt	Fear of people of color
Unempathetic and unaware	Low	Low	Moderate
Empathetic but unaccountable	High	Low	Low
Informed empathy and guilt	High	Highest	Low
Fearful guilt	Moderate	High	High
Insensitive and afraid	Low	Low	Highest

Table 1.5

Predicted Effects of Closing Racial Gaps in Education, Healthcare, and Income in the United States

Disparity		Predicted outcomes without disparities		
		2008–2012	2020 or 30	2050
Income	Percent of workers of color	37%[1]	46%[1]	55%[1]
	Gross domestic product (GDP)	12% increase ($1 trillion)[1] 8% increase[2]	16% increase (>$5 trillion)[1]	20% increase[1]
	Total US earnings	12% increase ($1.9 trillion)[1]	–	–
	Corporate profits	$180 billion increase[1]	$450 billion increase[1]	–
	Federal income-tax revenues	$290 billion increase[1]	>$1 trillion increase[1]	–
	Federal deficit	2.3% reduction of GDP ($350 billion)[1]	–	–
Education	Percent of students of color	49%[3]	54%	–
	GDP	2% to 4% increase ($310–$525 billion)[4]	–	–
Healthcare	Excess medical costs	$60 billion[5] wasted $24 billion[6] wasted	$126 billion[4] wasted	$363 billion[4] wasted $50 billion[5] wasted
	Potential of productivity lost due to poor health	$22 billion[4]	–	–
	Potential of productivity lost due to premature deaths	$250 billion[4]	–	–

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[1] Data and predictions are from 2011 (Roebrig, 2013). Predictions do not consider the costs associated with closing the income gap and include potential earnings from unemployed and incarcerated.

[2] Data and predictions are from 2011 (Teixeira & Halpin, 2013). The predictions consider only current wage earners (not potential earners).

[3] Data are from 2012, and predictions are for 2024 (Racial/Ethnic Enrollment in Public Schools, 2015).

[4] Data and predictions are from 2008 (McKinsey & Company, Social Sector Office, 2009).

[5] Data and predictions are from 2009 (Gaskin, LaVeist, & Richard, 2012).

[6] Data and predictions are from 2008 (Waidmann, 2009).

Psychological costs aside, a number of economic costs result from racism via the major racial disparities. The major disparities that influence the country's economy include healthcare, education, employment opportunities and compensations, and education—all of which are largely influenced by policy (Turner, 2013). Table 1.5 provides a summary of the predicted effects closing these gaps would have on the US economy.

If these predictions are correct, they show significant setbacks in income, education, and healthcare as a result of the racism in this country. Ta-Nehisi Coates summarizes the current state of North America: "Two hundred fifty years of slavery. Ninety years of Jim Crow. Sixty years of separate but equal. Thirty-five years of racist housing policy. Until we reckon with our compounding moral debts, America will never be whole." (para. 1, 2014). Repairing these gaps may be the key to strengthening the country and improving the United States' academic rankings compared to other developed countries. For example,

- The United States ranks 17th in standardized reading scores, 27th in math scores, and 20th in science (PISA, 2012);
- Lower voter turnout in the United States than in most other developed countries (Desilver, 2015);
- Greater US defense expenses than those of the next seven countries combined (Stockholm International Peace Research Institute, 2014);
- The United States ranks 26th for infant mortality rates (MacDorman, Mathews, Mohangoo, Zeitlin, 2014);
- Incarceration rates in the United States exceed those of all other developed countries, while victimization rates are similar (Walmsley, 2013);
- The United States ranks 10th in broadband speed (Ehrlich, 2014); and

- The United States rates 19th in terms of how individuals experience the rule of law (Rule of Law Index, 2015).

To help educate White people about the costs to the White community of systemic racism, social activists have developed some simple checklist tools (e.g., Kivel, 2002). For example, not knowing one's heritage beyond roots in Europe reduces cultural celebrations and traditions. However, such tools are not enough. Demographic predictions suggest that the percentage of people of color in the United States will exceed 50% by 2043 (United States Census, 2011). To create any changes to reduce the systemic practices of racism, all communities must understand the harm racism inflicts. Other countries will continue to surpass the United States in any or all of the areas described above (education, health, voter turnout, etc.) if the North American people maintain current attitudes toward people of color.

Intersectionality. All people have a number of identities, such as race, gender, religion, and income level. People use these identities to describe themselves and to describe people around them. The descriptions that people use for themselves may or may not be the same as the ones others use to describe them. All of these identities influence people's daily lives in an intertwined manner. Gopaldas defines *intersectionality* as the connected nature of people's identities (2013). Crenshaw (1991) coined the term initially to describe the interaction between one being both Black and a woman. This concept also emphasizes that people have different needs and interests based on their identities and the intersection of their identities (Gopaldas, 2013).

Understanding intersectionality is important for this research because the study participants had many marginalized identities that influenced how they interacted with daily life events. These identities also shaped the stereotypes that applied to the participants and the choices participants made for their futures. Many times individuals are asked to represent one single part of their identities, which simplifies a person's identity and does not honor the complete person. Those who have multiple oppressed identities (e.g., Black woman) often experience this single focus on one identity and are asked to respond to inquiries representing one specified identity group (e.g., speak as a woman, or speak as Black person, but not speak as a Black woman).

Stereotype threat. Racism leads to stereotyping and grouping people with others who may be different from them (Nieto & Bode, 2012). For example, although African American and Caribbean American individuals both typically have brown skin color, they have different cultural backgrounds and practices. Many people use stereotypes to place individuals into associated groups of people who are then treated differently in many settings, including classrooms. One of the hypotheses used to explain this racial and gender gap in representation of STEM fields is stereotype threat. Steele (1997) described *stereotype threat* as stereotypes influencing groups' performances. Knowledge of this stereotype then negatively influences the stereotyped person's performance on certain tasks. For example, the stereotype that "women are not as skilled as men in math and science" often leads to women not performing as well as men in math and science. A number of concepts and theories both support and contradict the presence of stereotype threat (e.g., attributional ambiguity, cognitive dissonance, social-identity theory, identity negotiation, and identity salience).

For people who interact with someone experiencing stereotype threat, there are a number of ways to support the individual. For instance, one might emphasize the person's high standards and ability to excel by providing feedback that includes a focus on strengths, weaknesses, and concrete examples; make positive assumptions about the individual's strengths and abilities instead of challenging them; and encourage self-reflection of strengths, skills, values (Cohen, Steele, & Ross, 1999). The next two approaches involve changing the perspective. One can reframe the task by describing it with words that disassociate from specific social identities, or by placing a phrase at the top of the task (e.g., an assessment) noting that the task is unbiased (Quinn & Spencer, 2001; Spencer, Steele, & Quinn, 1999). Another way to change the perspective is to deemphasize threatened identities by avoiding requests for demographic information that includes associated stereotypes, reminding individuals of their nonthreatened identities, and emphasizing social identities without stereotype associations (Ambady, Paik, Steele, Owen-Smith, & Mitchell, 2004; Rosenthal, Crisp, & Suen, 2007). For example, one would not request gender or name at the beginning of a math exam because of the stereotype that *boys do better than girls in math*.

The last two strategies for support incorporate external factors of role models and attributions to challenges. One could provide role models by matching the administrator's identity to the participant’s stereotyped identity; for example, have a woman administer a math test because women stereotypically do not perform as well in math as men (Blanton, Crocker, & Miller, 2000). The other approach includes providing external attributions for challenges, highlighting external factors that may contribute to difficulties (Ben-Zeev, Fein, & Inzlicht, 2005). An example of external attributions is a nonnative speaking student getting made fun of for his accent, and his friend saying “they’re just jealous of your accent!” These methods attempt to minimize the negative self-perceptions and create opportunities for individuals to see themselves as successful and high achievers. In the ways previously listed, many of the student activities and student-mentor interactions in out-of-schooltime programs provide support to those experiencing stereotype threat.

Although my research is not directly related to stereotype threat, this is one of the ways in which racism is pertinent in US society. I included the details above as research-supported methods that help to reduce the effects of stereotyping, which inherently also reduces the effects of racism. I referenced the above-listed suggestions in an effort to formulate some hypotheses to explain study participants' academic accomplishments. I see racism as having a potentially huge influence on the academic outcomes of my study participants, and the above-listed suggestions as an antibiotic to racism. I investigated both possibilities in my research. The following section described the purpose of my research, the theoretical framework, and the study design.

CHAPTER 2: PRESENT RESEARCH OVERVIEW

In this chapter, I present the purpose of the research, including my long-term goals for the research. I also describe the 4-part theoretical framework that I used when developing the project and during the analyses. This chapter ends with an overview of the methods I used for this research.

Overview of Purpose of Research

I had two intentions with this study. The first intention was to develop insight into some of the negative factors such as racism and science, technology, engineering, and math (STEM) perceptions/stereotypes that may influence youth of color not to complete their degrees after high school, or to navigate away from STEM disciplines. The second intention was to investigate some of the positive factors (assets of communities of color, such as community cultural wealth and participation in an out-of-schooltime academic program) that may assist youth of color in completing degrees and specifically within STEM disciplines (Figure 2.1).

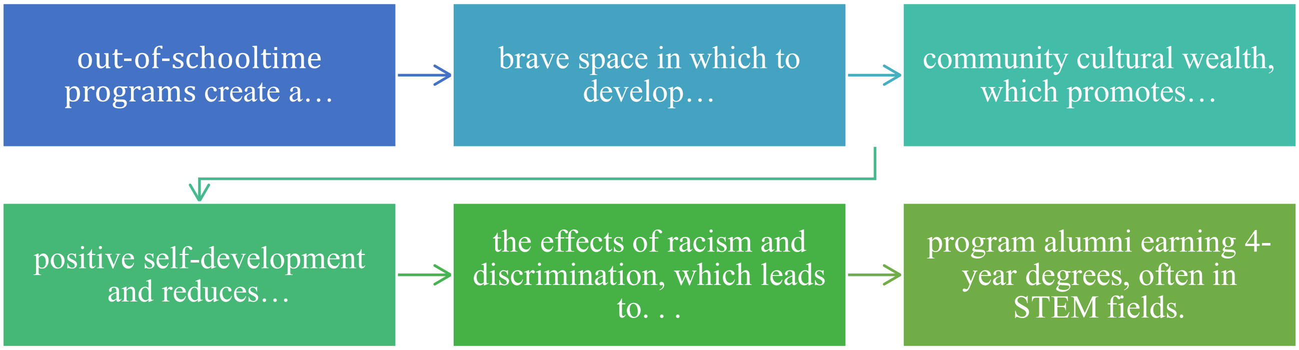
out-of-schooltime programs create a…
brave space in which to develop…
community cultural wealth, which promotes…
positive self-development and reduces…
the effects of racism and discrimination, which leads to. . .
program alumni earning 4-year degrees, often in STEM fields.

Figure 2.1. Backward mapping of the out-of-schooltime program's goals and intended academic outcomes related to identity.

My overall assumption for the study was that the out-of-schooltime program would create an environment in which youth of color would begin to self-identify and understand the strengths of their communities (Tatum, 2003). In learning about their strengths, individuals would become able to capitalize on and further develop their own strengths. In the long run, then, self-identified strengths would help reduce the effects of racism (Cohen, Garcia, Apfel, & Master, 2006).

The results of this research suggest ways in which youth development and college readiness professionals, specifically those geared toward STEM, can bridge the racial and gender gap among individuals represented in the STEM fields. I used a mixed-methods approach in this research project to provide a quantitative and qualitative interpretation of the experiences of racism by youth of color. I also investigated the results of racism in the participants' academic and STEM outcomes.

I investigated my three research questions with focus groups to gain an understanding of the community-cultural-wealth (CCW) components of the program, then I followed-up with quantitative and qualitative survey data. I expected that participation in the out-of-schooltime academic program would increase participants' sense of CCW, their academic achievement levels overall, and their retention in STEM disciplines and that it would reduce the effects of racism. I used the dosage of the program to determine how engaged participants were during my analyses of the outcomes. This research adds to the minimal existing research on out-of-schooltime programming for youth as an effort to reduce the demographic disparities in STEM fields. I analyzed each component of the study through the 3-part theoretical framework: CCW, critical race theory (CRT), and bioecology.

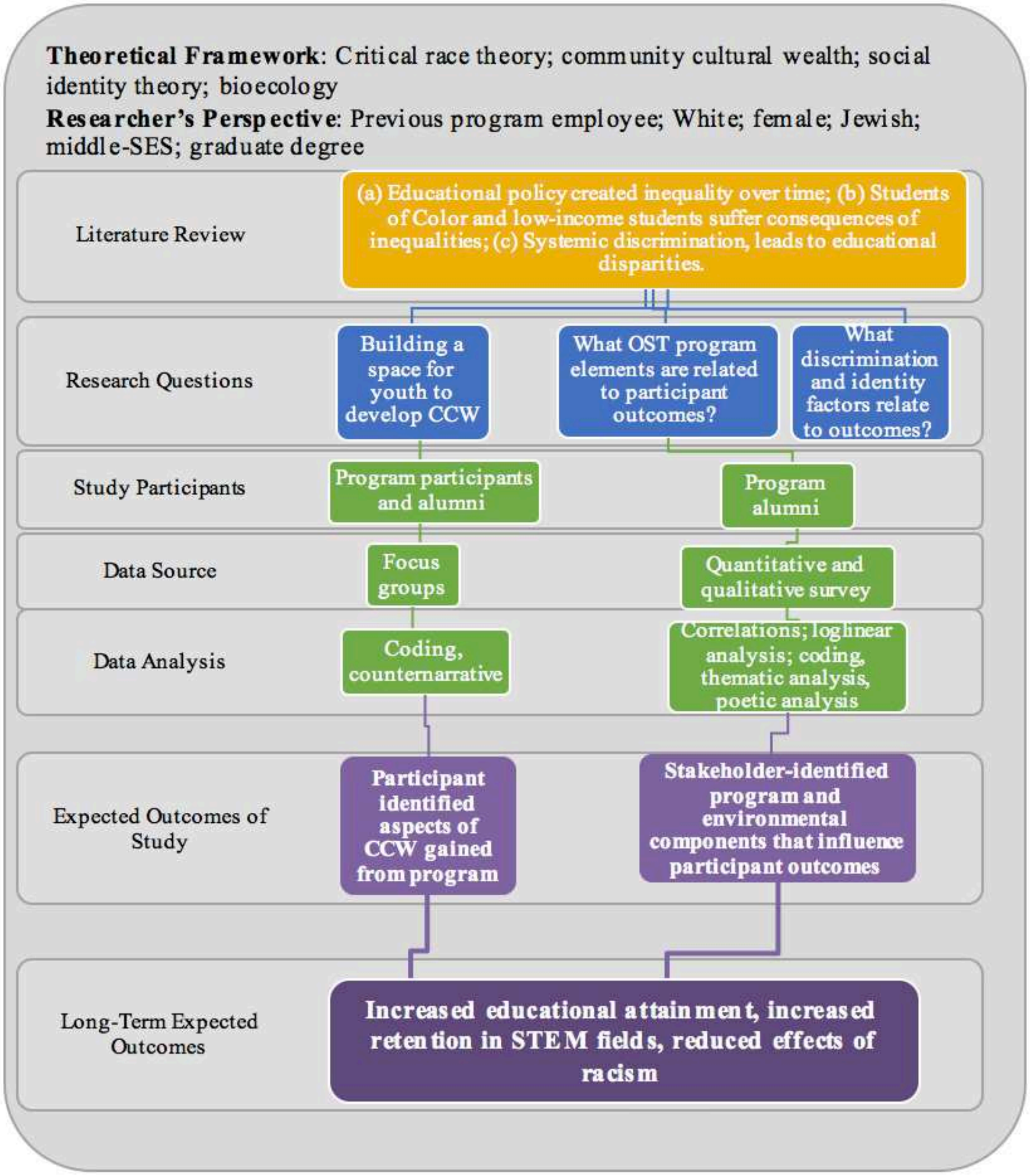
Theoretical Framework: Critical race theory; community cultural wealth; social identity theory; bioecology
Researcher's Perspective: Previous program employee; White; female; Jewish; middle-SES; graduate degree
Literature Review
(a) Educational policy created inequality over time; (b) Students of Color and low-income students suffer consequences of inequalities; (c) Systemic discrimination, leads to educational disparities.
Research Questions
Building a space for youth to develop CCW
What OST program elements are related to participant outcomes?
What discrimination and identity factors relate to outcomes?
Study Participants
Program participants and alumni
Program alumni
Data Source
Focus groups
Quantitative and qualitative survey
Data Analysis
Coding, counternarrative
Correlations; loglinear analysis; coding, thematic analysis, poetic analysis
Expected Outcomes of Study
Participant identified aspects of CCW gained from program
Stakeholder-identified program and environmental components that influence participant outcomes
Long-Term Expected Outcomes
Increased educational attainment, increased retention in STEM fields, reduced effects of racism

Figure 2.2. Study diagram showing background information and highlights of each study. (CCW = community cultural wealth; CRT = critical race theory; OST = out-of-schooltime)

Diagram of Study

The diagram of the study components (Figure 2.2) presents the background information; theoretical frameworks; and the research questions, including methods. I intend for this diagram to help in visualizing the complex factors, addressed in the study, that contribute to the disparities in education, and in STEM fields in particular. Additionally, I note the theoretical frameworks and the researcher's perspective in the outskirts of Figure 2.2 because they were the underlying context for the research and strongly influenced each step in these studies. The desired outcomes from the study were to determine whether out-of-schooltime program participation reduced the negative effects of racism, increased educational attainment, and improved STEM retention for underrepresented youth who participated in the study.

Theoretical Framework Overview

I framed this research by three theories that include CCW, CRT, and bioecological theory. CCW highlights the strengths of the community of color and counterbalances the deficit perspective of communities of color. CRT provides the framework within which I examined this content from the perspective of people of color. Social identity theory contributes to my understanding of the importance of having a sense of belonging in the community. Last, bioecological theory provides a framework by which I could understand the potential influence of the environment on the participants' learning and academic success.

Community Cultural Wealth (CCW) Overview

Yosso (2005) developed the concept of CCW to provide ways to talk about the types of capital found in communities of color. She developed CCW by critiquing the deficit lens commonly used to examine communities of color and incorporating the results of previous research on strengths in communities of color. Often, educators and researchers use Bourdieu's (1977) definition of *community capital*, which is cultural knowledge, and the skills inherited by those who are a part of the privileged society to explain the gaps in educational achievement. According to Bourdieu, there are three types of capital—social, economic, and cultural, which one can attain through interactions with one's family or through formal schooling. In Bourdieu's theory, some communities are culturally wealthy and others are culturally poor. Yet Yosso's (2005) CCW goes beyond simplistic explanations of Bourdieu's deficit levels of capital incorporating six factors to highlight the cultural strengths in communities of color.

According to Yosso (2005), individuals and communities develop CCW through at least six forms of capital that interact with each other. The six forms of capital she included in her research are

- *Aspirational capital*: This capital refers to the ability to uphold positive dreams for the future regardless of discriminatory actions. It is the ability to believe there is a better life ahead of oneself, and that children can do better than their others in the community. Aspirational capital is often developed through familial and social capital.
- *Linguistic capital*: Strong linguistic capital is the ability to speak more than one language. In this context, language includes different languages (Spanish, French, English, etc.), dialects (Haitian Creole, Ebonics, standard English, etc.) and art forms (art, music, poetry, spoken word, etc.), each of which serves as a mode of communication. Linguistic capital strengthens through the tradition in many communities of color to use stories to teach valuable lessons. In the United States, this form of capital is often seen in children's abilities to translate for their families.
- *Familial capital*: This form of capital includes gaining strength from one's family, community members, and organized communities (churches and youth programs, etc.). Through familial capital, the individual forms connection to others in the community and to the resources the others provide. This factor increases the moral values of individuals and also provides individuals with support in pursuing their dreams and navigating systems that are inherently racist or discriminatory.

- *Social capital*: Social capital pertains to belonging to a network of people and community resources that provide emotional and logistical support to navigating discriminatory systems. This capital provides the venue through which individuals learn how to navigate these systems and build individual strengths through learning from others’ experiences. Additionally, in this context, each individual has a responsibility to share the information with others and support others.
- *Navigational capital*: Individuals develop navigational capital when they can use each of the benefits from other factors to navigate a system successfully. Navigational capital is evident when people of color use their individual strengths to achieve their dreams.
- *Resistant capital*: This form of capital is the ability to resist against the dominant and discriminating community. Parents improve resistant capital by teaching their children that they are beautiful, intelligent, and self-reliant and that their cultural background has strength. Additionally, resistant capital refers to the ability to understand the systems and work toward transforming their discriminatory aspects.

In an attempt to redefine the way America’s education system sees youth of color, researchers and activists redefine how society views capital. Through the CCW lens, researchers can present communities of color as communities full of cultural strength (Burciaga & Erbstein, 2012; Jayakumar, Vue, & Allen, 2013; Lu, 2013; Luna & Martinez, 2013; Pérez Huber, 2009; Yosso, 2005).

Each factor of CCW contributes to an individual’s success. For example, a native Spanish-speaking student who graduates from college with all expenses covered by scholarships and speaks about his experiences embodies the enactment of all six forms of capital. The individual shows aspirational capital by having the dreams to go to college. Individuals have linguistic capital in their bi or multilingual abilities. Familial and social capital both provide emotional and logistical support to the individual before and during his college years. Navigational capital is evident in the individual's ability to attain scholarships and college admission, maintain scholarships, interact with professors, and manage his money. Last, participants gain resistant capital as the person tells his success stories after graduation, which shows his belief in self and how he used community cultural wealth to graduate from college.

CCW contrasts with the traditional concept of capital, which is often defined according to Bordieu and Passeron (1977) as the collection of cultural experiences, and the skills and abilities one has learned through engagement with dominant communities. CCW considers the counternarrative to explain successes in communities of color instead of supporting the view of the lack of capital as a deficit for communities of color. Other researchers have used the CCW theory to shape similar studies with mentoring of undergraduate Latin@ youth (Marsh & Desai, 2012; Salas, Aragon, Alandejani, & Timpson, 2014).

Critical Race Theory (CRT) Overview

Initially developed in response to the lack of progress toward equality after the civil rights movement, many academics have adapted and use the concept of CRT to present the perspective of people of color. CRT uses race as a central aspect of analysis and description of the experience. CRT in education emphasizes the importance of a person's identity, specifically one's race, and in general how the person's identity influences one's experiences.

CRT has a number of complicated and intertwined concepts. CRT is grounded in the concept that experiences of Whites are not universal and that people of color have unique experiences. Instead of assuming the White experience is the norm, researchers using CRT analyze experiences of subordinated groups in an effort to understand the complexity of subordinated identities (Solorzano & Yosso, 2002).

A number of themes define CRT:

(a) Race and other forms of subordination connect to define each person's identity;

(b) Racism exists in American society and citizens often do not recognize it in American legal and political structures;

(c) Color blindness and neutrality cannot exist in American culture because of the historical events and unequal treatment of people belonging to subordinated groups;

(d) Subordinated individuals can share their experiences and critique liberalism to change the systems that reinforce racism; and

(e) CRT takes a multidisciplinary approach toward understanding race and racism in the current society (Solórzano & Yosso, 2002; Yosso, 2005).

Since its initial presentation, CRT has grown to encompass many different types of discrimination including gender, sexuality, and people of color. CRT is unique compared to other educational frameworks because it allows for exploration of multiple subordinated identities, encourages strength-based thinking about the subordinated groups, and supports social-justice movements through a presentation of individual stories (Solorzano & Yosso, 2002). Through a CRT lens, the researcher recognizes these identifying categories as socially constructed and largely influential on people's individual experiences (Valdes, 1998). This perspective is fitting, given the intersectionality of each person's identity. As Lorde (1983) said,

> I simply do not believe that one aspect of myself can possibly profit from the oppression of any other part of my identity . . . children need to learn that they do not need to become like each other in order to work together for a future they will all share. (para. 4)
>
> . . .There is no hierarchy of oppression. (para. 6)

> . . .I cannot afford the luxury of fighting one form of oppression only. I cannot afford to believe that freedom from intolerance is the right of only one particular group. . . . (para. 7)

This inclusivity of multiple identities allows for intersectionality to emerge and represent the depictions of individuals' experiences. To fully understand an experience, one must understand a person as a whole, without overlooking certain aspects of the multiple identities.

Critical Race Quantitative Intersectionality (CRQI) Overview

I frame the qualitative and quantitative aspects of this research by CRT. Qualitatively, CRT is consistently present in the front of my mind as I code, as I look for situations in which participants may be in because of their skin color, or ways of thinking that align with a certain race. The challenges are presented as simply that—challenges, many of which people were able to overcome. I have outlined and defined this framework, along with the other three, on a visible paper to ensure these concepts stay at the front of my mind while I analyze. The quantitative data are informed by my qualitative findings in every instance. The structure to this framing is defined by critical race quantitative intersectionality (CRQI), which is heavily informed by CRT. This method was developed to help researchers create quantitative research that begins and ends with the story of the people who are represented in the numbers. When using this approach, researchers should use the standard values of CRT as the backbone for developing the stories and interpreting the quantitative data. The working definition of CRQI is

> Critical race quantitative intersectionality is an explanatory framework and methodological approach that utilizes quantitative methods to account for the material impact of race and racism at its intersection with other forms of subordination and works toward identifying and challenging oppression at this intersection in hopes of achieving social justice for students of color, their families, and their communities. (Covarrubias & Vélez, 2013, p. 276)

We must account for people's unique identities when we are describing trends in our community. This framework for analysis encourages us to incorporate multiple different identities to account for effects of intersectionality. The CRQI framework encourages us to tell people's stories as they have been influenced by multiple identities (i.e., telling the stories as they are actually experienced, not as a separate person experiencing discrimination for her race, and a separate person feeling discrimination for her gender, but as one woman who experiences discrimination for her race and gender simultaneously).

The CRQI framework is grounded in five principles. First, measuring the material influence of racism and intersectionality, also called *intersectional data mining*, states that "numbers cannot 'speak for themselves'" (Covarrubias & Velez, 2013, p. 277). All quantitative data must be informed by qualitative data. To address intersectionality in the quantitative research, CRQI suggests a multidimensional analysis of power-based relationships (e.g., three-way crosstabs, or multivariate analysis of variance [MANOVA]). Second, CRQI challenges the notion that quantitative data are neutral and instead questions the framework within which the data were gathered. The third principle highlights the importance of fluidity of identity status. For example, the experience of people of color should be shared in the context of being fluid and not representative of a static experience for all current or future people of color. The fourth principle, research addresses intersectionality, states that this research will lead to greater change in policy. The fifth principle states that analysis and research development should be created in a transdisciplinary context to encourage discovery of complex patterns (Covarrubias & Velez, 2013).

Because CRT is grounded in the notion that color blindness exists in US society and the strengths of the nondominant group of people, it serves as the primary theoretical foundation for this research. CRT often uses methods that include storytelling to illuminate the perspectives of people of color. The stories allow for the marginalized community to construct its own reality and help people understand more than just their own stories (Ladson-Billings, 1999). I used a critical-race counternarrative to present a contrast to the majoritarian story and to examine the societal assumptions made by the dominant culture. I used CRT and CCW as the main theories for the frameworks to challenge the deficits that are often associated with communities of color. These frameworks highlight the strengths of communities of color.

Bioecology and Cultural Influences on Environment

People regularly interact with many different environments, and the characteristics of the environment affect their lives and perceptions of the world for many reasons. Each aspect of the environment contributes to individuals' social and cognitive development in positive or negative ways (Evans, 1999). Additionally, everyone experiences each environment differently based on individual identity and personal cultural experiences (Super & Harkness, 1999). Identity includes factors such as race, ethnicity, age, religion, body type, and ability. Culture includes other people and actions in the environment, customary practices, group norms, and beliefs (Super & Harkness, 1999). Bronfenbrenner's bioecological theory of human development (1979, 2005; Bronfenbrenner & Morris, 2006) defines the environment in a way that describes its multiple, interacting levels of complexity. Using this theory, researchers can identify environmental influences and study them as a whole in a way that incorporates the influence of individual culture (Super & Harkness, 1999).

The process-person-context-time model. For completeness, the study of human development should be based on a process-person-context-time model (Bronfenbrenner & Morris, 2006; Guhn & Goelman, 2011). Within this model, the proximal processes create the foundation of bioecology. *Proximal processes* include the interactions among the evolving person, objects, and environmental messages (Bronfenbrenner, 1999). There are five characteristics of proximal processes: (a) The person must participate in the activity; (b) the activity must occur frequently and over a long period of time; (c) the complexity of the activity must increase over time; (d) the activity must be multidirectional, with instigation and reaction coming from all parties; and (e) the objects and messages in the environment must encourage exploration, thoughtfulness, and creativity (Bronfenbrenner, 1999; Bronfenbrenner & Morris, 2006). It is the interaction among proximal processes that influences human development. The characteristics of the person, the context, and the time in history all influence the magnitude of the process (Bronfenbrenner, 1999; Bronfenbrenner & Morris, 2006). The process-person-context-time model equally weights the value of the process with the value of the influence of the person.

Three types of characteristics define the person component of the model: *dispositions*, *resources*, and *demand characteristics* (Bronfenbrenner & Morris, 2006). A person's *disposition* can influence the initiation and duration of the proximal processes. For development to happen, individuals must be actively engaged in their lives (Lerner, 2002). The *resources* (e.g., proficiencies, previous experiences, knowledge) of each person also influence the nature of the proximal processes. Last, the person's *demand characteristics* are those qualities about the person's appearance or energy that modify the interaction between the person and the proximal process. The demand characteristics encourage or discourage the progression of the proximal processes by responding to the social cues of the environment (Bronfenbrenner & Morris, 2006). An example of demand characteristics influencing the proximal process is prettier women being let into the dance club and the less attractive women and men being told to leave or continue waiting.

The context is continually salient for each person. Throughout development, individuals may remain in their current environment or migrate to a different environment. Additionally, different characteristics of the environment may contribute to positive development and other components may contribute to negative development (Wachs, 1999). For the youth in this study, the context may either look like individuals not pursuing a college degree and working a minimum wage job, or attending college, and getting a professional job.

The environmental experiences are largely influenced by the time context in which a person has an experience (Wachs, 1999). The time context can refer to the frequency and duration (in hours, days, months, years) of the proximal processes, the changing beliefs, and worldly events (Bronfenbrenner & Morris, 2006). It can also be the developmental process that happens over time. In Chapter 1, I included the background information about the current demographics of the STEM fields and the forms of racism today to provide the time context for this research.

The interactive system. Further, the process-person-context-time model exists within an interactive system, which includes the microsystem, mesosystem, exosystem, macrosystem, and chronosystem (Bronfenbrenner & Morris, 2006; Guhn & Goelman 2011). The *microsystem* is a single environment in which the developing person and other key players (caretakers, siblings, other family members) interact, and in which the developing person has a specific role (brother, child, participant, student). For example, in the home environment, the developing person may be both a brother and a child, and in the youth program, the developing person would be a participant (Bronfenbrenner, 1977). The *mesosystem* develops when there are interactions between different microsystems that directly involve the individual. An example of a mesosystem is the participant's home life (e.g., parenting styles, feeling of safety at home, or

SES), which relates to the frequency of participation, and the experience during participation in the youth program (Bronfenbrenner, 1977; 1986). The effects of the mesosystems build on each other to influence the person's development (Bronfenbrenner & Morris, 2006).

The *exosystem* is the interaction of multiple environments, of which at least one does not directly involve the developing person (Bronfenbrenner, 1977; 1986). An example of an exosystem for a child is the interaction between the caretaker's place of employment and the child's home or neighborhood. Specifically, imagine a single father living in a low-income neighborhood with two children. The father loses his job, which results in the family being evicted. As a result of the eviction, the family moves to another city, the children miss school and need to transfer to a different school, and they can no longer regularly attend the youth program. Although the children do not directly engage in the father's workplace, what happens at work largely relates to the children's academic success and extracurricular activities.

The *macrosystem* is different from the previous three systems in that it is based on a set of cultural beliefs or practices that determine the structure of the other systems (Bronfenbrenner, 1977). An example of a macrosystem is the K-through-12 schooling system: There are a set of beliefs, policies, and best practices that provide the structure for all schools in the United States. The *chronosystem* incorporates the changes that occur over time in each of the developing person's systems (Bronfenbrenner, 1986). Bronfenbrenner (1986) described these changes, or transitions, as being either *normative* (e.g., puberty, going to college, or marriage) or *nonnormative* (e.g., family death, moving, or winning the lottery).

Changes in each of these systems over time are both products and producers of historical changes in developmental processes and outcomes (Bronfenbrenner & Morris, 2006). Understanding these changes and transitions is also essential for a complete understanding of human development. When one studies human development, it is essential to consider the interactions between each of the described components of the environment (Bronfenbrenner, 1977).

Influences of the macrosystem. This multilevel system of bioecology incorporates influences of the culture and other macrosystemic factors (Super & Harkness, 1999). Super and Harkness (1999) described three types of cultural influences: contemporary redundancy, thematic elaboration, and chaining. *Contemporary redundancy* is the repetition of messages from various parts of the environment during the same period of time. In this study, an example of this influence is youth learning from their families, youth program staff, and teachers that education and college are important. The repetition of a similar message by different parties strengthens the value of the message, making it more salient compared to the effect when only one source conveys the message (Super & Harkness, 1999). The message strengthens when it incorporates other beliefs and community practices.

The second type of cultural influence Super and Harkness (1999) described is *thematic elaboration*, in which the environment and culture send repeated themes and implicit messages through word choice, values, and images. This influence includes the population receiving messages recognizing and internalizing the abstract patterns and unstated themes of the environment. For the population in this study, some potential themes that reference deficit perspectives found in the literature might have included “Black and Latin@ youth do not graduate from high school or attend college,” “STEM is a difficult area to succeed in,” and “Black and Latin@ youth do not do as well as White and Asian youth on standardized tests.” Such themes repeat throughout various stages of life and multiple mediums, which often results in changes to an individual’s life experiences. The magnitude of these messages is also reflected in how strongly the individual internalizes the message (Super & Harkness, 1999).

The last influencing factor Super and Harkness (1999) described is *chaining*, when a series of events results in an outcome. In this case, no single component of the environment is robust enough to create the result; however, the combination of multiple components results in one outcome. The outcome arises as a result of multiple, seemingly unrelated events. The timing and context of the events may relate to this outcome. For the youth involved in this study, such a series of events may have included attending school on the day of the program-recruitment presentation, becoming a member of the program, having high-school grades and activities monitored by program staff, and earning scholarships to pay for college. With chaining, people reach their final outcome as a result of particular events and the timings of those events (Super & Harkness, 1999).

Individuals uniquely experience each of the three influencing factors and the components of the environment as described by bioecological theory because each individual’s identity is unique. The environment also interacts differently with each individual based on the individual’s unique identities (Super & Harkness, 1999). It is important to consider both this subjective and feeling-based experience, and the objective characteristics of the environment in the research process (Bronfenbrenner, 1977; Bronfenbrenner & Morris, 2006; Wachs, 1999). I emphasize this point to remind us that persistent themes in one community may not align with the themes in other communities.

Theoretical Framework Summary

In summary, I framed this research by three theories that include critical race theory, CCW, and bioecological theory. Critical race theory provided the framework within which I examined this content from the perspective of people of color. CCW highlighted the strengths of the community of color and countered the deficit perspective of communities of color. Social identity theory contributed to my understanding of the importance of having a sense of belonging in the community. Last, bioecological theory provided a framework by which I could understand the potential influence of the environment on the participants' learning and academic success. The primary research questions that guided this research are

(a) How do students of color who participate in an out-of-schooltime program experience community cultural wealth (CCW)?

(b) What out-of-schooltime program elements are related to program participants' academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?

    (i.) For which participants was the youth program a proximal process, based on level of academic aspirations, STEM persistence, academic persistence, STEM resilience, and academic resilience?

(c) Is the level of awareness of personal identity related to program participants' academic aspirations, STEM persistence, academic persistence, STEM resilience, and academic resilience?

    (i.) How does the level of experienced discrimination relate to program participants' academic aspirations, academic persistence, STEM persistence, academic resilience and STEM resilience?

    (ii.) How do individual identities relate to participants' academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?

Researcher's Perspective

I am a White woman who grew up in a lower-middle-class home with a single mother. Until I went to college, I knew very little about other cultures or people with identities different from my own. I have spent the past 15 years learning about myself: the strengths and weaknesses of my identity, and the differences and similarities between others and myself. Much of this learning happened during my time working with the out-of-schooltime program. I worked as a mentor, program coordinator, and program director between 2005 and 2012. As a result of my time as a staff member of the out-of-schooltime program, I personally know all of the research participants and program staff. This personal connection between the participants and myself may have influenced study participants' responses. The participants may have been protective of me and provided nicer comments than the reality. Additionally, the participants may have feared that I would tell the current staff about the information I gathered. At the same time, the participants may have felt comfortable with me and have been more honest with their responses than they would have been if they had not known the researcher. The participants may also have understood that I needed honest feedback to improve the program. I have had multiple people review the survey to ensure it includes no leading comments that might have skewed the responses or resulted in skewed reporting of the data.

I am aware of how my past experiences and relationship with the program may have influenced my research lens. Therefore, I identify myself primarily as a constructivist who is also influenced by critical and participatory philosophies. Through this combination of constructivism, critical theories, and participatory research, I hope that I have engaged in research that is meaningful and impactful to those populations whose voices often go unheard.

Regardless of the level of objectivity in the research, one’s perspective influences the interpretation of findings. In general, I believe that my perceptions and interpretations of each life event depend on my experiences. Even during my years of doing cell-biology research, I found myself to be a constructivist. Although certain results may seem objective, there are also alternative reasons for those results. For example, if researchers test the presence of a specific enzyme in the mouth, a variety of unknown mechanisms potentially could alter the influence of that enzyme. Considering various lived experiences and perspectives enables researchers to imagine an alternative hypothesis. Given my constructivist identity, I can relate to the data, have a personal interest in the data, and possibly provide a new perspective on the findings. The critical and participatory components of my research stance further demonstrate these characteristics.

The critical and participatory influences in my research goals connect to my beliefs that research should support the community. When I reference the community, I refer to a community who needs additional support, the community who does not have the resources or privilege to demand equal treatment in various contexts, and the community who speaks but is not heard. To me, the main reason to do research is to better lives. This belief has made it difficult for me to understand some components of the PhD community. It seems common that many brilliant minds are doing research; however, many practitioners in the applied field do not use the findings. Then, I wonder, what is the purpose of conducting research? “Simply to understand” seems selfish to me. It seems as though researchers would want to share knowledge so that it can create change in our world. What are the contributions to the community as a whole? How is anyone other than the other elite, educated folks benefiting from the countless hours, energy, and money put into the research? These questions drive me to use my advanced degrees to represent underrepresented communities and to ensure that the research I am conducting focuses on the needs of the community (as identified by the community).

Specifically applying these perspectives to a mixed-methods context is simple. Because of the nature of mixed-methods research and the inclusion of both quantitative and qualitative data, it is much easier to accurately represent the underrepresented communities. In an applied setting, mixed-methods findings present the severity of the problems through both the numerical findings and the words spoken by the community members. Local organizations can use these findings to represent their target communities and earn more funding to contribute to their organizational missions. To me, the most successful way to create change in the community is through a constructivist research stance that incorporates influences from critical theories and participatory research.

Methods Overview

The overall study design was a multiphase, convergent parallel, mixed-methods design that sought to identify the common factors within each academic outcome for alumni of an out-of-schooltime program. In a mixed-methods approach, the researcher uses both qualitative and quantitative methods to gather and interpret data. My goal with this approach is to broaden formal and informal educators understanding of the topic (Creswell & Plano Clark, 2011) beyond either a purely qualitative or purely quantitative level. More specifically, I used a multiphase, convergent parallel design. The design was multiphase because I conducted multiple different studies in a sequence in which the first study provided context for the second two studies. The convergent parallel design indicates that qualitative and quantitative data collection and analyses happened simultaneously for studies 2 and 3. In the final level of analysis, I compared the findings from the three studies, which resulted in a cumulative interpretation of the participants' experiences and outcomes (Creswell Plano & Clark, 2011).

I used a mixed-methods design for this research because the nature of the constructs was qualitative, as descriptions of personal experiences; however, the nature of the research was quantitative, as specific data regarding the disparities in educational attainment and in the STEM fields. The benefit of a mixed-methods approach for this research is evident through my survey questions. For example, I asked whether the participant had children (*yes* or *no*). Then I used an open-ended question to inquire about how the child (if any) influenced the participant's educational pursuits. If I had asked only the yes or no portion, I would not have gained an understanding of the effects a child had on the participant's educational pursuits. The mixed-methods approach allowed me to attain a deep understanding of the participants and the motivations/reasons behind different aspects of their lives. This approach also allowed me to explore areas that otherwise might rarely be documented in current research.

In study 1 (Chapter 3), I used focus groups of current participants and program alumni to study the culture of the out-of-schooltime program and the aspects of community cultural wealth that participants gained through participation. I presented the results of the focus-group analyses through composite counternarratives, which I used to inform the instrument development for the second and third studies. For both the second and third studies, I used a qualitative and quantitative measure to gather data on factors related to academic and STEM accomplishments, and characteristics of participants who were academically resilient and STEM resilient. In study 2 (Chapter 4), I focused on how the program activities and program structure contributed to the participants' accomplishments and resilience. In study 3 (Chapter 5), I incorporated many research-supported environmental factors that promote or deter academic and STEM resilience and accomplishments (see Figure 2.3).

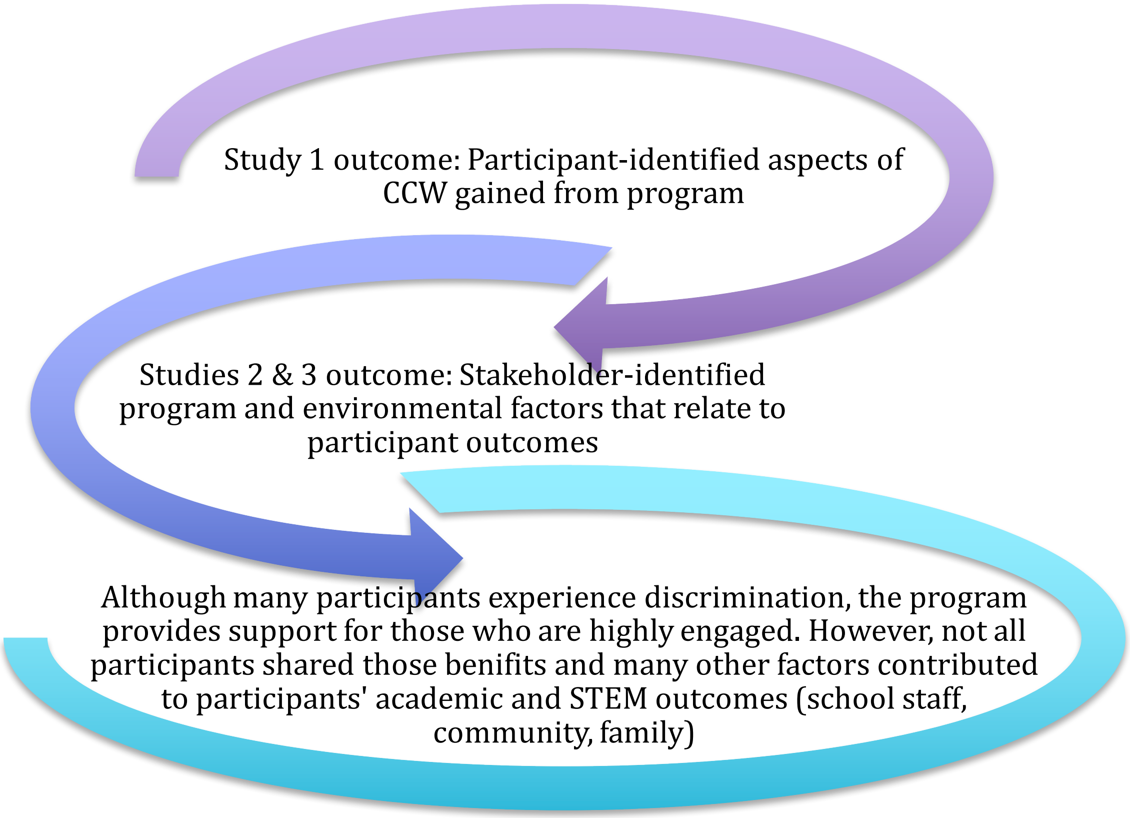
Study 1 outcome: Participant-identified aspects of CCW gained from program
Studies 2 & 3 outcome: Stakeholder-identified program and environmental factors that relate to participant outcomes
Although many participants experience discrimination, the program provides support for those who are highly engaged. However, not all participants shared those benifits and many other factors contributed to participants' academic and STEM outcomes (school staff, community, family)

Figure 2.3. Overview of the relation of the three studies and the final purpose of the research project.

Participants Overview

All participants in this study were alumni from a set of out-of-schooltime programs hosted by an informal science educational institution. According to youth-program funding regulations, all program participants must be either low-income or first-generation, college-bound students. However, most of the program participants were both low income and first-generation college bound (87%). Grant regulations also required that participants attended or lived in the district for some of the lowest-performing high schools in the city (based on district grading data). Program staff recruits most program participants during their eighth-grade year from the middle schools in each feeder pattern. For program acceptance, each student must complete an application, including some short essays and teacher-recommendation forms. Staff review the applications and interview students and parents attend an orientation; then staff accept students formally to the program. Staff expect students to commit to the program throughout their high-school careers; however, some students cannot meet this commitment, and others begin the program after they have begun high school. I summarize the participants' demographics for all three studies in Table 2.1.

Table 2.1

Summary of the Number of Survey Participants Identifying with Each Demographic Identity Included in This Three-Part Dissertation, Separated by Study Outcomes (Academic and STEM Persistence Levels)

	STEM persistent (*n* = 37) earning(ed) a(n). . .				NonSTEM persistent (*n* = 84) earning(ed) a(n). . .			
	AS or less (*n* = 3)	AA (*n* = 4)	BA/BS (*n* = 16)	Master's/ Doctorate (*n* = 14)	AS or less (*n* = 15)	AA (*n* = 15)	BA/BS (*n* = 35)	Master's/ Doctorate (*n* = 19)
Female (*n* = 74)	1	3	7	8	10	10	21	14
Black (*n* = 45)		3	3	4	4	8	13	10
Latin@ (*n* = 8)			2		1	1	1	3
S. Asian (*n* = 1)				1				
White (*n* = 16)	1		2	3	2	1	6	1
Multiracial (*n* = 1)							1	
Male	2	1	9	6	5	5	14	5
Black (*n* = 28)	1	1	3	5	5	4	6	3
Latin@ (*n* = 10)			4	1		1	3	1
S. Asian (*n* = 0)								
White (*n* = 8)	1		1				5	1
Multiracial (*n* = 0)								

Note. See page 141 for a description of STEM- and NonSTEM-Persistent. AS = Associates of Science/Technical degree; AA = Associates of Arts degree; BA/BS = bachelor's degree.

Procedures Overview

Program staff provided me with participants' contact information gathered from a participants' database. An external evaluator of the out-of-schooltime program who worked for the program provided me with the secondary data used for study 1. I did not need IRB approval or consents for this component because it was anonymous secondary data. I received a letter from Evelyn Swiss documenting this (Appendix D). For all primary data collected (studies 2 and 3), all participants were more than 18 years old and provided implicit consent to participate in the research, simply by answering the survey questions. The first page of the online survey contained information about the survey, the research goals, and implicit consent to participate in the research. The final sentence of the survey's first page reads, "By continuing with the survey and responding to the questions, you are consenting to participate in this survey." My research was exempt from needing IRB approval (IRB approval letter, Appendix D). In chapters 3 through 5, I provide more details about specific procedures used in each study.

Focus Groups Overview

I used focus group transcripts to analyze the factors of CCW that were prevalent in the program participants. As discussed earlier, the CCW theory provides a foundation for understanding the types of capital found in communities of color (Yosso, 2005). Yosso (2005) developed CCW by critiquing the deficit lens through which communities of color are commonly examined, and incorporating previous research on strengths in communities of color. Individuals and communities develop CCW when at least six forms of capital interact with each other. The six initially established capital forms include aspirational, familial, social, navigational, resistant, and linguistic.

Focus groups provided a setting that allowed for people to express their ideas using their own words, making them particularly beneficial for this research. Focus groups provide data through people's own voices, instead of forcing them to match their thoughts with categories determined by the evaluators (Sofaer, 1999). The focus group data provided an overview of the youth programs and the contexts for the research. These data were also instrumental as I created the survey questions and response options.

Measures Overview

I developed the mixed-methods survey specifically for the second and third studies in this research project. I began with two preexisting surveys: a survey developed to inquire retrospectively about girls' experience in an informal STEM program (McCreedy & Dierking, 2013), and the Perceived Ethnic Discrimination Questionnaire-Community Version (PEDQ-CV; Brondolo, Kelly, Coakley, Gordon, Thompson, & Levy, 2005). I then revised to make the questions appropriate for the survey population, and reflective of programmatic activities and goals. I revised the survey multiple times based on pilot-study feedback from 11 individuals who represented past program participants, program staff, and educational professionals. Additionally, I incorporated feedback from experts in education, human development, and survey design. The survey measured five outcome variables: academic and STEM persistence, academic aspirations, and academic and STEM resilience. The outcome variables include

- *Academic persistence*. Academic persistence identified individuals who had earned or were actively enrolled in a 4-year or higher degree program.
- *STEM persistence.* STEM persistence identified individuals who had earned or were actively enrolled in a STEM degree program (including associate's degree programs or trade schools) beyond high school.

- *Academic aspirations.* Academic aspirations refer to any goals participants had regarding the degrees they hoped to earn in the future.
- *Academic resilience.* Academic resilience identified participants whom I coded as academically persistent, and who had experienced hardships or risk factors related to their academic pursuits. Risk and protective factors included multiple environmental factors that prior research indicated affects an individual's academic accomplishments.
- *STEM resilience.* STEM resilience identified participants who persisted in STEM despite experiencing hardships or risk factors related to STEM.
    - *STEM identity.* Research supports that STEM identity strongly influences STEM resilience, specifically for people of color and women who do not have a strong presence in STEM fields. Underrepresented individuals in STEM fields often feel excluded in the STEM setting, which leads to decreased desire to pursue STEM fields (Good, Rattan, & Dweck, 2012). A strong STEM identity can help underrepresented individuals combat the biases they often experience in professional settings. STEM identity is the overlap of competence, recognition, and performance in the STEM context (Carlone & Johnson, 2007). Someone with a strong science identity would be one who performs well, demonstrates competence in a subject, and receives recognition from others in the field for accomplishments.

Additionally, I inquired through the survey about participants' personal identity, experiences of discrimination, and experience during the youth program(s). I introduced these questions to provide the context of potential environmental factors that might have contributed to participants' academic and STEM outcomes. Racial identity and discrimination have been widely found to influence academic outcomes (e.g., Brand, Glasson, & Green, 2006; Dotterer, McHale, & Crouter, 2009); however, the intersectionality of identity and discriminatory practices had not been frequently studied at this point. I intentionally wrote the questions in this survey to determine the intersectionality of identities.

Participants took this survey retrospectively, which was suitable for the research questions and the audience. I was interested in participants' connections between program activities and educational experiences beyond high school. In the following pages, I describe the survey questions, response options, and coding guidelines used for each outcome variable and the predictor variables. I have integrated the findings from all three studies to further develop the aspects included in the CCW theory, and to provide guidance to the out-of-schooltime program.

Analyses Overview

The analyses for these studies include a combination of qualitative and quantitative procedures. For the qualitative data, I coded all responses using various guidelines further described in chapters 3 through 5. In some situations, I assigned frequencies to the codes and integrated the information with my quantitative data for statistical analysis. In other instances, I used those codes to conduct thematic analysis and presented the research story using counternarratives and poetic analysis.

For the quantitative data, I conducted an exploratory factor analysis (EFA) to determine whether I had multi-item constructs within the survey specifically related to motivation for participation and perceptions of program influence. For the more complex research questions, I used MANOVA and multiple logistic regression. A summary of the research questions and associated analysis plans is in Table 2.2. I provide more detailed information on analyses in chapters 3 through 5.

Table 2.2

Research Questions, Analyses, and Effect Size

Research question	Analysis	Effect
Study 1 How do students of color who participate in an out-of-schooltime program experience community cultural wealth (CCW)?	Qualitative coding using CCW framework	NA
Study 2 What out-of-schooltime program elements are related to program participants' academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?	Multiple logistic regression	χ^2
For which participants was the youth program a proximal process, based on level of academic aspirations, STEM persistence, academic persistence, STEM resilience, and academic resilience?	Descriptive analysis based on multiple-choice and open-ended survey questions	NA
Study 3 Is the level of awareness of personal identity related to program participants' academic aspirations, STEM persistence, academic persistence, STEM resilience, and academic resilience?	Spearman correlation	r
How does the level of experienced discrimination influence program participants' academic aspirations, academic persistence, STEM persistence, academic resilience and STEM resilience?	Spearman correlation	r
How do individual identities relate to participants' academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?	Hierarchical log-linear analysis	χ^2

Reliability, Validity, and Trustworthiness of the Studies: Overview

Throughout my studies, reliability and validity were primary concerns. The internal validity of these studies is medium. Although I included a number of potential influencing factors in my survey, the study design does not allow for claiming causality of academic outcomes (Gliner, Morgan, & Leech, 2009). I matched groups of participants with other groups that had similar survey responses to determine the potential influence of factors, such as activity level in youth programs, to create *similar groups*. Although I did not collect data in a controlled environment, most participants grew up in a similar inner-city environment. I collected data through the online survey program Qualtrics (Gliner et al., 2009).

To address external validity concerns, I included all prior program participants to ensure that the youth-program population was accurately represented. I expected a high response rate because of my personal relationships with the study participants. Current staff were planning a large alumni event in early 2016, which I think increased my response rate. The evaluator facilitated the focus groups at the youth-program facility, which was a comfortable space for most participants. I administered the surveys through an online program (qualtrix.com) so that participants could complete the survey in their choice of environments (Gliner et al., 2009).

I considered measurement reliability and validity throughout this research. To support measurement validity, I developed this survey based on themes in literature related to underrepresented groups in higher-education programs and STEM fields. Throughout the survey, I included sporadic item reversals to screen for response sets. Additionally, I used exploratory factor analysis to test for constructs with normally distributed items. I then compared the factor analyses results to the literature to determine whether my data matched prior findings and supported the measurement's validity. For each construct, I determined the internal consistency reliability (Cronbach's Alpha; Morgan, Leech, Gloeckner, & Barrett, 2013). At this time, I have not had an opportunity to retest the survey over time or with different survey versions. I adapted the PEDQ-CV for the portion of the survey related to experiences of discrimination (Brondolo et al., 2005). This instrument assesses five constructs, with internal reliability between 0.65 and 0.88 when tested with a group of college students (Brondolo et al., 2005).

I also tested the survey with 11 people in a pilot test. The pilot test participants included program alumni, staff, and STEM educators. I modified the survey based on suggestions from those participants to improve applicability and readability of the questions and response options. I adapted many of the survey questions from other surveys; however, I generated the questions based on research.

For the qualitative components, I ensured transferability and trustworthiness through a number of procedures. I used two common procedures for data collection (focus groups and survey). All participants had the option to participate in the survey, which resulted in comparisons between data on participants with contradicting outcomes (e.g., STEM resilient vs. nonSTEM resilient). Additionally, once I completed preliminary analysis, I requested that the current and former program staff review the findings (Morse, Barret, Mayan, Olson, & Spiers, 2002; Shenton, 2004).

Delimitations

This study focused on a population of youth who attended an out-of-schooltime program in a southeastern state. The out-of-schooltime program was a voluntary program for youth who were first-generation college bound and considered low-income by the US government (as determined from Federal TRiO programs' current-year low-income levels, 2015). At time of program admission, participants also needed to live in specified school neighborhoods for program acceptance.

I administered the survey to approximately 600 individuals who participated in the youth programs between June 1996 and May 2014. I calculated effect size based on a power of 0.80 and six predictors. With these assumptions, I would need a sample of 684 participants to obtain statistically significant results with a small effect size of $f^2 = 0.02$, and a sample of 97 participants to obtain significant results with a medium effect size of $f^2 = 0.15$. The demographics of the population were roughly 55% Caribbean American, 40% Latin@, and 5%

White, Asian, other, or mixed race. This was a very specific population of youth and did not represent youth or youth of color as a whole. Staff recruited the program participants recruited during their eighth-grade years through presentations. Teachers, friends, and family members also made recommendations for new participants. Applicants completed a multipage application that included some basic demographic information and short essay questions regarding their interest in STEM. The applicants also needed to provide two recommendation forms and a copy of their transcripts (although participants' GPAs were not a factor considered for admission until 2013). These application requirements required some component of internal motivation to complete. I did not control for this kind of internal motivation; however, I did measure motivation for participation include it in the analyses.

Limitations

I purposefully selected the population for this study, and the population represented a specific group of people who were primarily first-generation college-bound, low-income people of color. This study would have been more representative if it had included a control group because the majority of the participants were also participants in an intensive, multiyear, youth program. The study design does not allow for causal statements. The first component of the study used secondary data, so I did not take the research questions into account when I determined the focus-group guidelines; however, the intentions of the prior data-collection period were similar to those of the present research. In the second and third parts of the research, I collected retrospective data. The elapsed time may have skewed participants' memories of their experiences with the program and in college. A number of additional factors that may influence youth of color STEM perceptions, experiences with racism, academic outcomes.

CHAPTER 3: DEVELOPING COMMUNITY CULTURAL WEALTH IN AN OUT-OF-SCHOOLTIME PROGRAM SETTING—STUDY 1[2]

> Her notion of safety had been based upon finding a comfortable and secure place where she could simply be herself … she insists that new places must be forged in coalitions through a process of struggle, examining our own assumptions and privileges, challenging not only others' ignorance, but our own ignorance, and seeking new ways of interacting with those who are differently positioned from ourselves (Fox & Ore, 2010, p. 630).

Successful out-of-schooltime programs include different approaches. The commonality among many of these programs is that youth have a brave space (both physically and emotionally) when they are not in school. The Upward Bound Math & Science program is an example of a successful out-of-schooltime program. The Upward Bound program is one of eight programs funded by the US Department of Education's, TRiO funds to support underrepresented (low-income, first-generation college-bound, veteran, and differently abled) college students and students preparing for college (US Department of Education, 2014). The overall goal of the out-of-schooltime program is to encourage students to acknowledge their strengths in math and science and ultimately pursue science, technology, engineering, and mathematics (STEM) careers (US Department of Education, 2014). One main reason for the success of out-of-schooltime programs is that they provide a brave space for youth to develop and learn about themselves.

The out-of-schooltime program in this investigation created a safe environment for the participants. The setting allowed for individuals to develop a positive self-identity, understand

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[2] The blue text is very similar to or exactly the same as a different part in the dissertation. I will make it unique prior to publication.

the complexity of their identities and interact with others. Research has found that safe spaces help youth perform better academically, reduce the negative effects of stereotype threat (Steele, 1997), increase class participation (Holley, 2005), and strengthen marginalized communities (Tatum, 2003). Additionally, within a safe environment, individuals are challenged to embrace the discomfort of questioning their perspectives and biases, embrace their own identities, and understand other people's perspectives (Boostrom, 1998; Holley, 2005; Stob, 2013; Tatum, 2003). Staff and peers do not laugh at participants for their questions, ignorance is addressed, and there is no harm to marginalized groups (Holley, 2005). "We can become less isolated by expressing our diverse individuality; and students thrive in a classroom in which individuality is freely expressed" (Boostrom, 1998, p. 398). Although a brave space may create some discomfort and vulnerability, individuals and their complex identities are visible there. Contrarily, without the brave space, individuals often have to negotiate their identities, selecting which part of themselves they would like to be at a particular time and place. Such a scenario creates anxiety about one's judgment and emotional disconnect from the community.

The group leader, peers, individual participants, and the physical space influence the level of comfort in the space (Boost Rom, 1998). The group leader plays many roles, as a mentor, teacher, critic, storyteller, and confidant (Holley, 2005; Stob, 2013). Often, group leaders share their own vulnerabilities without expressing judgment to help normalize the program participants' feelings and encourage discussion of controversial topics (Holley, 2005). To inspire trust and security within the participants, group leaders develop ground rules for the participants, facilitate small group work, and arrange seats in a circular formation (Lepp & Zorn, 2002). Ideally, participants are open minded, honest about their perspectives, active listeners, and nonjudgmental. To create a brave space, participants must engage emotionally and mentally and prepare for personal growth.

For this first study in my overall research, I focused on one specific out-of-schooltime program located in the southeastern United States because I worked there. I worked as a mentor, program coordinator, and program director between 2005 and 2012. As a result of my time as a staff member of the out-of-schooltime program, I personally knew all of the research participants and program staff. However, I did not collect the data for this research project while I worked there. Additionally, focus-group participants did not know that I would use the focus groups for my research because I conducted the focus groups before I approached the current program staff about collaboration.

The primary research question guiding this study is “How do students of color who participate in an out-of-schooltime program experience community cultural wealth (CCW)?” In this study, I aimed to emphasize the importance of the out-of-schooltime program as a brave space for participants in which to develop CCW for youth of color. CCW evolved out of a critique of researchers and practitioners who viewed communities of color through a deficit lens (Yosso, 2005). To achieve CCW, the epistemological lens must be shifted from the Eurocentric epistemology; hence, I used critical race theory (CRT) to interpret the study data. Reframing the epistemological lens in this manner allows for people of color to express their experiences and challenge the dominant culture’s perceptions of the norm. Additionally, I used the theory of CCW (Luna & Martinez, 2013; Salas et al., 2014; Yosso, 2005) to understand the data and frame the experiences of the people of color in a positive perspective as opposed to the dominant culture’s typical deficit-based framing.

Theoretical Framework for Understanding the Community Cultural Wealth Gained From Out-of-Schooltime Program Participation

The theories I use to frame the research include critical race theory and CCW. Each theory supports the other and encourages positive thought about communities of color. These theories present people of color as holders of knowledge, and they do not place blame on the individuals or on community characteristics. To further support the importance of the voice of people of color, I present the data through counterstories. Generally, counterstories present the story of the marginalized people or community through their voices (Ladson-Billings, 1999). I used CCW to code the qualitative text, and I used critical race theory to frame my understanding and interpretations of the texts. I describe this technique in more detail in the following section.

Community-Cultural-Wealth Framing of Out-of-Schooltime Program Benefits to Academic and STEM Outcomes

Yosso (2005) developed the concept of CCW by critiquing the deficit lens used to examine communities of color and then incorporating previous research on strengths in communities of color. Explanations for the gaps in educational achievement are typically supported by Bourdieu's (1977) definition of *community capital*, cultural knowledge and skills inherited by members of the privileged society.[3]

The six factors of CCW consistently interact to strengthen the overall CCW within each community and individual. One factor may be gained through one of the other factors, or it may help to build one of the other factors. I describe the factors according to Yosso, 2005.

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[3] See the complete discussion in Chapter 2 that includes the additional forms of capital Yosso (2005) introduced.

Aspirational capital refers to the ability to uphold positive dreams for the future regardless of discriminatory actions. Participants often develop aspirational capital through familial and social capital. Strong *linguistic capital* is the ability to speak more than one language. In this context, language includes different languages (Spanish, French, English, etc.), dialects (Haitian Creole, Ebonics, standard English, etc.) and art forms (art, music, poetry, spoken word, etc.), each of which serves as a mode of communication. Linguistic capital strengthens through the tradition in many communities of color to use stories to teach valuable lessons. In the United States, this form of capital is often seen in children's abilities to translate for their families.

Familial capital includes gaining strength from one's family, community members, and organized communities (e.g., churches and youth programs). Through familial capital, the individual forms connect to others in the community and to the resources the others provide. This factor increases the moral values of individuals and also provides individuals with support in pursuing their dreams and navigating systems that are inherently racist or discriminatory. *Social capital* pertains to belonging to a network of people and community resources that provide emotional and logistical support to navigate discriminatory systems. This capital provides the venue through which individuals learn how to navigate these systems and build individual strengths through learning from others' experiences. Additionally, in this context, each individual has a responsibility to share the information with others and to support others.

Individuals develop *navigational capital* when they can use each of the benefits from other factors to navigate a system successfully. People of color show navigational capital they use their individual strengths to achieve their dreams. Participants show *resistant capital* in the ability to resist against the dominant and discriminating community. Parents improve resistant capital by teaching their children that they are beautiful, intelligent, and self-reliant, and that their cultural background has strength. Additionally, resistant capital refers to the ability to understand the systems and work toward transforming their discriminatory aspects.

I used this framework to guide my analyses of questions related to support that participants received related to their plans after high school, reasons participants had not yet completed their degrees, critical incidents related to participants' science, technology, engineering, and mathematics (STEM) perceptions, and how the out-of-schooltime programs contributed to the participants as a whole. Using CRT and CCW as frameworks challenges the deficits that society often associates with communities of color. Instead, these frameworks highlight the strengths of communities of color. Additionally, using counterstories is supportive of the traditions of people of color passing knowledge through storytelling. In preparation for the counternarrative, I present a description of the data-collection context and the methods I used for this research.

Critical-Race-Theory Framing of Out-of-Schooltime Program Benefits for Academic and STEM Outcomes

Initially developed in response to the lack of progress toward equality after the civil rights movement, many academics have adapted and use the concept of CRT to present the perspective of people of color. CRT uses race as a central aspect of analysis and description of the experience. CRT in education emphasizes the importance of a person's identity, specifically one's race, and in general how the person's identity influences one's experiences.

CRT has a number of complicated and intertwined concepts. CRT is grounded in the concept that experiences of Whites are not universal and that people of color have unique experiences. Instead of assuming the White experience is the norm, researchers using CRT analyze experiences of subordinated groups in an effort to understand the complexity of subordinated identities (Solorzano & Yosso, 2002).

A number of themes define CRT:

(f) Race and other forms of subordination connect to define each person's identity;

(g) Racism exists in American society and citizens often do not recognize it in American legal and political structures;

(h) Color blindness and neutrality cannot exist in American culture because of the historical events and unequal treatment of people belonging to subordinated groups;

(i) Subordinated individuals can share their experiences and critique liberalism to change the systems that reinforce racism; and

(j) CRT takes a multidisciplinary approach toward understanding race and racism in the current society (Solórzano & Yosso, 2002; Yosso, 2005).

Since its initial presentation, CRT has grown to encompass many different types of discrimination including gender, sexuality, and people of color. CRT is unique compared to other educational frameworks because it allows for exploration of multiple subordinated identities, encourages strength-based thinking about the subordinated groups, and supports social-justice movements through a presentation of individual stories (Solorzano & Yosso, 2002). Through a CRT lens, the researcher recognizes these identifying categories as socially constructed and largely influential on people's individual experiences (Valdes, 1998). This perspective is fitting, given the intersectionality of each person's identity. As Lorde (1983) said,

> I simply do not believe that one aspect of myself can possibly profit from the oppression of any other part of my identity . . . children need to learn that they do not need to become like each other in order to work together for a future they will all share. (para. 4)
>
> . . .There is no hierarchy of oppression. (para. 6)

> . . .I cannot afford the luxury of fighting one form of oppression only. I cannot afford to believe that freedom from intolerance is the right of only one particular group. . . . (para. 7)

This inclusivity of multiple identities allows for intersectionality to emerge and represent the depictions of individuals' experiences. To fully understand an experience, one must understand a person as a whole, without overlooking certain aspects of the multiple identities.

Because of the complexity and intersectionality of identities, and the cultural value of educating through stories in communities of color, researchers often use counterstories to present the *outgroup's* experience. I present my counterstories through dialogue, a first-person account, or a third-person account of the story (Yosso, 2002). I created composite characters to tell the stories that the researcher develops and adds a humanistic aspect to the research (Solórzano & Delgado Bernal, 2001). Counterstories present the story of the marginalized people or community through their voices (Ladson-Billings, 1999). These often contradict the majoritarian stories, which describe the dominant perspective and do not provide an accurate representation of all people's experiences. The stories serve many purposes for individuals and communities.

I present the purposes of the stories for individuals, marginalized communities and dominant communities. Although I have categorized these purposes, some may fit into more than one category. For individuals, the stories allow individuals to express the intersectionality of their own identities in a protected environment, show a different potential future beyond the current reality (Solórzano & Yosso, 2002), and teach others to combine elements from their own stories and others' stories to build their knowledge of navigating systems in North American society (Solórzano & Yosso, 2002). In marginalized communities, the stories build strength from the individual telling the story (Ladson-Billings, 1999), share approaches for countering racism and discriminatory processes (Solórzano & Yosso, 2002), serve as a therapy against prejudice, and bridge personal experiences with social and systemic patterns (Delgado, 1989). In the dominant community, stories show alternatives to the dominant story (Delgado, 1989; Fernandez, 2002), contribute to the dominant community's understanding of the pain caused by some of their actions (Delgado, 1989), and develop an understanding of how the systems work against the subordinated groups (Delgado, 1989). Counterstories present the marginalized people's experiences within the historical context and societal assumptions. Additionally, the stories highlight differences among diverse groups of people in a way that aspires for a better understanding of other people and can bring us together in the future.

Method to Investigate Out-of-Schooltime Program Benefits to Academic and STEM Outcomes

This is the first of three connected studies. In this study, I used focus groups of current participants and program alumni to study the culture of the out-of-schooltime program and the aspects of CCW that participants gained through participation. I present the results of the focus group analyses through composite counternarratives, which I used to inform the instrument development for the second and third studies. For both the second and third studies, I used a qualitative and quantitative measure to gather data on factors related to academic and STEM accomplishments, and characteristics of participants who are academically resilient and STEM resilient. In Study 2, I focus on how the program activities and program structure contributed to the participants' accomplishments and resilience. In Study 3, I incorporate many environmental factors that have been supported by literature as promoting or deterring academic and STEM resilience and accomplishments.

Study 1: Participants

All participants in this study were alumni from a set of out-of-schooltime programs hosted by an informal science educational institution. According to youth-program funding regulations, all program participants must be either low-income or first-generation, college-bound students. However, most of the program participants were both low income and first-generation college bound (87%). Grant regulations also required that participants attended or lived in the district for some of the lowest-performing high schools in the city (based on district grading data). Program staff recruits most program participants during their eighth-grade year from the middle schools in each feeder pattern. For program acceptance, each student must complete an application, including some short essays and teacher-recommendation forms. Staff review the applications and interview students and parents attend an orientation; then staff accept students formally to the program. Staff expect students to commit to the program throughout their high-school careers; however, some students cannot meet this commitment, and others begin the program after they have begun high school. The focus-group participants represented the program-participant demographics regarding race (59% Black, 40% Hispanic, and 1% White), gender (approximately 50% for both male and female), and high-school grade level (22% freshmen, 33% sophomores, 26% juniors, 19% seniors, and 10% alumni).

Study 1: Setting

The out-of-schooltime program of focus is located in the southeastern United States, near the beach. This program strives to increase underrepresented youths’ enrollment in postsecondary degree programs (specifically in STEM fields) through mentoring, workshops on life skills, career opportunities, STEM-focused classes, field trips, and college-readiness activities. The program staff serves as a liaison between the school system, the youth participant, and the guardian. Staff and peers mentor participants in a formal, multiyear, goal-oriented, group-mentoring approach.

The STEM classes during the 6-week summer have a marine-science focus, with a different theme each week (i.e., marine ecology, marine biology, marine geology, meteorology, oceanography, and marine resource management). The county school district reviews the curriculum each year and awards participants credit for an integrated science class. During the school year, program staff selects STEM-class topics based on the participants' and mentors' interests. Examples of class topics include robotics, bridge construction, nutrition, human anatomy, the science of cooking, math tricks, computer animation, and ecological restoration. Participants also have the opportunity to attend college and career fairs to encourage conversation and reflection of future planning for participants. I summarize the program structure and activities in Table 1.3.

Table 1.3

Activities Included in Academic-Year and Summer Components of the Out-of-Schooltime Program

Academic year (28 Saturdays)	Summer (6 weeks, 5 days/week)
Science Saturday academy	30-day intensive marine-science program
College preparation classes	Overnight trip
College tours (day and overnight trips)	Mentoring
Career fairs	2 days/week of beach exploratory learning
Tutoring	Weekly STEM-related field trips on Fridays
STEM-related field trips	Project-based learning
Mentoring	Team building
Team building	School credit for participation
Family nights	Research symposium

The grant regulations structure the recruitment efforts because the US Department of Education TRiO Programs is the primary source of funding. The program staff recruits participants from Title I schools. Most participants begin the program the summer before their first year of high school and continue in the program throughout their 4 years of high school.

Grant regulations require for two-thirds of the participants to be both low income and first-generation college bound. The program serves roughly 50 participants at all times.

During the mentoring sessions, mentors guide participants through a process of self-learning and learning how their identities influence their interactions with and experiences in the outside world. Additionally, the participants learn about the identities that give them privilege and how to use those privileges as the basis for alliances with others. The program's culture is diverse in many ways and encourages self-learning opportunities and new experiences.

Study 1: Procedures

I used secondary data for this research. An external evaluator for the out-of-schooltime program located in the southeastern part of the United States gathered the data. The evaluator sent me the data without participant identifiers, in password-protected files. The evaluator gathered the data between December 2012 and June 2014. The evaluator had four goals: to assess the program objectives as defined by the funding-agency guidelines, to monitor the outcomes of the program participants, to work toward continuous improvement of the program, and to share the story of the program and its participants with program shareholders. The secondary data included six focus groups composed of program alumni and current program participants.

Study 1: Focus Groups

I used a common procedure for data collection (focus groups). There were three focus groups, one with four alumni, one with 10 ninth-grade and tenth-grade participants, and one with 10 eleventh-grade and twelfth-grade participants (during winter 2012, winter 2013 and summer 2014). Participants were asked four semistructured questions about how they found out about the program, their experience during the summer program, how the program could best prepare the participants for college, and what recommendations they had for the program. I used focus-group transcripts to analyze the factors of CCW that were prevalent in the program participants. Focus groups were particularly beneficial for this research because they provide a setting that allows for people to express their ideas using their own words. Focus groups provide data through people's own voices, instead of forcing them to match their thoughts with categories determined by the evaluators (Sofaer, 1999). The focus-group data from this initial study provided an overview of the youth programs and the contexts for the research. These data were also instrumental as I created the survey questions and response options.

Analyses to Understand Out-of-Schooltime Program Benefits to Academic and STEM Outcomes

First, I read the focus-group transcripts multiple times for general themes. Second, I used the Dedoose application (www.dedoose.com) to deductively code the data with concepts related to CCW and brave space. I then categorized the codes into larger themes that shaped the counternarratives. I used my own knowledge of the out-of-schooltime program to develop the narration and context of the counterstory. To present the research findings, I developed composite counterstories (Solórzano & Yosso, 2002) of the experiences that participants shared in the focus groups.

For the qualitative components, I ensured transferability and trustworthiness through a number of procedures. I used two common procedures for data collection (focus groups and survey). All participants had the option to participate in the survey, which resulted in comparisons between data on participants with contradicting outcomes (e.g., STEM resilient vs. nonSTEM resilient). Additionally, once I completed preliminary analysis, I requested that the current and former program staff review the findings (Morse, Barret, Mayan, Olson, & Spiers, 2002; Shenton, 2004).

Three themes became evident through the stories: (a) strong influence of CCW in shaping the participants' lives and experiences, (b) the importance of developing a strong self-identity, and (c) the necessity of a space for the participants to call their own away from family members and others who did not strive to understand the participants. The context of the counternarrative represents the actual structure of the summer program, which was a 6-week marine science academy. Staff divided students into grade levels and led students throughout the entire summer. I further describe the structure of the program in the *Setting* subsection that directly precedes the counternarrative discussion in the next main section of this chapter.

From the focus-group analyses, I identified four types of characters. I present the characters' interactions through a journal of the summer component of the out-of-schooltime program. The four types of characters in this counternarrative were (a) new program participants, (b) underclassmen program participants (students who would be starting ninth and tenth grades in the fall), (c) upperclassmen program participants (students who would be starting eleventh and twelfth grades in the fall), and (d) program alumni who had returned to serve as mentors of the summer program. The alumni/mentors shared their experiences as program participants with the current program participants. I developed the composite characters based on the real-life experiences participants shared through the focus groups. I developed the context of the counternarrative based on my knowledge and experiences with the program. I developed the text of the counternarrative and the characters' quotes based on my analyses of the focus groups. Finally, I based the main topic of each conversation that follows on the themes I found in my analyses of the focus groups.

Allow me to introduce the composite characters (Delgado Bernal & Villalpando, 2002) in this nonfiction counternarrative. I created these characters as pseudonyms for the individuals who participated in the focus groups. I made six total characters in the counternarrative, representing the 14 program participants and alumni who participated in the focus groups, who represent the hundreds of youth who have been a part of the youth programs. Rafael and Leila are both program alumni who were serving as mentors for the summer. Fritto is a full-time staff member who graduated from the program in 2000. He has been connected to the program since he graduated. The other characters are current program participants, divided into ninth- and tenth-grade participants, and eleventh- and twelfth-grade participants. I represent the 50 current participants from the six focus groups through three characters: Alberta (representing the new participants), Ben (representing the underclassmen), and Calvins (representing the upperclassmen).

To share the findings of the analyses, I developed a narrative account of participants' experiences, what they valued, and how they experienced CCW during the summer marine science component of the program. I presented the participants' reflections, constructed from the focus-group analyses, through conversations between participants and mentors. The quotations included in the narrative are not direct quotes from the focus groups. I developed the quotes based on comments in the focus groups and placed the quotes in context based on my knowledge of the program structure. To help develop meaning to the counternarratives, I analyzed the narrative for each day, denoted by the subheading *Analysis.* Please continue reading with an open mind and consideration toward the strengths of communities of color presented in this fact-based narrative of the program experience. I also request that you compare your preconceived notions of communities of color with the experiences presented.

The Out-of-Schooltime Program Experience: A Counternarrative

Throughout the following narrative, the text switches between italics and regular font to indicate narration (italics) and narrative (regular font). Some of the narration is based on descriptions of participants' experiences during the programs, and some is simply based on my 7 years of intimate involvement with the program. I also include a brief analysis section at the end of each daily entry of the counternarrative.

Day 1. *The first day of the summer program began just like every other day, with all participants and staff reciting the program mission*: . . .To ensure that underrepresented high-school students are excited by science and inspired to become responsible and successful college graduates and community leaders through personal and academic enrichment.

[*Next was the moment everyone was waiting for—mentor introductions! As each mentor was introduced, there was a loud cheer from the participants.*]

Ben [*excitedly whispering to a new participant whom he knows from school*]: I hope we get Rafael; he was in the program, and he really understands you. I feel like the mentors are my older siblings, except that they won't judg you or make you feel bad. You can be yourself here. You don't have to worry about hiding who you are or getting bullied for your opinions or anything.

. . .

[*The participants loaded the buses to go home. Their voices beamed with anticipation, all chatting about their days.*

Alberta: Why is everyone here so friendly??

Calvins: I wondered that too when I first started, then I *peeped* [realized] that this program is not like it is in the *hood* [neighborhood] or at school; this is like a big family reunion.

Like, that's just how everyone is at the program—super friendly! I know it's weird at first, but you'll grow to love it soon.

. . .

Analysis. After the first day of the program, participants knew two things about the program. First, they knew the importance of the program mission and the overall goal of all activities related to the program. Starting in 2008, participants recited the mission statement daily, which built resistant and aspirational capital. Second, participants were aware of the family-like nature of the program. The family environment enabled participants to feel safe, develop a strong self-identity, and question life events to gain a deeper understanding. This brave space for reflection provided the foundation for them to develop strong CCW. Participants mentored each other regarding expectations of the program, which demonstrated their social and navigational capital.

Day 5. [*It's Friday! That means it is time for a field trip. The bus rides provide a perfect opportunity for mentors to have a heartfelt conversation with the mentees. When participants arrive at the field-trip location, informal educators guide them through STEM content.*]

Leila: What have you enjoyed so far in the program?

Alberta: Well, I've never liked science, but this program is actually really fun, and I learned something! I didn't even think that was possible.

Leila [*smiled*]: This program taught me far more than I learned at school. I am a math major now because of this program. And my experiences in this program actually made me more confident in general, but specifically in my science and math classes.

Alberta: The things I have done this week have been so cool! Like we went snorkeling, and I learned how to swim! I never would have done that if not for the program."

. . .

Calvins: I'd really like to do personal training, but I just don't know how to get started in that field, or like what I could be doing to prepare for it right now.

Fritto: Why don't you do an internship? That's how a lot of the older kids have actually found out what they wanted to be when they grow up. We can help you make a resume and contact internship placements. Or we could have a class in the school year that focuses on personal training. I bet a lot of people would enjoy that class.

. . .

Analysis. Every moment of the day was an opportunity for mentors and participants to build trust and further the family relationship that contributed to the success of the program. Leila began by explaining how the program helped her with resistant capital, by helping her have self-confidence. The conversation continued as she and Alberta conversed about the aspirational capital gained from the new experiences, just within the first week.

Day 13. [*Today's lunch conversation was about how the program prepared the participants for college. Leila and Rafael sat at the table with participants of all grade levels.*]

Leila: The ways are endless, really. I heard one of the seniors this year got a scholarship from one of the grant funders; and you've got the college tour, help with scholarships, learning how to talk to professors, financial aid officers, and people in authority positions. . .

Rafael [*cutting in*]: . . .and don't forget about all of the general things we learned here, like time management, budgeting skills, dealing with different types of people, being social, public speaking skills, and of course the writing skills. I would help my friends all the time with different things that I learned here. I mean, don't get me wrong, there was still a lot I had to learn when I started college though.

Leila: You have to learn to live on your own and manage your money and your time and make sure you take care of everything. Like, I was really lucky; I got the Dell and Gates scholarships, and the Dell is only available for Upward Bound participants, so make sure you stay in the program for that. . . but anyway. . . like when I first got my financial aid money, I went crazy buying all sorts of things I really didn't need. But of course Fritto texted me right around then and checked me.

Ben: I am really worried about college. An education is expensive, and it's rough out there. Like, how do you get scholarships and everything?

Rafael and Leila [*simultaneously*]: Good grades.

Leila: There are different scholarships for different things. Like, being in this program can give you a ton of different community-service activities, leadership opportunities, and even jobs. A friend of mine from the program got her job through connections with the program.

Rafael: But honestly, don't worry; at the end of junior year, Fritto starts working with you on scholarships. They push you to make sure you don't get lazy.

. . .

Analysis. This excerpt highlights the linguistic, navigational, and social capital participants gained through the program. Rafael referred to linguistic capital as he learned how to communicate and interact with people who are different from themselves, and Leila referenced linguistic capital she gained in learning how to communicate with authority figures. Leila focused on the social and navigational capital by explaining all of the ways in which participants are assisted with their college-application process. Given that many of the participants are first-generation college-bound students, these components are essential for participants to be accepted into colleges and universities. Leila also referenced the importance of the connections (social capital) participants gain through the program, including access to specific scholarships, employment opportunities, and leadership opportunities. Leila and Rafael also referenced navigational capital as they discussed the mentoring that continues throughout the duration of the program and after participants graduate from the program.

Day 17. [*On the bus ride back from the overnight trip, Leila spent some time surveying the bus and watching the kids interact with each other. She saw that the mentors' efforts to break up the cliques and encourage people to branch out and interact with new people had worked. As Leila walked through the bus chatting with people along the way, she noticed that one participant looked upset, staring sadly out the window. Leila slid into the seat next to him and asked what was wrong.*]

Ben: I don't wanna go home. Everyone there tells me I am worthless and will never even graduate from high school, and people with the program are so encouraging. . .

Leila: Different people have different roles in our lives. Like your family probably teaches you good values and about being Haitian, while the mentors at the program are like your cheerleaders and will always motivate you. You'll see. . . one of my favorite memories was the Senior Dinner. It's right around graduation, and only the seniors who have been active in the program can come—and all of the mentors of course. . . and they all sign a graduation card with really nice, encouraging comments; and you get a senior basket too—like, they gave us bed sets, dishes, school supplies, a tool kit. Like, seriously, everything I needed for my room.

[*Ben's expression had changed from being upset to looking intrigued and excited.*]

. . .

[*A few rows ahead on the bus, Rafael was talking to another participant about her project for the program. Each grade level works on a project, which is presented in a symposium at the end of the summer.*]

Rafael: Honestly, teamwork is one of the most valuable lessons you learn from this program. They are always putting you in different teams, and you have to learn what each person's strengths are and figure out how to use those strengths for the team's benefit. You'll see once you get a job how important that skill really is.

Alberta: I just hate working with people who don't put in effort, like they are trying to make it harder for everyone else.

Rafael: I know you are frustrated, but I bet your teammate is really frustrated about something, too. So maybe if you sit down and talk with them, you can find out what is going on and how to make the team better overall.

[*Alberta nods her head, and gives him a big hug.*]

. . .

Analysis. Each summer, the participants go on a STEM-related overnight trip. The staff takes this opportunity to challenge the participants socially by putting them in groups of people they do not know. This is a strong source of familial capital and contributes to creating an environment where all participants find social connections. Through these connections and understanding how to benefit from different people in their lives, participants build social capital and resistant capital. Through his conversation, Rafael encouraged growth of familial and linguistic capital when he mentored Alberta on her group research project, building the team's strengths and communicating with her team.

Day 20. *Ben*: The sophomores got in so much trouble because a couple of them plagiarized their papers! Now each group has to write an additional four pages in their papers! But really, that's nothing. I heard if you do that in college, they could kick you out and it goes on your record!

Calvins: Yeah, bro, I heard about that. I guess the mentors were really pushing the family thing, in all contexts . . . you know, it's so weird for me to call the people in the program my family, because everyone is so different; I mean, we've got Hispanic, Caribbean, African American, Haitian, and White people . . . but we really are all like a family. Like, if I had a problem, I would call Fritto before I would call a lot of my family.

Ben: You are so right. I don't think I had ever interacted with anyone who wasn't a *Zoe* (Haitian) before being in this program … and now I call these people family! [*Laughing*]

. . .

Analysis. Throughout many conversations, the mentors and participants relate their experiences to experiences they may have or have had in college. This process reinforces the expectations from mentors and peers for participants to go to college, building aspirational, navigational, and social capital. It also makes a connection in the participants' minds about the value of their current experiences in preparing for the future.

Day 26. [*In preparation for the final symposium, each grade level reserved time in the theater to practice its project presentations. The mentors also spent a great deal of time teaching the participants how to be good public speakers, how to speak confidently, and how to design their presentations to be visually appealing. Rafael and Leila stood with Rafael's class, awaiting their turn for the theater to practice their final presentations at the symposium.*]

Alberta: I don’t even think I will invite my parents. I mean, they won’t understand anyway. I would just end up having to translate and explain it all to them; and with my parents here, I won’t be able to be myself.

Ben: I think I will invite my parents. They love to see these kinds of things . . . Then I won’t have to explain as much to them about the program—they can see it with their own eyes.

Rafael: Honestly, it makes your life much easier if you invite your parents because they will be more trusting in the mentors. The mentors do a great job of reaching out to parents, but only when necessary, so this is a great way to allow your parents to meet the mentors. And you know Fritto and Leila speak Creole, and Felicia, Daniele,[4] and I speak Spanish, so there are plenty of people to speak to each of your parents.

Calvins: Yeah. Like my mom didn’t believe anything I was saying about the program because she hadn’t met any of the mentors, and it just seemed too good to be true that I could be going on all of these trips for free. She actually didn’t even let me go on a couple of the trips until Fritto called her. Like my mom never trusted me in the kitchen or to watch my little brothers; but now, after I went on the overnight trip, and she heard from Fritto how much we did and how we took care of ourselves, my mom trusts me to babysit and even make my own breakfast!

Alberta: I believe that, actually. I guess I’ll invite them. Let them meet the mentors.

Leila: Good! Yeah, this program teaches you a lot about yourself and how to have confidence in yourself.

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[4] Felicia and Daniele are other mentors.

Alberta: *Could you imagine if our parents came to the program with us!?!? We couldn't tell the mentors half the stuff we tell them!*

Ben: For real! I have gotten really close to the mentors, and there is no way that would have happened if there were a bunch of other people around who don't get me; like no way!

[*Everyone nodded in agreement.*]

. . .

Analysis. The relationships formed between the mentors and the participants are all encompassing of every aspect of the participants' lives. Development of this relationship is largely supported by the 40-hour mentor training before the program and the space that is allocated only to the program activities. These kinds of connections build the familial, navigational, and social capital in participants. This excerpt of the day also highlights the linguistic capital that participants gained from learning presentation skills and being bilingual. Leila also referenced resistant capital from learning self-confidence. Participants also stressed the importance of the youth-program location and the other people in the vicinity, reinforcing the need for emotional safety to enable them to develop the familial capital.

Day 30. [*The last day of the program includes the participants' project presentations and a reception where each mentor makes a speech and participants are also invited to speak if they desire. After the presentations and speeches are finished, the participants socialize, introduce their families to the mentors and their friends, and cry. Across all grade levels, participants reassure each other that they will see each other again and make plans to hang out after the program is over.*]

. . .

Analysis. This family event is one of the strongest examples of familial capital because of the emotion and connection between the participants, their peers, and their mentors. The family event also provided participants' families and friends an opportunity to get to know the program, the staff, and other participants. This aspect brings the social capital into the community.

Discussion of Findings Related to Out-of-Schooltime Program Benefits on Academic and STEM Outcomes

In addition to the overall evidence of CCW developed through program participation, I identified three themes from my focus group analyses related to the kinds of CCW the participants developed. I summarize the themes in Table 3.2. Specifically, the focus-group participants, who were current study participants, emphasized their appreciation for the opportunity to access college, be mentored, try new things, receive academic support, and make friends. These themes show aspirational, familial, social, and navigational capital. The program alumni spoke highly of the life skills they had developed through the program, including presentation and public-speaking skills, leadership abilities, the ability to be social with others unlike them, and the ability to talk to authority figures. In reference to college, alumni spoke of feeling prepared for classes, enjoying their STEM classes, and understanding STEM better than they had before they joined the program. Ultimately, the familial capital built during the program was the single unifying theme that emerged in every comment. Program alumni also referenced social and navigational capital.

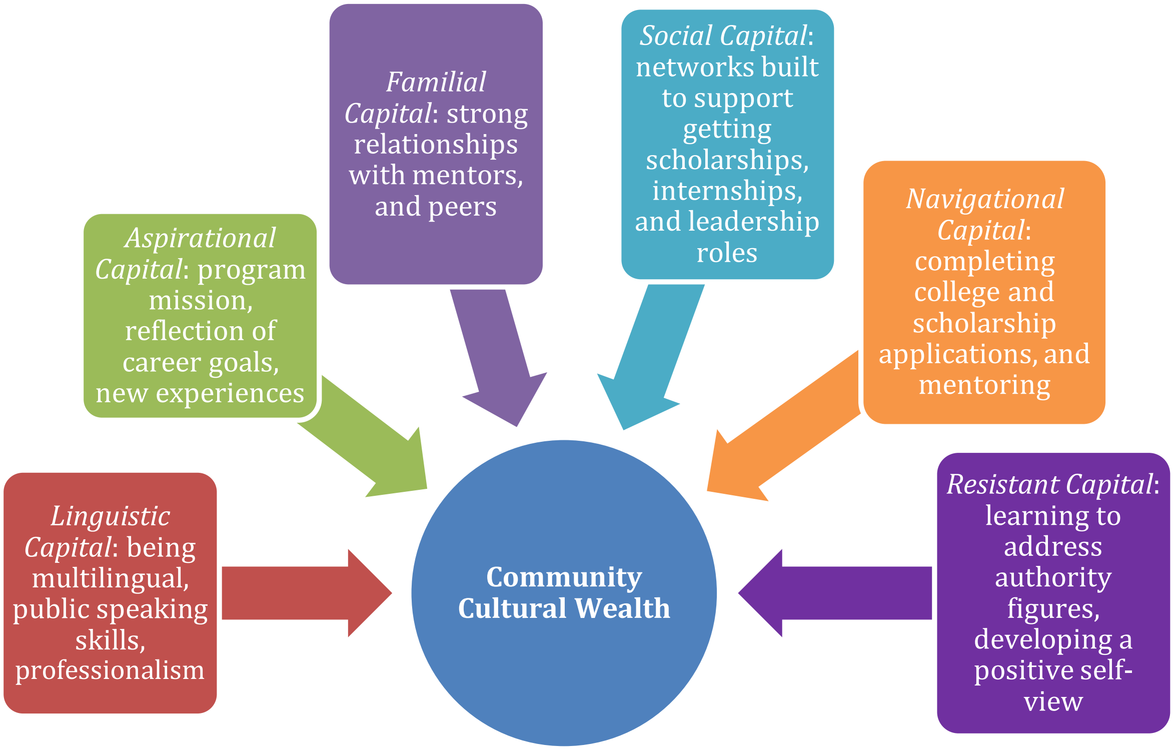
Table 3.2

Major Themes of Program Benefits for Current Participants and Program Alumni

Current participants	Program alumni
	Life skills (presentation skills, leadership, branching out to interact with others)
Access to college	Talking to authority figures
Mentoring on personal life	Readiness for college-level work
Pushing to try new things	Continued support from peers and mentors
Tutoring, academic assistance/guidance	Liking STEM more and being prepared for the content in STEM classes
Friends	

The out-of-schooltime program took place in a facility where the participants could be themselves. Staff encourages participants to challenge what they did not understand and to support each other through that process. Additionally, the participants emphasized the family-like nature of the mentors and other participants (familial capital), which encouraged trust and honest discussion of life experiences. The mentors supported and pushed the participants academically and emotionally, and created a nonjudgmental environment. The program's structure and staff created a space in which participants could be themselves and develop a positive self-identity with supportive criticism (resistant capital).

The counternarrative provides examples of each of the six factors of CCW (Yosso, 2005). I summarize examples of each of the six factors in Figure 3.1. The program's structure provided aspirational capital via the participants' recitation of the program's mission every morning. This mission statement reminded them why they were in the program and also provided a big-picture goal for the future. The mentors strengthened the aspirational capital by helping the participants



Familial Capital: strong relationships with mentors, and peers
Social Capital: networks built to support getting scholarships, internships, and leadership roles
Aspirational Capital: program mission, reflection of career goals, new experiences
Navigational Capital: completing college and scholarship applications, and mentoring
Linguistic Capital: being multilingual, public speaking skills, professionalism
Community Cultural Wealth
Resistant Capital: learning to address authority figures, developing a positive self-view

Figure 3.1. Summary of the different ways in which I identified community cultural wealth developing as a result of program participation.

to reflect on career goals and discover new interests through all of the unique experiences the participants had in the program, including shark tagging, college tours, and learning how to swim. Linguistic capital is evident as the participants learned professionalism and public-speaking skills and expressed concerns about inviting their parents to the symposium at the end of the summer. The multilingual mentors modeled strong linguistic capital. Both aspirational and linguistic capital contribute to the strength of the familial capital. Familial capital persisted through the strong relationships formed among all personnel involved in the program. The mentors actively working to build relationships among the participants, and the participants learning that they were not alone in their struggles to succeed further strengthened familial capital.

Familial capital was the source of social, navigational, and resistant capital. Participants showed their social capital through the networks participants built to help them get scholarships, internships, community service, and leadership roles. Participants helping their peers who were not in the program and telling their peers to join the program is further evidence of the social capital they developed beyond the program. This outcome relates to Grove, Kibel, and Haas's EvaluLEAD framework, which described three types of results in participants of a leadership-development program. The first is *episodic results*, which are facts and opinions from individuals about experiences (2005). The next category is *developmental results*, which are markers of small successes toward a larger goal. Last, *transformative results* are evidence of shifts in life status of individuals or a community as a result of program participation (Grove, Kibel, and Haas, 2005). In the context of the youth program, participants exhibited all levels of results. Social capital relates to transformative results in particular because of the community-wide benefits of program participants sharing their knowledge about navigating the college system with their peers.

Learning how to interact with people who are not from the same cultural background is also a part of social capital evident in these outcomes. Development of navigational capital is apparent through the process of mentors helping the participants complete college and scholarship applications, giving advice on academic and personal problems, and teaching the participants accountability for their actions and the life skills they needed to navigate academia and the professional world. Additionally, the requirement that participants bring in their school progress reports encouraged high achievement regardless of the stresses in the students' lives. Participants built resistant capital by learning to address authority figures (professors or financial-aid officers), became more confident through the program activities and learned about their cultural backgrounds.

Set in the early 21st century in the United States, out-of-schooltime programs provide assistance to youth of color in navigating the systems that were created for White individuals. There is much need to change the educational system and other systems that rule the United States; however, until then, youth of color need support in navigating these systems. As Bray noted, “It [systemic reform] is work that must be done—and it can’t be done in places where women [people of color] are an afterthought, a token voice. . . No: We’re better, brighter, more contentious, more serious than that” (Bray, 1997, p. 2). In this out-of-schooltime program, participants were the focus of all programmatic activities, which built a community specifically for them. In this space, they felt safe to learn how they might struggle to navigate the education systems. Participants also developed support to help them through the challenges and celebrate the successes.

Recommendations for Practice and Future Research Related to Out-of-Schooltime Program Benefits for Academic and STEM Outcomes

The theoretical frameworks and the structure of my analyses assist me in studying the experiences of youth of color. I encourage the use of CRT and counternarratives for future research. This approach allows for individuals to share their unheard stories. Additionally, counternarratives indulge the reader in the journey of the characters and also allow for researchers to present the muted stories without making the real-life characters vulnerable. Through counternarratives, researchers have an opportunity to be social activists, advocating on behalf of others about the trials and tribulations people experience. The CCW theory provides a strong structure for strength-finding in communities of color. Using this theory, I could focus on finding the positive aspects of the community and was minimally influenced by the typical deficit perspectives that I have learned throughout my life. Likewise, combining the counternarrative and CCW concepts provides a setting that other researchers can consider for similar studies whose focus is on the strengths of communities of color.

Additionally, the youth-program setting eased facilitation of the study practices for both the participants and me as the researcher because I value conducting the research in a place where the participants felt comfortable expressing themselves. The youth program facility provided that space. Based on this research, recommendations for practice revolve around the benefits that youth of color can gain from participating in an out-of-schooltime program. Specifically, program directors might ensure that their program has a space where participants can feel courageous and that they can claim as their own. I advise this space to include resources (computers or other technology equipment, books, tutors, mentors, etc.) geared toward the participants' needs. Additionally, based on my experiences in youth development and my extensive literature review of youth empowerment, collaboration and development programs, the space should have furniture arrangements (seats arranged in circles) that encourage group discussions and collaboration; and walls decorated with informational posters or participants' work. The ideal space would be open to participants based on the participants' schedules. Staff should encourage self-discovery and provide nonjudgmental feedback and support to participants during the self-discovery process. Finally, to encourage development of CCW within the community, staff would be advised to also keep the CCW concepts in mind when interacting with the youth.

The results of this research study provide details about the out-of-schooltime program and its strengths. It may be interesting to investigate the outcomes of youth participants as a result of their participation in the program, or as a result of the CCW they have gained. Considering that the goal of the program is for youth to attend college and focus their education in STEM fields, future research might investigate how participants' CCW supports those program goals. These questions relate to the overall goal of the out-of-schooltime program and should be further researched to increase the available resources for increasing our understanding of the effectiveness of the structure of this youth program.

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CHAPTER 4: THE RELATION BETWEEN OUT-OF-SCHOOLTIME PROGRAM PARTICIPATION FACTORS AND ACADEMIC AND STEM OUTCOMES—STUDY 2[5]

To keep up with other countries' technological developments, the United States should increase the representation of underrepresented populations in the STEM disciplines. Doing this will better help to address the demands of the growing US workforce and provide a more diverse perspective in the STEM fields (STEM: Education for Global Leadership, 2015). Because of discrepancies in school resources and opportunities for learning, Black, Latin@, and Native American students starting as early as fourth grade achieve far below White and Asian students (Aud, Fox, & KewalRamani, 2010). These disparities grow as students graduate from high school and enter college (George & Malcom, 2011; see Appendix B). These data reveal major disparities in all of the STEM degrees earned, and even more broadly in doctoral degrees awarded.

When one considers the intersectionality (the combined effect of multiple forms or systems of oppression) of ethnic and gender identities, the gaps are even more evident than when one considers only one identity. Hill, Corbett, and St. Rose (2010) found that Black men and women and Latino men earned more degrees in computer sciences when compared to American Indian/Alaskan Native men and women and to Latina and American Indian/Alaskan Native women. Additionally, Black and Latino men earned more degrees in engineering when compared to other groups. Many factors contribute to persisting inequalities between the academic

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[5] Some of the introductory text is very similar to or exactly the same as a different part in the dissertation, but will be made unique prior to publication.

achievements of underrepresented groups and the dominant population. Because of the diverse contributing factors, the potential solutions are also diverse.

The suggestions directly related to education include improved STEM education at the K-through-12 level and supplemental STEM instruction programs (out-of-schooltime, summer, and informal STEM education). There is also a need for mentoring programs and role modeling, and student research experiences in STEM fields. Last, policy changes and improved data collection on student progress in STEM could also contribute to this effort (Moore & Shulock, 2010; Tyson, Lee, & Hanson, 2007).

The US Department of Education also has a number of grants geared toward helping underrepresented groups in STEM and education overall. One example, the TRiO programs support individuals from low-income backgrounds who are the first generation college bound in their families, and those with disabilities. Initially, there were three programs, hence the name TRiO; however, now there are seven different types of TRiO programs: Educational Opportunity Centers, McNair Scholars, Student Support Services, TRiO Staff Training, Upward Bound, Upward Bound Math & Science, and Veteran Upward Bound. Many other efforts are being conducted nationwide; however, this research focuses on the TRiO programs, specifically an Upward Bound Math & Science program.

The out-of-schooltime program of focus is located in the southeastern United States, near the beach. This program strives to increase underrepresented youths' enrollment in postsecondary degree programs (specifically in STEM fields) through mentoring, workshops on life skills, career opportunities, STEM-focused classes, field trips, and college-readiness activities. The program staff serves as a liaison between the school system, the youth participant, and the guardian. Staff and peers mentor participants in a formal, multiyear, goal-oriented, group-mentoring approach.

The STEM classes during the 6-week summer have a marine-science focus, with a different theme each week (i.e., marine ecology, marine biology, marine geology, meteorology, oceanography, and marine resource management). The county school district reviews the curriculum each year and awards participants credit for an integrated science class. During the school year, program staff selects STEM-class topics based on the participants' and mentors' interests. Examples of class topics include robotics, bridge construction, nutrition, human anatomy, the science of cooking, math tricks, computer animation, and ecological restoration. Participants also have the opportunity to attend college and career fairs to encourage conversation and reflection of future planning for participants. I summarize the program structure and activities in Table 1.3.

Table 1.3

Activities Included in Academic-Year and Summer Components of the Out-of-Schooltime Program

Academic year (28 Saturdays)	Summer (6 weeks, 5 days/week)
Science Saturday academy	30-day intensive marine-science program
College preparation classes	Overnight trip
College tours (day and overnight trips)	Mentoring
Career fairs	2 days/week of beach exploratory learning
Tutoring	Weekly STEM-related field trips on Fridays
STEM-related field trips	Project-based learning
Mentoring	Team building
Team building	School credit for participation
Family nights	Research symposium

The grant regulations structure the recruitment efforts because the US Department of Education TRiO Programs is the primary source of funding. The program staff recruits participants from Title I schools. Most participants begin the program the summer before their first year of high school and continue in the program throughout their 4 years of high school.

Grant regulations require for two-thirds of the participants to be both low income and first-generation college bound. The program serves roughly 50 participants at all times.

During the mentoring sessions, mentors guide participants through a process of self-learning and learning how their identities influence their interactions with and experiences in the outside world. Additionally, the participants learn about the identities that give them privilege and how to use those privileges as the basis for alliances with others. The program's culture is diverse in many ways and encourages self-learning opportunities and new experiences.

Critical Race Theory (CRT) Framing the Investigation of the Influence of Discrimination and Identity-Awareness on Academic and STEM Outcomes

Initially developed in response to the lack of progress toward equality after the civil rights movement, many academics have adapted and use the concept of CRT to present the perspective of people of color. CRT uses race as a central aspect of analysis and description of the experience. CRT in education emphasizes the importance of a person's identity, specifically one's race, and in general how the person's identity influences one's experiences.

CRT has a number of complicated and intertwined concepts. CRT is grounded in the concept that experiences of Whites are not universal and that people of color have unique experiences. Instead of assuming the White experience is the norm, researchers using CRT analyze experiences of subordinated groups in an effort to understand the complexity of subordinated identities (Solorzano & Yosso, 2002).

A number of themes define CRT:

(k) Race and other forms of subordination connect to define each person's identity;

(l) Racism exists in American society and citizens often do not recognize it in American legal and political structures;

(m) Color blindness and neutrality cannot exist in American culture because of the historical events and unequal treatment of people belonging to subordinated groups;

(n) Subordinated individuals can share their experiences and critique liberalism to change the systems that reinforce racism; and

(o) CRT takes a multidisciplinary approach toward understanding race and racism in the current society (Solórzano & Yosso, 2002; Yosso, 2005).

Since its initial presentation, CRT has grown to encompass many different types of discrimination including gender, sexuality, and people of color. CRT is unique compared to other educational frameworks because it allows for exploration of multiple subordinated identities, encourages strength-based thinking about the subordinated groups, and supports social-justice movements through a presentation of individual stories (Solorzano & Yosso, 2002). Through a CRT lens, the researcher recognizes these identifying categories as socially constructed and largely influential on people's individual experiences (Valdes, 1998). This perspective is fitting, given the intersectionality of each person's identity. As Lorde (1983) said,

> I simply do not believe that one aspect of myself can possibly profit from the oppression of any other part of my identity . . . children need to learn that they do not need to become like each other in order to work together for a future they will all share. (para. 4)
>
> . . .There is no hierarchy of oppression. (para. 6)
>
> . . .I cannot afford the luxury of fighting one form of oppression only. I cannot afford to believe that freedom from intolerance is the right of only one particular group. . . . (para. 7)

This inclusivity of multiple identities allows for intersectionality to emerge and represent the depictions of individuals' experiences. To fully understand an experience, one must understand a person as a whole, without overlooking certain aspects of the multiple identities.

Critical Race Quantitative Intersectionality (CRQI) framing of quantitative analyses. For the quantitative data, I used the Critical Race Quantitative Intersectionality (CRQI) framework, which is informed by CRT. This method's primary purpose is to develop a story using the quantitative data (Covarrubias and Velez, 2013). CRQI research is based on five principles, including (a) data mining related to intersectional aspects of the data to quantify the complex and intersectional impacts of racism and associated discrimination; (b) challenging the neutrality of quantitative data and supporting the data with the story around the data; (c) highlighting the counternarrative as a valuable source of knowledge to inform the data; (d) committed to addressing injustice; (e) Working toward a solution for the systemic racism with a transdisciplinary approach (Covarrubias and Velez, 2013).

A Community Cultural Wealth Framework for Understanding the Influence of Participation in an Out-of-Schooltime Program on Academic and STEM Outcomes

Yosso (2005) developed the concept of CCW by critiquing the deficit lens used to examine communities of color and then incorporating previous research on strengths in communities of color. Explanations for the gaps in educational achievement are typically supported by Bourdieu's (1977) definition of *community capital*, cultural knowledge and skills inherited by members of the privileged society.[6]

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[6] See the complete discussion in Chapter 2 that includes the additional forms of capital Yosso (2005) introduced.

The six factors of CCW consistently interact to strengthen the overall CCW within each community and individual. One factor may be gained through one of the other factors, or it may help to build one of the other factors. I describe the factors according to Yosso, 2005.

Aspirational capital refers to the ability to uphold positive dreams for the future regardless of discriminatory actions. With this capital, participants believe there is a better life ahead of oneself, and that children can do better than others in their communities. Participants often develop aspirational capital through familial and social capital. Strong *linguistic capital* is the ability to speak more than one language. In this context, language includes different languages (Spanish, French, English, etc.), dialects (Haitian Creole, Ebonics, standard English, etc.) and art forms (art, music, poetry, spoken word, etc.), each of which serves as a mode of communication. Linguistic capital strengthens through the tradition in many communities of color to use stories to teach valuable lessons. In the United States, this form of capital is often seen in children's abilities to translate for their families.

Familial capital includes gaining strength from one's family, community members, and organized communities (e.g., churches and youth programs). Through familial capital, the individual forms connect to others in the community and to the resources the others provide. This factor increases the moral values of individuals and also provides individuals with support in pursuing their dreams and navigating systems that are inherently racist or discriminatory. *Social capital* pertains to belonging to a network of people and community resources that provide emotional and logistical support to navigate discriminatory systems. This capital provides the venue through which individuals learn how to navigate these systems and build individual strengths through learning from others' experiences. Additionally, in this context, each individual has a responsibility to share the information with others and to support others.

Individuals develop *navigational capital* when they can use each of the benefits from other factors to navigate a system successfully. People of color show navigational capital they use their individual strengths to achieve their dreams. Participants show *resistant capital* in the ability to resist against the dominant and discriminating community. Parents improve resistant capital by teaching their children that they are beautiful, intelligent, and self-reliant, and that their cultural background has strength. Additionally, resistant capital refers to the ability to understand the systems and work toward transforming their discriminatory aspects.

I used this framework to guide my analyses of questions related to support that participants received related to their plans after high school, reasons participants had not yet completed their degrees, critical incidents related to participants' science, technology, engineering, and mathematics (STEM) perceptions, and how the out-of-schooltime programs contributed to the participants as a whole. Using CRT and CCW as frameworks challenges the deficits that society often associates with communities of color. Instead, these frameworks highlight the strengths of communities of color. Additionally, using counterstories is supportive of the traditions of people of color passing knowledge through storytelling. In preparation for the counternarrative, I present a description of the data-collection context and the methods I used for this research.

A Bioecological Framing of Complicated Systems Related to Academic and STEM Outcomes of Out-of-Schooltime Participants

Each aspect of the environment contributes to individuals' social and cognitive development in positive or negative ways (Evans, 1999). Additionally, everyone experiences each environment differently based on individual identity and personal cultural experiences (Super & Harkness, 1999). Identity includes factors such as race, ethnicity, age, religion, body type, and ability. Culture includes other people and actions in the environment, customary practices, group norms, and beliefs (Super & Harkness, 1999). Bronfenbrenner's bioecological theory of human development (1979, 2005; Bronfenbrenner & Morris, 2006) defines the environment in a way that describes its multiple, interacting levels of complexity. Using this theory, researchers can identify environmental influences and study them as a whole in a way that incorporates the influence of individual culture (Super & Harkness, 1999).

Study 2: The Process-person-context-time Model

For completeness, the study of human development should be based on a process-person-context-time model (Bronfenbrenner & Morris, 2006; Guhn & Goelman, 2011). Within this model, the proximal processes create the foundation of bioecology. *Proximal processes* include the interactions among the evolving person, objects, and environmental messages (Bronfenbrenner, 1999). There are five characteristics of proximal processes: (a) The person must participate in the activity; (b) the activity must occur frequently and over a long period of time; (c) the complexity of the activity must increase over time; (d) the activity must be multidirectional, with instigation and reaction coming from all parties; and (e) the objects and messages in the environment must encourage exploration, thoughtfulness, and creativity (Bronfenbrenner, 1999; Bronfenbrenner & Morris, 2006). It is the interaction among proximal processes that influences human development. The characteristics of the person, the context, and the time in history all influence the magnitude of the process (Bronfenbrenner, 1999; Bronfenbrenner & Morris, 2006). The process-person-context-time model equally weights the value of the process with the value of the influence of the person.

The context is continually salient for each person. Throughout development, individuals may remain in their current environment or migrate to a different environment. Additionally, different characteristics of the environment may contribute to positive development and other components may contribute to negative development (Wachs, 1999). The environmental experiences are largely influenced by the time context in which a person has an experience (Wachs, 1999). The time context can refer to the frequency and duration (in hours, days, months, years) of the proximal processes, the changing beliefs, and worldly events (Bronfenbrenner & Morris, 2006). It can also be the developmental process that happens over time. In Chapter 1, I included the background information about the current demographics of the STEM fields and the forms of racism today to provide the time context for this research.

Study 2: The Interactive System

Further, the process-person-context-time model exists within an interactive system, which includes the microsystem, mesosystem, exosystem, macrosystem, and chronosystem (Figure 4.1; Bronfenbrenner & Morris, 2006; Guhn & Goelman 2011). The *microsystem* is a single environment in which the developing person and other key players (caretakers, siblings, other family members) interact, and in which the developing person has a specific role (brother, child, participant, student). The *mesosystem* develops when there are interactions between different microsystems that directly involve the individual. The effects of the mesosystems build on each other to influence the person's development (Bronfenbrenner & Morris, 2006).

The *exosystem* is the interaction of multiple environments, of which at least one does not directly involve the developing person (Bronfenbrenner, 1977; 1986). An example of an exosystem for a child is the interaction between the caretaker's place of employment and the child's home or neighborhood. The *macrosystem* is different from the previous three systems in that it is based on a set of cultural beliefs or practices that determine the structure of the other systems (Bronfenbrenner, 1977). The *chronosystem* incorporates the changes that occur over time in each of the developing person's systems (Bronfenbrenner, 1986). Bronfenbrenner (1986) described these changes, or transitions, as being either *normative* (e.g., puberty, going to college, or marriage) or *nonnormative* (e.g., family death, moving, or winning the lottery).

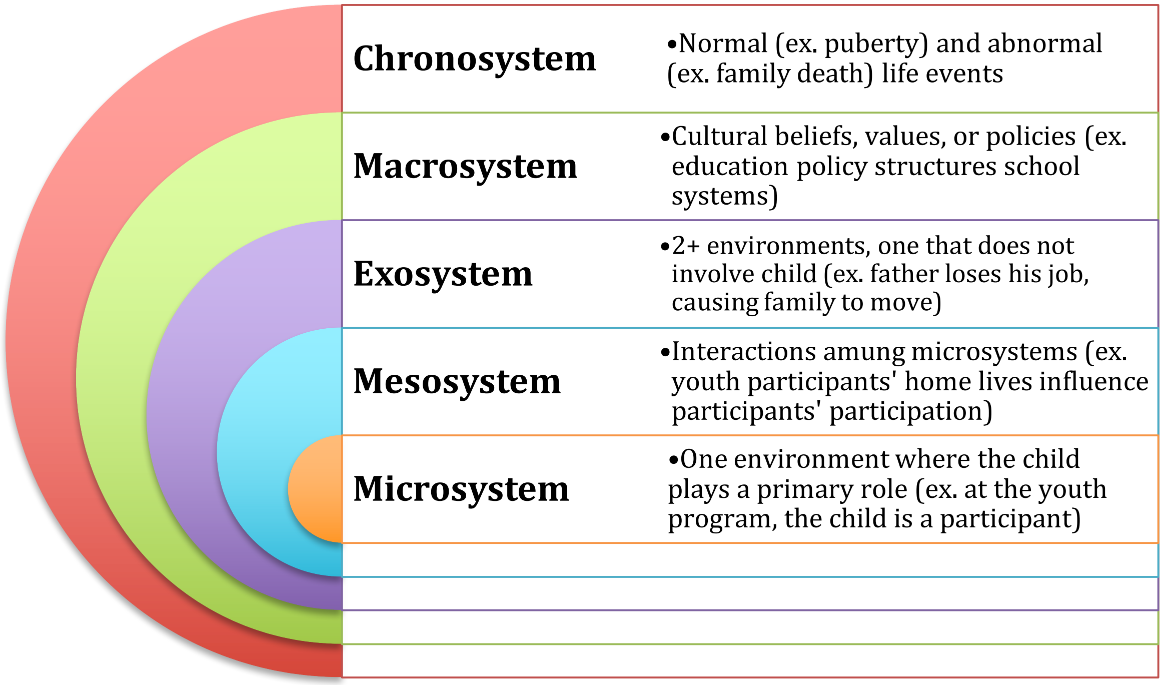
Chronosystem
•Normal (ex. puberty) and abnormal (ex. family death) life events
Macrosystem
•Cultural beliefs, values, or policies (ex. education policy structures school systems)
Exosystem
•2+ environments, one that does not involve child (ex. father loses his job, causing family to move)
Mesosystem
•Interactions amung microsystems (ex. youth participants' home lives influence participants' participation)
Microsystem
•One environment where the child plays a primary role (ex. at the youth program, the child is a participant)

Figure 4.1. This describes the five levels of influences for each developing person. The influences start with the largest systems the chronosystem, and get more specific with each level lower.

Study 2: Influences of the Macrosystem

This multilevel system of bioecology incorporates influences of the culture and other macrosystemic factors (Super & Harkness, 1999). Super and Harkness (1999) described three types of cultural influences: contemporary redundancy, thematic elaboration, and chaining. *Contemporary redundancy* is the repetition of messages from various parts of the environment during the same period of time. *Thematic elaboration* is the environment and culture send repeated themes and implicit messages through word choice, values, and images. The last influencing factor Super and Harkness (1999) described is *chaining*, when a series of events results in an outcome. In this case, no single component of the environment is robust enough to create the result; however, the combination of multiple components results in one outcome. The outcome arises as a result of multiple, seemingly unrelated events.

Individuals uniquely experience each of the three influencing factors and the components of the environment as described by bioecological theory because each individual's identity is unique. The environment also interacts differently with each individual based on the individual's unique identities (Super & Harkness, 1999). It is important to consider both this subjective and feeling-based experience, and the objective characteristics of the environment in the research process (Bronfenbrenner, 1977; Bronfenbrenner & Morris, 2006; Wachs, 1999). I emphasize this point to remind us that persistent themes in one community may not align with the themes in other communities.

Present Research to Understand the Influences of Participants' Out-of-Schooltime Program Participation on Academic and STEM Outcomes

The current study is one of three studies conducted as part of a larger research project based on responding to two intentions. I first intended to examine the relation between racism, and also STEM perceptions, and academic and STEM outcomes. Second, I investigated some of the positive factors (assets of communities of color, such as CCW and participation in an out-of-schooltime academic program) that may assist youth of color in being successful in overall degree completion, specifically within STEM disciplines. My overall assumption for the three-study project was that the out-of-schooltime program would create an environment in which youth would begin to self-identify and understand the strengths of communities of color (Tatum, 2003). In learning about their own strengths, individuals would become able to capitalize on and further develop their strengths. In the long run, then, self-identified strengths would help reduce the effects of racism (Cohen, Garcia, Apfel, & Master, 2006).

Study 2 contributes to the project by informing the ways in which participants' involvement in the out-of-schooltime program related to their academic and STEM outcomes. I intended to gain an understanding of how the environment and program culture related to the out-of-schooltime participants' outcomes and perceptions of the program. The research questions guiding the overall convergent parallel, mixed-methods study were "What out-of-schooltime program elements are related to program participants' academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?" and "For which participants was the youth program a proximal process, based on level of academic aspirations, STEM persistence, academic persistence, STEM resilience, and academic resilience?" Additionally, I included information related to the participants' lives outside of their time with the program because of the important roles the community, family, and schools played in helping and challenging the program participants in reaching their goals.

In this current, second study of a three-part research project, I expected that participation in the out-of-schooltime academic program would increase participants' sense of CCW, their academic achievement levels overall, and their retention in STEM disciplines and that it would reduce the effects of racism. I used the dosage of the program to determine how engaged participants were during my analyses of the outcomes. This research adds to the minimal existing research on out-of-schooltime programming for youth as an effort to reduce the demographic disparities in STEM fields.

Methods to Investigate the Influences of Out-of-Schooltime Program Participation on Participants' Academic and STEM Outcomes

In this section, I introduce the study participants and how they became connected to the youth program. Then I describe the survey tool and coding details for each variable and construct. Reflective of the mixed-methods design of this research, my survey contained multiple-choice and open-ended questions. Additionally, for some constructs, I analyzed the qualitative and quantitative data simultaneously, which I describe in the following sections.

Study 2: Participants

For study 2, I used a cross-sectional, associational research design to collect one round of data. I administered a quantitative and qualitative survey (Appendix E) to roughly 600 program alumni (program participants between 1996 and 2015, $n \approx 97$ to 634, based on effect-size calculations). I estimated number because I posted this on the closed Facebook alumni group and asked participants to encourage their peers to take the survey. I calculated effect size based on a power of 0.80 and six predictors. Based on these assumptions, I needed a sample of 97 to obtain significant results with a medium effect size of $f^2 = 0.15$ and a sample of 684 to obtain statistically significant results with a small effect size of $f^2 = 0.02$.

All participants in this study were alumni from a set of out-of-schooltime programs hosted by an informal science educational institution. According to youth-program funding regulations, all program participants must be either low-income or first-generation, college-bound students. However, most of the program participants were both low income and first-generation college bound (87%). Grant regulations also required that participants attended or lived in the district for some of the lowest-performing high schools in the city (based on district grading data). The detailed participants' demographics are provided in Table 4.2.

Table 4.2

Summary of the Number of Participants Identifying with Each Demographic Identity Included in This Three-Part Dissertation, Separated by Study Outcomes (Academic and STEM Persistence Levels)

	STEM persistent (*n* = 37) earning(ed) a(n). . .				NonSTEM persistent (*n* = 84) earning(ed) a(n). . .			
	AS or less (*n* = 3)	AA (*n* = 4)	BA/BS (*n* = 16)	Master's/ Doctorate (*n* = 14)	AS or less (*n* = 15)	AA (*n* = 15)	BA/BS (*n* = 35)	Master's/ Doctorate (*n* = 19)
Female (*n* = 74)	1	3	7	8	10	10	21	14
Black (*n* = 45)		3	3	4	4	8	13	10
Latin@ (*n* = 8)			2		1	1	1	3
S. Asian (*n* = 1)				1				
White (*n* = 16)	1		2	3	2	1	6	1
Multiracial (*n* = 1)							1	
Male	2	1	9	6	5	5	14	5
Black (*n* = 28)	1	1	3	5	5	4	6	3
Latin@ (*n* = 10)			4	1		1	3	1
S. Asian (*n* = 0)								
White (*n* = 8)	1		1				5	1
Multiracial (*n* = 0)								

Note. See page 141 for a description of STEM- and NonSTEM-Persistent. AS = Associates of Science/Technical degree; AA = Associates of Arts degree; BA/BS = bachelor's degree.

Program staff recruits most program participants during their eighth-grade year from the middle schools in each feeder pattern. For program acceptance, each student must complete an application, including some short essays and teacher-recommendation forms. Staff review the applications and interview students and parents attend an orientation; then staff accept students formally to the program. Staff expect students to commit to the program throughout their high-school careers; however, some students cannot meet this commitment, and others begin the program after they have begun high school.

Study 2: Data Collection Procedures

I allowed the study participants 6 weeks to complete the online survey (administered through qualtrics.com), between December 2015 and January 2016. Because I personally knew many of the study participants, I sent out multiple reminders on social media (individual Facebook messages, Instagram messages, and Snapchat), text messages, and e-mail messages. I sent the reminders 10 days after I commenced administration, and three additional times in the 10 days before the survey closed. I also asked participants to encourage their peers from the program to complete the survey. I did not request names on the survey responses.

Study 2: Measures

I designed the survey instrument by combining and adapting two preexisting surveys—the McCreedy and Dierking (2013) instrument to assess the influences of afterschool program participation through retrospective questions, and the Perceived Ethnic Discrimination Questionnaire-Community Version (PEDQ-CV; Brondolo et al., 2005). Questions with an asterisk are those that I adapted from the McCreedy and Dierking (2013) survey, and the PEDQ-CV questions are identified in the description of the instrument. I also wrote some of my own questions to assess participants' environmental contexts, based on background information from the bioecology framework, human development, education, and survey design. I piloted the survey with 11 individuals who represented program alumni, past program staff, and educational professionals.

The instrument measured five outcome variables (academic and STEM persistence, academic aspirations, and academic and STEM resilience) and other details regarding the participants' experiences during the program. The instrument included a number of questions about predictor variables related to the participants' personal identities and experiences with discrimination. I describe the survey questions, response options, and coding details of the instrument, organized by construct or variable, in the following sections. The responses were normally distributed unless noted in the descriptions below. I conducted all quantitative analyses using SPSS and qualitative or mixed methods analyses using Dedoose.

Quantitative variables. Included were seven quantitative outcome variables: academic persistence, STEM persistence, academic aspirations, and four variables that describe the participants' experiences in the program. I analyzed the academic and STEM persistence and academic aspirations first because they shaped the grouping of my participants for the qualitative coding, and then incorporated these values into my mixed-methods analyses for the resilience scores. Finally, I used these resulting variables for statistical analysis.

Academic persistence. I used one survey question to measure academic persistence. The question and response options were "For each educational level, indicate your current academic standing and goals." For each of the six educational levels (high school, trade school, associate's, bachelor's, master's, doctorate), participants selected one of five multiple-choice options: *I do not plan to earn this degree; attended, but left before finishing; currently earning; completed; ultimately, I would like to earn this degree*.

I assigned an academic persistence code of 3 to participants who respond with *currently earning* or *completed* a graduate degree (master's or doctoral degrees). Of the remaining participants, I coded a score of 2 to those who earned or are earning a bachelor's degree, and a 1 to those who earned or are earning an associates of arts degree. I defined academic nonpersistence (0) as those who selected *I do not plan to earn this degree;* or *attended, but left before finishing* for associates of science degrees, trade school, or high school. The data were skewed toward higher levels of persistence (1.39).

STEM persistence. I measured STEM persistence with two survey questions. The first question was "Are you pursuing a STEM degree or profession?" The three multiple-choice options for this question were *yes; no, but started as a STEM major;* and *no*. The second question provided an opportunity for participants to indicate their specific focus of schooling. Participants filled in six text boxes to disclose their educational focus while they were earning the following degrees or certificates: high school, trade school, associate's, bachelor's, master's, or doctorate. I assigned the STEM persistence code of 1 to participants who responded with *yes* to the first question and provided verified STEM educational foci in the second question. All others were coded as STEM nonpersistent (0).

Academic aspirations. This outcome variable had five possible levels. I determined each participant's level of academic aspirations with one question: "For each educational level, indicate your current academic standing and goals." For each of the six educational levels (high school, trade school, associate's, bachelor's, master's, doctorate), participants selected one of five multiple-choice options (*I do not plan to earn this degree; attended, but left before finishing; currently earning; completed; ultimately, I would like to earn this degree*). I coded each participant with a value from *0* (*no plan to earn a degree, including high school/GED*) to *6* (*plan* *to earn a doctorate*) based on which degrees the participants would like to earn (see Table 4.3). The data for this are skewed toward the higher aspirations (-1.71).

Table 4.3

Description of Code Assignments for Academic Aspiration Outcome Variable

Academic aspiration code	Highest degree for which "ultimately, I would like to earn/currently earning this degree" is selected	Degrees for which "I do not plan to earn this degree" selected
0	None	All
1	High school/GED	Trade school/Associate of Science, Associate of Arts, bachelor's, master's, and doctoral
2	Trade school/Associate of Science (AS)	Associates of Arts, bachelor's, master's, and doctoral
3	Associate of Arts (AA)	Bachelor's, master's, and doctoral
4	Bachelor's	Any combination of selections of high school, trade school, Associate of Arts, or bachelor's, specifically including master's and doctoral
5	Master's	Any combination of selections of high school, trade school, Associate of Arts, bachelor's, or master's, specifically including doctoral
6	Doctoral	Any combination of selections of high school, trade school, Associate of Arts, bachelor's, or master's

Experience during out-of-schooltime program(s). To determine whether the program predicted participants' outcomes and whether the youth program was a proximal process for the youth, I measured multiple aspects of participants' experiences in the program(s). I determined the strength of the program influence by measuring the dosage of participation, the types of activities participants engaged in, and the participants' motives for participating. To understand how the participants experienced the out-of-schooltime programs, I also inquired about the participants' sense of community in their experiences through the program. Last, to understand the program's contribution to future planning and orientation, I investigated how the museum experiences related to the participants' development of life skills and interest in academics. I describe the questions, response options, and coding details in the following subsections.

Program activities. There was one question related to program activities. The list of 22 possible program activities for participants included, for example, “STEM-related classes,” “tutoring,” and “leadership opportunities.” The participants selected all activities in which they participated. For the regression analyses, the number of activities was summed and then converted to sextiles ranging from 0 to 5. Also, to guide some of the feedback I provide for the program, I used the data to explore trends of activities in which STEM-resilient or academically resilient individuals participated.

Program dosage. One question provided information about participants’ actual time spent in youth programs. For each grade level (9 through 12), participants reported on their level of participation from 0 (*NA—not enrolled in the program*) to 5 (*more than 1/week*) during the academic year and summer (with a total of 10 possible points per year). The sum of points for the 4 years represents the dosage. This value was calculated from a variable that ranged from 0 and 40. For statistical calculations, I determined a normal score for program dosage by finding the *z* scores.

Motivation for participation. This section of the assessment contained 13 statements, divided into two sections. The two sections included initial reason(s) for participation and the reason(s) participants engaged in activities. Examples of the statements for initial reason(s) for participation include “My parent/guardian made me” and “I enjoyed interacting with peers and mentors from the [program].” Examples of the statements for reasons to engage in activities included doing activities that would have food, doing everything, or doing “as little as I could while staying in the program.” For each of the 13 statements, participants selected the level of agreement on a 6-point Likert scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). I categorized the statements by type of motivation: internal, external, and social. I conducted exploratory factor analysis with varimax rotation to assess whether the three motivation types would emerge as separate factors. The three categories that did emerge were general motivation, motivation from anything that provided self-benefits, and activities related to college preparation (see Table 4.4). Three items related to motivation did not load onto a factor. They fit together as a nonmotivation category; one item was the participant doing as little as she could, and the other two involved other people pushing the participant to engage with the program (i.e., "My teacher or school administrator suggested I join," and "My parent(s)/guardian(s) made me"). All factors were normally distributed except for the motivation driven by college readiness, which was skewed (-1.63).

Table 4.4

Principle Components Analysis of Factors Related to Motivation to Join Program and Attend Program Activities (n = 121)

	Component loading		
Item	1	2	3
Initial reason for participation: I liked learning about STEM	.869		
Reason for choosing program activities: "everything I was able to do"	.610	.353	
Reason for choosing program activities: STEM-related activities	.609		
Initial reason for participation: "I enjoyed interacting with mentors/ peers in the program"	.554		
Reason for choosing program activities: "activities that my friends were doing"		.831	
Reason for choosing program activities: "activities that I knew would have food"		.496	
Reason for choosing program activities: "activities that sounded beneficial to me"		.384	
Reason for choosing program activities: college-readiness activities			.789
Reason for choosing program activities: required activities		.356	.445
Initial reason for participation: "I wanted to go to college"			.436
Eigenvalues	3.140	1.900	1.310
% of variance	24.100	14.600	10.100

Mean motivation calculation. In addition, I computed the mean for each set of statements to determine the level of general motivation, self-benefit motivation, and college-readiness motivation, which resulted in a score between 1 and 6 for each type of motivation. I then calculated the overall motivation by finding the mean of the three scores, also between 1 and 6. Each participant also received a score for lacking motivation, which was the mean of the three items that did not fit in the factors. There were seven missing values for at least one form of motivation; therefore, I conducted missing data imputation using the fully conditional Markov chain Monte Carlo (MCMC) with 20 imputations, which is the recommended strategy for handling normally distributed dependent variables (Graham, 2012). This strategy assumes an iterative approach that fits a single variable, using all other variables in the model as predictors, and then imputes missing data for the single variable being fit. Then, because the STEM persistence and STEM resilience constructs were highly correlated, I combined them by calculating their z scores to standardize the values. Last, there were strong correlations between the STEM resilience and persistence ($r = .84$, $p \leq .01$) variables, so I combined them. I computed the mean of STEM resilience and STEM persistence, which resulted in a single *STEM outcome* construct to use in regression analysis.

Participants' sense of community. These questions served as protective and risk factors for experiences in the program. I developed these questions based on the findings from study 1 and my knowledge of perceived benefits from program participation. The set of questions included two 6-point Likert-scale questions regarding the participants' sense of belonging.

The second set of questions inquired about participants' current frequency of communication with other program participants or mentors. The first question asked about who participants actively have communicated with over the past 1 to 3 years. The response options, with code values in parentheses, ranged from “no” (0), to “no, but I feel I could if I needed something” (1), “with peers only” (2), “with mentors only” (2) and “yes, with both” (3). The second question inquired about participants’ frequency of communication. There was a 6-point Likert scale for each category (mentors and peers): *more than 1/week* (5), *1/week* (4), *1/month* (3), *less than 1/month* (2), *1/every 3 months* (1), *1/year or less* (0). I summed all of the responses in this section to determine the connectedness score. This value was calculated from variables determined by the sum of all the points for this category for each participant, which ranged from 0 (disconnected from program staff and peers) to 14 (highly connected). I used this sum as a predictor in the regression analysis.

*Life skills and personal development***.** I used four statements, encompassed in one 6-point, Likert-type question, to address this construct. These statements provided an overview of the program benefits that persisted after participants stopped participating. I found the mean of the codes for each participant and used that value as the predictor variable for the statistical analyses. I developed these statements based on the findings from study 1 and my knowledge of perceived benefits from program participation. Examples of items related to the program’s perceived contribution to developing life skills include “take on leadership roles” and “participating in the youth program(s) improved my ability to think critically as I make decisions or solve problems.” I calculated this value by taking the mean of the four responses, resulting in values between 1 and 6. My data had 23 missing values for the *life skills* construct; therefore, I conducted data imputations for the missing values, again using the MCMC method with 20 imputations. These data were skewed toward higher development of life skills (-1.71).

Qualitative coding for CCW and resilience. I included 11 open-ended questions that informed the themes of CCW in the youth participants. These questions helped to provide context and to build the story of participants' lives and experiences in the program. I coded these first by question, which I describe in each of the following subsections. Second, I coded by participant, with a focus on CCW and resilience. After completing question-based inductive coding, I conducted participant-based deductive coding using the CCW factors, as highlighted in Tables 4.5 and 4.6. These factors also contributed to the participants' resilience scores.

Table 4.5

Coding Guide for Academic and STEM Risk Factors, Organized by CCW Coding Themes

CCW theme	Outcome category	Codes
Family capital	Academic	Lack of family and school support for setting high, long-range educational goals Family stress Peer rejection
	STEM	Same as academic factors
Social capital	Academic	Peer pressure: Friends who gave negative perception of the chosen field
	STEM	Same as academic factors
Linguistic capital	Academic	None
	STEM	None
Navigational capital	Academic	None
	STEM	None
Aspirational capital	Academic	None
	STEM	Not liking STEM because the participant prefers social or artistic activities
Resistant capital	Academic	Stereotypes and implicit messages telling youth they will not attend, or graduate from college, and that they do not belong in STEM fields
	STEM	Same as academic factors

Table 4.6

Coding Guide for Academic and STEM Protective Factors, Organized by CCW Coding Themes (All Academic Factors Also Apply to STEM Achievement)

CCW theme	Outcome category	Codes
Family capital	Academic	Parental support, parental attitudes, and knowledge of career choice have influence on minority students' college major decisions
	STEM	Same as academic factors
Social capital	Academic	Prosocial activities Mentor and student-advisor support Positive experiences with instructor Faculty support in applying to graduate school or obtaining a job
	STEM	Same as academic factors
Linguistic capital	Academic	Effective instruction by instructor Instructional congruency: Mediate academic disciplines with student's "languages" and culture to make the content more meaningful
	STEM	Attendance at professional conferences, research experiences
Navigational capital	Academic	Academic preparation Knowledge of financial support sources and postsecondary application processes
	STEM	Enrollment in high-school STEM classes Acquisition of resources from professor, advisors, and other students Knowledge of STEM careers, such as internships
Aspirational capital	Academic	Favorable attitude to school Positive future orientation Parental expectation of success Interesting description of courses in course catalog Presence of high, long-range goals such as earning a college degree
	STEM	Exposure to the discipline Extracurricular exposure and experiences to enhance learning, create, and maintain interest (Summer jobs, part-time jobs in the relevant field, entering science fairs or contests, attending summer science programs, and taking field trips) Hands-on science experiments Connect science to real life Showing the relevance of STEM courses in the classroom
Resistant capital	Academic	Positive self-esteem, self-efficacy
	STEM	Same as academic factors

I determined these codes based on prior research regarding the factors and key life experiences that contribute to students pursuing a graduate degree in geoscience (Levine et al., 2007). Although this research targeted the geoscience field, the findings were applicable to the general STEM fields because the researchers used general STEM research to create their model. The CCW categorizations are informed by two publications that applied the framework to a similar college-readiness program setting (Pérez Huber, 2009; Yosso, 2005). In my third paper for this research project, I analyze these data through an additional lens of seeking instances of discrimination.

I used the data to inform my description of the participants' experiences and influences from the program, the participants' academic profiles, and the ways in which CCW is integrated throughout each example. I also used the data to inform suggestions for program activities and additional support for youth participants. I describe my coding process in more detail in the following paragraphs. I coded and factored some of these questions into the academic-resilient and STEM-resilient scores and noted with an asterisk (*). I used these responses to develop the counterstories, which I present through poetic analysis at the end of the results section.

Communication about and support regarding plans after high school.* I asked participants two open-ended questions about their communication with others (family, friends, community members, etc.) about the participants' plans after high school. In the prompt, I asked participants to describe the method, frequency, and subject matter of the communication, and with whom they communicated. I coded these responses based on those four characteristics of the communication engagements.

I also asked participants about the amount and kind of support they received from their social networks regarding academic efforts and achievements. For this question, I coded the responses based on who was providing support, the participants' feelings or response to the support, and in what area participants were supported (college preparation; current life issues with friends, family or school; and making tough decisions).

Noncompletion of a degree.* If participants selected *attended, but left before completing* as their academic standing for any degree level, they were then prompted with an open-ended question to explain why they did not finish this degree. I conducted question-based coding by degree types and which factor(s) prevented completion (internal motivation, too much responsibility, lost financial aid, not enough money, etc.), and lacking components of CCW (i.e., risk factors).

If participants selected *ultimately, I would like to earn this degree*, the survey prompted them with an open-ended question inquiring why they had not earned the degree yet. For the responses, I coded the following themes: financial reasons, not sure what to specialize in, have not completed the prior degree yet, or have not been accepted. Last, I asked participants, "If you had any break in your educational pursuits, please explain what factors contributed to the break(s)." I coded this open-ended question using the same guidelines as those noted previously for the *attended, but left before completing* response.

Changing from a STEM to liberal arts degree.* If participants indicated that they have changed their major from a STEM to a liberal arts degree, I inquired what factors contributed to that change. For this question, I coded the responses based on the factors that contribute to building a STEM identity. These factors include competence, recognition, and performance. Competence is the participant's ability to do STEM-related activities and academic work. Recognition is both pride and self-confidence, and external recognition of the participants' achievement. Performance is based on the grades or accomplishments one earns in STEM fields.

Feedback and challenges in the program.* I asked two questions to understand the ecology of the program's environment. In the first question, I asked participants to provide examples of how program(s) staff were informed about performance. I coded responses by the category of feedback received (academic, behavior, participation, and other) and how the participants were informed (casual conversation in the office, formal meeting with all staff, formal meeting with teachers or parents/guardians, or peer feedback). I also looked for clues that indicated how participants received feedback—positively and put into action of making self-improvements, or negatively and resulting in lowered self-confidence or negative attitude.

The other open-ended question pertained to what participants found challenging during their participation in the program, with examples requested. I coded the responses for the different types of challenges (academic, emotional, mental, physical, social). I also looked for words that indicated the challenge was too much or not enough for the participant.

Suggestions for the program. For the question related to suggestions for the programs, I coded the responses by type of activity (college tours, college exam-preparation courses, increased parental involvement, etc.) and by people involved in the activity (alumni, parents, current participants, teachers, mentors, etc.). I have incorporated these responses into the discussion portion of this paper, where I provided suggestions for the program.

Mixed-methods variables. There were three variables that I believed required both qualitative and quantitate inputs. These variables include the academic and STEM resilience scores and the proximal process categorization. Resilience is a complicated concept with many contributing factors; therefore, I wanted to include as many facts and emotional accounts as possible in my determinations of participants' resilience scores. I coded the qualitative components the same way I described in the preceding qualitative section. To identify the program as a proximal process, one in which participants are highly engaged, I considered quantitative factors including frequency and duration, and qualitative factors including participants' descriptions of growth experiences as a result of the program.

Academic resilience. For this construct and the STEM-resilience construct, I developed specific response options that, when selected, represent protective factors or risk factors. The questions for academic resilience tapped into the factual and experiential components of a participant's home life during high school. This construct included seven questions relating to factual components of the participant's home life during high school and college. The questions addressed topics including eligibility for free/reduced lunch, parent/guardian(s) level of education, where the participants lived during high school, whether the participants worked during high school or college, and whether such employment related to the participant's majors. Two questions related to the experiences of the participant's home life. These questions asked about the structure of the participants' home and their feelings about having supportive people during high school and college.

This section also included two open-ended questions. The first of these asked about the type of communication participants had in their communities about plans for after high school. I coded the responses to these questions first by presence or absence of communication about future plans. Then I coded by how the communication made the participants feel, the kind of communication (spoken, written, subliminal, or unspoken), and the frequency. The second open-ended question inquired about the kind of support (or lack of support) the participants received from community members. I coded this by the key people involved in the support role and what kind of support or nonsupport the participants received.

Two open-ended questions inquired about respondents' perceptions of how the program "contributed to who you are as a person," as well as any suggestions for improvements to the programs. I coded the first question by personal characteristics (positive and negative), academic characteristics, development of life skills, and comments that supported community cultural wealth and bioecology. I also looked for evidence of cascading influences when participants credited the programs for later choices in life; e.g., pursuing a STEM degree and profession. I suspected that there would be responses similar to "made me more open-minded," "made me a better leader," "made me enjoy STEM," "taught me how to interact with those different than myself," and "taught me how to approach authority figures." I based these intuitions on my prior work with the youth program and the results from the first study. I used the resulting codes from this question for the resilience score.

I determined the resilience score using three factors: the sum of codes that indicated risk factors and a second sum of protective-factor codes for all questions described in this section and the Academic Persistence section. For the qualitative answers, I added a point for each indicator of support and future-planning communication, and subtracted points for indicators of lacking support or negative communication. Table 4.7 shows the coding guide for the academic resilience score. The academic resilience score ranges between 0 (no resilience/no risk factors, high levels of protective factors, and no academic persistence) to 24 (the most extreme levels of all risk factors measured, minimal protective factors, and the highest level of academic persistence). Please note that, in Table 4.7, the number of risk factors included in each resilience score decreases as more risk factors accumulate. I reduced the number of risk factors to account for the possibility that the more risk factors people encounter, the more challenging each additional hardship feels for the individual. In this context, the individuals becoming more vulnerable than average is referred to as *sensitizing effects*. The alternative is also possible, that individuals become stronger from experiencing risk factors. These are *steeling or annealing effects*, which result in decreased vulnerabilities for the individuals (Rutter, 2012).

I conducted exploratory analysis to try to understand which participants had *sensitizing* or *steeling effects* and whether I could determine a pattern regarding the effects of the total number of risk factors; however, I found no patterns. I combined the academic persistence and academic resilience constructs because they were highly correlated ($r = .95$; $p < .001$). For each participant, I computed the mean of academic resilience and academic persistence, resulting in a single *academic outcome* construct to use in regression analyses.

Table 4.7

Academic Resilience Score Calculation Guide

			Risk factors sum							
		Protective factor sum	0	1 to 12	13 to 24	25 to 30	31 to 36	37 to 40	41 to 44	≥ 45
Academic persistence level	0	0–15	11	18	19	20	21	22	23	24
		16–30	11	17	18	19	20	21	22	23
		31–45	11	16	17	18	19	20	21	22
		≥ 46	11	15	16	17	18	19	20	21
	1	0–15	11	14	15	16	17	18	19	20
		16–30	11	13	14	15	16	17	18	19
		31–45	11	12	13	14	15	16	17	18
		≥ 46	11	11	12	13	14	15	16	17
	2	0–15	3	4	5	6	7	8	9	10
		16–30	2	3	4	5	6	7	8	9
		31–45	1	2	3	4	5	6	7	8
		≥ 46	0	1	2	3	4	5	6	7

STEM resilience. Four questions were used to determine STEM resilience. The first question asked participants to describe, regarding their opinions of STEM, three to five of the most influential (positive or negative) experiences or individuals in their lives. This technique measures the critical incidents related to participants' STEM perceptions. Much research has used critical incidents, as documented in Fivars and Fitzparick's (2001) extensive bibliography. I coded the open-ended responses to this question first by negative, neutral, or positive experiences, and then by age. Then I examined the context of the influence (school, the program, home, media, and other), and the outcome of the influence (improved opinions of STEM, worsened opinions of STEM, or no apparent change in opinion). After doing the qualitative coding, I added one point for each positive factor participants described and subtracted one point for each negative factor described. I also used these data to create a qualitative overview of participants' experiences in STEM based on themes.

The second question was a multiple-choice question: "Are you pursuing a STEM degree or profession?" The three multiple-choice options, with codes noted in parentheses, were *no* (0); *no, but started as a STEM major* (0.5); and *yes* (1). For those who responded with *no, but I started as a STEM major,* I asked a follow-up, open-ended question asking what factors contributed to their leaving a STEM major. I anticipated that this question would help describe the non-STEM-resilient individuals' characteristics and experiences that steered them away from STEM fields. I anticipated characteristics including sense of alienation; feeling like an outsider, helpless defeated, or like a failure; lacking self-confidence, or losing motivation. Some potential experiences also might have been having too low of a GPA to stay in STEM, doing poorly in associated math classes, losing interest in STEM, gaining interest in a different major, a professor telling the participant that she didn't belong, or unsupportive family/social network. I summed each of the STEM risk and protective codes.

Two questions assessed the participant's STEM identity. Specifically, for people of color, research supports that these strong STEM identities are essential for success in the STEM fields (Ahlqvist, London, & Rosenthal, 2013) because there are often conflicts between personal identities and how STEM professionals "should be." Therefore, I considered STEM identity a protective factor for STEM resilience in this research. The first question of this section asked participants to rate the recognition they had received in STEM settings. Participants selected from six multiple-choice options ranging from *very negatively* (0) to *very positively* (5).

The last question clarified the intensity of various influences in participants' lives as related to STEM identity. The question was a list of statements that completed the sentence, "The following helped me…". Some examples of the statements include "Imagine myself as a STEM professional in while in high school and/or college," and "feel like I belonged in the STEM community." Participants were asked to distribute 20 points among the presented influences ("school," "youth program(s)," "other-sports, family, partner, friends, religious leader, etc.," and "None—I do not agree with the statement"). To determine the total STEM protective factors scores, I counted the protective codes, the coded value for STEM recognition, and the total points allocated to all categories except "none." I repeated the same procedure for the STEM risk factor score. I computed the sum of all points allocated to all categories except for *none,* and then subtracted the sum of all points in the *none* category from the total score.

I used three factors to determine the STEM-resilience outcome variable: STEM risk factors, STEM protective factors, and STEM persistence. Table 4.8 shows the coding guide for participants' STEM resilience scores. The STEM resilience score ranges between 0 (no STEM resilience/no risk factors, high levels of protective factors, and no STEM persistence) to 34 (the most extreme levels of all risk factors measured, minimal protective factors, and STEM persistence). I used the same concepts as those used to calculate the academic resilience (*sensitizing* and *steeling effects*) to determine the STEM-resilience score.

The questions asking participants to distribute 20 points and describe three to five critical incidents seemed to be too difficult for some participants given that 29 participants stopped the survey at this point, or skipped these two questions. I conducted missing data imputation using the MCMC method with 20 imputations. Therefore, I conducted missing data imputation using the fully conditional Markov chain Monte Carlo (MCMC) with 20 imputations, which is the recommended strategy for handling normally distributed dependent variables (Graham, 2012). It assumes an iterative approach that fits a single variable using all other variables in the model as predictors and then imputes missing data for the single variable being fit. Then, because the STEM persistence and STEM resilience constructs were highly correlated, I combined them by calculating their z scores to standardize the values. Last, there were strong correlations between the STEM resilience and persistence ($r = .84$, $p \leq .01$) variables, so I combined them. I computed the mean of STEM resilience and STEM persistence, resulting in a single *STEM outcome* construct to use in regression analysis.

Table 4.8

STEM Resilience Score Calculation Guide

		STEM persistence level											
		1						0					
Protective factor sum		0–25	26–50	51–75	76–100	101–125	≥ 126	0–25	26–50	51–75	76–100	101–125	≥ 126
	0	16	16	16	16	16	16	16	16	3	2	1	0
	1–20	23	22	21	20	19	18	17	16	4	3	2	1
	21–40	24	23	22	21	20	19	18	17	5	4	3	2
	41–60	25	24	23	22	21	20	19	18	6	5	4	3
	61–80	26	25	24	23	22	21	20	19	7	6	5	4
Risk factor sum	81–95	27	26	25	24	23	22	21	20	8	7	6	5
	96–110	28	27	26	25	24	23	22	21	9	8	7	6
	110–120	29	28	27	26	25	24	23	22	10	9	8	7
	121–130	30	29	28	27	26	25	24	23	11	10	9	8
	131–135	31	30	29	28	27	26	25	24	12	11	10	9
	136–140	32	31	30	29	28	27	26	25	13	12	11	0
	141–145	33	32	31	30	29	28	27	26	14	13	12	11
	≥ 146	34	33	32	31	30	29	28	27	15	14	13	12

Proximal processes. For the mixed methods descriptive research question regarding the program that served in participants' lives as proximal processes, I coded all responses using the bioecological framework's definitions of proximal processes. I describe my analyses process for this question in Figure 4.2 Because Bronfenbrenner and Morris (2006) do not define the length of time, or the frequency, for proximal processes, I determined those parameters myself based on the nature of the program. In this study, I define a "long period of time" as being 1 year or more because that gives participants an opportunity to experience all activities at their levels. I determined this frequency by summing the total number of program sessions that participants attended. I defined "frequent" as including participants who attended the summer session at least three times each week, and once a week for each academic-year session.

One condition, increasing complexity of the activity, is not included in the process chart (Figure 4.2) because increasing complexity is inherent in the program structure for all participants who engage for more than 1 year. This assumption of the program structure was also supported by data from the open-ended question that asked about the types and levels of challenge participants experienced in the program. For analyses, I sorted the participants for whom the program was a proximal process based on participants' outcome values for the five outcome variables. More participants had the program as a proximal process than those who did not (-1.76).

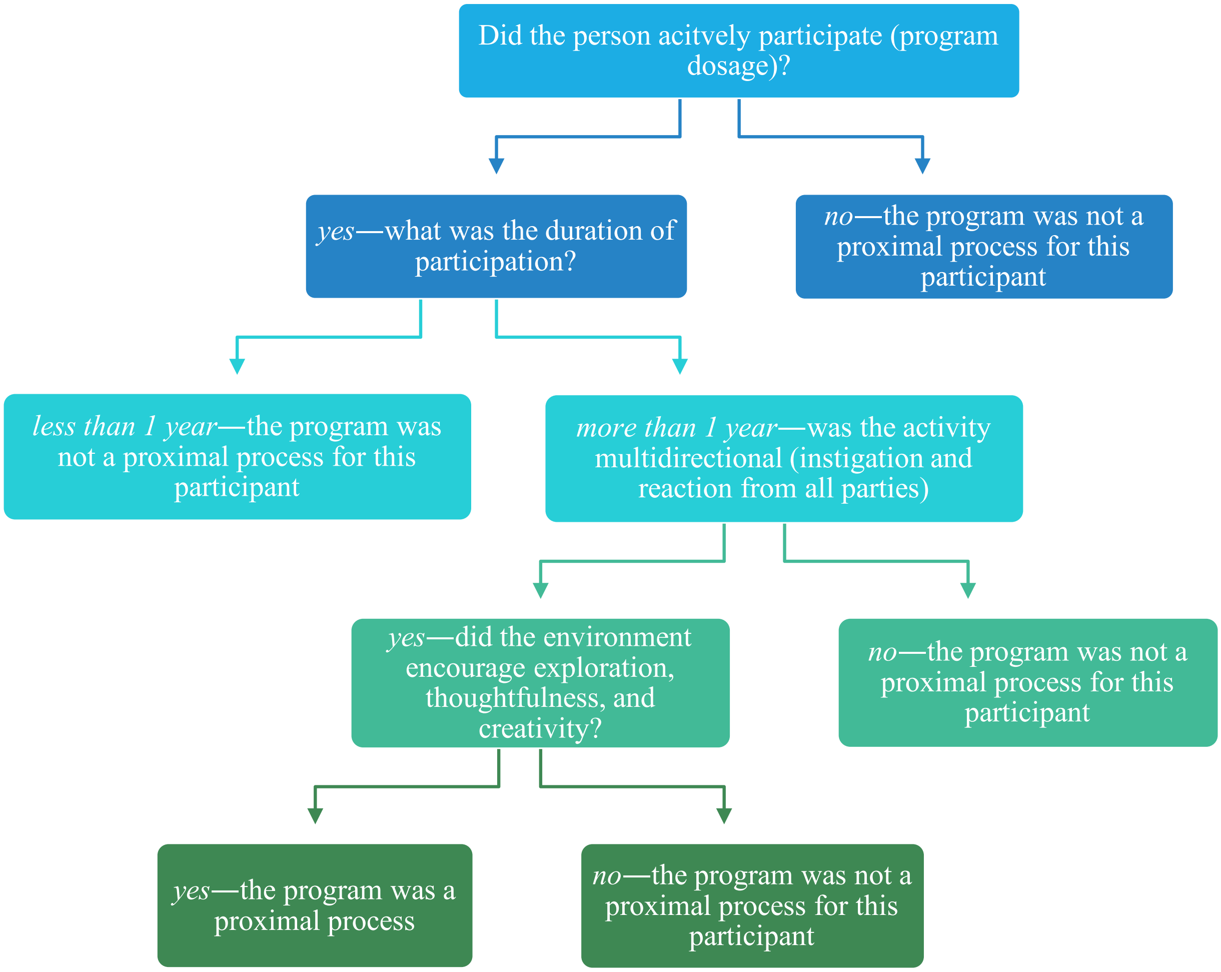
Did the person acitvely participate (program dosage)?
yes—what was the duration of participation?
no—the program was not a proximal process for this participant
less than 1 year—the program was not a proximal process for this participant
more than 1 year—was the activity multidirectional (instigation and reaction from all parties)
yes—did the environment encourage exploration, thoughtfulness, and creativity?
no—the program was not a proximal process for this participant
yes—the program was a proximal process
no—the program was not a proximal process for this participant

Figure 4.2. Chart describing the analysis process to determine if participants have the youth program as a proximal process or not (101 participants had the program as a proximal process and 20 did not)

Preliminary Factor Analyses of Program Features and Putative Predictors

I conducted all statistical analyses in SPSS. I conducted one preliminary factor analysis to determine whether the items related to program features and other putative predictors of academic success and positive youth development formed coherent scales. The analysis revealed three components that encompassed all of my predictor variables. The value of principal-component analysis with orthogonal rotation is that each component captures unique variance in the set of predictors, because the components are uncorrelated with each other and, as a set, the components preserve all of the variance across the individual items. All items met the assumptions of independent sampling: normality, linear relationships between variable pairs, and moderate correlations between variable pairs (*KMO* = .71; *p* = < .001). I requested the components based on eigenvalues. After analysis, the first component accounted for 29% of the variance, the second and third components accounted for 20% and 13% of the variance, respectively, (totaling 62% of the total variance). In Table 4.9, I present the items and component loadings, with absolute values less than 0.30 omitted for clarity.

Table 4.9

Principle Component Analysis of Factors Related to Program Features, Discrimination and Personal Identity (N = 121)

Item	Component loading		
	1	2	3
Program dosage	.89		
Program as a proximal process	.89		
Number of activities participant engaged in	.79		
Sense of community within the program	.54		.53
Experienced discrimination		−.80	
Level of support during high school		.66	
Level of support during postsecondary education		.60	
Number of dominant identities		.52	
Amount of life skills gained from the program			.85
Overall motivation for participation			.73
Eigenvalues	2.89	1.99	1.30
% of variance	28.90	19.98	13.00

I described the first component as the *program influence*. All four items had positive and generally high loadings for the items pertaining to engagement in the program. The second component measures *external influences* on the participant—specifically, support, and its obverse, lack of discrimination encountered. The item measuring a number of dominant identities also had a positive loading on this component, which suggests that having multiple identities covaries with social support and minimal experienced discrimination (i.e., the more dominant identities a person has, the more support she feels and the less discrimination she experiences). I label the third component as *perceived benefits* because these are both factors related to the explanations for a level of engagement and potential outcomes related to program engagement. Interestingly, the participants' sense of community also loaded on this component, which indicates there may be a relation between the participants' social connections and their life-skill development and motivations for participation.

Checking Assumptions and Hypothesis Testing

Before I conducted the analyses related to hypothesis testing, I checked that the data met the assumptions for the tests, particularly those related to a multivariate normal distribution with no outliers. For this step, I used Cook's *D* as a diagnostic for linear associations between predictors and the criterion variable, and homoscedasticity. For each outcome variable, there I had instances of both assumptions being violated, which means there were different patterns of those variables than the typical patterns of variables used in this analysis. These differing patterns are not ideal for these statistics; however, I calculated the *z* scores for all variables and proceeded with analysis because the test is generally robust to violations of assumptions. For testing the hypotheses, I used multiple logistic regression for my quantitative analysis.

Incorporating the Qualitative Findings to Descriptive Data

I incorporated the qualitative findings in the narrative that described the quantitative findings. I also used poetic analysis to present the qualitative findings, particularly those that address a sensitive topic (Furman, Langer, Davis, Gallardo, & Kulkarni, 2007). *Poetic analysis* is a creative way to present direct quotes or themes from qualitative data. I chose to correct the spelling errors and indicate meaning in brackets for slang words. Poetic analysis allows the researcher to add emphasis and tone to the data. I used line spacing, bold, italics, or punctuation to add emphasis to the quoted content and my interpretations (Cahnmann, 2003). I used this technique to express the voices of my study population and preserve the actual lived experiences participants described through the data (Furman, 2006). Poetic analysis allows for the counternarrative to be expressed in contrast to the White majoritarian perspective, and frames the marginalized community as the sources of knowledge (Delgado Bernal, 2002).

Results Regarding the Program's Relation to Participants' Academic and STEM Outcomes

I sought to understand what program elements related to participants' academic and STEM outcomes. I found that regardless of academic achievement level or STEM persistence, participants referenced many factors that contributed to their success from the program and from individuals distinct from the program. Therefore, in this report of findings, I focus primarily on the relations between the participants and the program, and include highlights of ways the participants' families, communities, or others support and engaged with the participant.

Study 2: Overview

Generally, participants with academic aspirations to earn a doctorate degree felt supported consistently throughout their lives in a variety of emotional, logistically and financial ways. Those who strived to earn a master's degree still felt a great deal of support from the youth program but did not reference support from many other sources. For those participants who aspire to earn a bachelor's degree or less only referenced gaining some life skills from the program and communicated about plans after high school in writing.

Overall, the study participants earned much higher degrees than their peers in the city and state where they program was hosted, with an average of 70% of study participants earning or having earned at least a bachelor's degree, compared to only 26.5% of people in the city and state earning a bachelor's degree. Study participants who were active in the program and earning a graduate degree accessed many different types of sources to support their educational journeys. Generally, the participants earning or having earned a bachelor's degree described understanding their strengths and weaknesses and feeling most supported by peers compared to other sources of support. Most of those earning an associate's degree or less felt disconnected from the program and had minimal other support.

STEM persistent participants were similar to the highly academic persistent participants in that they felt strongly connected to the youth program and had multiple sources of support. The nonSTEM persistent group felt generally unsupported, including regarding academic and tutoring support. These participants described many reasons for not pursuing STEM degrees including preferring artistic content, having self-doubt in their abilities academically and in STEM, and having few experiences to learn about STEM fields.

In the sections below, I described the results I gathered that related to the first research question, "What out-of-school program elements are related to program participants' academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?" I conducted correlations to find patterns in my data and reduce the number of variables. Then did hypothesis testing using linear regressions in an attempt to develop a model that would predict the variables that related to academic and STEM outcomes. Lastly, I describe how the qualitative data informed my limited quantitative findings by presenting my findings through participant portfolios based on the participants' academic and STEM outcomes. I provide further detail with the qualitative findings and descriptive data to create portfolios of the participants based on their academic and STEM outcomes, and if they were actively engaged in the program or not.

Correlations Among Variables Used in Predicting Academic and STEM Outcomes for All Participants

Noteworthy findings included the moderate correlations between the participants' sense of community with the development of life skills, motivation for participation, and proximal process (Table 4.10). This outcome follows conceptual logic because active participants (proximal process) are more likely to build a stronger community among program peers and staff, and consequently participants developed more life skills than those who were minimally engaged with the program. The last correlation I mention is between support and discrimination. There was a moderate negative correlation among participants between experienced discrimination and amount of perceived support during high school. There was also a moderate positive correlation between the amount of perceived support during and after high school.

Table 4.10

Correlations Among Predictor Variables (n = 121)

Variables	1	2	3	4	5	6	7	8
1.Development of life skills	—							
2.Motive for participation	.460**	—						
3.Active participant	–.005	.05	—					
4.Sense of community	.350**	.29**	.35**	—				
5.Support in high school	.240**	.23**	.16	.09	—			
6.Support after high school	.220*	.16	.01	.09	.33**	—		
7.Dominant identities	.020	.10	.09	–.02	.14	.13	—	
8.Experienced discrimination	.090	–.19*	.05	.10	–.36**	–.35	–.24**	—

*$p < .05$. **$p < .01$.

Linear Regression Analyses to Investigate Predictions of Academic and STEM Outcomes for all Participants

To investigate how well program involvement, external influences, and perceived benefits predict academic outcomes, STEM outcomes, and academic aspirations, I computed three hierarchical linear-regression analyses, each with two steps: I entered program involvement in step 1, and external influences and perceived benefits in step 2. Neither model tested in the three regression analyses resulted in significant results (Table 4.11).

Table 4.11

Hierarchical Multiple Regression Predicting Academic Outcomes, STEM Outcomes, and Academic Aspirations From Program Involvement, External Influences, and Perceived Benefits (N = 121)

Variable	*B*	*SEB*	β	ΔR^2
Academic outcomes				
Step 1				.019
Program involvement	–0.129	0.086	–.137	
Step 2				.012
External influences	–0.035	0.086	–.038	
Perceived benefits	0.095	0.086	.101	
R^2 total				.030
STEM outcomes				
Step 1				.000
Program involvement	–0.015	0.088	–.016	
Step 2				.013
External influences	0.102	0.089	.106	
Perceived benefits	–0.039	0.089	–.041	
R^2 total				-.012
Academic aspirations				
Step 1				.000
Program involvement	0.006	0.089	.006	
Step 2				.035
External influences	–0.132	0.088	–.136	
Perceived benefits	0.125	0.088	.129	
R^2 total				.010

Although I did not have significant findings from the regressions analyses, the component loadings (program involvement, external influences, and perceived benefits) show validity in the constructs the tool measured because of the logical way in which the variables grouped. Additionally, the qualitative analyses show that, for 45% of participants, the program involvement was instrumental in helping them reach their academic and STEM goals, and in encouraging high academic aspirations; however, program participation was not the only component necessary for postsecondary-degree attainment. The research question guiding this portion of the work was "For which participants was the youth program a proximal process, based on level of academic aspirations, academic persistence, academic resilience, STEM persistence, and STEM resilience," which is a subset of the main research question.

Participants' for Whom the Program was a Proximal Process Felt Supported

Participants expressed that they felt supported by the out-of-schooltime program (88%) and as if the mentors believed in them (91%). As participant 37 expressed, "The fact [is] that it challenge[d] me to grow and be someone."

Another participant (123) explained,

> My mentors saw something and believed in me more than I believed in myself. They constantly encourage and motivate me to drive for more in life. They are a big part of why I go to college and am continuing my education now. A lot of things I do in life is to make them proud.

Participants also felt supported by their peers (67%) and became leaders (59%). Overall, participants indicated that the museum felt like family (94%).

Portfolios of Participants for Whom the Program was a Proximal Process

In this section, I have developed portfolios of each the potential level or category of each academic and STEM outcome using common characteristics in each group. The characteristics relate to the participants' experiences in the program, at home, in their communities, and at school. All participants represented in the outcome-related portfolios had the youth program as a proximal process. I present my analysis in the regular text in paragraph format, interspersed with quotes from the surveys. I also present some samples of my poetic analysis to share the voices of the participants at the end of this analysis section. I created the poetic analyses by taking quotes from participants' survey responses and adding context and additional phrases to the quotes to build the story.

Academic aspirations. About half of the participants (52%) indicated they aspired to earn a doctorate degree. In the middle achievement level that included 21% of respondents, the participants indicated they wanted a master's degree as their highest degree. Only 11% of participants indicated academic aspirations of a bachelor's degree or lower.

Participants aspiring for a doctoral degree. The participants aspiring to earn a doctoral degree indicated a level of resourcefulness and ambition. Ninety percent of this group were first-generation college-bound students, and they found themselves learning about college with their families, and striving to earn the highest degrees they can. They also used and appreciated the technology resources from the program (72%). Participant 61 described the influence the program had on her, saying, "It has shaped me academically and professionally. I owe all school and work successes to the [program]. It helped me to develop a strong sense of work ethic, computer skills, and love and appreciation for nature." I found diverse themes, representing the dreams of many assorted program participants.

Participants aspiring for a master's degree. The participants who aspired to earn a master's degree seemed to have in common a feeling of connection to the youth program, and to show a great deal of appreciation for how the program helped them understand the value of school. Participant 76 expressed that **"**They also instilled a thirst for education. I'm still not at the level I desire to be; but because of them, I've never stopped trying to get there."

*Participants aspiring for a bachelor's degree***.** The group aspiring to earn bachelor's degrees had short and unique qualitative responses, primarily indicating they made decisions by weighing the cost-benefit of continuing with school beyond a bachelor's degree or accepting a satisfying job. For example, participant 31 explained, "I just wasn't sure what I wanted to major in, so I stopped halfway through the bachelor's program at [university name]. During the break, I worked full time for [the local school district] as a Microsystem Technician." These participants indicated they had learned many life skills during the program and had found a satisfying job (42% and 30%, respectively).

Aspiration of doctoral-level degree (*n* = 62)

- Participants felt supported by family, mentors, and community members.
- For all participants, support came financially, through community-building, and through sharing experiences.
- Multiple participants described chaining events, including the program and other environments that simultaneouslysupported college.

Aspiration of master's degree (*n* = 25)

- Most participants felt appreciation for the program, and recognized it increased their value of education; they also indicated school staff support.
- Participants did not have a strong family foundation and had been pushed away from college.

Aspiration of bachelor's or lower degree (*n* = 13)

- Some participants gained life skills during the program and have since found a satisfying career.
- All of the participants who indicated they had communicated in writing about plans after high school were in this group.

Figure 4.3. Highlights of participant profiles, subdivided by academic aspiration.

Participants aspiring for an associate's degrees or lower. These participants showed navigational capital in their decisions to minimize their debt by not attending graduate school; however, they lacked aspirational capital related to academics. They represented those individuals who typically received minimal support for pursuing college and instead their families pushed them toward the military. I include more details about each group's characteristics in Figure 4.3.

Academic persistence. Participants in this category ranged from having earned a high school diploma to pursuing a doctorate degree at the time of data collection. Of all participants actively engaged with the program (proximal process), 25% had or were pursuing a graduate degree, 44% had or were pursuing a bachelor's degree, and 16% were pursuing an associate's degree. Only 15% had chosen not to pursue a degree after high school graduation.

Study participants' academic outcomes compared to the city and state when the program is located. As displayed in Figure 4.4, these educational attainment rates are significantly better than others in the city or state where the youth program is located. The survey participants, proximal-process and nonproximal-process participants alike, overall earned higher degrees than the general public (an average of 70% of survey participants had or were earning a bachelor's degree, compared to an average of 26% of city and state residents who had at least a bachelor's degree; US Census Bureau, 2011).

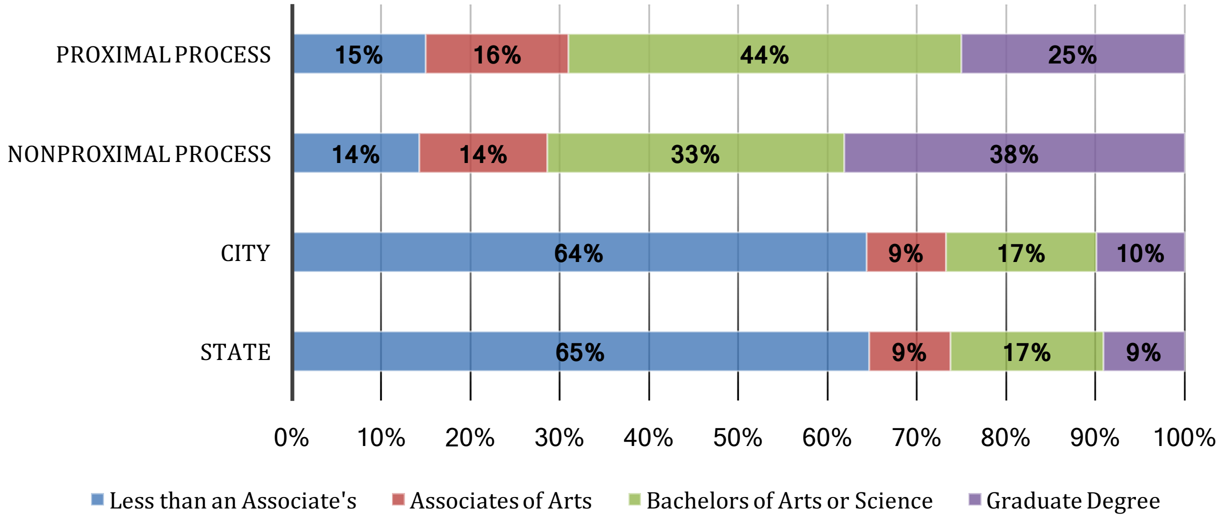

Figure 4.4. Comparisons between educational attainment of all students earning degrees in the city and state where the youth program was hosted and of highly involved (proximal process) and uninvolved (nonproximal process) youth-program participants who took the survey.

Many factors may have contributed to the similarities between the engaged and less engaged youth participants, compared to the data for state and city residents overall. One possibility is that all of these participants had some level of direct contact with the youth program, and likely had additional, prolonged contact with the resources through the social capital the participants had built during their time in the program. Also, all of those who participated in the program were likely more motivated compared to those who represented the city and statewide data, simply because of their involvement in an educational extracurricular activity. Additionally, 72% of participants indicated they had either gained or shared information with their peers. Participant 49 explained this peer support: "Most of my friends are STEM majors, so we would help each other out with scholarships."

Contemporary redundancy in participants earning at least a bachelor's degree. Most participants earning 4-year degrees or higher indicated experiencing contemporary redundancy (i.e., similar messages from multiple sources) (75%). Participant 113 described his experience in this context:

> There was verbal discussion of college multiple times . . . one of my high school's goals was actually to make sure at least every senior had been accepted to Miami Dade at the very LEAST. And that was clarified at tenth grade for the PSATs; and then once I stacked [the Program] on that, it was very evident how adamant I was about college, as well as a lot of the faculty and staff that was in my every day scholarly life as of 2010.

In this case, most participants felt highly engaged with the youth programs and also having detailed and frequent conversations with a family member about their plans after high school (71%). Additionally, participants exhibited both pride and doubt in their academics (46% and 51%, respectively). As one participant stated, "I made it to be the first one in my family to graduate high school, and graduating college was another one on that to-do list. In my book, it was the ultimate accomplishment."

Participant characteristics for those earning a bachelor's degree. The participants who had earned or were earning their bachelor's degrees had a higher level of appreciation for the program and its benefits (84%). For example, these participants indicated as benefits learning about themselves, increasing the value of education, and having mentors believe in the participants. Participant 89 spoke to the ways in which she became aware of her abilities:

> I got to see a great deal of the world and experience many things that I surely know I wouldn't have experienced if it weren't for the programs existence. Now I'm more aware of the real world and more importantly, I'm more aware of what I'm capable of.

Participant characteristics for those earning a graduate degree. The majority of participants working on their graduate degrees described their parents as being highly involved in the college application process (88%). Participant 127 described his environment relative to college: "My community, family, and friends have often supported my educational ambitions through encouraging words when they find out I have been achieving in the academic fields and discussing the importance to continue to strive in the educational field."

Additionally, 80% of participants learned about college from many different sources such as school, friends, siblings, the youth program, and church. These participants indicated having participated in an internship associated with the youth programs. When funding was available (for 50% of the time that these study participants were in the program), the program had offered high-performing participants the opportunity to serve as a medical intern at the local public hospital. Student 86 described his experience: "One positive experience was when I was trying to decide if I should continue going to trade school or pursue college, I was allowed the opportunity to do a six-week shadowing which inspired me to switch careers and purse physical therapy." This hospital worked with a university and a top-ranked teaching hospital, so medical staff was well versed in teaching their crafts and talking with others about their experiences. These internships and shadowing experiences proved to be monumental to some participants' career choices and skill development (60%).

Persistence of Graduate Degree (*n* = 25)

- Participants' parents were highly involved in the college application process and the participants learned from different types of sources about college
- Participants appreciated the technology and opportunity resources provided by the youth program

Persistence of Bachelor's Degree (*n* = 44)

- Most participants understood their strengths and weaknessess, have increased value in education, and indicate mentors believe in them because of program
- All participants felt supported by friends and a part of a learning and sharing community

Persistence of Associate's Degree (*n* = 16)

- Some participants experienced minimal support from thier families, had written communication, disliked doing "school stuff" over the summer, and were disturbed by other children in the class
- Some participants had medical problems

Persistence of some college (*n* = 15)

- Most participants had little support other than the youth program, and did not feel as connected as others to the youth program
- Most participants indicated academic challanges

Figure 4.5. Highlights of participants' profiles subdivided by academic persistence levels.

Participant characteristics for those earning an associate's degree or lower. Putting numbers aside, each group represents unique characters, with unique circumstances (see Figure 4.5). Overall, 87% of those who had earned only a high-school degree lacked support and struggled academically: "I was average C student. It was simple for me. Just be average I guess and I was OK" (participant 70). Given those conditions, it seemed logical that this group would not pursue too much higher education. The group who had earned or was earning an associate's degree had minimal support and did not actively engaged with the youth programs as a whole. Instead, 87% of this group indicated they engaged with only one person from the program and felt disconnected from and even judged by the rest of the group. Participant 103 described the ways he was challenged in the program: “It was challenging to know that a mentor was judging me harshly even though she didn't really know me.” Personal health or medical problems had also been a problem for half of this group (50%).

Academic resilience. I bifurcated academic resilience into low and high groups. Many of the characteristics of the highly resilient aligned with those of the academically persistent participants. The same is true for the low-resilient and low-persistent participants.

Characteristics of highly resilient participants. The highly academic resilient group felt supported by their families and school staff for college readiness: “My mom wanted me to become a doctor or another professional. We spoke about college often; I knew there was no other option but to continue my education by going to college” (participant 55).

These highly resilient participants felt supported by peers and mentors, were a part of a community, and described appreciating the many new experiences they had through the program:

> I picked my major (Microbiology) because my mentor had taken me to [the University] a couple of times to her Microbiology classes and I fell in love with it. . . . I think [the mentor] taking me to her classes at [the University] was a life changing experience I didn't get much guidance on what major I should pick. I had applied for biology because my parents always wanted me to become a doctor and I thought that was the only option for MDs. She really challenged that idea and opened up my eyes to other options. Even though I had gone on college tours, actually sitting in on a class and hearing her and her friends’ experiences was life changing. She did this once again when I was interested in pursuing an MPH. Pride, role models, putting intentional action into self-improvement, and motivated by the competition are some freestanding words that describe this group. (student 102)

Communication between participants and peers or adults in their lives varied across participants, ranging from frequent to nonexistent, nonverbal to verbal, and direct to indirect.

All of the English language learners were in the academically resilient group. These individuals described the program as having helped in many ways with their learning a new language. Although the CCW framework defines language as a strength, these participants were harmed by people's actions that were based on the deficit perspective of them as English language learners.

Challenges for academically resilient participants. The participants also had many different obstacles related to navigating the educational system. Regarding challenges participants experienced in the youth program, the most common was a fear of engaging in water activities during the summer marine-science component of their program activities. Participants were employed during their schooling when necessary, which built life skills and responsibility in them, and took attention and time away from their academic work.

Characteristics of participants with low resilience. The low-resilient group contained participants who shared similar characteristics to the other low levels of this analysis: using written communication to communicate about college; disliking "school stuff"; and not feeling supported regarding college. Additionally, participants indicated getting no feedback from youth program staff about performance and having medical problems.

STEM Persistence. The STEM-persistent group may have used many factors to build the foundations on which to continue their STEM educations. These factors include tangible items such as financial aid, scholarships, and a savings account to pay for college (32%); mental factors, including self-confidence and self-knowledge (26%); and having basic needs met, including a stable home environment and sufficient calorie intake (9%). Participant 98 expressed her challenges in STEM classes:

> When I dropped my first class in college, I felt like a failure, but my friends encouraged me to pick myself up and learn from my mistakes. I saw an improvement in my study habits as well as my grades.

The youth program served as a great foundation for many of these participants by providing a source of friends (94%), an ear to listen (78%), and a way to experience new things (91%). Nearly two thirds of the participants indicated the youth program was a foundation of their lives (62%); as participant 43 described it, “My mentors [from the program] helped me feel like I could do whatever I wanted.”

STEM persistent participant’s connections to the youth programs. These participants exhibited a deep connection to the youth program and the skills it helped them build (89%). Having graduated from high school 7 years prior, participant 137 described his lasting connection to the program: “All the trips and activities helped me view the world in a different way . . . The activities that they had us participate in, I still do till this day: kayaking, snorkeling, swimming, and researching.”

The STEM-persistent participants indicated seeking their mentors’ feedback (54%) and attributed their success to the youth programs (59%). Describing the feedback, he received from the program and mentors, participant 39 said,

> You did assignments and got grades, so there’s that; but the mentors also spoke to you about their observations, making sure you were aware if you were looking angry or sad or hurt. And the superlatives were also a nice way. Like winning Most Likely to Be a Mentor told me that I probably acted a lot like how the mentors did even though I was a student. That told me I carried myself well in the program.

Regardless of their outcomes related to STEM, these participants were invested in the activities and the mission of the program and felt supported by their interactions at the program.

Environmental support factors for STEM-persistent participants. These participants had very few negative environmental factors and many sources of support for educational efforts.

Overall, they perceived the youth program participants and staff to be like family (79%), as participant 118 described: “I love it there; always had someone to talk to and help when I needed it. They treated me as if I was family over there. Never wanted to leave, my little safe haven.” Half of these participants described ways in which they seized opportunities that came their way to grow. Participants indicated some challenges related to vague communication (37%) and changing majors partway through school (24%). As related to STEM, most people in this group had received positive feedback from a STEM educator (65%) and had constructed a STEM support network to support them in different times and ways (40%). As participant 89 described,

> All the teachers that I was close to in high school always told me to pursue a STEM career because I enjoyed it and I was good at it. My mentors in the Upward Bound Math and Science program also always encouraged me to pursue a STEM career or education.

This small group of STEM-persistent participants consisted of resourceful people who were supported in many different ways. Generally speaking, these participants were critical thinkers, resourceful, and social. They used all of their skills to progress with life.

NonSTEM persistent participant’s characteristics. Two thirds of participants were not STEM persistent, meaning they did not pursue a STEM degree or profession after high school. These participants indicated many reasons for not pursuing education in a STEM field, including being creative and artistic, having minimal experiences in STEM, and having self-doubt in STEM fields. Participant 107 described one of her most impactful experiences related to STEM being very positive: “My math teacher suggested for me to take honor-roll math classes the following year. I was always more interested in the arts, so I never took the advice of that teacher.” Some participants in this group also expressed having unsupportive families and teachers (28%), but having supportive community and youth-program networks (64%). Many in this group faced challenges relating to academic performance, specifically in STEM classes (72%), or related to lacking a foundation to support their academic efforts.

STEM resilience. This outcome represents the amount of resilience participants showed in STEM areas. This is related to how the number of obstacles and supports they encountered related to STEM. Although this is different from the STEM persistence outcome because it considers factors that have contributed or taken away from the participants' successes in STEM, the low group resembles the STEM nonpersistent group. The group included 84% of participants who felt generally unsupported by school staff and 72% who felt unsupported by their families, but who found great support in the youth program (83%). It is from the youth program that these participants built their familial and social capital.

STEM-resilient participants' characteristics. Participants who persisted in STEM fields had many different characteristics, summarized in Figure 4.6. Most noteworthy of the STEM-resilient group is that 89% mentioned having had positive STEM experiences in elementary school, and many participants indicated having taken opportunities to better themselves (47%). Participant 111 described his early influential experiences with STEM: "When I was in third and fourth grade I was part of the math club, and we participated in the Math Brain Bowl. This really excited me, and I've loved math ever since." All of the participants indicated experiencing cascading effects, starting with their experiences in the program, and resulting in a later career in STEM fields. For example, participant 41 described one of the most influential moments in his life related to STEM:

> Probably the most influential of all and what got me into the career I'm pursuing now, the summer before ninth grade was the [Program Name] with Dr. Lopez, where I was introduced to the world of 3D graphics for entertainment, using Maya and SecondLife. This single class has been the foundation of everything I have done after in STEM, and where all my efforts toward achieving a bachelor's in the field of computer engineering started.

The participants who described these kinds of cascading effects represent only 6% of the study participants, but they include 21% of the STEM-resilient participants.

STEM Persistent (n = 36)

- Most participants felt strongly connected to the youth program
- Most participants had multiple support systems, including peers in STEM fields, mentors, family members and community members

NonSTEM Persistent (n = 85)

- Some participants described feeling unsupported by teachers and family
- Some participants felt academically challanged during high school or college

Figure 4.6 Summary of characteristics differentiating participants who were persistent in STEM fields and those who were not persistent in STEM fields.

These participants perceived strong support from the youth programs, peers, and community regarding college readiness (61%), but they also described engaging in vague communication about plans after high school (30%). Participant 125 explained his experience with support: “My community, family, and friends played a hugely supportive role. Anything from advice, funding, transportation, tutoring, materials, and care packages.” In fact, 35% of participants in this group said that the youth program staff and peers were like family, as this quote from participant 56 suggests:

> The [youth program] has been an integral part of my success as a college student. My mentors and peers are like family and have helped with advice, applications, and have spent time getting to know me as a person. If it were not for the [youth program], I do not believe that I would be a candidate for a doctoral-level degree.”

This participant described the familial capital he gained through the Program staff and peers getting to know him. He also referenced the navigational capital he gained through help with applications and advice.

Two percent of this group discontinued their graduate programs because they were offered a competitive opportunity to further their professional and personal development. Almost all of the STEM-resilient participants (89%) were active youth-program participants, which indicates some connection between program activity level and perusing in STEM fields. However, note that there were also many participants who both actively engaged with the youth program and did not persist in STEM fields.

Challenges related to STEM resilience. These students expressed having trouble with academics (69%), particularly STEM-related classes (37%). For example, participant 25 described some of the support he received from a teacher:

> During eleventh grade, I was failing calculus. I hated math and I felt as though I was stupid. My math coach sat in on a class with me in the back and wrote notes. She was a math genius and she began to tutor me.

This group had a wide range of communication styles and encountered multiple challenges such as disruptive peers in the classroom (35%), self-doubt and academic challenges (65%), and life challenges that included the need to work and growing up in a tough neighborhood (80%).

Both the STEM-resilient and nonresilient groups had difficulties navigating the school systems (27% of resilient and 39% of nonresilient participants; see Figure 4.6). Participant 38 described the ways in which the program staff helped her to navigate the academic system, resulting in her graduating from a top-ranked university:

> While I was in UBMS [Upward Bound Math Science] I believe I was in tenth grade. One of the mentors believed I was smart enough to get into [a university], which I ultimately graduated from, that was ranked sixth in the nation. He believed in me more than I did, and without him I probably wouldn’t even know about the college/high school dual-enrollment program. Because of him, I was open to take more STEM classes than what were offered at a regular high school.

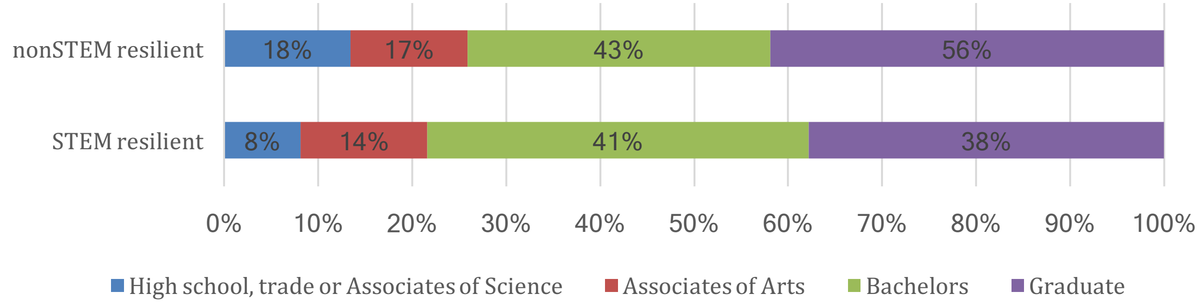

Figure 4.7. Comparison of academic persistence for STEM resilient and non-STEM resilient participants, displayed by academic achievement level. The values within each bar represent the percent of participants in each group.

However, the non-STEM-resilient participants had a more difficult time, as is evident from the graph below, showing that 78% of STEM-resilient versus 65% of non-STEM resilient participants were earning or possessed at least a 4-year degree. Although this was not statistically significant, $\chi^2(3, n = 121) = 4.70, p = .20$, there were some interesting differences between the number of participants who earned a bachelor's degree compared to those who earned a graduate degree in STEM fields. There were 4.2 more people than expected earning graduate degrees in STEM fields. There were also 2.4 more people earning less than an associate's degree in a non-STEM area compared to the expected number. This data makes me wonder whether there is something unique about the STEM-persistent participants that made them also more academically successful. There were three main reasons why participants did not pursue STEM fields, including participants seeing a disconnect between STEM fields and creativity; lacking experiences in STEM fields; and having self-doubt related to STEM ability.

Portfolio of the Nonproximal-Process Survey Participants

I defined the participants in this group using the chart in Figure 4.2. These participants all had some connection to the youth programs; however, the connection was minimal compared to those participants I classified as having the program as a proximal process. Three quarters of this group of nonproximal-process participants had earned at least a bachelor's degree. Forty percent of the total sample expressed receiving family and academic support, and 65% received support from friends. As participant 5 described her conversations, "The conversations are held quite often considering the preparation needed for college, app deadlines, financial aid deadlines, college gear day, purchases for dorms. . . My parents were persistent about letting me know what I was getting into." Participant 17 stated that "My mother made it very clear that college was the next step following high school. There was not a question and it was not up for debate." Considering that lacking support and feeling powerless covaried for many of the same participants in the qualitative analyses, I suggest either that the relationship between the two is based on communication with many different sources (e.g., family, program staff, school staff, tutors, church members) about academic progress, or academic or professional plans after high school led to participants feeling more powerful regarding their future plans, or that it is a combination of these

Lacking support. Six of the participants in this group (30%) indicated not having had any support throughout high school, as expressed by participant 14: "In a way I felt bad at times because I knew they had supporting parents who pushed them to do good and strive for the best, while in my case I didn't get that." These six individuals represent 25% of all survey participants who indicated they had no support during high school, yet the nonproximal-process group represented only about 10% of the whole group. Although there seemed to be a higher prevalence among nonproximal-process participants of lacking support during high school when compared to proximal participants, the Cramer's V was not significant, $\chi^2(3, n = 120) = 5.81, p = .12$.

Communication. Some of these same individuals described feeling powerless (17%) and disengaged in conversations about college during high school (12%). Half of participants in the nonproximal-process group described the communication about pursuing more education after high school as spoken and infrequent. As student 3 stated, “There wasn’t much plans talked about.” Student 7 explained in more detail: “I wasn't ready to take on the world and didn't know the first step toward it. We rarely had any conversations . . . about how important it is to have plans after high school.” According to the coding of the qualitative data, it also seems that academic persistence aligns with the type of communication—those who engaged in detailed conversation about college had higher levels of education compared to those who engaged in vague conversation. At some point during their education, 60% of the participants with low engagement indicated they had taken a break in their postsecondary education because of life events (e.g., having an employment or educational opportunity, needing to work, having a child, experiencing a loss in the family).

College as an expectation. Within the group who indicated that college was an expectation in their household, there were two extremes. Some participants described feeling supported throughout the college processes by their community, school, or family; but others did not describe having the resources necessary to navigate the academic system. Thirty percent of participants indicated that they had sufficient familial support and guidance toward the college application process. These participants engaged in conversations in which they learned about the college process, and they had involved parents. Others, however, received messages, explicit and otherwise, that going to college would not be as easy. It was much more difficult for those participants who lacked in academic, financial, and emotional/familial support to earn a 4-year degree or higher. This group represented 31% of all the participants who had low program-engagement levels.

Poetic Analysis of All Survey Participants

In this section, I present samples of poetic analyses to bring additional depth to the counternarratives of the out-of-schooltime program participants. These poems intend to bring light to a story that differs from the story most commonly told in the majoritarian society about students of color from low income. These poems are the actual words of the participants, with additional emphasis through some added phrases. I also did this to provide context for the participants' experience to come to life. I number each poem to distinguish them. Also, before each poem, I provided a description of how I developed the poem and a brief analysis. See Appendix F for a list of quotes that informed the poetic analyses and the overall findings.

Poem 1—Social development and new experiences. I developed this poem by starting with two participants' responses. Using my own narrative, I expanded the explanation of the relationship between the participants' social challenges and the benefits they gained from the program. Through these poems, the participants describe their sense of community and belonging with the program, and how that experience led to their building navigational and aspirational capital through new experiences.

. . .

I was very **antisocial growing up** and
was bullied for a good portion of my life.
When I got to middle school *this changed* however not drastically.
I stuck out because of my **interests in science**.
I wanted to join the program. I wanted to belong to somewhere,to something.

The program opened me to a new world to me.
I **participated in events** that
I'd never *dreamed* of doing before.
I learned and **explored new territories** that
opened my eyes to the *great opportunities in this world*.

. . .

Poem 2—Value of self and others. I developed this poem by starting with two participants' responses. In these excerpts, the participants describe the ways in which the program supported them by contributing to their social and familial capitals. Participants learned to value themselves, showing resistant capital, and to interact with each other regardless of differences (social and familial capital).

. . .

The program showed me the importance of family and friends,
it showed me that **I was worth**
more than *what others told me*.
I consider myself to be a
drifter sometimes,
but the **mentors worked on me**.
They **challenged me** to do better
(*I love a good challenge*).
The [program] *challenged us to interact*,
love and honor each other.
We learned from each other and supported each other.

We were all *different in our own ways*, but it worked.

. . .

Poem 3—Future planning and achievements. This poem is a composite of the responses of two participants' responses with my own analysis of participants' learnings. This artistic text highlights the participants' realizations of the value of planning for the future and the value of school. These participants described knowing themselves and learning about themselves through the program. This shows participants building resilient capital as they grow stronger from the inside.

. . .

It taught me that being **aware** of your **future** and
present is *the most important thing you can do*.
Somehow the program made me *enjoy learning*!
I **learned about myself**, including what kinds of characteristics I might like in a college.
Because of the program **I recognize myself**.
I know *who I am*, *what I stand for*, and
I don't have to second guess it.
I suffer a lot from low self-esteem but
after high school and the program, I feel as though
my self-esteem has risen and **I feel more confident.**
Being with so many high **achieving** and **inspirational** individuals
from the program really pushed me.
I was ***surrounded*** by *all of the young people* who were
grade A students and me. . .

. . .

Poem 4—On support, now as a college graduate. This poem represents one participant's words. In these words, there is pain and regret and wistfulness for a different past. The reasons this participant may not have had the support he needed are plentiful, including that his parents could not provide guidance regarding college because equitable educational opportunities are limited to people of color (Nieto & Bode, 2012). Or the lacking support and guidance as a result of his parents working multiple jobs because they earn lower wages (Patten, 2016), receive less favorable interest rates (Boehm, Thistle, & Schlottmann, 2006), and receive fewer professional-development opportunities than their White peers (Killewald, 2013).

. . .

I *constantly look back and think* . . . **I have the potential**
I always did,
just **never** the *support* or *lending hand* leading me in the *right path*.

. . .

Poem 5—Support and guidance of mentors. The major theme across almost all participants was feeling supported and building familial capital with the mentors from the program. Mentors served as participants' source of power and inspiration to do better. They supported participants in ways the participants did not know they had until after the contact became less frequent. I created this poem by combining three participants, and then adding my own elaborations in relation to details around support.

. . .

I didn't realize it until now,
but I currently feel **lost in my decision** for my master's or choice in career.

In high school **I was confident** in everything because
I was able to **bounce my ideas off of a caring ear**.
My **mentors [from the program] helped** me feel like
I could do whatever I wanted . . .
Now, I realize even though **I can be that powerful** girl I was 5 years ago,
I am wishing, looking back and *wondering*, is theresupport and encouragement in my current
educational experiences *compared to the depth* of support ofmy past **mentors**.
The [program] staff,
believed in
me and
made me feel like
I could do anything
no matter what.
They are my cheerleaders and soul supporters no matter what. **I made it** because of God
guiding me, and **because of** what I was given from **the program.**

. . .

Summary. These poems represent the participants' voices and their emotions around the major themes in this data. These poems highlight the ways in which participants gained CCW and the importance of support. Participants with parents who were unable to provide support because of the effects of systemic inequities particularly need other kinds of support.

Study 2: Discussion

This study was the second of a three-part research project. In this study, I used mixed methods to gain an understanding of what factors contributed to participants' academic and

STEM outcomes and amount of resilience. The questions guiding this research were “What out-of-schooltime program elements were related to participants’ academic and STEM outcomes?” and “For which participants was the youth program a proximal process, based on the academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?”

Study 2: Summary of Study Methodology

I collected data using a qualitative and quantitative survey from 121 youth-program alumni. These participants were primarily low-income, high-school students of color attending Title I schools in a large city. The participants had graduated from high school between 1 year and 15 years before they took the survey.

I analyzed the data using correlations, multiple logistic regression, descriptive analysis, and qualitative coding analyses. I used the CCW, CRT, and bioecology frameworks, and considered resilience concepts throughout all aspects of the analyses. The bioecology framework is evident through the participant portfolios because they include a description of many aspects of participants’ environments. Through the academic outcomes, STEM outcomes, and recommendations, I describe the ways in which the program did or future programs can help their participants to build CCW and resilience.

Study 2: Overview of Theoretical Framing

Through this research, I strive to contribute to the movement to reverse the deficit narrative about students of color by consistently reflecting on my CRT theoretical framework and highlighting the ways in which the findings support the tenets of CRT. I described each of the tenets and included in parentheses how I referred to them in the rest of the discussion. The five tenets of the CRT framework I used for this research are: (a) Identity is defined by multiple forms of subordination (intersectionality); (b) CRT questions the meritocracy and objectivity of educational systems; this means questioning how education does not provide equal access and is bound in a myriad of systemic, structural biases that prevent equitable education. There is a belief that if people "worked harder," they can become educated, but this is a belief that ignores how systemic inequality operates in our schools, communities, and society (questioning meritocracy); (c) CRT supports a transformative response rooted in social justice (social justice response); (d) People of color experience life differently than White people and those experiences should be shared as lessons to others, often through the voice of counternarratives (counternarratives); (e) CRT takes a multidisciplinary approach to confronting discrimination that includes examining how racism may be viewed through more than one discipline (i.e., the educational discipline in general and the science discipline specifically, which is a multidisciplinary approach).

I acknowledge that complex factors contribute to these outcomes, many of which are completely out of the participants' control. Some possible examples of these factors may also include the adults in their families needing to work more and longer hours than White families because they get paid lower wages, or parents and guardians being unable to guide their child through the college-application process because of the inequitable schooling practices in the United States (Nieto & Bode, 2012). Although this point is not my focus, I do not ignore the fact that some students struggled with finding sufficient financial and emotional support—particularly from their teachers, parents, or guardians—or with feeling they were good enough or belonged in the university system. Mentoring and out-of-schooltime programs provide support for students of color because of the multitude of external barriers such as these.

Study 2: Overview of Findings

I addressed two research questions in this research. For my first research question, “What out-of-schooltime program elements were related to participants’ academic and STEM outcomes?” I conducted linear regressions that had no significant results; therefore, I focus my attention on the qualitative and descriptive findings as related to the second research question: “For which participants was the youth program a proximal process, based on the academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?”

I focus this research on showing the ways in which participants of the out-of-schooltime program developed CCW, as defined by Yosso (2005), particularly in response to discrimination and as an aid in navigating the school and university systems. Society might place restrictive stereotypes on people for their skin color, or socioeconomic status, which is evident through their having to work long hours through school. The participants in my study experienced the consequences of discrimination from society through discrimination and unfair treatment. I introduced these concepts in this study, but go into more detail regarding discriminatory experiences in the third and final study in this research project. Simultaneously, many of the participants in my study also exhibited aspects of CCW and overall strength in their ability to navigate multiple systems that were not constructed with *people like them* as the intended audience or users. For instance, the schooling system in the United States and particularly STEM education often takes a color-blind approach to the content, assuming that culture does not influence STEM content. Yet, research shows that STEM is not acultural and provides framework for addressing that issue. This aligns with the questioned colorblind and counternarrative CRT tenets (Bang & Medin, 2010).

The majority of participants from this study flourished through these challenging systems and earned or were earning at least a bachelor's degree at the time of data collection. Most participants aspired to earn a graduate degree; shared experiences, resources, and knowledge with their peers. Through these accomplishments, aspirations, and personal stories displayed aspirational, navigational, and social capital. Additionally, participants sharing their knowledge and stories with peers supports the counternarrative tenet of CRT because it provides ideas of other possible ways to navigate the systems. Luna, Evans, and Davis (2013) found similar results in their study of the relationship between academic aspirations and participation in a community-based program for Latin@ students. Their study participants described many instances of learning from new experiences and finding support in many places, including the youth program, their families, and their communities (familial capital). Additionally, they spoke multiple languages, which is linguistic capital. Participants expressed great appreciation for the program and the experiences with their mentors, demonstrating social and familial capital, which aligns with prior research (e.g., Salas, Aragon, Alandejani, & Timpson, 2014).

In the following sections, I discuss my findings on the participants as they relate to prior research and the limitations of the current research. I analyzed the quantitative data using correlations and multiple logistic regressions. I found significant correlations between outcome variables such that academic persistence and academic resilience were highly correlated, and the STEM resilience and STEM persistence variables were also highly correlated. I analyzed qualitative data by coding for the presence of specific concepts and factors. Because of the complex nature of these outcomes, I have combined my qualitative and quantitative findings throughout this discussion. The majority of my quantitative analyses were statistically insignificant; therefore, unless otherwise noted, the discussion is regarding qualitative findings.

For all of the findings discussion, I refer to the actively-engaged participants of the out-of-schooltime programs (n = 100). In the Academic Outcomes section, I describe the trends and factors that were more common in participants, grouped by academic achievement levels. Then I describe the trends in participants' experiences, grouped by their STEM persistence or lack thereof. Both the academic and STEM outcomes are important components of this research because of my focus on how an out-of-schooltime program supports asset building in underrepresented students and contributes to their successes in earning advanced degrees overall and more specifically in the STEM fields.

Support for Active Participants, as Related to Academic Outcomes

Overall, a number of factors seemed to be important for program participants to earn at least a 4-year degree (n=69). From the CCW framework, participants most widely described familial and social capital. Although some prior research indicated that students need only one supportive person to be resilient through life (Werner & Smith, 1992), many participants in the current study described multiple venues of support encouraged and actively engaged with them regarding their plans after high school. In fact, all of the participants earning graduate degrees (n=25) indicated multiple sources of support regarding their academics, including parental involvement in the college application process.

This finding also supports prior research indicating the value of having a community when Black males navigate the college-going process (Jayakumar, Vue, & Allen, 2013). The community provided opportunities for participants to learn about life after high school from multiple perspectives. The presence of a community also translates into the participants having multiple resources from whom to ask questions about college, and subsequently increasing their social, navigational, aspirational, and resistant capital. In this study, one common college and general-support venue was the youth-program staff and peers. Liou, Antrop-González, and Cooper (2009) obtained similar findings in that students of color used multiple resources to learn the skills to succeed in college, and they built on their CCW to be able to successfully navigate the college-going process (Martinez, 2012).

The combination of these strong support mechanisms leads to participants having more opportunities than if their support venues were limited. This is familial capital in participants who have multiple sources of support, which leads to social capital as reflected in participants sharing experiences with each other. Some examples of activities that often seemed to make a difference in the academically successful participants' lives included their having academic pride, and also their exposure to STEM during elementary school. Navigational and aspirational capital became stronger in the participants' lives when they saw others as role models and heard others' stories of how they navigated life. This is also an activity supported by CRT counternarrative tenet as it brings value to the participants' experiences, distinguishes their experiences from the white experience, and strengthens the communities of color ability to overcome the barriers of discrimination.

Communication, as Related to Academic Outcomes

Going into this research, I had the assumption that participants build their academic support systems through communication about college between the participant and teachers, family members, peers, mentors, or any other caring adult. In my analyses, I found communication styles vary across outcomes, with minimal patterns related to which communication style may be better than others as the young adult navigates high school. Instead, the overarching theme was that when participants only engaged in vague communication about college with their social and familial support, they felt helpless, but specific or intentional conversation about college made participants feel better prepared to succeed in college. Contrary to the white dominant belief systems that assert the importance of parents' knowledge about college-going experiences to support their child into college, I found in this study that students found other community cultural support to attend college.

Even though the participants' parents and guardians did not know about the U.S. university systems, they did know about life skills and techniques for navigating systems; participants described the efforts their parents made to ensure participants could access the necessary support to navigate the college-going process. In many cases, parents and participants found the support they needed to understand the university systems in the mentors and activities provided by the programs. This supports the value of linguistic capital and navigational capital, and the counternarrative and multidisciplinary tenets of CRT because participants found resources in multiple areas, including hearing the stories of successes and challenges.

These conditions resonate with the CCW framework. Participants who had earned at least a bachelor's degree gained social and familial capital through their interactions with individuals who invested in them by inquiring about the participant's plans after high school. Having people ask questions of the participants about the self or their plans for the future after high school was an essential part of the self-reflection process that contributed to participants' self-growth and aspirational capital. Additionally, these individuals became part of the participants' social networks that provided connections that led to opportunity structures, an outcome that again is similar to prior research (e.g., Liou, Antrop-González, & Cooper, 2009). This also aligns with the multidisciplinary tenet of CRT because mentors represent all areas of STEM fields and have opportunities to modify and contribute to their curricula.

Challenges Faced by Active Participants Who Earned or Were Earning at Least a Bachelor's Degree

This group of participants did not progress through their college experiences without challenges. They did not feel supported enough in navigating the academic or political systems. Additionally, many in this group felt supported financially with scholarships, but they still had to work in part- and full-time positions to maintain financial stability throughout school. All in this group eventually graduated or had been persistent thus far in higher education, which indicates that they continue to build navigational capital. Many participants in this group indicated that they had learned life skills and understood personal strengths and weaknesses. This contributes to the participants' linguistic and resistant capital.

Participants for Whom the Program was a Proximal Process Earning Less than a Bachelor's Degree

The main themes for participants who had not earned a bachelor's degree and were working on their associate's degrees or not working on a degree at all was a feeling of lack of support. Some also experienced medical problems that, combined with lack of support, would be enough to prevent many people from persisting in school. Interestingly, these participants also did not recall receiving feedback from the youth programs. Hearing and incorporating feedback connect to having a growth mindset, which research has linked to academic success and seems to reduce the effects of poverty (Claro, Paunesku, & Dweck, 2015). Receiving feedback is also a key characteristic in understanding the ecology of the program itself. In this study some participants, more commonly those who had earned bachelor's degrees, did feel the program provided feedback to them. One participant explained:

> I was informed by the mentors; they will help me in areas where I needed to improve for my future coming in the real world. I love the fact that they will see the areas where we needed to improve and not feel offended at all.

Program staff providing participants with more consistent and intentional feedback may elicit a positive change for the program participants.

STEM Outcomes for Participants for Whom the Program was a Proximal Process

In addition to college readiness, the program in the current study was also highly focused on exposing participants to STEM content, career fields, and role models in an effort to increase the number of people of color who pursue a STEM career. One third of the participants pursued a STEM degree or career field. The majority of these participants described having aspects of a strong STEM identity. For example, participants mentioned recognition for doing well in a STEM activity or having a young experience related to STEM. The components of having a STEM identity reflect prior research, thus validating the need for individuals pursuing STEM to have a strong STEM identity (Carlone & Johnson, 2007). These participants also felt supported by the program and teachers, which aligns with the multidisciplinary tenet of CRT by providing participants with multiple venues through which to explore and learn about STEM. Having the opportunity to learn STEM in school, through the youth programs, and through field trips to regional STEM, informal learning centers contributed to participants' understanding of the ways in which STEM fields work together. Feeling supported contributes to the sense of belonging, which also connects to the participants' STEM identity.

Interestingly, those who pursued STEM degrees and career fields were more statistically likely to earn higher degrees beyond postbaccalaureate, compared to those who did not pursue STEM fields. Nearly all (90%) of these participants describe their processes of considering finances in making these decisions regarding their advanced degrees. One participant explains:

“[I] just completed my second degree in nursing and will begin the process of furthering my degree once I find employment that offers tuition reimbursement.” And another described the ways in which finances drove her decisions of what degree to pursue: “I did not like the program I was in, but had taken it since I had received a Fellowship and stipend.” Because of the program’s goals to reduce disparities in who pursues STEM degrees, STEM educators should understand the factors that contribute to people’s choices to pursue a STEM degree. This is supported by prior research, which found finances to be a determining factor in graduate students’ decisions to pursue an advanced geosciences degree (Levine, Gonzalez, Cole, Fuhrman, & Le Floch, 2007).

Limitations and Strengths

One limitation of this research was that the sample purposefully focused on alumni of a youth program. Also, the majority of the population was Black and Latin@, with a small percentage of White and Asian people. The participants were primarily low-income and first-generation, college-bound students. For all of these reasons, the study was not representative of the general population, which was intentional because my purpose was to examine the educational experiences of underrepresented youth. I would also recommend that future research includes a control group in order to make stronger claims about the effect of mentoring programs. In addition, the survey data I collected was retrospective, with some participants being asked to recall experiences from as long as 15 years ago, and others recalling only to 6 months prior. The final limitation is in the survey design. Although I did pilot testing, four questions still did not provide me with the data I anticipated. Therefore, those survey data were often unused.

For those using this survey in the future, attention should be paid to the notations implied by the word choice. For example, in my survey, I asked participants to describe the ways in which the program challenged them. In reading this question, many participants seemed to associate challenge with being negative; however, I meant it in a positive way, synonymous with growth and development. A second question to note, which some people understood well and others completely missed, was one that asked participants to describe three critical moments in STEM that influenced their opinions of the field. Many participants indicated that they had no experiences in STEM. This was surprising to me, given that the majority of those participants were active members of the Upward Bound Math Science (UBMS) program at an informal science education center.

Recommendations for Practice in an Out-of-Schooltime Program Setting and for Developing Community Cultural Wealth

Because of the value I place on applying the research and my deep connection to out-of-schooltime programming, I have generated a number of examples to help put this information into practice in a formal or informal educational setting and address the multidisciplinary tenet of CRT by engaging the participant in multiple ways. This research showed that the most important trend was for participants to have multiple support mechanisms, through which to develop strong familial and social capital. Youth programs can help facilitate a support system that includes individuals who are in a potential position of great influence for each participant (e.g., family members, community leaders, sports coaches, peers, teachers). To form the support network, the youth program staff may sporadically reach out to each of those individuals and compare observations of the participant. All study participants who indicated having multiple influential individuals in their lives all had academic outcomes of a bachelor’s degree or higher. The majority of participants who had only one person supporting them earned at least a bachelor’s degree.

Developing academic pride and professionalism. Programs may also allow all participants opportunities to be proud of an academic-related accomplishment. This can happen through program staff reviewing academic progress and rewarding academic gains (not grades, but improvements; for those getting straight As, I suggest encouraging students to maintain the straight As to get the reward or providing students with other leadership opportunities or special projects to provide them with more stimulation if possible), or participants having time during the program to share or journal on something they were proud of that week. Some participants recall reviewing their grades with program staff and others do not. During my time as a staff member, the staff actively requested grade reports from students and at some points had a partnership with the school district to obtain the grade reports from the district directly.

Reviewing academic progress builds navigational capital through discussions with the participants about their experiences and how they might approach similar situations differently in the future. These conversations may also lead to discussions about future career plans and goals, which would build on aspirational capital and support the counternarrative tenets of CRT. One participant describes her experience:

> In high school I was confident in everything because I was able to bounce my ideas off of a caring ear. My mentors helped me feel like I could do whatever I wanted. . . . Now, I realize even though I can be that powerful girl I was five years ago, I seek the support and encouragement of my mentors.

Aspirational capital and the counternarrative are tightly related in that the counternarrative helps to build aspirational capital, particularly in this case. The participants share their dreams and future goals, which builds excitement and aspirational capital. Annual family events also provide opportunities to show participants their strengths. This time can support academic or socio-emotional learning,[7] and contributes to the participants' familial and aspirational capital.

Participants also thrive from opportunities to gain professional and life skills. A perfect example of this is a (paid) internship or professional learning opportunity. These hands-on experiences allow for participants to learn professionalism (navigational capital) and apply their knowledge in new settings (multidisciplinary CRT tenet). This provides an opportunity for participants to learn about the career field and develop role models, which also builds aspirational and resistant capital. One participant describes the three major STEM events in her life: "During an internship during high school I was encouraged by the professionals that I worked with to pursue an engineering degree. Also, through the museum I received a scholarship that encouraged me to dedicate my studies in engineering." Additionally, when participants engage in an internship, they may use the opportunity to explore career options, which fosters an ideal environment for conversations about the future (aspirational capital). Last, in addition to learning about future life options, participants need to be prepared to navigate the world (navigational capital). The youth participants in this study encountered many difficult scenarios that were made more difficult because of the differences between middle-class and upper-class cultures and the working-class culture. To prepare participants for those difficult conversations and situations, the youth program needs to be a brave space where participants can feel safe being vulnerable to ask a variety of questions.

Creating a brave space. Staff develop the brave sense of the space through extended and frequent contact between the participants and the space, in which the participants have

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[7] Socioemotional learning (SEL) is a process of learning that incorporates skills and knowledge necessary for expressing emotion, building relationships and making smart choices.

opportunities to reflect and build their own counternarratives. Youth program staff can take participants through scenarios to practice having difficult conversations and advocating for themselves during college. “I had help from museum staff . . . regarding financial aid. Because my parents were undocumented and my grandmother claimed me on her taxes, I had issues with financial aid every year and every year they would decrease my aid.” This activity supports the participants’ navigational capital and the counternarrative tenet in CRT by providing the participant with opportunities to work through difficult scenarios in a low-risk environment. These conversations may include professors, roommates, resident advisors, security guards, financial-aid officers, or potential or current managers. It is also important that participants’ basic needs are met; so having a staff- person’s support in finding and using free resources is beneficial for participants to experience positive academic outcomes.

Building STEM persistence. To achieve STEM-persistent individuals, there were common factors found in the program where participants were provided with positive STEM recognition and positive STEM experiences at a young age. Youth programs can create opportunities for positive STEM recognition in the same ways described above, through awards. Programs could also host a symposium at the end of their training, and invite peers and local experts to critique participants. One participant described how his family engaged with the program: “We would have family night and get trophies and certificate would be given out to participate with good academic and behavior. My mom would gather my little brothers and bring everyone because it was in the [informal STEM learning center]” Youth programs, similar to the one I studied for this research, can provide opportunities for participants to bring their family members to the program for a day, and ensure that the program includes fun STEM activities to engage the young family members. These diverse activities and approaches contribute to the multidisciplinary approach supported by CRT because they are structured around application of STEM concepts to reality which typically includes concepts from many STEM fields.

Conclusions

Overall, this research aligns with the growing information resources that support out-of-schooltime programs that benefit youth of color through building CCW. The researched program included staff from with many educational backgrounds including STEM areas and social sciences, who each contribute to the participants learning experiences and support efforts to minimize the participants' experiences with discrimination. The majority of these study participants prospered and shared stories of their CCW, particularly that which they gained from the youth programs. Additionally, participants described the great amount of familial and social capital and the value of that capital in helping them navigate the academic systems. Participants gained life skills and social skills from their engagement in the program, which contributed to their overall level of CCW.

This research supports the value of familial and social capital for participants to earn postsecondary degrees. The most academically successful participants were supported from multiple directions in consistent manners. Academically successful participants showed strong familial and social support, which they transitioned into navigational and resistant capital. The participants' capital in the respective areas was strengthened by their multitude of opportunities to grow and exhibit pride, and their needs to explore different venues in order to grow or shine. Similarly, in STEM, participants need opportunities to explore and enjoy STEM. Living in US society without those opportunities, they do not develop confidence in STEM. These opportunities also enhance participants' aspirational capital, providing them with diverse snippets of potential future selves and supporting the counternarrative tenet of CRT. The combined effect of participants having confidence and pride in STEM, with the effect of participants having new experiences creates an environment in which participants can create their own stories to guide their futures.

Future Research

Future potential research to build on the current study includes gaining a better understanding of how different people experience the out-of-schooltime programs. For example, what benefits do English language learners who immigrate to the United States without knowing English gain from out-of-schooltime program participation? What are the effects on participants who were disengaged in the program, for their own personal reasons or because they did not feel they fit into the program?

Another interesting topic to expand on the concept of CCW would be to increase our understanding of how the parents and families benefit from their children participating in out-of-schooltime programs, if at all. This information would contribute to our understanding of the bioecological and CCW frameworks and in turn increase our understanding of the secondary effects of out-of-schooltime programs. I would be interested to explore the growth mindset as it relates to participation in out-of-schooltime programs. Relative to STEM, I found that STEM-persistent participants earned higher degrees. Further research would be beneficial, particularly if it focused on understanding the relation between pursuing a STEM field and having a higher degree, and whether that association relates to individual motivational factors or the field's needs and level of competition. This explanation would be fascinating, particularly viewed through a CCW lens.

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CHAPTER 5: THE RELATION BETWEEN EXPERIENCES WITH DISCRIMINATION AND ACADEMIC OUTCOMES FOR UNDERREPRESENTED YOUTH—STUDY 3[8]

To keep up with other countries' technological developments, the United States should increase the representation of underrepresented populations in the STEM disciplines. Doing this will better help to address the demands of the growing US workforce and provide a more diverse perspective in the STEM fields (STEM: Education for Global Leadership, 2015). Because of discrepancies in school resources and opportunities for learning, Black, Latin@, and Native American students starting as early as fourth grade achieve far below White and Asian students (Aud, Fox, & KewalRamani, 2010). These disparities grow as students graduate from high school and enter college (George & Malcom, 2011; see Appendix B). These data reveal major disparities in all of the STEM degrees earned, and even more broadly in doctoral degrees awarded.

When one considers the intersectionality (the combined effect of multiple forms or systems of oppression) of ethnic and gender identities, researchers found larger gaps than when one considers only one identity. Hill, Corbett, and St. Rose (2010) found that Black men and women and Latino men earned more degrees in computer sciences when compared to American Indian/Alaskan Native men and women and to Latina and American Indian/Alaskan Native women. Additionally, Black and Latino men earned more degrees in engineering when compared to other groups. Many factors contribute to persisting inequalities between the academic achievements of underrepresented groups and the dominant population.

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[8] Some of the introductory text is very similar to or exactly the same as a different part in the dissertation, but will be made unique prior to publication.

One potential explanation for these disparities is the racism and discrimination that is infused into many aspects of the education systems. What are the differences in quality in the education that students of color often receive compared to White students? When students of color enter a classroom, they do not engage with texts or content that accurately represents their histories or places strong values on their cultures (Zamudio et al., 2011). Teachers and school staff rarely greet students of color with expectations to attend college. Primarily, teachers greet students of color with (often) unconscious judgments of the students based on their identities before the teachers get to know them (Tatum, 2003). Consistently for the past 30 years, research has found that, regardless of teachers' races or their inclinations about racism, they often have many biases that inadvertently emerge through their interactions with students (e.g., Eberhardt & Fiske, 1998; Lawrence, 1987; Sparks, 2015). Unless individuals actively fight racism, biases emerge through (what are considered to be) normal daily behaviors. Once these students join the workforce, racism persists. Specifically, in STEM fields, racism influences the underrepresented population's ability to form these strong STEM identities. This reality makes it challenging for these students to persist in STEM fields, because it prevents people of color from developing strong social support from professional peers (Carlone & Johnson, 2007).

Although racism has greatly changed since the civil rights era, it is still very much present in the modern-day United States. The participants in this study had experienced racism in their educational histories. They also had been targets of racism in everyday life, which may have influenced their life paths. There are many different forms of racism, each of which fit into one or more of four categories, as described by Scheurich and Young (1997): civilizational, societal, institutional, and individual. *Civilizational racism* refers to the assumptions humans make based on the White-lived experience. Through this mentality, the White experience is the so-called normal experience for all individuals. Things are done *the way they were meant to be,* and these traditions are not questioned.

The next two levels, *societal* and *institutional racism*, are the assumptions that control society and the rules that regulate the institutions that harm people of color. Last, *individual racism* includes overt and covert racism. Overt (also referred to as *old-fashioned*) racism is when a White individual openly does or says something that damages or oppresses a person of color. Covert racism (also called microaggressions, or modern racism) is the practice of someone doing something privately that hurts a person of color, but blaming the action on something else (for example, not hiring someone because the person does not have reliable transportation, which is discriminatory against people with low SES). People of color experience obstacles related to the different levels of racism.

All people have a number of identities, such as race, gender, religion, and income level. People use these identities to describe themselves and to describe people around them. The descriptions that people use for themselves may or may not be the institutional labels used to describe them. All of these identities influence people’s daily lives in an intertwined manner. Crenshaw (1991) defined *intersectionality* as the connected nature of people’s identities. This concept also emphasizes that people have different needs and interests based on their identities and the intersection of their identities.

Understanding intersectionality was important for this research because the participants had many marginalized identities that influenced how they experienced daily life events. These identities also shaped the stereotypes that participants had lived with for their whole lives. Many times individuals are perceived to only represent one single part of their identities, which simplifies a person’s identity. This singular focus is common for those who have multiple oppressed identities (e.g., Black woman) and are asked to respond to inquiries representing one specified identity group (e.g., speak as a woman, or speak as a Black person, but not speak as a Black woman). Intersectionality requires a conscious awareness of people of color's multifaceted identities and how oppression is not simply one-dimensional.

Racism leads to stereotyping and grouping people with others who may be different from them (Nieto & Bode, 2012). For example, although African American and Caribbean American individuals both typically have Black skin color, they have different cultural backgrounds and practices. The stereotypes often place individuals into associated groups of people who are then treated differently in many settings, including classrooms. Steele (1997) described *stereotype threat* as stereotypes that influence groups' performances. Knowledge of this stereotype may then negatively influence the stereotyped person's performance on certain tasks. This is an example of societal racism because the ways in which individuals are *supposed* to act do not align with the reality of the way individuals are. However, individuals are influenced on personal and community levels to act according to the stereotypes. And even more detrimental, the individuals may believe the stereotypes to be the truth (Steele, 2010). For example, picture a young Black male who has gotten the message from society, his high school, and family that Black men do not go to college, but rather go into the military because that is how other men in the community have been successful. Despite these messages directing him away from college, he chooses to pursue college because of his involvement in a college readiness program. The young man begins college and does not do well his first semester. His mind fills with self-doubt, constantly pondering if all of those messages and stereotypes he heard in high school could be correct. One participant expressed this:

> It was very evident how adamant I was about college. . . . The problem there was my guardian didn't care and probably didn't want me to go to college. She was

> adamant about the military in fact and [she] saw all of the collegiate opportunities in my life as ways to keep my grades up and get higher ranking upon entering the military. . . . in other words, she saw good grades as a way for more money. When I finally got to college, and failed a few classes, I doubted my ability to earn my bachelors. Yet, I have almost made it-I will graduate next semester.

It can be challenging to overcome the effects of stereotypes for individuals, even if they make just one mistake. The participant above felt great support from the college readiness program, staff, and peers and was able to use that support to navigate his college career.

For people who interact with someone who is experiencing stereotype threat, there are a number of ways to support the individual. For instance, one might emphasize the person's high standards and ability to excel by providing feedback that includes a focus on strengths, weaknesses, and concrete examples (Cohen, Steele, & Ross, 1999). The next two approaches involve changing the person's perspective. One can reframe the task by describing it with words that are not associated with specific social identities, or by placing a phrase at the top of the task (e.g., an assessment) noting that the task is unbiased (Quinn & Spencer, 2001; Spencer, Steele, & Quinn, 1999). This may be reminding participants of other people of color or women who succeeded in these contexts. One may also deemphasize threatened identities by avoiding requests for demographic information that includes associated stereotypes (Ambady, Paik, Steele, Owen-Smith, & Mitchell, 2004; Rosenthal, Crisp, & Suen, 2007).

The last two strategies for support incorporate external factors of role models and attributions to challenges. One could provide role models by matching the test administrator's identity to the participant's stereotyped identity; for example, have a woman administer a math test because women stereotypically do not perform as well in math as men (Blanton, Crocker, & Miller, 2000). The other approach involves providing external attributions for challenges, highlighting external factors that may contribute to difficulties (Ben-Zeev, Fein, & Inzlicht, 2005). An example of external attributions is a nonnative-speaking student being made fun of for his accent, and his friend saying, “They’re just jealous of your accent!” These methods attempt to minimize the negative self-perceptions and create opportunities for individuals to see themselves being successful and high achievers.

In the ways previously listed, many of the student activities and student-mentor interactions in out-of-schooltime programs provide support to those who may experience stereotype threat. Although my research is not directly related to stereotype threat, this is one of the ways in which racism is pertinent in US society. I include the details above as research-supported methods that help to reduce the effects of stereotyping, which inherently also reduces the effects of racism. Next, I will describe in more detail the ways mentoring can support participants who have experienced discrimination.

Mentoring As a Tool for Countering the Effects of Discrimination

Research supports positive changes in mentees’ self-esteem, social skills, sense of belonging (Karcher, 2005), ethnic identity, and educational achievement (Fruiht & Wray-Lake, 2013; Hurd, Sanchez, Zimmerman, & Caldwell, 2012) while students engage in mentoring programs. Research has shown mentoring to increase academic achievement, regardless of socio-economic status, parental support, peer influence, or school resources (Erickson, McDonald, & Elder, 2009). Mentoring is a key component of the out-of-schooltime program I used for this research.

Mentoring is often a means for developing the character and the competencies underrepresented youth need to successfully transition into adulthood (Roth & Brooks-Gunn, 1998). As Thompson and Kelly-Vance (2001) pointed out, mentors provide the extra individual attention that underrepresented youth need to navigate societal systems and act as a positive role model to help reduce academic risk factors. Youth who might not otherwise have the support or skills to navigate school successfully, and achieve academically, gain such resources through mentoring relationships and the programs to which they belong.

Specific components beneficial to underrepresented youth and their academic achievement have to do with the support and navigational skills participants gain through mentoring and its programming. Often, underrepresented youth populations lack the skills necessary to navigate academic systems, given the current racist academic structures in the United States. Through a mentoring program, youth can build social supports and feel safe through self-development. By having social supports, youth can gain great psychological benefits that build their confidence in school, strengthen their academic abilities, and provide them with access and knowledge regarding attainment of academic success (Hurd et al., 2012). The presence of a mentor increased positive long-term educational success. This association was mediated by improved self-perceptions of academic success and increased racial identity (Hurd et al., 2012).

Description of the Out-of-Schooltime Program

The out-of-schooltime program of focus is located in the southeastern United States, near the beach. This program strives to increase underrepresented youths' enrollment in postsecondary degree programs (specifically in STEM fields) through mentoring, workshops on life skills, career opportunities, STEM-focused classes, field trips, and college-readiness activities. The program staff serves as a liaison between the school system, the youth participant, and the guardian. Staff and peers mentor participants in a formal, multiyear, goal-oriented, group-mentoring approach. I summarize the program structure and activities in Table 5.1.

Table 5.1

Activities Included in Academic-Year and Summer Components of the Out-of-Schooltime Program

Academic year (28 Saturdays)	Summer (6 weeks, 5 days/week)
Science Saturday academy	30-day intensive marine-science program
College preparation classes	Overnight trip
College tours (day and overnight trips)	Mentoring
Career fairs	2 days/week of beach exploratory learning
Tutoring	Weekly STEM-related field trips on Fridays
STEM-related field trips	Project-based learning
Mentoring	Team building
Team building	School credit for participation
Family nights	Research symposium

The grant regulations structure the recruitment efforts because the US Department of Education TRiO Programs is the primary source of funding. The program staff recruits participants from Title I schools. Most participants begin the program the summer before their first year of high school and continue in the program throughout their 4 years of high school. Grant regulations require for two-thirds of the participants to be both low income and first-generation college bound. The program serves roughly 50 participants at all times.

A Multifaceted Approach to Framing Examination of the Influence of Discrimination and Identity-Awareness on Academic and STEM Outcomes

This study was framed by community cultural wealth (CCW), critical race theory (CRT), critical race quantitative intersectionality, and bioecology. CCW was one of the theories I used to describe the rich asset based culture of participants and participants' uses of their strengths to achieve graduate level degrees, in STEM and nonSTEM fields. I described CRT as it challenged and guided assumptions framing the research; then awareness was highlighted through the bioecological environments where participants interact with their environments, which had potential to positively influence their learning. For this particular study, these frameworks were applied in the context of participants experiencing intersectional discrimination, and the relation of that discrimination to the participants' academic and STEM outcomes.

A Community Cultural Wealth (CCW) Framework of the Influence of Discrimination

Yosso (2005) developed the concept of community cultural wealth (CCW) to provide ways to talk about the types of capital found in communities of color. A historic definition of community capital is that of Bourdieu (1977), who described it in terms of cultural knowledge, and the skills inherited by those who are a part of the privileged society, which in part explains the gaps in educational achievement. According to Bourdieu, there are three types of capital: *social, economic*, and *cultural*, all of which one can attain through interactions with one's family or through formal schooling. In Bourdieu's theory, some communities are culturally wealthy and others are culturally poor. Yet Yosso's (2005) CCW goes beyond Bourdieu's deficit-oriented explanation of capital to incorporate six factors that highlight the cultural strengths in communities of color.

The six factors of CCW consistently interact to strengthen the overall CCW within each community and individual. One factor may be gained through one of the other factors, or it may help to build one of the other factors. Following are descriptions of the factors, according to Yosso (2005).

Aspirational capital refers to the ability to uphold positive dreams for the future regardless of discriminatory actions. It is the ability to believe there is a better life ahead of oneself. Aspirational capital is often developed through familial and social capital.

Strong *linguistic capital* is the ability to speak more than one language. In this context, language includes different languages (Spanish, French, English, etc.), dialects (Haitian Creole, Ebonics, standard English, etc.) and art forms (art, music, poetry, spoken word, etc.), each of which serves as a mode of communication. Linguistic capital strengthens through the tradition in many communities of color to use stories to teach valuable lessons. In the United States, this form of capital is often seen in children's abilities to translate for their families.

Familial capital includes gaining strength from one's family, community members, and organized communities (e.g., churches and youth programs). Through familial capital, the individual forms connections to others in the community and to the resources the others provide. This factor increases the moral values of individuals and also provides individuals with support in pursuing their dreams and navigating systems that are inherently racist or discriminatory.

Social capital pertains to belonging to a network of people and community resources that provide emotional and logistical support for navigating discriminatory systems. This capital provides the venue through which individuals learn how to navigate these systems and build individual strengths through learning from others' experiences. Additionally, in this context, each individual has a responsibility to share the information with others and support others.

Individuals develop *navigational capital* when they can use each of the benefits from other factors to navigate a system successfully. In the case of this study, participants are using their social, familial, linguistic, and resistant capitals in particular to navigate the academic systems. Navigational skills include using both social and psychological expertise to avoid being pushed out of higher education institutions.

Resistant capital is the ability to resist against the dominant and discriminating community. Parents improve resistant capital by teaching their children that they are beautiful, intelligent, and self-reliant, and that their cultural background has strength. Additionally, resistant capital refers to people of color challenging the systems that promote inequity, inequality and discrimination. Current examples of resistant capital are in the Black Lives Matter campaign, families of wronged individuals standing up for their unjust treatment, and the athletes who kneel during the national anthem before the sporting event.

I have used this framework to guide my analyses of questions related to the support participants received relative to their plans after high school, reasons participants had not yet completed their degrees, critical incidents related to participants' STEM perceptions, and how the museum programs contributed to the participants as a whole. Using CRT and CCW as frameworks challenges the deficits that are often associated with communities of color. Instead, these frameworks highlight the strengths of these communities. Additionally, using counterstories is supportive of the traditions of people of color passing knowledge through storytelling. This study presents counternarrative through poetic analyses, alongside quantitative findings.

The main goal of redefining how society views capital is to alter the way America's education system sees youth of color. Through the CCW lens, researchers can present communities of color as communities full of cultural strength (Burciaga & Erbstein, 2012; Jayakumar, Vue, & Allen, 2013; Lu, 2013; Luna & Martinez, 2013; Pérez Huber, 2009; Yosso, 2005).

CCW contrasts with the traditional concept of capital, which is often characterized in a way that is consistent with Bordieu and Passeron's (1977) definition as the collection of cultural experiences and skills one has learned through engagement with dominant communities. CCW considers the counternarrative to explain successes in communities of color instead of supporting the view of the lack of capital as a deficit for communities of color. Other researchers have used the CCW theory to shape similar studies about the mentoring of undergraduate Latin@ youth (Marsh & Desai, 2012; Perez-Huber, 2009).

The Critical Race Theory (CRT) Framework of the Influence of Discrimination

Initially developed in response to the lack of progress toward equality after the civil rights movement, many academics have adapted and use the concept of CRT to present the perspective of people of color. CRT uses race as a central aspect of analysis and description of the experience. CRT in education emphasizes the importance of a person's identity, specifically one's race, and in general how the person's identity influences one's experiences.

CRT has a number of complicated and intertwined concepts. CRT is grounded in the concept that experiences of Whites are not universal and that people of color have unique experiences. Instead of assuming the White experience is the norm, researchers using CRT analyze experiences of subordinated groups in an effort to understand the complexity of subordinated identities (Solorzano & Yosso, 2002).

A number of themes define CRT:

(p) Race and other forms of subordination connect to define each person's identity;

(q) Racism exists in American society and citizens often do not recognize it in American legal and political structures;

(r) Color blindness and neutrality cannot exist in American culture because of the historical events and unequal treatment of people belonging to subordinated groups;

(s) Subordinated individuals can share their experiences and critique liberalism to change the systems that reinforce racism; and

(t) CRT takes a multidisciplinary approach toward understanding race and racism in the current society (Solórzano & Yosso, 2002; Yosso, 2005).

Since its initial presentation, CRT has grown to encompass many different types of discrimination including gender, sexuality, and people of color. CRT is unique compared to other educational frameworks because it allows for exploration of multiple subordinated identities, encourages strength-based thinking about the subordinated groups, and supports social-justice movements through a presentation of individual stories (Solorzano & Yosso, 2002). Through a CRT lens, the researcher recognizes these identifying categories as socially constructed and largely influential on people's individual experiences (Valdes, 1998). This perspective is fitting, given the intersectionality of each person's identity. As Lorde (1983) said,

> I simply do not believe that one aspect of myself can possibly profit from the oppression of any other part of my identity . . . children need to learn that they do not need to become like each other in order to work together for a future they will all share. (para. 4)
>
> . . .There is no hierarchy of oppression. (para. 6)
>
> . . .I cannot afford the luxury of fighting one form of oppression only. I cannot afford to believe that freedom from intolerance is the right of only one particular group. . . . (para. 7)

This inclusivity of multiple identities allows for intersectionality to emerge and represent the depictions of individuals' experiences. To fully understand an experience, one must understand a person as a whole, without overlooking certain aspects of the multiple identities.

Critical Race Quantitative Intersectionality (CRQI) Framing of Quantitative Analyses

For the quantitative data, I used the Critical Race Quantitative Intersectionality (CRQI) framework, which is informed by CRT. This method's primary purpose is to develop a story using the quantitative data (Covarrubias and Velez, 2013). CRQI research is based on five principles, including (a) data mining related to intersectional aspects of the data to quantify the complex and intersectional impacts of racism and associated discrimination; (b) challenging the neutrality of quantitative data and supporting the data with the story around the data; (c) highlighting the counternarrative as a valuable source of knowledge to inform the data; (d) committed to addressing injustice; (e) Working toward a solution for the systemic racism with a transdisciplinary approach (Covarrubias and Velez, 2013).

The Final Theoretical Frame: A Bioecological Perspective on the Influence of Discrimination

Each aspect of the environment contributes to individuals' social and cognitive development in positive or negative ways (Evans, 1999). Additionally, everyone experiences each environment differently based on individual identity and personal cultural experiences (Super & Harkness, 1999). Identity includes factors such as race, ethnicity, age, religion, body type, and ability. Culture includes other people and actions in the environment, customary practices, group norms, and beliefs (Super & Harkness, 1999). Bronfenbrenner's bioecological theory of human development (1979, 2005; Bronfenbrenner & Morris, 2006) defines the environment in a way that describes its multiple, interacting levels of complexity. Using this theory, researchers can identify environmental influences and study them as a whole in a way that incorporates the influence of individual culture (Super & Harkness, 1999).

Study 3: The process-person-context-time model. For completeness, the study of human development should be based on a process-person-context-time model (Bronfenbrenner & Morris, 2006; Guhn & Goelman, 2011). Within this model, the proximal processes create the foundation of bioecology. *Proximal processes* include the interactions among the evolving person, objects, and environmental messages (Bronfenbrenner, 1999). There are five characteristics of proximal processes: (a) The person must participate in the activity; (b) the activity must occur frequently and over a long period of time; (c) the complexity of the activity must increase over time; (d) the activity must be multidirectional, with instigation and reaction coming from all parties; and (e) the objects and messages in the environment must encourage exploration, thoughtfulness, and creativity (Bronfenbrenner, 1999; Bronfenbrenner & Morris, 2006). It is the interaction among proximal processes that influences human development. The characteristics of the person, the context, and the time in history all influence the magnitude of the process (Bronfenbrenner, 1999; Bronfenbrenner & Morris, 2006). The process-person-context-time model equally weights the value of the process with the value of the influence of the person.

The context is continually salient for each person. Throughout development, individuals may remain in their current environment or migrate to a different environment. Additionally, different characteristics of the environment may contribute to positive development and other components may contribute to negative development (Wachs, 1999). For the youth in this study, the context may either look like individuals not pursuing a college degree and working a minimum wage job, or attending college, and getting a professional job.

The environmental experiences are largely influenced by the time context in which a person has an experience (Wachs, 1999). The time context can refer to the frequency and duration (in hours, days, months, years) of the proximal processes, the changing beliefs, and worldly events (Bronfenbrenner & Morris, 2006). It can also be the developmental process that happens over time. In Chapter 1, I included the background information about the current demographics of the STEM fields and the forms of racism today to provide the time context for this research.

Study 3: The interactive system. Further, the process-person-context-time model exists within an interactive system, which includes the microsystem, mesosystem, exosystem, macrosystem, and chronosystem (Figure 5.1; Bronfenbrenner & Morris, 2006; Guhn & Goelman 2011). The *microsystem* is a single environment in which the developing person and other key players (caretakers, siblings, other family members) interact, and in which the developing person has a specific role (brother, child, participant, student). The *mesosystem* develops when there are interactions between different microsystems that directly involve the individual. The effects of the mesosystems build on each other to influence the person's development (Bronfenbrenner & Morris, 2006).

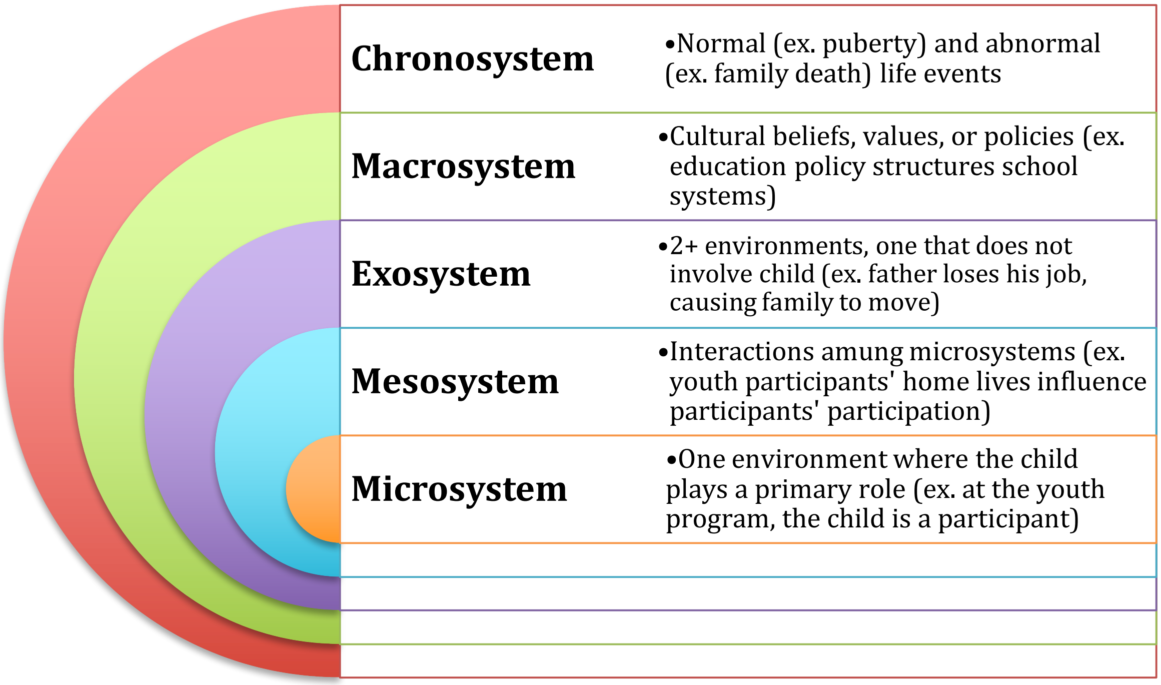
Chronosystem
•Normal (ex. puberty) and abnormal (ex. family death) life events
Macrosystem
•Cultural beliefs, values, or policies (ex. education policy structures school systems)
Exosystem
•2+ environments, one that does not involve child (ex. father loses his job, causing family to move)
Mesosystem
•Interactions amung microsystems (ex. youth participants' home lives influence participants' participation)
Microsystem
•One environment where the child plays a primary role (ex. at the youth program, the child is a participant)

Figure 5.1. This describes the five levels of influences for each developing person. The influences start with the largest systems the chronosystem, and get more specific with each level lower.

The *exosystem* is the interaction of multiple environments, of which at least one does not directly involve the developing person (Bronfenbrenner, 1977; 1986). An example of an exosystem for a child is the interaction between the caretaker's place of employment and the child's home or neighborhood. The *macrosystem* is different from the previous three systems in that it is based on a set of cultural beliefs or practices that determine the structure of the other systems (Bronfenbrenner, 1977). The *chronosystem* incorporates the changes that occur over time in each of the developing person's systems (Bronfenbrenner, 1986). Bronfenbrenner (1986) described these changes, or transitions, as being either *normative* (e.g., puberty, going to college, or marriage) or *nonnormative* (e.g., family death, moving, or winning the lottery).

Study 3: Influences of the macrosystem. This multilevel system of bioecology incorporates influences of the culture and other macrosystemic factors (Super & Harkness, 1999). Super and Harkness (1999) described three types of cultural influences: contemporary redundancy, thematic elaboration, and chaining. *Contemporary redundancy* is the repetition of messages from various parts of the environment during the same period of time. *Thematic elaboration* is the environment and culture send repeated themes and implicit messages through word choice, values, and images. The last influencing factor Super and Harkness (1999) described is *chaining*, when a series of events results in an outcome. In this case, no single component of the environment is robust enough to create the result; however, the combination of multiple components results in one outcome. The outcome arises as a result of multiple, seemingly unrelated events.

Individuals uniquely experience each of the three influencing factors and the components of the environment as described by bioecological theory because each individual's identity is unique. The environment also interacts differently with each individual based on the individual's unique identities (Super & Harkness, 1999). It is important to consider both this subjective and feeling-based experience, and the objective characteristics of the environment in the research process (Bronfenbrenner, 1977; Bronfenbrenner & Morris, 2006; Wachs, 1999). I emphasize this point to remind us that persistent themes in one community may not align with the themes in other communities.

The Current Study of the Influence of Discrimination

Study 3 addressed three main research questions: “Is the level of awareness of personal identity related to program participants’ academic aspirations, STEM persistence, academic persistence, STEM resilience, and academic resilience?,” “How does the level of experienced discrimination relate to program participants’ academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?,” and “How do individual identities relate to participants’ academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?” I used a convergent parallel, mixed-methods design for this research. The convergent parallel design indicated that qualitative and quantitative data collection and analysis were conducted in tandem for this study.

Methods to Investigate the Influence of Discrimination and Identity-Awareness on Academic and STEM Outcomes

This study addressed three research questions, which I present in Table 5.2. I selected these methods in particular because the correlation is well suited for a scenario with multiple influencing factors. This approach allowed me to ask multiple questions about potential influencing factors, which also supported my bioecological framing. The log-linear analysis allows for consideration of many variables with the same roles, which is appropriate for exploring the roles of different identities, and thus reflects the CRT framework.

Table 5.2

Research Questions, Variables, and Statistics Analyses

Research question	Variables	Analysis plan
Is the level of awareness of personal identity related to academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?	Predictor: Level of awareness of personal identity Outcome: Academic aspirations, academic outcomes, STEM outcomes	Spearman correlation with Bonferroni corrections, then qualitative data to create the story
How does the level of experienced discrimination relate to program participants' academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?	Predictor: Amount of discrimination Outcome: Academic aspirations, academic outcomes, STEM outcomes	Spearman correlation with Bonferroni corrections, then qualitative data to create the story
How do individual identities relate to participants' academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?	Academic outcomes or STEM persistence, SES, race, and academic or STEM outcomes	Hierarchical log-linear analysis

This was a cross-sectional, associational research design. I administered a quantitative and qualitative survey (Appendix E) to all program alumni. The sampling frame included approximately 600 individuals who participated in the youth programs between 1996 and May 2014. This is not an exact number because I posted the link on social media and asked people to tell others who were in the program. All statistical calculations included 121 participants. With an effect size of 0.15 and 5% chance of Type 1 error, I calculated the power to be 0.128; with an effect size of 0.05, the power was 0.058. The participants' demographics are in Table 5.3.

Table 5.3

Summary of the Number of Participants Identifying with Each Demographic Identity Included in This Three-Part Dissertation, Separated by Study Outcomes (Academic and STEM Persistence Levels)

	STEM persistent (*n* = 37) earning(ed) a(n). . .				Non-STEM persistent (*n* = 84) earning(ed) a(n). . .			
	AS or less (*n* = 3)	AA (*n* = 4)	BA/BS (*n* = 16)	Master's/ Doctorate (*n* = 14)	AS or less (*n* = 15)	AA (*n* = 15)	BA/BS (*n* = 35)	Master's/ Doctorate (*n* = 19)
Female (*n* = 74)	1	3	7	8	10	10	21	14
Black (*n* = 45)		3	3	4	4	8	13	10
Latin@ (*n* = 8)			2		1	1	1	3
S. Asian (*n* = 1)				1				
White (*n* = 16)	1		2	3	2	1	6	1
Multiracial (*n* = 1)							1	
Male	2	1	9	6	5	5	14	5
Black (*n* = 28)	1	1	3	5	5	4	6	3
Latin@ (*n* = 10)			4	1		1	3	1
S. Asian (*n* = 0)								
White (*n* = 8)	1		1				5	1
Multiracial (*n* = 0)								

Note. See page 234 for a description of STEM- and NonSTEM-Persistent. AS = Associates of Science/Technical degree; AA = Associates of Arts degree; BA/BS = bachelor's degree.

All participants were alumni of the out-of-schooltime programs hosted by the informal learning center. Program participants met the federal funding guidelines determined by the TRiO Programs. Program participants attended some of the lowest performing schools in the district, according to district grading scales. The majority of participants begin programming the summer between their eighth- and ninth-grade years; however, some students start when they are older. The program's expectations were for participants to be a part of the program throughout all 4 years of high school, but some participants had withdrawn from the program prior to graduation. All of these participants were invited to take the survey.

I allowed the study participants 6 weeks to complete the online survey (administered through qualtrics.com), between December 2015 and January 2016. Because I personally knew many of the study participants, I sent out multiple reminders on social media (individual Facebook messages, Instagram messages, and Snapchat), text messages, and e-mail messages. I sent the reminders 10 days after I commenced administration, and three additional times in the 10 days before the survey closed. I also asked participants to encourage their peers from the program to complete the survey. I did not request names on the survey responses.

Measure

I developed this survey specifically for this research, based on my understanding of the community-of-interest as a staff member of the program I reference. I also incorporated theoretical and research-based information to help create the questions and answer options. I began survey development with two published surveys, McCreedy and Dierking (2013) and the Perceived Ethnic Discrimination Questionnaire-Community Version (PEDQ-CV). Questions with an asterisk are those that I adapted from the McCreedy and Dierking (2013) survey that retroactively assessed girls' STEM afterschool programs. I made minor adjustments to the

PEDQ-CV to develop the Likert-scale questions regarding discrimination (Brondolo, Kelly, Coakley, Gordon, Thompson, & Levy, 2005). I adapted the questions related to social identity from the Voices of Discovery (2005). The instrument as a whole measured five outcome variables, social identity, and experiences of discrimination. This is a quantitative and qualitative survey. I describe the survey questions, response options, and coding details in the following subsections, quantitative, qualitative, and mixed outcomes.

Quantitative outcomes. There were six quantitative outcome variables: academic persistence, STEM persistence, academic aspirations, level of dominance of identity, amount of experienced discrimination, and sense of community. The most important factor for me to understand in this project was the experience of discrimination; therefore, I first determined participants' degree of discrimination and compared it to the level of dominant identity. These two outcomes were negatively related. I divided the participants into groups based on whether they reported a high or low discrimination level. Then I analyzed participants' academic and STEM persistence and their academic aspirations, which shaped the secondary grouping of my participants for the qualitative coding, and these values were incorporated into my mixed-methods analyses for the resilience scores. Then I used these resulting variables for statistical analysis.

Academic persistence. I used one survey question to measure academic persistence. The question and response options were "For each educational level, indicate your current academic standing and goals." For each of the six educational levels (high school, trade school, associate's, bachelor's, master's, doctorate), participants selected one of five multiple-choice options: *I do not plan to earn this degree; attended, but left before finishing; currently earning; completed; ultimately, I would like to earn this degree*.

I assigned an academic persistence code of 3 to participants who respond with *currently earning* or *completed* a graduate degree (master's or doctoral degrees). Of the remaining participants, I coded a score of 2 to those who earned or are earning a bachelor's degree, and a 1 to those who earned or are earning an associates of arts degree. I defined academic nonpersistence (0) as those who selected *I do not plan to earn this degree;* or *attended, but left before finishing* for associates of science degrees, trade school, or high school. The data were skewed toward higher levels of persistence (1.39).

STEM persistence. I measured STEM persistence with two survey questions. The first question was "Are you pursuing a STEM degree or profession?" The three multiple-choice options for this question were *yes; no, but started as a STEM major;* and *no*. The second question provided an opportunity for participants to indicate their specific focus of schooling. Participants filled in six text boxes to disclose their educational focus while they were earning the following degrees or certificates: high school, trade school, associate's, bachelor's, master's, or doctorate. I assigned the STEM persistence code of 1 to participants who responded with *yes* to the first question and provided verified STEM educational foci in the second question. All others were coded as STEM nonpersistent (0).

Academic aspirations. This outcome variable had five possible levels. I determined each participant's level of academic aspirations with one question: "For each educational level, indicate your current academic standing and goals." For each of the six educational levels (high school, trade school, associate's, bachelor's, master's, doctorate), participants selected one of five multiple-choice options (*I do not plan to earn this degree; attended, but left before finishing; currently earning; completed; ultimately, I would like to earn this degree*). I coded each participant with a value from *0* (*no plan to earn a degree, including high school/GED*) to *6* (*plan *to earn a doctorate*) based on which degrees the participants would like to earn. The data for this are skewed toward the higher aspirations (-1.71).

Personal identity. Two questions asked respondents to share their social identity and which identities they thought about more than once a week. The 10 social-identity categories included fill-in-the-blank spaces for participants to describe their identities regarding their ethnicity, race, sexual orientation, socioeconomic status, sex, religion or belief system, age, gender, national origin, physical/psychological/mental/learning abilities, and physical appearance. For analyses, I recoded this text as 1 if the identity was dominant and 0 if the identity was marginalized based on Table 5.4. The second question pertained to a series of 10 statements (for each identity category) for which the participants responded *yes* or *no* to thinking about that identity more than once a week.

Table 5.4

Examples of Social-Identity Categories

Social-identity category	Examples of identities within each category
Race	**White**, Black, Latin@, Asian/Pacific Islander, Native American, Biracial, Multiracial
Socioeconomic class	**Owning class**, middle class, working class, poor
Sexual orientation	**Heterosexual**, Bisexual, Lesbian, Gay, Queer, Questioning
Religion/spiritual affiliation	**Christian**, Jewish, Muslim, Bahai'I, Agnostic, Atheist
Gender	**Man**, Woman, Transgender, Queer

Note: Dominant identities are indicated by bold font.

Experiences of discrimination. I addressed experiences with discrimination with 17 statements that were part of the Perceived Ethnic Discrimination Questioner-Community Version (PEDQ-CV; Brondolo et al., 2005) and three additional questions directly inquiring about experiences with discrimination. I made some modifications to the statements in order to better fit the population under study. The statements inquired about topics related to discrimination at school and work, aggression related to discrimination, rejection or devaluation because of identity, and long-term messages. All of the statements began with, “Because of my identity. . .” Some example statements include “others thought I couldn’t do things or handle a job;” “policeman or security officers have been unfair to me;” “others have actually damaged my property;” and “it has been hinted that I must be lazy.” In the original PEDQ-CV, participants rated statements on a 7-point Likert scale ranging from 1 (*never*) to 7 (*very often*). To avoid neutral responses, I chose to use a 6-point Likert scale ranging from 1 (*never*) to 6 (*all of the time*). This instrument assessed five constructs, with internal reliabilities between .65 and .88. I assessed reliability again for my participants because I changed the format of the response options for this survey and to confirm that this survey is reliable for my population. The Cronbach’s *alpha* for this sample of the PEDQ-CV was $\alpha = .90$.

To transition from the PEDQ-CV questions to the questions directly asking about discrimination, I presented participants with a definition of discrimination in an effort to ensure that all participants had a mutual understanding of the word. Further, I defined the concept in an effort to follow critical-race research practices and not hide the topic of discrimination. Through these questions, I directly addressed discrimination by asking participants whether they had felt discriminated against. I used the three additional questions to understand in which setting(s) and for which identity(s) the participants had felt discriminated. Participants responded *yes* or *no* to having experienced discrimination in three settings (school, work, and personal) for each of 10 personal identities.

For the analyses, I summed the frequency of discrimination as measured by the PEDQ-CV and responses to the three additional questions. The total discrimination score ranged from 0 (minimum amount of experienced discrimination) to 30 (maximum amount of experienced discrimination). I examined the participant-specific sum as a predictor for five of the outcome variables. Additionally, I tested for program dosage as a moderator, to test my hypothesis that program participation is a protective factor for discrimination.

Qualitative outcome—description of experiences with racism. There was only one qualitative outcome of this study, which was to determine how participants experienced racism and other forms of discriminations. I did not ask participants to describe their discrimination experiences directly; instead, I coded all of the qualitative text with codes related to different levels and experiences of discrimination (Table 5.5). These responses to questions included descriptions of why participants had not completed their degrees, what kind of communication and support participants had in preparing for life after high school, and a description of the three most impactful experiences they had related to STEM.

Table 5.5

Scheme Used During Coding for Signs of Discrimination

Level of discrimination	Description of experience
Individual	Discrimination from family
Individual and institutional	Discomfort/discrimination because of ability and lacking support
Institutional	Being first generation, not knowing the system
Institutional	SES discrimination
Institutional and societal	Awareness of underrepresentation in the field
Societal	Role model
Civilizational	Result of systemic racism
Civilizational	Stereotypes
Civilizational	Awareness of underrepresentation in a larger context

Mixed-methods variables. There were three variables that I believed required both qualitative and quantitate inputs. These variables include the academic and STEM resilience scores and the proximal process categorization. These are the resilience outcomes related to the supporting and preventive factors that may have contributed to participants' experiences. I coded the qualitative components the same way I described in the preceding qualitative section. To identify the program as a proximal process, one in which participants are highly engaged, I considered quantitative factors including frequency and duration, and qualitative factors including participants' descriptions of growth experiences as a result of the program.

Academic resilience. For this construct and the STEM-resilience construct, I developed specific response options that, when selected, represent protective factors or risk factors. The questions for academic resilience tapped into the factual and experiential components of a participant's home life during high school. This construct included seven questions relating to factual components of the participant's home life during high school and college. The questions addressed topics including eligibility for free/reduced lunch, parent/guardian(s) level of education, where the participants lived during high school, whether the participants worked during high school or college, and whether such employment related to the participant's majors. Two questions related to the experiences of the participant's home life. These questions asked about the structure of the participants' home and their feelings about having supportive people during high school and college.

This section also included two open-ended questions. The first of these asked about the type of communication participants had in their communities about plans for after high school. I coded the responses to these questions first by presence or absence of communication about future plans. Then I coded by how the communication made the participants feel, the kind of communication (spoken, written, subliminal, or unspoken), and the frequency. The second open-ended question inquired about the kind of support (or lack of support) the participants received from community members. I coded this by the key people involved in the support role and what kind of support or nonsupport the participants received.

Two open-ended questions inquired about respondents' perceptions of how the program "contributed to who you are as a person," as well as any suggestions for improvements to the programs. I coded the first question by personal characteristics (positive and negative), academic characteristics, development of life skills, and comments that supported community cultural wealth and bioecology. I also looked for evidence of cascading influences when participants credited the programs for later choices in life; e.g., pursuing a STEM degree and profession. I suspected that there would be responses similar to "made me more open-minded," "made me a better leader," "made me enjoy STEM," "taught me how to interact with those different than myself," and "taught me how to approach authority figures." I based these intuitions on my prior work with the youth program and the results from the first study. I used the resulting codes from this question for the resilience score.

I determined the resilience score using three factors: the sum of codes that indicated risk factors and a second sum of protective-factor codes for all questions described in this section and the Academic Persistence section. For the qualitative answers, I added a point for each indicator of support and future-planning communication, and subtracted points for indicators of lacking support or negative communication. Table 4.7 shows the coding guide for the academic resilience score. The academic resilience score ranges between 0 (no resilience/no risk factors, high levels of protective factors, and no academic persistence) to 24 (the most extreme levels of all risk factors measured, minimal protective factors, and the highest level of academic persistence). Please note that, in Table 4.7, the number of risk factors included in each resilience score decreases as more risk factors accumulate. I reduced the number of risk factors to account for the possibility that the more risk factors people encounter, the more challenging each additional hardship feels for the individual. In this context, the individuals becoming more vulnerable than average is referred to as *sensitizing effects*. The alternative is also possible, that individuals become stronger from experiencing risk factors. These are *steeling or annealing effects*, which result in decreased vulnerabilities for the individuals (Rutter, 2012).

I conducted exploratory analysis to try to understand which participants had *sensitizing* or *steeling effects* and whether I could determine a pattern regarding the effects of the total number of risk factors; however, I found no patterns. I combined the academic persistence and academic resilience constructs because they were highly correlated ($r = .95$; $p < .001$). For each participant, I computed the mean of academic resilience and academic persistence, resulting in a single *academic outcome* construct to use in regression analyses.

Table 4.7

Academic Resilience Score Calculation Guide

			Risk factors sum							
		Protective factor sum	0	1 to 12	13 to 24	25 to 30	31 to 36	37 to 40	41 to 44	≥ 45
Academic persistence level	0	0–15	11	18	19	20	21	22	23	24
		16–30	11	17	18	19	20	21	22	23
		31–45	11	16	17	18	19	20	21	22
		≥ 46	11	15	16	17	18	19	20	21
	1	0–15	11	14	15	16	17	18	19	20
		16–30	11	13	14	15	16	17	18	19
		31–45	11	12	13	14	15	16	17	18
		≥ 46	11	11	12	13	14	15	16	17
	2	0–15	3	4	5	6	7	8	9	10
		16–30	2	3	4	5	6	7	8	9
		31–45	1	2	3	4	5	6	7	8
		≥ 46	0	1	2	3	4	5	6	7

STEM resilience. Four questions were used to determine STEM resilience. The first question asked participants to describe, regarding their opinions of STEM, three to five of the most influential (positive or negative) experiences or individuals in their lives. This technique measures the critical incidents related to participants' STEM perceptions. Much research has used critical incidents, as documented in Fivars and Fitzparick's (2001) extensive bibliography. I coded the open-ended responses to this question first by negative, neutral, or positive experiences, and then by age. Then I examined the context of the influence (school, the program, home, media, and other), and the outcome of the influence (improved opinions of STEM, worsened opinions of STEM, or no apparent change in opinion). After doing the qualitative coding, I added one point for each positive factor participants described and subtracted one point for each negative factor described. I also used these data to create a qualitative overview of participants' experiences in STEM based on themes.

The second question was a multiple-choice question: "Are you pursuing a STEM degree or profession?" The three multiple-choice options, with codes noted in parentheses, were *no* (0); *no, but started as a STEM major* (0.5); and *yes* (1). For those who responded with *no, but I started as a STEM major,* I asked a follow-up, open-ended question asking what factors contributed to their leaving a STEM major. I anticipated that this question would help describe the non-STEM-resilient individuals' characteristics and experiences that steered them away from STEM fields. I anticipated characteristics including sense of alienation; feeling like an outsider, helpless defeated, or like a failure; lacking self-confidence, or losing motivation. Some potential experiences also might have been having too low of a GPA to stay in STEM, doing poorly in associated math classes, losing interest in STEM, gaining interest in a different major, a professor telling the participant that she didn't belong, or unsupportive family/social network. I summed each of the STEM risk and protective codes.

Two questions assessed the participant's STEM identity. Specifically, for people of color, research supports that these strong STEM identities are essential for success in the STEM fields (Ahlqvist, London, & Rosenthal, 2013) because there are often conflicts between personal identities and how STEM professionals "should be." Therefore, I considered STEM identity a protective factor for STEM resilience in this research. The first question of this section asked participants to rate the recognition they had received in STEM settings. Participants selected from six multiple-choice options ranging from *very negatively* (0) to *very positively* (5).

The last question clarified the intensity of various influences in participants' lives as related to STEM identity. The question was a list of statements that completed the sentence, "The following helped me…". Some examples of the statements include "Imagine myself as a STEM professional in while in high school and/or college," and "feel like I belonged in the STEM community." Participants were asked to distribute 20 points among the presented influences ("school," "youth program(s)," "other-sports, family, partner, friends, religious leader, etc.," and "None—I do not agree with the statement"). To determine the total STEM protective factors scores, I counted the protective codes, the coded value for STEM recognition, and the total points allocated to all categories except "none." I repeated the same procedure for the STEM risk factor score. I computed the sum of all points allocated to all categories except for *none,* and then subtracted the sum of all points in the *none* category from the total score.

I used three factors to determine the STEM-resilience outcome variable: STEM risk factors, STEM protective factors, and STEM persistence. Table 4.8 shows the coding guide for participants' STEM resilience scores. The STEM resilience score ranges between 0 (no STEM resilience/no risk factors, high levels of protective factors, and no STEM persistence) to 34 (the most extreme levels of all risk factors measured, minimal protective factors, and STEM persistence). I used the same concepts as those used to calculate the academic resilience (*sensitizing* and *steeling effects*) to determine the STEM-resilience score.

The questions asking participants to distribute 20 points and describe three to five critical incidents seemed to be too difficult for some participants given that 29 participants stopped the survey at this point, or skipped these two questions. I conducted missing data imputation using the MCMC method with 20 imputations. Therefore, I conducted missing data imputation using the fully conditional Markov chain Monte Carlo (MCMC) with 20 imputations, which is the recommended strategy for handling normally distributed dependent variables (Graham, 2012). It assumes an iterative approach that fits a single variable using all other variables in the model as predictors and then imputes missing data for the single variable being fit. Then, because the STEM persistence and STEM resilience constructs were highly correlated, I combined them by calculating their z scores to standardize the values. Last, there were strong correlations between the STEM resilience and persistence ($r = .84$, $p \leq .01$) variables, so I combined them. I computed the mean of STEM resilience and STEM persistence, resulting in a single *STEM outcome* construct to use in regression analysis.

The questions asking participants to distribute 20 points and describe three to five critical incidents seemed to be too difficult for some participants, given that 29 participants stopped the survey at this point, or skipped these two questions. Therefore, I conducted missing-data imputation using the fully conditional Markov chain Monte Carlo (MCMC) with 20 imputations, which is the recommended strategy for handling normally distributed dependent variables (Graham, 2012). This method assumes an iterative approach that fits a single variable, using all other variables in the model as predictors and then imputing missing data for the single variable being fit. Then, because the STEM-persistence and STEM-resilience constructs were highly correlated, I combined them by calculating their z scores to standardize the values. Last, I computed the mean of STEM resilience and STEM persistence, which resulted in a single *STEM outcome* construct to use in regression analysis.

Table 4.8

STEM Resilience Score Calculation Guide

		STEM persistence level											
		1						0					
Protective factor sum		0–25	26–50	51–75	76–100	101–125	≥ 126	0–25	26–50	51–75	76–100	101–125	≥ 126
Risk factor sum	0	16	16	16	16	16	16	16	16	3	2	1	0
	1–20	23	22	21	20	19	18	17	16	4	3	2	1
	21–40	24	23	22	21	20	19	18	17	5	4	3	2
	41–60	25	24	23	22	21	20	19	18	6	5	4	3
	61–80	26	25	24	23	22	21	20	19	7	6	5	4
	81–95	27	26	25	24	23	22	21	20	8	7	6	5
	96–110	28	27	26	25	24	23	22	21	9	8	7	6
	110–120	29	28	27	26	25	24	23	22	10	9	8	7
	121–130	30	29	28	27	26	25	24	23	11	10	9	8
	131–135	31	30	29	28	27	26	25	24	12	11	10	9
	136–140	32	31	30	29	28	27	26	25	13	12	11	0
	141–145	33	32	31	30	29	28	27	26	14	13	12	11
	≥ 146	34	33	32	31	30	29	28	27	15	14	13	12

Study 3: Results

To honor the CRT framing of this research, I investigated trends in individual identities and the intersectionality of identities. Although I do not present individual demographics in order to protect the study participants' identities, I describe some trends. The data contributing to this investigation represent the responses to 10 questions about their identities that participants provided. According to this group, at the time of the responses, only heterosexual individuals were earning or had earned graduate-level degrees. Only six of the 27 participants who identified as middle or lower-middle income (22%) had earned or were earning an AA or lower degree. For all of the following analyses, I used the coding schemes as presented in Table 5.8.

Table 5.8

Coding Guidelines for Variables Used in Quantitative and Qualitative Analyses

Variable	Coding guidelines
Academic aspirations	0 = not planning to earn this degree, including high school/GED 1 = planning to earn/earned an associates of science or trade degree 2 = planning to earn/earned an associates of arts degree 3 = planning to earn/earned a bachelor's degree 4 = planning to earn/earned a master's degree 5 = planning to earn a doctorate degree
Academic persistence	0 = not planning to earn this degree, including high school/GED 1 = earned or earning an associates of arts degree 2 = earned or earning a bachelor's degree 3 = earned or earning a graduate degree
Academic resilience	Referencing Table: 5.5 Low resilience (0): 0–13 High resilience (1): 14–24
Academic outcome	Mean of each participant's Academic Persistence and Resilience scores
STEM persistence	0 = anyone who was not STEM persistent 1 = participants who indicated being STEM majors and provided verified STEM educational foci in the second question
STEM resilience	Referencing Table: 5.6 Low resilience (0): 0–15 High resilience (1): 16–34
STEM outcome	Mean of each participant's STEM Persistence and Resilience scores
Experienced discrimination	Low (1) = 17–42 Medium (2) = 43–65 High (3) = 66–94
Race	0.00 = Black 0.33 = Latin@ 0.50 = Bi/multiracial 0.66 = Asian 1.00 = White
Gender	1 = Male 2 = Female
SES	1 = Poor 2 = Working class 3 = Low income 4 = lower middle income 5 = middle income

Study 3: Quantitative Analyses

In this section I describe my framing of the research using the CRQI model. I asked participants to share the frequency of their awareness of the 10 identities and how often they felt discriminated against because of their identities. I used SPSS for all advanced quantitative analyses. I conducted an exploratory analysis of the data to see whether trends exist in the identities which participants most commonly thought about or considered. I summated a count of participants for each of the identity categories in which at least two-thirds of the participants indicated they had experienced some or significant levels of discrimination or awareness for the specified identity. I present the responses in Table 5.9.

The STEM persistent group earning an associate's degree or less experienced discrimination and/or awareness of 7 out of 10 of their identities. There was not a significant difference between males' and females' academic achievement levels in the STEM fields ($\chi^2(1) = 2.882$, $N = 36$, $p = .090$). This contradicts the literature and demographics of STEM fields that there are often more men than women in the field—this may support the program working to reduce the gaps in women in STEM fields. Within the STEM-persistent group, it appeared that the more education participants had, the less discrimination and awareness they have of their identities; however, it did not result in a significant Cramer's V calculation, $\chi^2(1, n = 85) = 0.72$, $p = .40$.

Within the non-STEM-persistent group, the group earning graduate-level degrees experienced the most discrimination and were the most attentive to their identities compared to the other education-level groups. The participants earning less than an AS degree experience the second highest level of discrimination and identity-awareness. Both the group earning an AA and

BA/BS have few noteworthy experiences of discrimination and/or identity awareness. The Cramer’s V was not significant, $\chi^2(6, n = 121) = 10.04, p = .12$. Interestingly, of the whole

Table 5.9

The Number of Survey Participants Who Indicated High Levels of Discrimination or Awareness, Separated by Study Outcomes (Academic and STEM Persistence Levels)

	STEM-persistent (*n* = 37) earning(ed) a(n)…				NonSTEM-persistent (*n* = 84) earning(ed) a(n)…			
	AS or less (*n* = 3)	AA (*n* = 4)	BA/ BS (*n* = 16)	Masters/ Doctorate (*n* = 14)	AS or less (*n* = 15)	AA (*n* = 15)	BA/ BS (*n* = 35)	Masters/ Doctorate (*n* = 19)
Age	A = 2					A = 12		A = 15 D = 8; 6
National Origin	A = 2	D = 2; 1			D = 7; 3			
Sex		A = 3 D = 2; 1						
Gender		A = 3 D = 4; 0						
Religion or Belief System	A = 2	D = 3; 0	A = 10					A = 12
SES Class	A = 2	A = 3	A = 14 D = 7; 3	A = 10	A = 11 D = 10; 4		A = 25 D = 13;12	A = 14 D = 13; 3
Physical appearance	A = 3		A = 13	A = 12	A = 11 D = 8; 3			A = 15 D = 9; 2
Ethnicity							D = 10; 15	D = 8; 6
Race		D = 2; 2	D = 7; 4		D = 9; 2	A = 11		A = 12 D = 13; 2
Sexual Orientation	A = 2	A = 3						
Ability*	A = 2							

Key	*Aware* of identity at least once/week	*Aware* of and *discriminated* against for this identity	*Discriminated* against for this identity

Note. A = number of people who indicating being aware of the specified identity at least once a week; D = number of people experiencing some or substantial discrimination.
*Ability includes physical, psychological, mental, and learning abilities.

sample, in three out of four of the degree-attainment levels, participants who earned higher degrees had higher *Mean Dominant ID Scores*, although the results were not significant based on a Mann-Whitney U test or Cramer's V, χ^2(40, *n* = 121) = 44.07, *p* = .30).

Correlations to understand the relation between discrimination and the outcome variables. To determine the relation between discrimination overall and outcome variables, I computed a Spearman correlation with the Bonferroni correction, with *p* set at .005. I checked the assumptions and proceeded with the Spearman correlation as opposed to the Pearson correlation because the assumption of linearity was violated. The variables were all nearly normally distributed and outliers were winsorized. I calculated the Spearman *rho* statistic to determine the correlations between dominant identities, discrimination experienced, and the outcome variables (see Table 5.10).

Table 5.10

Correlations Among All Outcome and Predictor Variables (n = 121)

Variables	1	2	3	4	5	6	7	8	9
1. Academic aspirations	—								
2. Academic outcome	.12	—							
3. STEM outcome	.22*	.18	—						
4. Experienced discrimination	.18*	.04	.04	—					
5. Dominant identity	.03	.15	–.06	–.22*	—				
6. Sex	–.08	.02	–.01	–.03	–.63**	—			
7. Age	–.14	.25**	–.05	–.14	.30**	–.11	—		
8. SES	–.04	.21*	–.08	–.10	.09	–.03	.08	—	
9. Race	–.03	–.02	.07	–.22*	.18	.06	.20*	.01	—

*p < .05. **p < .01.

There were correlations between the academic outcome, age, and socioeconomic status (SES), with SES and the academic outcome having a small correlation. The academic-aspirations outcome was positively correlated with the STEM outcome and the level of discrimination people experienced. This means that both those who have experienced higher discrimination and those who have higher STEM outcomes have higher academic aspirations. I also expected significant correlations between the STEM outcomes and either the sex, race, or SES identities, but those were not significant. These correlations indicate that people experienced the most discrimination as a result of their physical appearances and races. For this research, the most salient predictors of the outcome variables included the participants' SES, age, and the amount of experienced discrimination.

Then, using the critical race quantitative intersectionality framework, I investigated the relations among multiple identities and the academic and STEM outcomes. This part of my analysis included a hierarchical log-linear analysis that tested the association between combinations of identities and the measures of STEM and academic persistence. I performed two calculations, one for the academic outcomes and one for the STEM outcomes. This should be considered an exploratory analysis, given that some small cell sizes violated the assumptions for log-linear analyses. In the analyses, I included STEM persistence, or academic persistence, and the three identities most commonly discriminated for and attended to (physical appearance, race, and SES).

None of the analyses resulted in significant effects when multiple levels of each identity were used, all $p > .714$. This outcome is likely the result of low cell frequencies because when identities were collapsed into dominant (1) or nondominant (0), a significant finding emerged: The fourth-order effect for academic outcomes, physical appearance, race, and SES was significant, $\chi^2(3) = 2.105$, $p = .035$. Applied to real life, the fourth-order effect means that three less complicated interactions were necessary for this four-part interaction to occur. This finding supported the concept of intersectionality in that both identity and the effects of identity are dependent on the most salient aspects of one's identity interacting together. It appears that physical appearance, race, and SES are the most salient identities related to academic accomplishments, but salient identities may change in different contexts. These are all visually noticeable identities, and therefore participants are more likely to be discriminated for those identities in large settings. This significant effect could be related to the amount of resilience participants have. Perhaps having three or more nondominant identities was a tipping point regarding the level of discrimination with which the study participants could cope.

The main effects in the log-linear analyses were significant for SES, $\chi^2(1) = 2.69$, $p = .007$; race, $\chi^2(1) = 3.97$, $p = < .001$; and for physical appearance, $\chi^2(1) = 3.96$, $p = .047$. For the SES identity, there were 3.3 more people than expected with lower-middle-class status who earned a bachelor's degree and 4.6 more people than expected who earned a graduate-level degree from the lower-middle-class group. For race, there were fewer people than expected in the White group earning any level of degree. There were 2.7 more Black people and 3.2 more Latin@ people than expected earning graduate-level degrees. Some of these main effects could lead to a conclusion that some forms of disadvantage are in fact beneficial for academic outcomes, and it may be true for certain individuals that having the social disadvantaged identity actually pushes them to do better than what others expect of them. However, recall the fourth-order effects that indicated the negative effects of multiple marginalized identities.

Only the main effects were significant with the STEM-persistent variable: SES, $\chi^2(1) = 2.32$, $p = .02$; race, $\chi^2(1) = 4.09$, $p < .001$; and physical appearance, $\chi^2(1) = - 2.53$, $p = .01$. Some unexpected results were there being 2.8 more people than expected in the middle-class group who earned STEM degrees. Regarding race, there were 4.2 more people than expected in the Black group who earned STEM degrees. There were also more White and Latin@ people than expected in the nonSTEM-persistent group. For both the academic and STEM-persistence calculations, the race main effect had the greatest significance with the highest absolute value *z* score.

Study 3: Qualitative Analyses

Throughout my analyses, I reminded myself of my theoretical framing and the associated coding guidelines. To analyze the qualitative data, I read the survey responses fully, participant by participant. Then I reread them question by question. Using the mixed methods analysis tool Dedoose, I conducted thematic coding, first with a general lens to simply describe the story of what was happening in the data, from my perspective. Then I did second and third rounds of coding with the CCW and CRT framings. I used both apriori codes to find the themes that explain the participants' experiences and empirical codes related to the theoretical frameworks. Then I searched for patterns in the codes that overlapped with each other and those that seemed opposing (Gibson & Brown, 2009). Through these comparisons, I determined the relationship of my primary codes (from my perspective) to the categories determined by my theoretical lens. I used the theoretically framed codes to categorize the codes into themes. I then used poetic analysis to examine the data by theme, and in most contexts, I also described the themes present in specific groups of the population (divided by academic or STEM outcomes or level of discrimination). I also incorporated feedback from program alumni, staff, and an external evaluator on a summary version of the findings. See Appendix F for a list of quotes that informed the poetic analyses and the overall findings.

As a reminder, the main themes in the quantitative data are in many cases, the highly discriminated participants' experiences leading them to aspire into higher degrees; and those earning a graduate degree in a STEM field experienced the most discrimination of all types of academic outcomes. According to crosstabs, SES and gender are statistically correlated to academic outcomes, with women and middle-class participants earning higher degrees; however, there were more people than statistically expected earning bachelor's and graduate-level degrees from the middle-income group. There were also more Black and Latin@ participants than statistically expected who were earning graduate degrees. In these data, some of the stereotypes are upheld and some are not. Given the demographics of this sample, these outcomes may not be surprising, with the study group having a higher representation of women, Black and Latin@, and low-income people compared to national demographics.

Participants' experiences with discrimination. The study participants distinguished between their awareness of an identity and being discriminated for the identity in school, social, and professional settings. Participants indicated many experiences of discrimination at all levels, from individual, to institutional, societal, and civilizational. Participants described the great deal of CCW they gained from different aspects of the community. I have included quotes throughout the narrative to provide a snippet of the participants' voices as you read the data. Then, at the end of this section, I provide some excerpts of my poetic analysis to illuminate the meaning behind the data.

I have described the experiences of participants who encountered high levels of discrimination throughout their lives. I selected these participants as those who had at least 50 points in their "total discrimination sum" score (31%). This included discrimination for all types of identities. I cross-checked these participants with participants who had codes related to discrimination assigned to them (example codes include "experience of discrimination," "difficulty navigating a system," "feeling like I don't belong in college," and "exceeding people's stereotypically based expectations of me"). Those who had discrimination-related codes were nearly all included in those who had high discrimination scores; I only coded one additional person for discrimination, with a score of 38.

Participants experienced different kinds of discrimination because of their skin color, their sexual orientation, and their socioeconomic class. The discrimination primarily came in unspoken and unseen forms (59%), and through the assumptions that guided conversations and interactions with participants (49%). Participants consistently reported feeling disempowered or helpless during the described experience (62%). When I categorized these experiences according to their level of discrimination, there was a slight trend upward in the number of people experiencing that kind of discrimination, with each broadening of the levels of racism (16% individual level; 24% institutional level; 30% societal level; and 38% civilizational level).

Experiences of individual discrimination for highly discriminated participants. The individual discrimination examples include specific situations to the participants and involved individuals in the participant's life. The two themes within the individual-discrimination category were that participants experienced changes in level of emotional or financial support because of a component of their identities (4 participants), and people assumed certain traits of participants, based on stereotypes, that were not true (2).

One participant told her story about her college freshman math class and "the TA said that I was not *smart* enough to be in that class and should consider changing into a lower-level class. Since then, I have developed a lack of confidence when taking other math classes in college." This example shows how societal and civilizational racism became an issue for this participant in her institutional environment because of stereotyping based on her race or gender influenced her self-confidence and career pathway.

Experiences of institutional discrimination for highly discriminated participants. Within the institutional-discrimination category, participants indicated some challenges with navigating the educational systems (13%) and noticed that they did "not belong" in the setting (5%). Participants also shared experiences in which they seemed helpless and were trying to improve the situation with the available resources, but to no avail because of the strength of the discrimination in the institution (5%). A participant described her frustration with the systems in trying to transfer from one university to another:

> I had to transfer schools from a private college to a public college because I couldn't afford to get another loan since the private school thought I was no longer eligible for having a college work study position; and none of my credits transferred, so I had to restart all over again.

Participants were also influenced by the financial system and their ability to pay for school, as a participant described: “It is a financial break. I currently do not have the money to pursue a master's degree, so I want to save some money. I don't want to take out more loans for school.” These examples describe institutional discrimination because policy(ies) and regulation(s) cause the hardship in the participant’s life.

Experiences of societal discrimination for highly discriminated participants. Participants also described encountering people who understood their additional efforts and energy, and tried to provide support against the stereotypes. As a participant described,

> In college I had a wonderful physics teacher who offered to tutor me personally when I had difficulty understanding the subject. There were only 5% of women in the class and I believe the professor wanted to make sure that we stayed in the class.

This example is of course within the contexts of societal and civilizational discrimination, wherein women of color are not common in the physics world. The professor contributed to the participant’s resilient capital by supporting her in passing the class and gaining confidence to stay in the major.

Societal discrimination shifts life experiences in ways that many people do not recognize unless they are specifically looking for them. The participants in the study experienced societal discrimination in two themes. The themes include people having a shocked reaction to a success (10%) and people lacking role models who looked like them (22%). As one participant noted, "The program provided me with leaders and role models that I did not see in my predominately White schools and further made me feel that race and socioeconomic status doesn't [*sic*] have to play a role in my success." This participant has to actively tell himself a different story than he usually heard in public. In this quote, he acknowledged his vulnerability, according to the majoritarian story, and redefining it in a way that matched his dreams and aspirations. His was an exhausting process that no student should need to undergo; however, many do. This scenario reflects the added struggle for students of color in most of the schools in the United States.

Experiences with civilizational discrimination. The most common type of discrimination experienced by study participants was civilizational discrimination. In this study, all of the participants who experienced civilizational discrimination did so through the effects of stereotype threat. They shared stories of actively fighting against the stereotypes being placed on them, and falling into and slipping back out of the stereotypes. One stereotype includes believing that college is too difficult or "not *for* the participant" (32%), and thus something else such as the military would be the choice *for* the participant. One participant described his experience:

> When the topic [of plans after high school] would arise, it would probably be a class assignment or in conversation about joining the armed forces. Not exactly empowering. The [program] was maybe one of the only places those kinds of conversation carried any [substantial] weight [guiding my future goals positively].

The other stereotype was that participants lacked confidence in their abilities, specifically related to STEM fields (5%). Overwhelmingly, most participants (74%) recognized the conversations and stereotypes at face value and moved past them to reach their aspirations.

Another stereotype was that participants lacked confidence in their abilities, specifically related to STEM fields (5%). A participant described their journey of self-discovery: "I lacked confidence in myself and my abilities. I believed that I was not smart enough to pursue a degree in any [of the] science[s] but I realized that although it would require a lot of work, I am more than capable of achieving my dreams." No student should need to undergo such an intensive internal exploration process in order to learn. That takes far too much work and demand of the student. An element of translation that takes place when one learns: the translation of the knowledge into its meaning to the learner. Students who are influenced by stereotypes have multiple levels of translation to undergo before they can engage in learning. In addition to grasping the knowledge of the course, the students also have to defend themselves consciously and unconsciously from stereotypes. Students may recognize signs of the stereotypes through the teacher's practices or words—for example, the teacher calling on Asian students more than Black students (Southern Poverty Law Center, 2016).

Of the 33 total participants who were earning or had earned a graduate degree, only 11% indicated having had others doubt their intellectual ability to earn an advanced degree. This data may indicate the strength of others' perceptions of an individual's academic outcomes. Unfortunately, participants did not indicate how those experiences affected them; however, I share some excerpts of this experience. One of the people in the study explained, "In my senior year of high school, my mom laughed in my face in a cruel way when I told her I wanted to be a doctor. That was discouraging." This participant is now a medical doctor, showing that despite the hardships faced because of stereotypes, some still persist to reach their dreams with strength from their CCW.

Evidence of CCW and themes by academic outcomes of those who experienced high levels of discrimination. Of those participants who experienced high levels of discrimination, 68% (compared to only 33% of those who reported low levels of discrimination) were earning or had earned at least a bachelor's degree. My exploration of how these participants had succeeded regardless of the discrimination was framed in CCW. The data support that the participants experienced and built CCW to support their academic efforts and successes.

All of the earners referenced having multiple support mechanisms, including the program, family, community, friends, and school professionals, whereas only 43% nonearners indicated feeling supported. Some codes that I used to describe the kinds of support participants received were descriptive of the people providing support, the areas in which they were providing support, and the frequency of support. I also discovered this by the multiple-choice questions that asked participants to identify the level of support they felt during high school and college. The youth program was a safe place, a “place of refuge” for participants in both groups (as reported by 84% earners, 90% nonearners). In all contexts, the participants described the community created within the youth programs and how supportive it was. For these participants at least, the social capital was a vital form of capital. Participants most referenced and gained social capital from the program.

The degree earners also displayed a high frequency of changing their majors because of a bad experience (38% earners, compared to 25% nonearners), and they found opportunities to challenge themselves academically (24% earners versus 15% nonearners). For example, some challenges included participants giving a teacher feedback on the lessons for the next semester, tutoring, or learning a topic on their own. A student in the study described the following: “In high school, I was determined to become a crime-scene investigator, and I would indulge myself in many technical and scientific activities to challenge my passion for that specific field.” It also shows resistant capital because these participants sought ways to challenge themselves when their environment was not inherently challenging enough for them. Participants also indicated building familial capital from being shown and learning how to show “true support” from the youth-program staff and participants, as one participant described: “The youth programs boosted my self-confidence. I felt like everyone at the [program] was my second family, and they were genuinely interested in me to doing well and going far with my education.” Roughly half, 49% of the participants described learning professionalism and 57% described interacting with people different than them, both of which are forms of linguistic capital because they each require different forms of communication.

Both the postsecondary-education-degree earners (*n* = 25) and nonearners (*n* = 12) indicated that they struggled with navigating the academic system (64% of earners, 83% of nonearners) and with learning about their strengths and weaknesses (76% of earners, 72% nonearners). Learning how to navigate the systems and about one's strengths and weaknesses are examples of navigational and resistant capital. In the program, participants learned about navigating the school systems, but not enough to ease their academic successes, which indicates an area of potential improvement for the program. Participants indicated gaining aspirational capital from talking to mentors about their futures (48% of earners and 50% nonearners) and to family members or peers about plans after high school (64% earners, 53% nonearners), and about having new experiences at the youth programs (94% earners, 92% nonearners).

Summary of qualitative analysis. Through the qualitative analyses sections, I strive to paint the story of participants' experiences with different levels of discrimination, including individual, institutional, societal, and civilizational discrimination. Participants experienced all levels of discrimination, with the most in civilizational and societal. In most cases, even the individual and institutional discrimination resulted from civilizational discrimination, indicating that the effects of civilizational discrimination may be much larger than they initially appear because the effects trickle down to individuals and influence people's behavior.

I also provide evidence of the CCW strengths in the participants and support for the CRT tenets. The participants who experienced high levels of discrimination and earned at least bachelor's degrees described their value paid to social and familial capital. Participants also describe the many ways in which they found linguistic capital, support and strength to navigate the academic systems. Aspirational capital was also important for participants in that they made and achieved goals and had people with whom to discuss these plans. In the next section, I substantiate these explanations by providing participants' quotes and analysis related to some of the main findings.

Study 3: Poetic Analysis

In this section, I provide excerpts of my poetic analysis. To develop these poems, I took quotes from the qualitative responses and added to them to give them more meaning. If you are able, read it out loud, allowing your voice to follow the visual aspect of the words, and the tabs and white space resemble pauses to reflect. I number the poems below and provide a bit of context that is more specific to the source of the text. See Appendix F for a list of quotes that informed the poetic analyses and the overall findings.

Poem 1—Learning the hard way and feeling supported. This poem combines excerpts from two participants and my own additions. This poem is a primary example of the individual harm caused by systemic challenges. It also shows how participants accessed their CCW (familial capital in this case) once they realized they need support. During high school, students are sheltered by their guardians, who try to protect them from the dangerous streets in many low-income areas (Jarrett, 1999). Guardians may also not know how to prepare their children for college success because the guardians were not able to have the same experience. The result is that participants enjoyed the social and networking opportunities afforded to them by living on a college campus, but did not have experience in turning opportunities down and therefore had difficulties balancing their priorities to maintain focus on school.

. . .

I have been **set back** *due to* **financial aid.**

I lost financial aid after *my first semester*.

I remembered being told there were *three things you had to do to keep financial aid*, and

quickly

forgot

about

those.

Because I was sheltered all of high school so

when I got to college and got some *freedom*

I didn't know how to act.

So now I am getting my life together and **my grades and GPA back up**.

I **reached out to my mentors** and they guided me to find *resources on campus*. . . .the tutoring

center, the student support center and other program alumni.

By this point, I was **frustrated in school** and

tired from having to work to pay everything.

I could only take one or two classes at a time,

So I didn't even feel like I was making progress.

My father always told me **I have to work twice as hard** to reach the same goal as others.

And to *never give up.*

I will continue to ***aspire to be the best!***

. . .

Poem 2—Defying expectations. This poem includes one participant's words about her experience excelling in class. The participant performed at a higher level than expected, and it gave her confidence. Through these words, the participant shows how she gained some confidence and resistant capital through this experience.

. . .

In **first grade**, as my teacher was explaining an assignment to the class
I completed it before she ended her explanation.
She was *shocked*
that **I** got
all of it right
on my own.
This **gave me confidence** in my math abilities, until I reached middle school.

. . .

Poem 3—A true male role model. This poem combines one participant's response and my additions regarding the details of lessons learned. His experience of lacking a male role model is more common in communities of color and low-income communities because of the school-to-prison pipeline that results in many men of color being arrested for nonviolent, drug-related crimes (Moore & Elkavich, 2008). This experience leaves young men of color with no one to look up to, without any fault of their own. Additionally, the young men of color who have interactions with the justice system experience an additional layer of consequences on their personal development of manhood and social interactions (Rios, 2009).

. . .

[**This mentor**] has actually been the
most influential male
in my life,
providing me with a *ton of life lessons* and
words of wisdom that **most black males** in modern day America **don't**
have the blessing of getting.
A true male role model.

This mentor has taught me how
    to *respect women* and
    communicate with **confidence**.
He has taught me the
    value of the dollar and
    some **valuable lessons** related to putting away *money for savings*.
He has even taught me how
    to *negotiate a point* and
    debate in a **thoughtful and captivating** way.

. . .

Poem 4—Feeling like college was not for them. This poem touches on a sensitive feeling of *not* belonging somewhere. It combines excerpts from three participants and my own additions. This poem is a primary example of the strong effects that societal and civilizational discrimination can have on individuals. Additionally, it shows the various ways in which participants activated their CCW to reduce their feelings of self-doubt.

. . .

I did **not** have much **interest** in **college** until *I was in Upward Bound* and the
support I received there is what actually **made me believe I could go [to college].**

. . .

I remember *multiple experiences* of feeling like
                college was a difficult thing to get to.
    While in *elementary school* **not much** of my **peers** talked about
    knowing **older siblings** being in *college*.
It wasn't until *high school* when **I began doing well** in school that **I thought college was for me**.

Furthermore, when I got involved in the **programs**,
that **catapulted myself into the college mindset**.

. . .

I tried to go several times to my **Chem 101 professor** my first semester and
he would just insult me and
tell me to switch majors because
I was never going to pass.

. . .

Poem 5—Feeling supported and motivated by mentors. This poem groups excerpts from two participants. The excerpts illustrate the emotion and depth of the personal relationships formed between mentors and participants (familial capital). Some participants described this support as being instrumental in their academic and professional achievements thus far.

. . .

Mentors would let you know.
You did assignments and got grades so there's that, but the
mentors also *spoke to you* about their observations,
making sure you were aware if you were looking **angry** or **sad** or **hurt**.

. . .

It made me so much **more confident** in what I can do,
the **mentors helped** with personal issues like depression or family,
I'm mostly ***grateful to the mentors***,
they **believed in me** and **pushed me** to do things *I would've never thought* of doing.

. . .

Summary of poems. These poems illustrate the pain participants experienced as they navigated the educational systems. The participants also described their use of resources and the ways in which they successfully achieved their goals. These complex emotional experiences were rooted in causes related to discrimination and were remedied through participants' CCW.

Study 3: Discussion

The purpose of this study was to provide a basis for increasing our understanding of how participants in an out-of-schooltime program experience discrimination, who overcomes the discrimination, and how they overcome it in relation to academic and STEM resilience. I used a three-part theoretical framing for the research that included CCW, CRT, CRQI, and bioecology to elicit participants' experiences with discrimination related to their STEM and academic achievements. I also asked participants to describe STEM-critical incidents and factors that had influenced their educational achievements thus far. Asking these broad questions allowed me to gain a full perspective of the participants' educational and STEM journeys. When coding participant responses using a CRT lens, a participant who had to stop school because of lost financial aid would be presented as the fault of the education and financial-aid systems. In the majoritarian narrative, this story often indirectly blames the participant or the participant's community for the incomplete degree by simply stating the disadvantage without providing the context around it. For example, a literature review of student success published by the National Postsecondary Education Cooperative (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2006) devotes pages to describing what is wrong with the communities of color to lead to the higher dropout rates, without providing any context for what might be causing those problems (e.g., systemic and civilizational racism).

Through this research, I strive to contribute to the movement to reverse the deficit narrative about students of color by consistently reflecting on my CRT theoretical framework and highlighting the ways in which the findings support the tenants of CRT. I described each of the tenants and included in parentheses how I referred to them in the rest of the discussion. The five tenants of the CRT framework I used for this research are: (a) Identity is defined by multiple forms of subordination (intersectionality); (b) CRT questions the meritocracy and objectivity of educational systems; this means questioning how education does not provide equal access and is bound in a myriad of systemic, structural biases that prevent equitable education. There is a belief that if people “worked harder,” they can become educated, but this is a belief that ignores how systemic inequality operates in our schools, communities, and society (questioning meritocracy); (c) CRT supports a transformative response rooted in social justice (social justice response); (d) People of color experience life differently than White people and those experiences should be shared as lessons to others, often through the voice of counternarratives (counternarratives); (e) CRT takes a multidisciplinary approach to confronting discrimination that includes examining how racism may be viewed through more than one discipline (i.e., the educational discipline in general and the science discipline specifically, which is a multidisciplinary approach).

Study 3: Quantitative Analyses Discussion

The participants in this study represented many different identities, but most of them share the identity of being first-generation, college-bound students and students of color. The identities proved salient in different environments. I describe the salience by starting with binary relationships. Based on Spearman correlations, the most salient identities, compared to other identities, were SES and age, given that these were correlated with the academic-outcome variable. SES and age were also key variables in determining the resources individuals have. This complex effects of having multiple subordinated identities support the intersectionality tenant of CRT. There was also a correlation indicating that those who experienced higher levels of discrimination aspired to earn higher degrees. The STEM-outcome variable was not correlated with anything except the academic-outcome variable. As I expected, the dominant identity variable was correlated with some identities, including SES, race, and sex, based on the qualitative data, prior research, and the intersectionality tenant of CRT.

To investigate the more complex relationships that involved the intersectionality of identities, I used hierarchical log-linear analysis. The only statistically significant multilevel interaction was that among SES, race, and academic outcomes. Individually, these identities had both positive and negative effects as related to academic outcomes. This seemingly contradictory finding supports the intersectionality tenant of CRT and the complex nature of identity and the unpredictable dynamics of having multiple salient identities simultaneously.

Study 3: Qualitative Analyses Discussion

Participants experienced different kinds of discrimination including all levels (individual, institutional, societal, and civilizational), and as attributed to multiple identities. Participants reported more incidents of discrimination as contexts became more remote from direct, personal experience, such that more examples of civilizational racism were reported than were incidents at the individual level. This supports the tenant of CRT that questions the meritocratic and colorblind nature of the academic systems and follows the trend on expressions against racism since the civil rights era, morphing from a blunt and direct experience or expression of racism to less overt and more nuanced experiences (Sue et al., 2007).

When describing discriminatory events, the majority of participants indicated feeling helpless and disempowered. I found that within the STEM-persistent group, the participants experiencing the most discrimination were those earning higher degrees. This makes sense, that the more advanced degree seekers felt more discrimination than lower-level degree seekers because as the degree becomes more advanced, fewer individuals are underrepresented (e.g., Aud, Fox, & KewalRamani, 2010; George & Malcom, 2011). Contrarily, in the non-STEM-persistent group, the participants earning the lowest degrees reported the most discrimination. There are many possible explanations for this pattern, such as that they may have felt more vulnerable overall because of their low education levels, and they also may have experienced discrimination in a more personal manner than those with college degrees. This also supports the tenet of CRT that questions the meritocracy of the systems because the experiences of study participants (primarily people of color) indicate that many who had not yet earned an associate's degree during data collection worked very hard, with minimal success in return (e.g., Aud, Fox, & KewalRamani, 2010; George & Malcom, 2011).

Often, participants who had earned advanced degrees and had experienced high levels of discrimination were motivated to earn those degrees because of others' disparaging perceptions of their academic abilities. Additionally, some participants found ways to overcome or compensate for the discrimination they experienced, as reflected in the fact that 25% of the individuals who experienced high discrimination were earning or had earned graduate-level degrees, and 37% were earning or had earned bachelor's degrees. I did not directly inquire how participants responded to their experiences of discrimination; however, the participants in this high-earning group indicated having different aspects of CCW.

Participants developed one aspect of CCW, aspirational capital, by talking to others about their future plans and having new experiences that opened their eyes to potential futures (Nurmi, 1991). I also saw aspirational capital in participants striving for advanced degrees, degrees that were earned more frequently by the high-level discrimination group than by the low-level discrimination group. These high aspirations may reflect the study participants because they were a self-motivated group simply in their motivation to join the program. Those in STEM fields had higher aspirations than those in the non-STEM fields. Because all participants were, to varying extents, engaged with a college-readiness, out-of-schooltime program, the program may have influenced their aspirations. This possibility is supported by prior findings that, upon college enrollment, more women of color than White women intend to pursue a major in STEM degrees (NSF, 2011; Smyth & McArdle, 2004); however, they do not all persist, making the initial enrollment representative of students' aspirations at the time of declaring their majors. Additional supporting research is in the findings that participants with high aspirations maintain those aspirations regardless of the intensity of their experienced discrimination. However, overall, that study found evidence that people who experienced more discrimination had lower academic aspirations, which contradicts my findings (e.g., O'Hara, Gibbons, Weng, Gerrard, & Simons, 2012).

Participants with high levels of discrimination showed the most strength in their familial capital, with multiple sources of support and an assortment of individuals, resources, or groups to reference common among those who earned 4-year degrees or beyond. They also indicated learning about "true support," both in the sense of learning what it is to receive it, and what it is to give it, which ultimately would strengthen their future abilities to build familial capital. Their familial capital would build resistant capital because each additional human resource would increase the possibilities for opportunities or alternative options for the participants, which supports the counternarrative CRT tenant. Additionally, some participants in the high-discrimination group gained resistant capital through learning about themselves, including their strengths and their weaknesses. Participants could learn about themselves through having novel experiences, actively engaging in identity-development work, or being encouraged to do guided self-reflection.

Another vital strength for academic success is navigational capital. Participants gained navigational capital in interacting with people different from themselves because those interactions offered participants new perspectives. In referring to those who were different than the participants, I included other participants from different high schools and neighborhoods, mentors who were usually college students or young adults, program staff (the youth-development staff and the staff in the host organization as a whole), and host-organization guests. Participants learned life skills and about the college navigation process from their peers, and about navigating the STEM fields from professionals. Luna and Martinez (2012) also found that participants gained much navigational capital from their peers. In the current study, participants described engaging with STEM professionals through career fairs and symposium presentations. In both cases, presenters included information about their educational and professional journeys. Both participants in the low- and high-discrimination groups of the study indicated they were struggling with navigating the systems. Yet, many were able to navigate successfully and earn advanced degrees, particularly in the STEM fields.

Participants can practice navigational capital through college tours, or visits to a museum, zoo, aquarium, or botanical garden. Providing opportunities for participants to learn their way around new buildings, particularly educational institutions, makes them feel that they belong in the environment. Knowing someone who has experienced that same experience also creates a sense of belonging for participants, provides program participants with role models whose stories they may recall when they are in similar contexts. These stories, counternarratives, may teach participants lessons of what to do or what not to do; both are beneficial and also support navigational capital. Programs can create this environment by having program alumni present and engaging with current participants. Therefore, this aligns with the counternarrative tenant of CRT.

Study 3: Limitations and Strengths

One limitation of this research was that the sample purposefully focused on alumni of a youth program. Also, the majority of the population was Black and Latin@, with a small percentage of White and Asian people. The participants were primarily low-income and first-generation, college-bound students. For all of these reasons, the study was not representative of the general population, which was intentional because my purpose was to examine the educational experiences of underrepresented youth. I would also recommend that future research includes a control group in order to make stronger claims about the effect of mentoring programs. In addition, the survey data I collected was retrospective, with some participants being asked to recall experiences from as long as 15 years ago, and others recalling only to 6 months prior. The final limitation is in the survey design. Although I did pilot testing, four questions still did not provide me with the data I anticipated. Therefore, those survey data were often unused.

For those using this survey in the future, attention should be paid to the notations implied by the word choice. For example, in my survey, I asked participants to describe the ways in which the program challenged them. In reading this question, many participants seemed to associate challenge with being negative; however, I meant it in a positive way, synonymous with growth and development. A second question to note, which some people understood well and others completely missed, was one that asked participants to describe three critical moments in STEM that influenced their opinions of the field. Many participants indicated that they had no experiences in STEM. This was surprising to me, given that the majority of those participants were active members of the Upward Bound Math Science (UBMS) program at an informal science education center.

Study 3: Recommendations for Practice

This work was based on an out-of-schooltime college-readiness program that also engaged participants in STEM content. I conducted this study to contribute to the understanding of how to reduce the disparities in degree attainment and people of color in STEM fields. The primary recommendation is that out-of-schooltime programs should include a component of identity work in their curricula.

Identity Work Engrained in the Curricula

Individuals living in low-income and urban areas tend to be stronger when they have a clear sense of who they are, including both their strengths and weaknesses (Gullan, Hoffman, & Leff, 2011). One participant described his growth during his time in the program: “When I was in the program I felt confident that I would get accepted into college. My confidence grew a little bit and that caused me to do better in school.“ There are many ways to facilitate identity development work. Some commonly described methods include self-construction and self-discovery (Schwartz, Kurtines, & Montgomery, 2005). I would suggest that program directors research different approaches and implement the one they believe would best suit their population.

Research-supported programs. Some programs that have been supported by research as being effective in self-concept development include Fostering Healthy Futures for youth ages 9 to 11 (Taussig & Culhane, 2010), INSIGHTS into Children’s Temperament for children in grades K through 2 (McClowry, Snow, & Tamis-LeMonda, 2005), and STEP UP for young people ages 11 to 14 (Fuller, Haboush-Deloye, Goldberg, & Grob, 2015). Additional programs can be found on the National Registry of Evidence-based Programs and Practices website (nrepp.samhsa.gov). Program staff may find it necessary to take more than one approach with the group, depending on its diversity and size.

Participants’ emotional health. Identity development may also contribute to participants’ emotional health. A number of youth experience depression and other mental illnesses in response to experiencing discrimination (Chakraborty, & McKenzie, 2002; Gordon, 2016), which make it difficult for them to persist in higher education (Backels & Wheeler, 2001). Many participants described a need for mentors to understand mental illness, the presence of mental illness in their own lives, and a desire to better understand living with a mental illness. One participant described her triumph: “The Museum has helped me greatly with becoming the person I am today. They've helped me become more confident and overcome my depression.” Another participant suggested structured class time to focus on coping with mental illness: “I think the youth program(s) should add a . . . class that helps with depression, mental and or emotional issues.” The youth programs should consider normalizing mental illness by talking about experiences related to mental illness, and teaching participants about different resources for help if they or a friend are experiencing a mental illness. This approach can ease the transition from high school to college, and reduce the effects of discrimination.

Counternarrative sharing of success stories and overcoming challenges. Another suggestion to ease the transition and overall success of the students’ experiences in higher education is to prepare them to navigate the academic systems. Some systems that study participants expressed both triumph and challenge in navigating include financial aid, scholarships, meeting all graduation requirements, approaching professors, and transferring credits. Participants triumphed through systems in which they felt supported by peers, teachers, and mentors. Contrarily, in instances when participants were challenged by the system, participants felt often somewhat alone in the system. Some suggestions for topics of conversation include understanding whom to go to for help, learning how to access academic information online, descriptions and understanding of typical campus or community resources, and ensuring students are taking steps toward graduation and making friends on campus.

College-engagement workshops in the community. An additional approach that may make a stronger impact in the long term would be to host a community gathering or workshop with university and school-system staff to change the Eurocentric culture of the organization. Doing this would begin to address the structural inequalities that are deeply rooted in educators' and administrators' subconscious by helping people to increase their awareness of certain practices that work. Stephens, Hamedani, and Destin (2014) described a university-wide intervention that successfully reduced the achievement gap associated with SES. The intervention includes participants hearing others' experiences related to college. In the stories, the intervention group was provided with information on the storyteller's background, a related struggle in school, and a solution. This process taught students navigational capital and led to great success. Students who were a part of this intervention sought more resources, had higher GPAs, and had more positive psychosocial outcomes.

Youth programs can guide alumni sharing their stories to ensure they address all three aspects of the story. As one participant suggested to improve the program: "A strong alumni emphasis. Participants going through their first semesters in college and throughout college should have structured reunions as well as the social ones we make ourselves." Another person said: "Further out reach with successful alumni in their field and constant reiteration in the youth that they are their own advocates!!!" To strengthen the college-going culture within the greater community, current participants can educate the community during community outreach efforts (having participants provide brief educational knowledge at a stand in front of a popular store or through classes sponsored by the local churches, libraries, or schools).

The United States has made some progress regarding the educational disparities; however, much work remains to be done. Young people are influenced by many external factors, particularly young people of color because of discrimination. The bioecological framework suggests that even events twice removed still have an influence on an individual's development.

Study 3: Conclusion and Future Research

This research adds to the growing body of work directed toward understanding the experiences of students of color with discrimination in academics. As a scholarly practitioner, I also provided applicable and realistic recommendations for practice in youth development and education. There is much to learn about the ways in which people of color use CCW to thrive in discriminatory environments, and the ways in which others can elicit participants to gain CCW. An organizational change area to investigate is the process around and experiences of changing a discriminatory system. Further research may also contribute to adding to the types of capital and contributing to original CCW framework also. A fascinating area of future research may also be looking deeper into the intersectionality of race and SES as related to academic and STEM outcomes.

Some suggestions for additional research on related topics include investigating differences between how participants of an out-of-schooltime program and their peers who do not attend out-of-schooltime programs navigate experiences with discrimination. Also, I suggest bolstering the research base with broader adoption of the CCW framework. This framework's way of organizing and viewing life events reforms the common perspective of communities of color and other discriminated communities. The more information people gain about the strengths of marginalized peoples, the more the research community and society as a whole are countering the effects of civilizational and societal racism.

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CHAPTER 6: SUMMATIVE DISCUSSION

This research addressed a current need to understand contributors to the underrepresentation of people of color in science, technology, engineering, and mathematics (STEM) fields and among those with advanced degrees and illustrates the ways in which society contributes to these disparities. The United States is suffering in STEM creativity and advancements because of these educational disparities (Tatum 2003). This research supports youth-development efforts to reduce disparities and calls for a need to increase awareness of the civilizational and systemic ways in which our society favors or impedes students based on their identities. This research project contained a three-part study; each part investigated whether and how participants' involvement in an out-of-schooltime program was associated with academic and STEM outcomes, and any negative impacts of discrimination.

My research covered two groups of participants, with the possibility of some participants being in both groups: (a) Alumni who were involved in the out-of-schooltime program in some capacity, ranging from minimally and only attending one event to intensively and attending multiple events each week for four years. These 121 participants completed a survey. The survey participants graduated from the program 9and high school) between 2000 and 2015. Some of the participants eventually became staff in this program or other departments of the host-organization; (b) The second group of informants included a combination of 24 alumni and participants who were members of the program between December 2012 and June 2014. These individuals participated in a focus group that was conducted by an external program evaluator.

The project was guided by a number of research questions:

a. (Study 1) How do students of color who participate in an out-of-school program experience community cultural wealth (CCW)?

b. (Study 2) What out-of-school program elements are related to program participants' academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?
    (i.) For which participants was the youth program a proximal process, based on level of academic aspirations, STEM persistence, academic persistence, STEM resilience, and academic resilience?

c. (Study 3) Is the level of awareness of personal identity related to program participants' academic aspirations, STEM persistence, academic persistence, STEM resilience, and academic resilience?
    (i.) How does the level of experienced discrimination relate to program participants' academic aspirations, academic persistence, STEM persistence, academic resilience and STEM resilience?
    (ii.) How do individual identities relate to participants' academic aspirations, academic persistence, STEM persistence, academic resilience, and STEM resilience?

Through these questions, I hoped to understand what overall factors contribute to out-of-schooltime program alumni's academic and STEM outcomes after high school. With this research, I intended to learn what is it about some participants that they earn graduate degrees and others find successful careers with associate's degrees. I also wanted to understand what components of the out-of-schooltime program contributed to the participants' academic outcomes.

I used a four-part framing for my research, including community cultural wealth (CCW) theory, critical race theory (CRT), critical race quantitative intersectionality (CRQI) model, and bioecology theory. CCW highlights the different ways in which communities of color have strengths. CCW is made up of at least six forms of capital, including *aspirational* (setting goals and having dreams for the futures), *linguistic* (ability to communicate in multiple different languages, including using art and creativity to communicate, communicating across SES levels and other identity barriers), *familial* (individual connections with one's personal family members, as well as other people from organized communities, including youth program staff and peers, church peers, etc.), *social* (benefits gained from having a network of people), *navigational* (ability to navigate the systems of education to earn a degree, for example, earning a bachelors or graduate level degree with minimal debt), and *resistant* (ability to challenge the dominant and discriminating community and practices).

I used CRT and bioecology to create the context in which I could identify the instances of CCW in the participants. CRT is based on five primary tenets including: (a) race and other subordinated identities jointly define a person's identity (i.e. intersectionality); (b) racism exists in North America and is often unidentified (i.e. civilizational racism); (c) CRT focuses on social justice and creating a transformative response to racial, gender, or class inequities (i.e. social justice response); (d) Marginalized people have unique experiences from those with primarily dominant identities; and these experiences should be shared (i.e. counternarratives); (e) CRT supports a multidisciplinary approach toward understanding racism and other forms of discrimination in the current US society (i.e. multidisciplinary approach).

CRQI was developed to provide a critical framing for quantitative researchers, and that is how I use it in my research in study 3. I primarily used this method to develop a story using the quantitative data (Covarrubias and Velez, 2013). CRQI research is based on five principles, including (a) data mining related to intersectional aspects of the data to quantify the complex and intersectional impacts of racism and associated discrimination; (b) challenging the neutrality of quantitative data and supporting the data with the story around the data; (c) highlighting the counternarrative as a valuable source of knowledge to inform the data; (d) committed to addressing injustice; (e) Working toward a solution for the systemic racism with a transdisciplinary approach (Covarrubias and Velez, 2013).

In using the bioecological process-person-context-time model, I consistently sought clues to the many external factors that may have influenced participants' levels of CCW. This model guided me through determining participants who were highly engaged in program activities (i.e. the program would be a proximal process for actively engaged participants) and helped me make comparisons between highly engaged and minimally engaged participants. The characteristics of the person (i.e. identity, personality, values, character), context (i.e. the physical environment, those present), and time (i.e. time in history, developmental stage, or timing of the activity) influence the person's experience with the proximal process.

In the following discussion, I first describe my overall mixed-methods approach for this research project. Then I provide some background to describe the program and the ways in which the program builds CCW for participants. This information was primarily synthesized from study 1. Then I share my findings from Study 2 on how the participants' program participation affected them regarding factors related to academic and STEM outcomes for each level of academic and STEM aspiration, persistence, and resilience. In the next section, concerning Study 3, I discuss the ways in which participants experienced discrimination and how their experiences of discrimination were related to their academic and STEM outcomes. I bring this information together through the participant portfolios, which describe some common trends in the participants, divided by academic achievement level and STEM persistence. I also highlight lessons learned in my recommendations for practice. I conclude the discussion with limitations, strengths, and suggestions for future research.

Mixed-Methods Analyses

In the quantitative portion of the study, I used a multiphase, convergent parallel, mixed-methods design to address my research questions. The mixed-methods approach allowed me to use specific techniques for each type of information I gathered. In the qualitative portion of the study, an evaluator conducted focus groups during the winter of 2012, winter of 2013, and summer 2014. The focus groups included 50 total participants and lasted 4.5 hours. A program evaluator conducted the focus groups and, who gave me the secondary data as transcripts and recordings. These focus groups helped me gather information on emotional connections and nuances of the participants' experiences in the youth programs. I sent out surveys to approximately 600 alumni who had participated in the program, and some as program mentors in the out-of-schooltime program. The surveyed information allowed me to ask the alumni broad range of questions about their life experiences. The survey combined multiple-choice and open-ended questions, which I analyzed in tandem. I framed all three studies with CCW, critical race theory (CRT), critical race quantitative intersectionality for the quantitative portions, CRQI, and bioecology.

The first study was purely qualitative and set the foundation for my other two studies. I did this so my survey for studies 2 and 3 would reflect the nuances of the program and the participants' experiences. The analyses of the first study showed that the participants developed a great deal of CCW from their experiences in the youth programs. I presented the data through a counternarrative, which maintains the meaning and nuances of the focus groups because the findings were complemented by narration and emphasis to bring the story to life.

For studies 2 and 3, some of the data on participants' outcomes were used in both studies. The second study focused on the program's characteristics and the participants' connections and benefits from the program in relation to their academic and STEM outcomes. I analyzed the data through community cultural wealth and bioecological lenses to understand how the participants used their strengths and resources to successfully earn their college degrees. I presented the data through poetic (Cahnmann, 2003; Delgado-Bernal, 2002) analysis supported by a multiple logistic regression assessing the program factors' relation to the participants' outcomes. This research built on the qualitative data gathered in the first study and provided focus for the third study.

Before explaining the second study, I'll explain how the third study connected to the first study; I sought to find a cause for the challenges and obstacles the participants underwent throughout their academic careers. Therefore, I focused on the participants' experiences with discrimination in relation to their academic and STEM achievements. Because I have not experienced discrimination for the same identities as many of my study participants, I read and reread the data at least four times, each time with the framing of a different level of racism (individual, institutionalized, societal, and civilizational (Scheurich & Young, 1997). I analyzed the data through thematic analysis (Gibson & Brown, 2009), poetic analysis (Cahnmann, 2003; Delgado-Bernal, 2002), Spearman correlations, and Cramer's V (Morgan, Leech, Gloeckner, & Barrett, 2013), and hierarchical log-linear analysis (Leech, Barrett, & Morgan, 2015). I found higher occurrences of racism as the scale enlarges from individual to civilizational discrimination. I present summarized findings of all three studies in the sections below, along with recommendations for practice and future research.

Study 1—General Experiences of Community Cultural Wealth (CCW) for Participants

In this section, I describe the program components and activities as they fit under each of the six types of capital described in Yosso's (2005) CCW framework. The types of capital include aspirational, resistant, familial, social, linguistic, and navigational capital. I also highlight the ways in which this program supports and promotes the tenets of CRT.

Familial Capital: The Foundational Form of Capital for Participants

The foundational form of capital for the participants in this study was familial capital. Every other form of capital relied on the individuals who contributed to participants' familial capital. Additionally, this was supported in study 2 and 3's quantitative survey data, as I found moderate correlations between the participant's sense of community with the development of life skills, motivation for participation, and proximal process (i.e., level of program involvement). One participant mirrors these characteristics in her description of the benefits of the program for her: "It connected me to lifelong friends, put me in internships to shape my life and career, and really forged my personality and confidence." This participant describes the lifelong friends she gained through the program (familial capital) who support her by connecting her to professional opportunities (social capital).

Participants in this study reported multiple ways in which to build familial capital—with family members, community members, classmates, and mentors and peers from the program activities. The value added of the peers from the programs aligned with research showing that peers from the out-of-schooltime programs are particularly positive influences because they share the drive to set and strive for goals (Garringer & MacRae, 2008). Many participants spoke or wrote about the importance of their mentors and friends from the program during high school, which means those relationships would have lasted up to 15 years, at the time of taking the survey. This research also supports other research in that participants learn together how to provide and receive support for and from others (Roth & Brooks-Gunn, 1998). The informal learning center as an after school environment promotes value in education, which also contributed to the participants' academic confidence and success. One participant explained: "The youth program helped me understand my future. The [mentors'] own experiences of college helped me understand what I would expect or not expect in further education." This is consistent with prior research showing that having a mentor contributes to academic success through developing a stronger racial identity and value in education leading to future success (Hurd et al., 2012). The family night events during out-of-schooltime programming greatly contribute to the familial capital because, ideally, all of the important individuals are present in support of the individual participants.

Social Capital: A Tool for Navigating the Present and Future

In addition to the personal growth that comes from these close relationships with caring adults and peers through familial ties found in this study, participants also gained the resource of networks and using social connections to make progress toward goals. Such development of social networks provides development of social capital, a major tenet of Community Cultural Wealth (Yosso, 2005). The present research supports prior findings showing that students who engage in after-school programs that expose them to different activities and are led by a caring adult tend to be more empowered (Erickson et al., 2009; Hanlon et al., 2009). Students who are empowered to use the benefits of community organizations found in businesses or institutions of higher education are more likely to achieve higher academic success than those who did not (Rios, 2010). One study participant described the ways the program benefited him: “I met a lot of amazing people that were very encouraging and believed in me. Because of this I was prepared to perform a thesis or any research in front of people. I built networking skills as well.”

Social capital also comes in the form of private access to specific scholarships, Summer Bridge transition programs, and leadership opportunities funded by TRiO programs, which sponsored the program, the focus of this research. Program participants also had full-time access to college advisors and mentors who were connected to participants through familial capital. Mentors and advisors also provided guidance, monitoring, and support of the participants during their college application processes, as one participant described: “It gave me structure and the knowledge to apply for scholarships and college.”

Linguistic Capital: Underdeveloped by the Program

Many participants came to the program with significant linguistic capital from their families in the form of being multilingual. The program supported this capital by having staff, publications, and events in Spanish and Haitian Creole. One participant describes the ways in which he added to his linguistic capital as a new immigrant to the United States: “These experiences helped quickly transition from being a stranger to the city/state to being used to living there. It also helped me in many ways with learning a new language.” I found few other examples of participants who built linguistic capital, indicating that the program may focus additional efforts toward developing linguistic capital.

Aspirational Capital: Setting and Reaching Goals

Participants gained a significant amount of aspirational capital from the program and their families. One of the foundational components of the youth program is youth participants reciting the program mission: “To ensure that underrepresented high school students are excited by science and inspired to become responsible and successful college graduates and community leaders through personal and academic enrichment.” Throughout their involvement in the program, participants recited the mission statement every program day, reminding them of the program’s expectations for them. A participant explains her experience: “I met many of my friends at the [program], because of the [program’s] mission, we all had the mindset of obtaining a college degree.”

Communication with mentors and family members about their future plans built aspirational capital in the participants. In casual conversations and learning contexts, mentors enlightened participants about the similarities and differences between high school and college life. Those conversations encouraged youth to reflect on what they want their futures to look like and how they might be able to achieve that outcome.

Resistant Capital: Building Internal Strength

Additionally, reflective conversations occurred with mentors guiding the participants to learn their strengths and areas for improvement, and developing positive self-images. Through conversations about their strengths, areas for growth, and self-image, participants grew to identify and combat stereotype threat (Cohen, Steele, & Ross, 1999), increasing their awareness of resistant capital. The current research aligns with prior research that positive changes in mentees' self-esteem, social skills, sense of belonging (Karcher, 2005), and ethnic identity (Fruiht & Wray-Lake, 2013; Hurd, Sanchez, Zimmerman, & Caldwell, 2012) result from student engagement in mentoring programs. One participant describes her experiences in the program: "Definite connection to the importance of giving youth a strong foundation from which to build productive futures. I have passed this on to my own children." Additionally, resistant capital was evident in that participants seek academic- and learning-related challenges. Resistant capital drove these participants to seek challenges. One participant explained: "They also instilled a thirst for education. I'm still not at the level I desire to be, but because of them I've never stopped trying to get there." This participant described the concept of not being satisfied with what one is given just because that is all one was given. These participants describe the ways in which they sought challenges to widen their knowledge and expertise. Aspirational capital helps participants to set their professional and academic goals and resistant capital prepares their inner selves to reach those goals.

Navigational Capital: Every Step of the Way

As participants achieved their goals, they developed navigational capital. Different people from the participants' familial background assisted the participant along the way of navigating complicated systems (e.g., school systems, financial systems providing aid, and consumerism found in expensive necessary goods such as purchasing a car). Yet, many participants indicated struggling with navigating the postsecondary education system, by losing financial aid, not registering for classes correctly, or challenges related to transferring from one institution to another, etc. One participant described her hardships related to completing her degree: “I transferred from a private to a public college because I couldn't afford to get another loan and I was no longer eligible for a work-study job. None of my credits transferred so I had to restart all over again.”

Many of those same participants who faced obstacles in the academic system did eventually build their navigational capital as they earned their degrees. Many participants also gained navigational capital through the scholarships they won for college. Familial capital was consistent throughout many of the participants’ lives, so participants can use their social capital to ease their navigation of the systems. During the program, participants gain a great source of navigational capital in hearing mentors’ and alumni’s college experiences. Through these stories and counterstories, participants listen to the ways in which others dealt with college experiences. This sharing process generally elicited strength and empowerment in the participants.

The program also prepared the participants to navigate the world by teaching participants life skills that benefited them in different contexts as they entered adult life. One participant describes how she grew professionally: “My first job was selling memberships. I was able to develop professional skills while employed at the [host-organization].” The program of focus related to other out-of-schooltime programs in that there were also consistent opportunities for volunteering and paid work to help participants build professionalism (Roth & Brooks-Gunn, 1998).

Study 2—The Relation of Program Activities and Experiences with Participants' Academic and STEM Outcomes

There were many trends in the ways in which participants gained CCW from their engagement in the program and their surrounding environments. Although my initial research question was phrased such that I would only focus on the program contributions to participants' academic and STEM outcomes, I found the participant data so rich in examples of familial and community factors that supported participants academic and STEM outcomes; therefore, I included findings regarding familial and community factors that influenced participants' academic and STEM outcomes. I begin this section by describing the characteristics of highly engaged participants, followed by some findings on the importance of support that apply to the whole study population. In the second half of this discussion, I describe the participants' stories based on their academic and STEM outcomes.

Highly Engaged Participants for Whom the Program was a Proximal Process

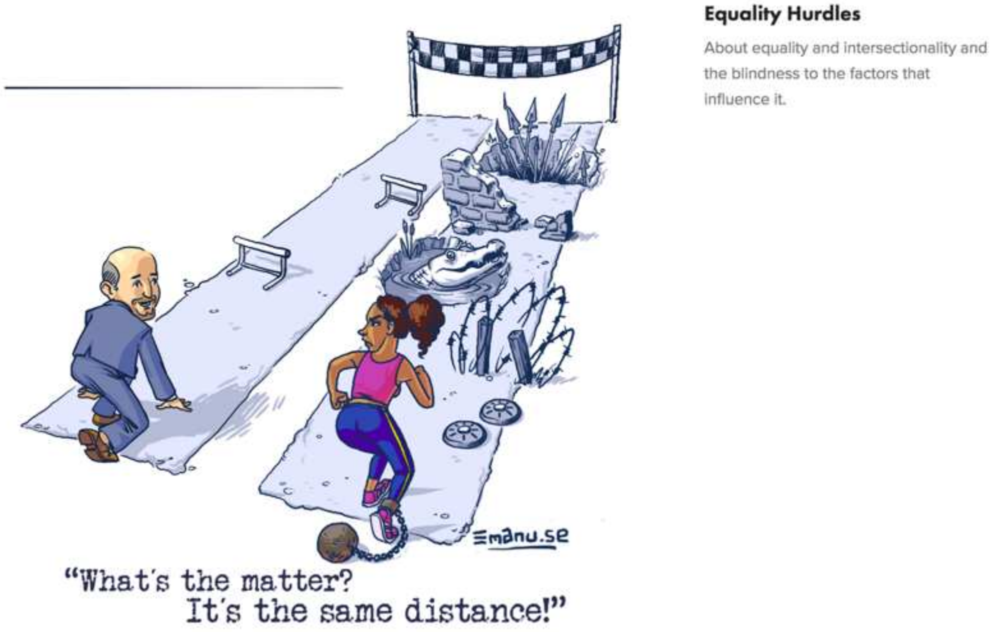
I classified the participants who actively engaged with the program for at least one year, as proximal process. Not surprisingly, actively involved participants in the out-of-schooltime program, such that the program served as a proximal process for them, were more likely than those who were minimally engaged to build a stronger community among program peers and staff, and more life skills were developed. Qualitatively, some participants indicated feeling a significant difference between the amount of support they received in high school compared to college, with the amount in high school being higher. Relatedly, I found a positive, moderate correlation between the amount of perceived support during high school and college, meaning that those who had significant support in high school also had significant support during college, and vice versa. Merging the qualitative and quantitative findings, this suggests that most participants, regardless of the amount of support they started with during high school, experienced less support during college. Therefore, it seems that although the program provided significant support for participants, they still sought more support in navigating college life.

The Need for and Accessing of Multiple Forms of Support

Conjointly, the qualitative and quantitative data indicated that the majority of participants felt supported by various people and networks. Additionally, the data showed a nearly uniform decrease in support after high school compared to that before high school. There are a number of potential explanations for this perceived decrease in support. It is possible that participants left home and felt less supported because of the distance between them and their supports mechanism. One participant put it bluntly: "The program provided resources via mentors and technology as well as campus visits to support high school related activities and promote going to college. After high school, I figured out the rest. "

Participants may have also perceived that they have less support because they actually need more support in the new college or university setting than they did in their familiar high school setting. This is even more likely for the study participants because many of them are students of color navigating difficult and new systems (Kirst, 2004). They would have likely encountered many more obstacles in navigating the systems than their White counterparts, related to earning their college degrees because the systems were not constructed with people of color in mind and were instead created to exclude people of color (Greene, Marti, & McClenney, 2008; Lynn, 2006).

Figure 6.1 shows a satirical comic created by Emanu, a Swedish illustrator and political cartoonist, exemplifies the concept by showing the comparison of a Black woman and a White man in a race. The track is mostly clear for the White man, with two easily navigated hurdles that naturally occur during the process of running a race. Contrarily, the Black woman's track is cluttered with dangerous and unpredictable obstacles that she is not equipped to combat; nor should she be expected to be equipped to combat these obstacles. This image is representative of the environment in which the dominant culture expects people with marginalized identities to succeed in a meritocratic system where individuals are supposed to achieve by themselves without the attention to the systems that hold them back. Yet, Another example of this is found in the youtube clip, titled, “Unequal Opportunity Race,” created by Erica Pinto and it shows this cartoon more clearly through an animated video that clearly highlights societal inequities that display clearly why meritocracy is a myth (Pinto, 2010).



Equality Hurdles

About equality and intersectionality and the blindness to the factors that influence it.

Figure 6.1. This is a satirical comic created by Emanu to describe the unforeseen challenges that people of color and particularly individuals with more than one marginalized identity. (Emanu, n.d.)

Substantial research supports the necessity of support for underrepresented college students (Kniess, 2013; Rendón, 2006), particularly those who do not attend Historically Black Colleges or Universities. Students of color are often the first generation to attend college in their families because their parents were not given the opportunity to do so, given the historical structure of the education system (Greene, Marti, & McClenney, 2008; Lynn, 2006; McCoy & Rodricks, 2015). One participant precisely describes this challenge:

> I felt supported before and after high school but after high school it was different [than in high school]. I was working three jobs during college with a 21 credit load and I think that affected my grades and my college experience. My parents did not understand the work load and they didn't know I was struggling financially and academically. I never told them anything because I did not want to put that burden on them. They thought college would be a solution to everything but it was not.

Although students now have the opportunity to attend school, many challenges persist that they need to navigate because educational leaders have not rebuilt the system that excluded their parents and grandparents; instead, policymakers have attempted to repair the U.S. education system, unsuccessfully as measured by the persisting educational disparities. Therefore, the system is still built upon the foundation that excludes people of color and solutions are less dramatic. Unfortunately, U.S. students of color are still largely in a disadvantaged position because the foundation of the system is still based on the roots of the original system, which was built to exclude them from equitable access (Lucas, 2001; Nieto & Bode, 2012; O'Day & Smith, 1993).

The amount of experienced discrimination was another factor that was statistically inversely related to the participants' feeling supported, meaning that the more discrimination participants typically experienced, the less support they felt. Through this mentoring program, youth could build social supports and feel safe through self-development. My research aligns with past research showing that having social supports had multiple psychological benefits in that youth can build their confidence in school, strengthen their academic abilities, and provide them with access and knowledge regarding attainment of academic success (Hurd et al., 2012).

Participants' Portfolios

In this section, I combined the findings from the second and third studies to create a profile for participants in each of the aspiration levels, academic outcome categories, and STEM persistence levels. Although this population may occupy a specific niche of the greater community, this research is applicable to the youth development community working with first-generation and low-income youth of color. All of the participants represented in the outcome-related portfolios have the youth program as a proximal process, meaning that they were active, frequent participants in programs.

In the following descriptions of highly active participant portfolios, there are patterns in some cases and not in others regarding the characteristics describing participants. This may mean that the lived experience is too complex with too many influencing factors and I did not find strong patterns; or it may mean that more research is needed to determine the patterns. I speak about the patterns as they relate to the participants' academic and STEM outcomes. The academic outcomes of this research include academic aspirations (the highest degrees that participants strive to earn), academic resilience (a computed score of academic resilience based on many research-supported factors that influence people's academic achievement levels. I determined the academic persistence outcome by the degree participants had earned or were earning at the time of taking the survey (Winter 2015-16). The STEM outcomes included STEM persistence, a simple dichotomous variable indicating if participants earned or were earning a STEM degree. I calculated the STEM resilience score using a similar metric as for the academic resilience score. For the portfolios, I have grouped the academic persistence and academic resilience outcomes together because they were strongly correlated, meaning that the two scores were similar for each participant. I also grouped the STEM outcomes for the same reasons. At the end of this section, I discuss the ways in which the program can best support the youth participants.

Academic aspirations. Based on descriptive data, participants who had experienced more discrimination had higher academic aspirations; however, this was not statistically significant (Figure 6.2). This may be because these highly discriminated and high-earning participants spent more time in places where their identities are underrepresented, including STEM fields or institutions of higher education, and therefore these participants experience more discrimination from the systems that control those environments or the individuals with whom they interact. This research aligns with prior research in traditionally marginalized individuals who find motivation to earn their doctorate degrees in response to others' discrimination toward them (Carlone & Johnson, 2007).

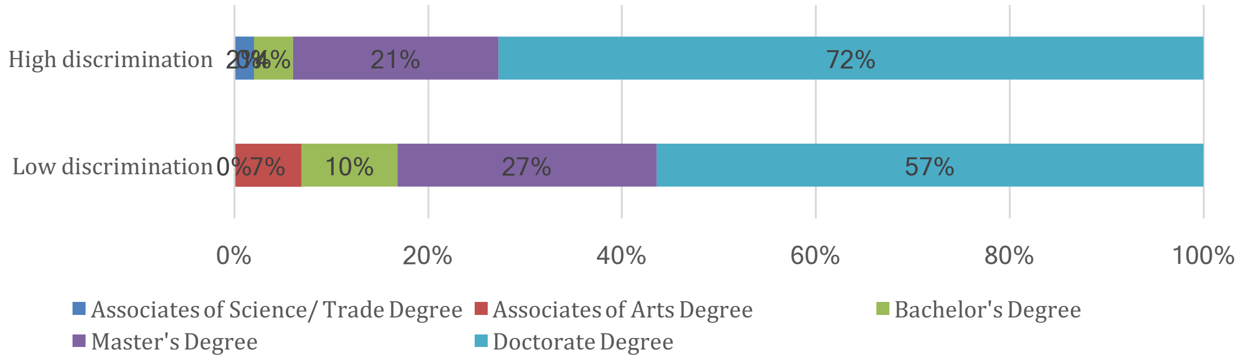


Figure 6.2. Percent of participants indicating each level of academic aspirations, with participants split based on their levels of experienced discrimination.

Academic achievement—participants who earned an associate's degree or lower. The profile of participants who had achieved or were achieving less than an associate's degree included feeling unsupported overall and facing academic challenges during K-12. These participants may have needed more support than they were given. Some may have had undiagnosed learning disabilities, compounded by the systemic failure and discrimination in the school systems. One participant shares his story: “I was verbal[ly] abused by my reading teacher, I've always had difficulties reading and the teacher would consistently call on me and make an example of my non ability to read.” Even worse in many underfunded schools and have high student-to-counselor ratios leaving students with less attention geared toward individual learning needs, compared to peers in well-funded schools. Additionally, many students attending the underfunded schools do not have access to updated textbooks and there are often not enough books for each student to take home a book at night for homework. These are implications of the policies related to school funding allocations.

Academic achievement—participants who had earned or were earning a bachelor’s or graduate degree. The group who was earning or had earned at least a four-year degree spoke differently about their experiences during high school. Many of them felt influenced by contemporary redundancy (repetition of the same message in multiple forms) beginning in high school or younger. Specifically, the group who was earning or had earned bachelor’s degrees indicated understanding their strengths and weakness, developing a stronger value in education because of the program, and feeling supported by mentors and friends. These participants had a strong sense of who they were and where they could go for support. Last, in their descriptions of the program, these participants used words showing their appreciation for the great opportunity they gained from the program.

Participants’ development and expressions of CCW. These examples of CCW are directly from the data and representative of ways in which participants built and used their strengths to persist their academic aspirations. The participants’ characteristics resonate with the CCW framework. Participants who earned at least a bachelor’s degree gained social and familial capital through the individuals who provided them with support and inquired about their plans after high school. Having multiple venues of support that encouraged and actively engaged with the participants regarding plans after high school was the most common trend in participants who earned postsecondary degrees and built navigational capital. The program encouraged self-reflection related to college readiness and career choices by requiring participants to write a one-page reflection after each of the 8 to 10 college- and career-readiness special events each year. The self-reflection processes, which contributed to self-growth, also fostered participants' aspirational capital. Participants strengthened their resistant and navigational capitals by learning life skills and professionalism and understanding personal strengths and weaknesses. When talking about how she received feedback in the program, one participant said: “Mentors kept me informed throughout. If I could do something different/better, they would share this with me.” The youth program contributed to participants' pre-existing sources of support and provided participants with a space for self-reflection and self-learning, which created the environment in which participants cultivated the CCW they use to navigate their lives during and beyond high school.

STEM Outcomes

The STEM-persistent participants were unique in many ways, including exercising initiative related to their learning and futures, having factors in their lives that contributed to a positive STEM identity, and having a strong and diverse network of resources surrounding them. These participants also indicated having important STEM experiences early in life (in elementary school), which is similar to the STEM career pathway model that began with experiences in middle school (Leviene, González, Cole, Fuhrman, & Le Floch, 2007).

These participants indicated receiving support from various sources including family, friends, and community members. Additionally, many indicated deep connections to the program mentors and peers, describing the program to be “like family.” They also showed appreciation for the skills the program helped them to build and giving credit to the program for their academic and professional accomplishments.

Even with this amount of support that participants gained from their engagement in the program of this study, some participants indicated struggling in STEM and lacking human support to persist in STEM fields. Additionally, the youth program did not have a strong support network for alumni, which made the participants' program support decrease after their high school graduation, particularly when participants left their hometown. Due to the fact that many participants started out as STEM majors and switched before graduating college, one may ponder what happens to the participants when they are in the STEM environment. In the following section, I describe some challenges that participants may have faced or may face as they advance in STEM fields. I share this information to make a call for additional research and action toward addressing some of the following challenges.

Challenges students of color face in STEM fields. Students of color are particularly influenced by lacking support because of the challenges ingrained in the systems running STEM fields. In the school systems, educators may reassess the way STEM classes are taught. Particularly in introductory college-level courses, lecture-style teaching for introductory STEM classes is common. This is an example of a system that was founded on the idea that there is an expert who shares knowledge, Socratic pedagogy, and secondarily created to exclude. This is a passive way of learning that only works for certain people. Lecturing assumes a one-size-fits-all approach to learning and is not effective in long-term knowledge retention because many students cram for the exams (DiPiro, 2009). Additionally, the skills used in a lecture class are unrepresentative of the skills used in the STEM fields themselves.

A study of geoscience professionals showed that participants prefer active, inquiry-based learning (Levine et al., 2007; National Academy of Sciences, 2011), which is something participants regularly engaged in during their time at the program. Additionally, participants suggested wanting more opportunities to engage in active learning, including internships or showing opportunities. Some other specific examples of activities included: "For example creating a museum exhibit, building a digital project, doing group project at the beach/ or [lab] where students have to interact with each other to accomplish the task in the project." Students were also more attracted to the courses if the material was engaging (McDaris, 2013) and relevant to their experiences and goals (Kozoll & Osborne, 2004; Levine et al., 2007; Mark et al., 2013). For these reasons it is possible that the youth program provided the participants with interest and motivation in STEM, leading participants to anticipate being STEM majors, but not completing STEM degrees.

Other characteristics that result in unbalanced representation of people of color in STEM fields is their interest in the field. Some factors that attract students of color to geoscience degrees, and I suspect more broadly to STEM degrees also include the content area's relevance to major issues in their communities (National Academy of Sciences, 2011; Riggs & Alexander, 2007; Stokes et al., 2007) and analytical dialogues regarding climate change, policy implications, and social justice concerns (Neito-Ferreira et al., 2012; Hundebøl & Nielsen, 2014; Mark et al., 2013). One student explained his reasons for stopping the STEM major as "I just have no interest in it anymore." Another participant explained, "It wasn't for me. I'm a creative naturally and only pursued because of family pressure."

Although the participants in this study did not describe personal experiences in a STEM professional environment, they credited the STEM professional culture as a reason to direct their professional attention away from STEM. One participant clearly stated her experience during an internship sponsored at a nearby public hospital: "During an internship during high school I was encouraged by the professionals that I worked with to pursue an engineering degree, but I chose not to because of how uncomfortable I felt in the setting." When person of color is able to navigate those challenges and find interest and connection to a STEM degree, there are more challenges awaiting them in the workplace.

People of color may encounter challenges with hiring policies and job performance expectations in the STEM fields that may intentionally or unintentionally exclude people of color from contributing to the field. Some discriminatory hiring practices include posting job opportunities in locations with primarily White contributors, showing job posting adds with only White and Asian males in the photos, having background checks that list the nonconvicted arrests (Roberts, 2012; U. S. Equal Employment Opportunity Commission, 2016), or basing hiring on credit history (Guerin, 2016). Once people of color are employed in STEM fields, potential obstacles include supervisors basing evaluation on proficiency tests that have shown bias or are based on stereotypes (U. S. Equal Employment Opportunity Commission, 2016). Underrepresented people in STEM fields have also reported needing to defend their competency more than White and/or male counterparts. being confused for janitorial or administrative staff, and women in particular do not feel supported by each other in the professional space (Williams, 2015).

Participants disengaging in STEM fields is a concern of the youth program participants also. According to the youth program staff, two-thirds of the participants began their freshmen years declaring a STEM major, and about one third of those switched out of STEM while in postsecondary institutions. Only 10% of study participants said they had started as a STEM major and switched out. People of color who aspire to earn graduate level degrees in STEM fields, analyzed separately by unique identity group, reported high affinities for mathematics and science (Christensen, Knezek, & Tyler-Wood, 2014). These findings align with others indicating that, at the beginning of their first years of college, more women of color than White women intended to major in a STEM degree program (NSF, 2011; Smyth & McArdle, 2004). The fact that so many people of color begin college aspiring to be STEM professionals, yet so few achieve that goal, indicates that there is something happening to participants during their time after high school that deters them from persisting in STEM. Much research on this topic exists, yet the disparities remain.

A number of research-supported factors either encourage or discourage students of color from pursuing STEM degrees. Those specific to students' time in a four-year college setting include class and major options, extracurricular activities, family and cultural values alignment with the content, financial resources, knowledge of STEM careers and future opportunities, mentors and role models, the job market and discriminatory experiences (Levine, et at., 2009). Research also supported this claim that racism is a factor that influences underrepresented populations' abilities to form strong STEM identities and persist in STEM fields, because it prevents people of color from developing strong social support from professional peers, which is an essential component of a strong STEM identity (Carlone & Johnson, 2007).

Study 3—Participants' Experiences of Discrimination and High-level Identity Awareness as Related to Academic and STEM Outcomes

Participants experienced different kinds of discrimination because of their skin color, sexual orientation, and socioeconomic status. When I categorized these experiences according to their level of discrimination, I found a slight upward trend in the number of people experiencing discrimination with each broadening of the levels of racism. The individual discrimination examples include very specific situations to the participants and involved individuals in the participant's life. The individual racism was often experienced in classrooms where teachers were surprised by a participant doing well in class. This aligns with prior research consistently showing that regardless of teachers' race or their inclination about racism, they are likely to have many biases that inadvertently emerge through their interactions with students (e.g., Eberhardt & Fiske, 1998; Lawrence, 1987; Sparks, 2015; Tatum, 2003). The other examples of individual discrimination were situations in which participants lost financial support from family because of a component of their identities and this occurred with some of the LGBTQ students.

Not Belonging in the Higher Education and STEM Environments

Regarding institutional discrimination, participants indicated feeling challenged by navigating the academic systems and that they "did not belong" in higher education or STEM fields. People of color feeling as though they do not belong in STEM has been supported by prior research, specifically related to the various fields (Johnson, 2007; Malone & Barabino, 2009; Ong, 2005; Tate & Linn, 2005). One participant described how he experienced and responded to this: "I used to be the only black kid in some of my classes. . . . I knew I was able to do the work just like them. So, I don't let people intimidate me or make me feel inferior because I'm black."

Some of the participants in this study experienced societal discrimination through the influences of stereotypes in shaping peoples' perceptions. Examples of this include participants being urged to pursue military options after high school rather than higher education. Other participants described instances when people were shocked at the participants' successes or noted the absence of positive role models.

The most commonly described experience was that with people in authority positions advising participants to stop taking a STEM class because of its rigor; as one participant experienced: "In my freshmen year in college, I raised my hand to answer a question. The teacher dismissed my answer and ridiculed me enough that the entire class laughed." Lacking role models with similar identities was a particular problem in the STEM fields, which aligns with prior research (e.g., Johnson, 2011; McCrea, 2010). The broadest, most nuanced, and unfortunately participants most commonly experienced civilizational racism. Civilizational racism is a result of the broad assumptions that drive decisions and prescribe *the way life should be* based on stereotypes and the White perspective and disregarding that some people may not share the same perspectives or experiences (Scheurich & Young1997). Participants experienced needing to actively fight civilizational discrimination that indicated that "college was not *for* them." Participants also described examples of internalizing the civilizational discrimination and doubting their skills or abilities in higher education or STEM fields.

The Stories of the Many of Students Who Earned College Degrees

In spite of the discrimination participants felt, they showed their resilience through their academic accomplishments. Of the participants in this study who experienced high levels of discrimination, 62% were earning or had earned at least a bachelor's degree. This group of participants had qualities of strength and determination to earn their degrees regardless of the discrimination. However, when comparing the high-discrimination group to the low-discrimination group, the former had not earned as many high-level degrees. Self-efficacy supports the concept that believing in the self helps to overcome negative external perceptions and influences (Luzzo & McWhirter, 2001). This supports research that when people develop a positive self-image, it is related to higher aspirations and a sense of self-efficacy (Strahan & Wilson, 2006).

Additionally, participants who experienced more discrimination tended to feel less supported overall. I found similar concepts in prior research on responses to social exclusion, which is an alternate term for discrimination (Leary, 1990). Conversely, the participants described gaining strength through their CCW; participants described feeling supported in navigating obstacles based on their social and familial capital of collective self-efficacy. One participant described his engagement in this collective self-efficacy: "Most of my friends are STEM majors so we would help each other out with scholarships." This relates to prior research on collective self-efficacy, in which peers support each other while navigating challenges (Bandura, 1997). Participants supported each other by sharing similar aspirations, providing emotional support, and sharing resources for scholarships or professional growth opportunities. One participant described her social and familial capital: “When I dropped my first class in college, I felt like a failure but my friends encouraged me to pick myself up and learn from my mistakes. I saw an improvement in my study habits as well as my grades.” The data support that the participants experienced and built community cultural wealth to support their academic efforts and successes, and the program actively worked to assuage the harmful effects of stereotypes.

Synopsis of Findings

Participants in this three-part research study provided evidence of the significant ways in which they use CCW to navigate life. Participants flourished from the familial capital they gained through their families, communities, and the program. This quickly grew into social capital for the participants, opening possibilities for significant opportunities through networking with family members, friends, and host-organization affiliates. This networking contributes to navigational capital, which participants exhibited in their professional and academic accomplishments. Participants provided their own linguistic capital and enriched the program culture. Aspirational capital was strong in participants who discussed their future plans and felt directed by the program’s mission statement. Participants described their resistant capital in the confidence they gained through the program and discussing future plans with family members and mentors.

From the participant profiles and the analyses of the program’s relation to academic and STEM outcomes in the second study, I found that participants who earned higher degrees tended to have more support than those earning lower degrees. Some participants who earned at least a bachelor’s degree also referenced experiencing contemporary redundancy (repetition of the same message in multiple forms). Contrarily, in addition to lacking support, the individuals who earned lower degrees tended to also have challenges related to navigating the academic systems. Those who persisted in STEM degrees tended to be well supported by different support mechanisms and have strong role model(s) in the field.

I also investigated the participants’ experiences with discrimination throughout all three studies, with particular focus to discrimination in the third study. All of the participants’ experiences with discrimination can be traced back to a source of civilizational discrimination. Many participants were influenced by negative stereotypes and many persisted academically regardless of the discrimination. Participants found support in their communities and the components of CCW in their communities.

Limitations and Strengths of This Three-Part Research Project

The primary limitations of this study were related to my participant selection techniques as I used purposeful selection and snowballing to increase my response rates, but having participants reach out to peers to complete the survey. I purposefully selected the participants because I wanted to understand their experiences in the out-of-schooltime program. I supplemented this with some snowballing techniques to encourage participants to ask their friends to complete the survey. I developed this study to investigate the experiences of mostly first-generation college-bound students of color. The study population was not representative of the general population; however, it was representative of the population of interest. Additionally, all study participants completed the application to join the programs. The statistical analyses would have been stronger if I had a larger group of participants, fewer assumptions would have been violated compared to the current study.

The measure I created for this research provided a comprehensive snapshot into the participants' lives and an accurate sense of participants' level of resilience related to academics and STEM. I also have some suggestions for future use to improve the data. There were three questions that did not provide me with the data I expected and therefore could not be used in testing hypotheses or analysis. The questions were regarding the participants' physical appearance, challenges participants experienced in the program, participants' degree-completion dates, and the description of the STEM events. Even though I had conducted a pilot test I received minimal amounts of feedback and I did not ask participants to actually take the survey.

For those who are considering using the survey, I would suggest adapting it to fit the culture of the participants and pilot testing the survey with a subset of participants. I also found myself lacking information on how participants felt discriminated. I debated on including this question during the survey development process and decided to exclude it with my participants' mental health in mind. I did not feel it necessary to ask my participants to describe potentially painful experiences related to discrimination. I would also suggest adding a question that openly requests critiques or feedback for the program.

The strengths of this research are in its three-part theoretical framework which informed each aspect of the research and ensured I review the data from multiple perspectives. Another strength is in the mixed methods approach. Synonymously with the three-part theoretical framework, the mixed methods design allowed me to make many different comparisons with the data and to see many different interpretations of the data.

Use of Critical Race Theory, Critical Race Quantitative Intersectionality, Community Cultural Wealth, Counternarratives, and Bioecology in Future Research

This four-part research study leaves me with many research practices to continue using, namely counternarratives, and questions remaining to be answered. The use of a structured framing with a theory such as CRT or CCW provides a fresh look at the research that is different from a typical lens. I appreciated an opportunity to grow from that experience. It would also be interesting as a white researcher, to investigate the use of critical white studies, which would provide a different perspective through which to understand racial and discriminatory related practices in the education systems. Additionally, the CRQI framing provided me with new perspectives through which to understand and examine my quantitative data. The use of counternarratives shares the absent voices in the dominant culture’s everyday dialogue. These voices need to be heard and support each other through being heard. Counternarratives indulge the reader in the journey of the characters and also allow for researchers to present the muted stories without making the real-life characters vulnerable. Through counternarratives, researchers have an opportunity to be social activists, fighting to educate others about the trials and tribulations people experience.

Some areas of interest to explore in the future include studying the different types of support participants receive and how it changes in high school compared to college. There is minimal research on this differentiation. I would be interested in understanding the relation between support during high school and that after high school. Other future research includes trying to understand what kind of multifaceted support youth need to succeed, and how much does parental involvement in the college application process matters when participants have the support of a youth program, and what are successful models to create an integrated parent-mentor-school professional triage of support for each participant. This is a complex field of multileveled components influencing participants academic and STEM outcomes. The components of the system are continually changing, increasing the need for continual learning and new developments.

Researcher's Reflections of the Process

I believe it is important to make a note as it relates to my dominant identity. I am a White middle-class woman. I have not experienced many of the forms of discrimination that are described by my participants. Although I have immersed myself in and become deeply connected to many individuals and communities of color, I have not actually experienced racism. Additionally, my university did not have specific courses in critical race studies, which resulted in me learning these concepts and theories from my advisor and through my own extended study, which was useful, but I would have benefitted from such coursework. Therefore, when engaged with research related to discrimination and traditionally marginalized communities, I found it important to intentionally frame the research with a framework that highlights the ways that included their struggles with racism as well as the strengths in the community.

The CCW theory provided a structure for rich asset strength-finding in communities of color and the CRT framework informed the reasons for the challenges many of my study participants experienced. Using CCW, I focused on finding the positive aspects of the community and was less distracted by the typical deficit perspectives that I have learned throughout my life. However, due to the nature of my research, I examined the systemic racism and oppression within society that directly impacts communities of color. This is where the use of CRT was beneficial for me. Likewise, I combined the counternarrative and CCW concepts, as many researchers have done in the past, to create a framework that provides focus on the strengths of communities of color and the root causes of educational disparities.

Another example of a conflict that I navigated during this process was my own White identity and my representation and use of CRT. I found instances in my research and life when I was supporting the deficit perspective and had to modify my view to unlearn that thinking. I have become more aware of the nuanced ways in which I support civilizational racism in my daily actions, conversation and, reactions to people of color around me. My awareness of this recently has increased, and I still have a great deal of awareness to build. This work has been emotionally challenging as I have attempted to balance the values of my own identity with showing a similar respect and value for others' identities. As I continue my professional and personal development as a scholarly practitioner, I will continue to be reflective of ways in which I am representing and promoting biases as opposed to debunking biases.

Recommendations for Practice in Out-of-Schooltime College-Readiness Programs

As a scholarly practitioner, I believe that research is meant to inform practice. For that reason, I provide an extensive list of recommendations, including practical information needed to put the recommendations into practice. I organize my recommendations into four categories: multiple sources of support and resources, brave space, stimulating and applicable activities, and operational conditions. Practitioners and researchers alike should be mindful of the target population because not all of these suggestions will work in all conditions or with all populations. I constructed these suggestions based on my research and the study participants' responses to a question regarding suggestions for the program, prior research, and my own experiences as a youth development staff person.

Multiple Sources of Support and Resources

Two primary roles of the out-of-schooltime learning environment are to surround participants with peers who share their aspirations and motivations and to serve as the connection between academics and real life.[9] Participants in a group mentoring environment, such as the program of focus for this research, have been shown to gain a sense of support, inclusion,

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[9] Real life in this context refers to their personal and family lives and their home environments.

networking and role modeling. Peers were motivated by being surrounded by other high achieving students and seeing alumni come back to visit and share some of their experiences with the group, as one participant explains: “Ten years later . . . I feel a strong bond with . . . mentors and participants. . . . Seeing older groups come back, . . . lets me know that I was not alone in feeling this continued support from the [program].”

Mentors or program staff can facilitate the participants building new relationships with peers from the program. These peers may have very different identities from each other, which amplifies the importance of mentors emphasizing learning about and valuing the differences. This built familial and linguistic capital in the youth program participants, as one participant explained: “Before the program, I was shy and very closed-minded. The program helped me to open up to such diverse groups of people. It was my first time making friends with people of different races and ages.” The mentors facilitated these relationships by assigning participants to engage in group project work. Mentoring during the group research project builds the team’s strengths and communication within the team and builds participants teamwork skills (Herrera, Vang, & Gale, 2002), and career readiness skills. The participants also appreciate having one-on-one time with mentors, to bring depth to the relationship and ensure the participants’ needs are being met: “The mentors should have more one on one discussions with individual students. It does not have to be formal, but enough to build better connections. Sometimes students often feel lost in the group.”

Regarding academics, the participants found their peers both motivating and defeating. The majority of participants were supported and encouraged to excel from their membership in the program’s college-going community. One participant described her experiences: “Being so close and constantly surrounded by my friends from the program made me an overachiever in high school and encouraged me through life to always want to do more or be more.” On the other hand, a few participants felt challenged by their peers as one described the negative effects of being surrounded by high-achieving peers: “I am very competitive and my grades weren't the best so I always got depressed when I compared myself to others. This was especially evident during senior year when many of my friends got fancy college acceptances.” For this reason, the program staff may pay special attention to individual academic needs, seeking ways to highlight other strengths of participants who may be struggling academically.

Particularly in a college-readiness, mentoring program such as the one studied, the staff is actively involved with the participants’ school lives as well as their personal lives. Parents confide in the mentors and seek assistance with their children and in understanding the way society works in the United States higher education system. One participant explained: “My parents try to make sure I went to the upward bound program so I can have an educational environment and after they made sure I had a way to college every day. They also called the mentors when they had questions.” Mentors and parents discussed the participants’ behavior, academics, and general concerns or proud moments during unscheduled but frequent contexts, as one participant described: “The mentor would discuss my performance one on one. Sometimes the director of the program would have chats with my mother when she would come pick me up, and then she would tell me what they discussed.” This linking between the youth participants and their families or schools is the first step in creating a multilevel support system for the youth.

It is through having multiple conversations about the same topic, with multiple people, that the youth develop a solid foundation of the topic and their opinions of the topic. The topic may be anything pertinent to life, including plans for after high school, career options, or general interests. Through these conversations and opportunities to reflect internally and with others, participants can gain an understanding of their likes, dislikes, strengths, and weaknesses. For example, the current research found that youth who had earned or were earning their graduate degrees had multiple sources of support, including parents, guardians, or teachers who were actively involved in the college application process. One participant explained: “The communication I had about plans after high school were with upward bound. The upward bound program helped me have communication with my parents about the plans I had after high school and it made me feel stronger and independent. “A hypothesis to explain this relationship is that participants who engaged in conversations about future selves with multiple parties throughout their lives had a better sense of what they wanted to do professionally and therefore were more focused during college—they were driven by knowing their long-term goals. One participant explains his experience as this: “During an internship during high school I was encouraged by professional coworkers to pursue an engineering degree. Through the program I received a scholarship for my interest in STEM that encouraged me to dedicate my studies in engineering.” Both hypotheses support the concept of *contemporary redundancy*, which is the repetition of messages from different sources (Super & Harkness, 1999).

Another final hypothesis is that participants gained confidence in themselves in successfully navigating the academic systems because they had so many resources and conversations about the topic. One participant explained his benefits from the program: “The programs boosted my self-confidence. Everyone at the [program]was my second family, and were genuinely interested in me doing well and going far with my education and supported me through a network each step of the way.”

Conversations About Future Selves

Many participants described ways in which they spoke to different family or community members about their ideas for after high school and explored new interests. One participant described one of the most influential experiences he had related to his STEM career: “I looked for different things to test during my winter break. My father knew I would come home with crazy ideas and he would help me in brainstorming and bringing my ideas to full effect and testing."

For those who do not have caring adults or family members inquiring about the future, out-of-schooltime programs can facilitate youth participants in having conversations with their families or other caring adults about their futures by providing the participants with coaching and suggestions of conversation topics to parents and youth participants. My findings resonate with others that these conversations with mentors make participants more likely to succeed in college (Crisp & Cruz, 2009). One participant explained: "[Mentors] are a big part of why I went to college and continuing my education now."

Participants in the current study suggested developing a plan for communication between parents and students. I developed the following suggestions for an example plan from my own experiences and the participants' feedback. This plan would best begin during the student's freshman year in high school or during the participant's first year in the program, and then the plan would be updated annually based on the participant's interests and ideas for after high school. To learn this information, there may be formal and informal discussions about options for after high school. The students could develop sample topics and questions to discuss with their parents or guardians based on the participant's priorities and concerns.

The participant's desired major does not need to be a primary factor in the conversations because of the possibility that participants will change their majors. However, it is important for participants to engage in conversations and thinking about possible future selves, and what they may be or look like in the future. This is supported by research that found mentors who discuss college with mentees increases interest in going to college (DuBois, Holloway, Valentine, & Cooper, 2002). I have found more success with participants who have multiple interests during high school. Major choice can also be a challenge for college students who believe they know what they want to do in high school, but they lose the interest in college and take a break from college because they do not know what major to pursue.

One primary goal of these conversations is for participants to be able to graduate high school knowing the skills they are good at, the environments they enjoy, and that participants have practice applying those skills in different environments to test that knowledge. This participant describes his struggles as a result of not having those skills and knowledge: “The passion you once had that was overshadowed by STEM in high school comes crawling back into your heart and you are left to figure it all out on your own.” To prevent this kind of downward spiral leading to college pushout, college readiness programs must equip their participants with the knowledge of finding resources. Additionally, some research supports preventing college freshmen from selecting a major until their sophomore years to allow time for students to make more effective choices than they would have as freshmen (Freedman, 2013). Often when participants leave for college, they feel alone and disconnected from the program, family, and peers, and they miss the support system that had there (Shaver, Furman, & Duane, 1985). To survive the transition, participants may benefit from knowing how to recognize what they need help with before it is too late (by knowing their strengths and being in-tune with the self and responses to experiences), and how to access the right kind of help for their situations.

Another form of support that programs can develop is providing participants with role models who share at least some of the participants’ identities. Many participants indicated having wonderful role models from the program staff. Program staff is a great way to expose the participants to strong and consistent role models. Additionally, participants may benefit from exposure to professional role models in their potential future fields. These exposure events should be as frequent as possible, either with repeated or new people each time. For example, a program may host career fairs throughout the year, highlighting different professions and the steps to enter into the fields and reach the desired profession. Other ideas are to “bring in guest presenters or activity facilitators,” or explore volunteer opportunities for participants. Although, these are one-time interactions with professionals, they open the world of possibilities to the participants. Additionally, if participants know how to network prior to the event, they may be able to initiate a second meeting with one of the professionals. One participant suggested having more diverse speakers with a “deeper connection to the program,” either in person or on Skype, to discuss STEM fields. This would allow participants to build a relationship with the individual and actually see that person as a role model.

Creating the Brave Space

The way the space makes participants feel shapes the participants’ experience. The current findings supported prior research that there are many emotional and physical safety factors to consider in training the staff, structuring the activities during engagements, and determining the space layout (Boost Rom, 1998). Staff training is an important component of incorporating new staff into the program family and consistently maintaining the brave space. Staff is essential in being role models as nonjudgmental and inviting of diverse perspectives. What has worked well for the program of the current research is a week-long training before the program begins. To ensure the caring adults are providing positive support for participants, all staff undergo a 40-hour training prior to engaging with the participants. In preparation for the training, staff complete reading and reflection assignments to help understand the participants’ backgrounds. Training topics include cultural competency, being a mentor versus a teacher, active and engaging teaching techniques, conflict resolution, teambuilding activities, and safety precautions (DeBois, Holloway & Valentine, 2002; DuBois & Kracher, 2012; Garringer, Kupersmidt, Rhodes, Stelter, & Tai, 2015). Program staff also learn the culture of the program during training to ensure they relay the program values to participants. For newer programs, or programs looking for additional support in their operations, there is an organization called the Mentoring Center, which provides technical assistance to mentoring programs (The Mentoring Center, 2016).

To create an emotional space where it is safe to share vulnerabilities, the mentors can share some personal experiences or experiences of their friends (ensuring the content is age-appropriate). In this space, the participants are encouraged to investigate their own identities and gain support regarding life changes and challenges. It is often a good idea to have a set of group norms to establish clear expectations of what is acceptable in the space (Goncalo & Staw, 2005; Lawrence & Tolbert, 2007). For it to be an effective brave space, participants need to be assured that if they share a sensitive topic they will not be ridiculed. Creation of a brave space is a delicate process in which participants are engaged and mentally prepared for personal growth. In this space, participants learn self-confidence and explore their likes, dislikes, beliefs, and values. These vulnerable situations can also lead to strengthening the relationships between participants, building on the social support overall. In the current research, stronger social support was associated with being highly engaged in the program.

Participants in the current research indicated a desire for more emotional support from the program staff and peers than they received while in the program. At times, participants indicated having felt left out or judged by a mentor. Similarly, emotional and real-life issues were the second most common theme of suggestions. Several students wanted to learn how to deal with depression. One suggested offering a “class that helps with depression, mental, and emotional issues.” Another suggested hiring mentors skilled in dealing with “at-risk teenagers,” as well as “one-on-ones with mentors” to allow more personal attention as “some kids get lost among everyone.” Documented resources on mentor training practices provide guidance on being aware of mentors’ perceptions, setting clear time and behavior expectations for mentors, and matching mentors with mentees (e.g., Crutcher, 2007; DeBois, Holloway & Valentine, 2002; DuBois & Kracher, 2012; Garringer, Kupersmidt, Rhodes, Stelter, & Tai, 2015). One participant also wanted more involvement in "the child's home issues" and "a deeper involvement in how the child is doing in school." Another wanted to learn "how to be social, make friends, and how to go about seeking out help."

The participants seek a space where they can share and feel unconditional support and protection. Why are these young people having so many emotional challenges? Life is hard as a teenager, and even harder as a person who regularly experiences discrimination. There is a multitude of resources that document the stresses and emotional distress caused by experiencing discrimination, which the American Psychological Association has synthesized in a recent report (2016). Even though many of the participants lived in mostly homogeneous communities and schools, they still experienced societal and civilizational discrimination through policies, overpolicing the neighborhoods, schools that look like prisons and are underresourced, and below average pay rates. Talking about these issues openly and how different people have dealt with similar situations may help to build trust and resilient and navigational capital.

Specifically, regarding the physical aspects of the space, program directors might ensure that their program has a space where participants can feel courageous and that they can claim as their own. I advise this space to include resources (computers or other technology equipment, books, tutors, mentors, etc.) geared toward the participants' needs. Additionally, based on my experiences in youth development and my extensive literature review of youth empowerment, collaboration and development programs, the space may have furniture arrangements (seats arranged in circles) that encourage group discussions and collaboration; and walls decorated with informational posters or participants' work. This space with the program was a computer and technology lab that was open to participants based on the participants' schedules, and close to participants' schools and homes. Related to the emotional and pedagogical elements of the brave space, staff may encourage self-discovery and provide nonjudgmental feedback and support to participants during the self-discovery process. One participant described this: "I was informed by mentors, they helped me . . . where I needed to improve for my future in the real world. I love that they saw the areas where we needed to improve and we were not offended." Finally, to encourage the development of CCW within the community, staff would be advised to also keep the CCW concepts in mind when interacting with the youth.

Stimulating and Applicable Activities

For participants to truly benefit from their time at the program, the activities should be active, hands-on, exploratory, applicable to life, and "not school-like." Some suggestions are to substitute sitting in the classroom with a more practical application in learning from field work, exploration of the local natural environments or current issues in their communities, and activities that expose them to the world. This included research projects, trips, and connecting to other events going on in their community such as "bicycle events and 5K's."

When thinking of these nontraditional learning experiences, consider the location of the program. What is your city or town best known for? What does your area specialize in? What are the environmental or geological factors that make your area unique? Are there activities or organizations that work in those areas with whom you could partner? How can you incorporate adventurous trips like camping or exploring new cultural areas into your curriculum? Some participants' suggestions included partnering with local businesses or universities to provide an option for internships. For these internship partnerships and programs to be successful, some staff time should be dedicated to building the networks, training the students in professionalism and the company culture, and finding an appropriate placement that suits the participant's' potential future interests. In this program's case, there were occasional opportunities for internships at the local public hospital. Participants were matched with attending-level physicians and scientific researchers for a 6- to 12-week summer internship, depending on the participant's and the staff host's schedule.

Participants also indicated wanting opportunities to learn life skills such as driving, budgeting, and investing skills. Along the same lines, participants strive for ways to advance academically. Participants' suggestions for academic support included connections to dual-enrollment programs, opportunities to take AP placement exams without having taken the course (due to courses not being offered at their schools), college entrance exam review courses, academic counseling, and tutoring.

Also, when thinking of the kinds of activities your participants may enjoy or benefit from, consider what their learning styles are and what kinds of extracurricular interests they have. If many participants are expressing creative ideas, you may consider a creation class in which participants construct a machine of some sort or develop a new product. The second part of the class could be teaching them how to protect their idea and ensure they receive proper credit for their contribution to society. The next portion might be teaching participants budgeting, marketing skills, using statistics to determine when to post ads and what kinds of promotions work best. Another option would be to incorporate creativity through media or art.

STEM activities. Specifically related to increasing representation of people of color and women in STEM fields, participants suggested more applied experiences like internships and shadowing. One participant suggested: "1. An informal networking event with people who work in STEM-related fields. 2. Shadowing someone who works in STEM once a week. Almost like an internship. 3. Telling participants that women and minorities need representation in these fields!" Someone else proposed type of STEM college-readiness program: "STEM buddy program, where college professors work with high school students at least twice a month to introduce them to the STEM field and give them insight so that [participants] can be better prepared when they begin a STEM degree" Some participants also noted that they did not have interest in STEM because like enjoyed the arts, so a suggested class could be around the ways in which one needs creativity to explore and expand the STEM fields.

Alumni Networks

At the time of publication, the youth program was actively working to build a stronger alumni network, but this was a newly started effort. One participant describes specific ways in which alumni could support each other: "Participants going through their first semesters in college and throughout college should have structured reunions as well as the social ones we make ourselves." Other participants expressed a desire to give back to the program as alumni, suggesting "Alumni events to help bring back a stronger community for future students."

Operational Conditions

The ideal context is to provide a multiyear program for youth starting as early as elementary school. In order for this to be sustained, it would be best for the program expenses to be incorporated into the operational budget of the institution. For programs that need some support in financial planning, there are some resources such as the Finance Project that provide guidance and support. The resource "Finding Resources to Support Mentoring Program and Services for Youth" (Anuszkiewicz, Salomon, Schmid, & Torrico, 2008) provides suggestions for assistance in developing a sustainable flow of income through building partnerships with community businesses and foundations. A second strategy the resource discussed is engaging the community in fundraising and the third presented how to make the most out of the revenue possibilities (Anuszkiewicz, Salomon, Schmid, & Torrico, 2008). Another helpful source in planning or revising an organizational budget is "The Cost of Quality of Out-of-School-Time Programs" (Grossman, Lind, Hayes, McMarken & Gersick, 2009). This resource guides program staff through thinking about the different types of costs the program may incur during the school year versus the academic year separated by the participants' ages. Then it closes with information on funding programs for each age level and policy and practice implications (Grossman, Lind, Hayes, McMarken & Gersick, 2009).

Program staffing. Hiring the best staff in your program can be difficult because there are often not enough role models who look like the participants applying and it can be difficult to assess empathy and ability to provide emotional support during an interview. Although typically, participants described feeling very supported by their mentors, this was a challenging area for the program at times. Some participants felt generalized and confronted with biases through their interactions at the program. One participant described this pain: "Kids are given expectations and others are left in the dust. The last thing I needed as an angry teenager who was going through all kinds of psychological, mental health stuff was to witness mentors talking or seeing me negatively." Transitional staff who communicate regularly with alumni during their first few years out of high school will help to remind participants of the skills they learned through the program and support them in navigating the academic system.

Academic counselors are important for participants during the program to ensure they are academically progressing during high school. For all three of the counselor roles, participants may be directly assigned to staff members to ensure all participants, including the quieter ones, are given direct and personal attention. Each program may also have a program coordinator to arrange activities and a program director to oversee the program activities. Support staff may include an administrative assistant, who could be a participant volunteering or interning during afterschool hours, program mentors or near-peer staff, or contracted specialists to support a specific area for the program (e.g., tutors, social worker or child psychologist, financial literacy specialist, college entrance exam teacher).

Challenges and Related Solutions of Sustaining an Out-of-Schooltime Program

There are many challenges to hosting multiyear programs at an informal learning institution. The grant funding model is difficult to sustain and creates great stress for the program and development staff. Therefore, these youth development practices need to stem from the operational budget of the institution. This will have a high return on investment in future constituencies of the informal learning environment. Also, program staff is often students and need to be hired and trained each year, making it difficult to maintain a strong culture and focus of the program. To address this issue, full-time program staff need to have a clear understanding of program values and engage in frequent professional development activities. This is particularly true for staff who have not experienced equity-related challenges throughout life.

Last, collaborations with formal learning institutions can be difficult to develop; however, these relationships are vital to disseminating knowledge to young people in unique strategies. A great way to entice university partnerships is through grant-funding partnerships that help them work toward an institutional mission. For example, maybe a school has been putting a strong push toward supporting women of color in STEM fields, and the program is meant to expose young women of color to STEM fields. Seek a way that both the practitioner and the institution can reach the single goal of increasing the representation of women of color in STEM fields. An example would be employing their women of color STEM-majors to be mentors over the summer and teach science content.

Conclusion

This research demonstrates the many ways in which participants of an out-of-schooltime program engage with each other and the academic world around them, building community cultural wealth and deflecting the effects of racism and other forms of discrimination. Many of the participants in my study showed great resilience and perseverance through the obstacles they faced in earning their degrees. In addition to learning about the strength of my participants, I have learned much about my own perceptions and the ways in which I can grow to be a better supporter of reducing civilizational racism in the future. I look forward to my continued journey of personal growth and contributions to reducing the inherent racism in the US society.

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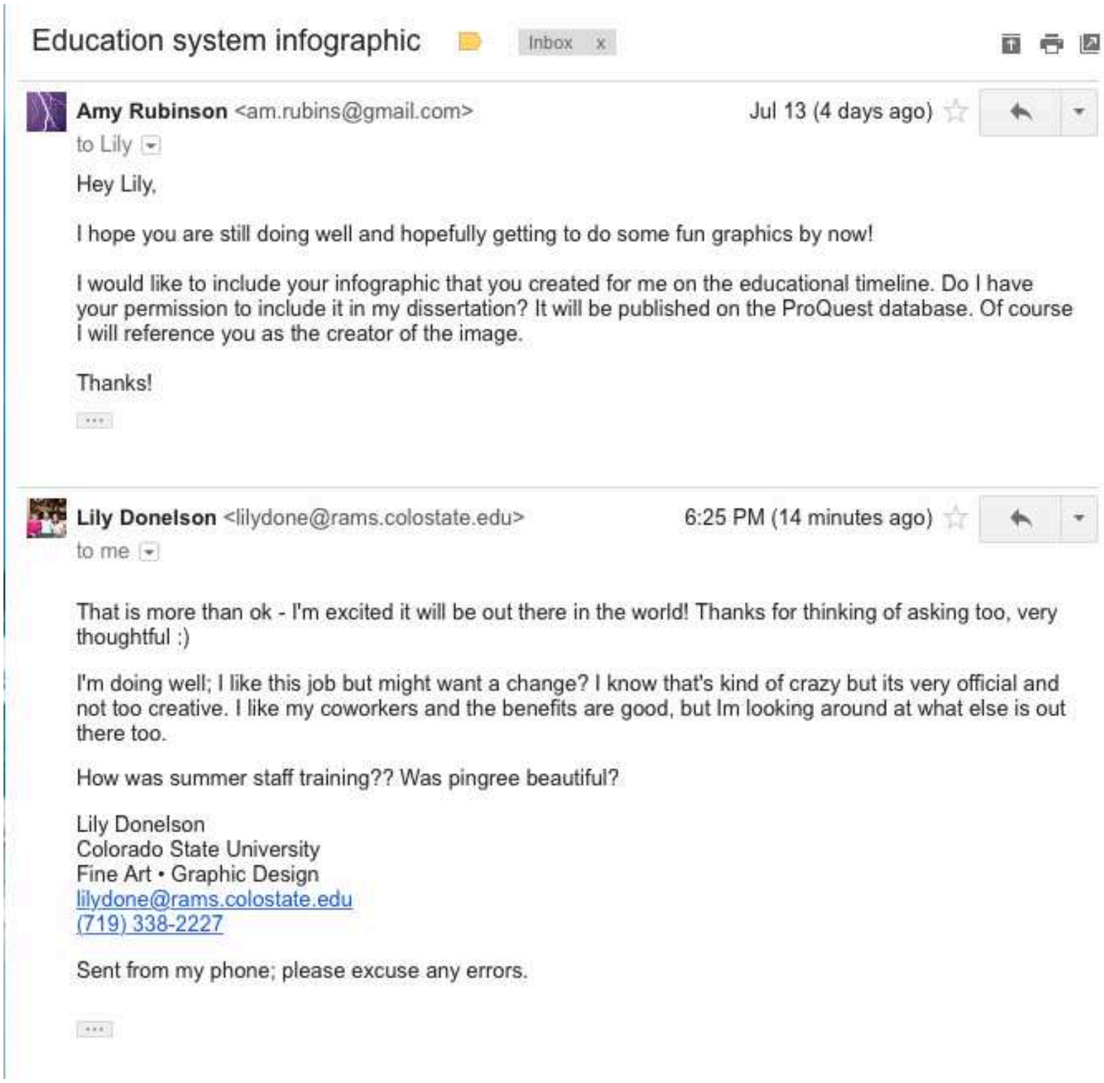
APPENDICES

Appendix A: Approval for Education Infographic (Figure 1.2)



Education system infographic

Amy Rubinson <am.rubins@gmail.com> Jul 13 (4 days ago)
to Lily

Hey Lily,

I hope you are still doing well and hopefully getting to do some fun graphics by now!

I would like to include your infographic that you created for me on the educational timeline. Do I have your permission to include it in my dissertation? It will be published on the ProQuest database. Of course I will reference you as the creator of the image.

Thanks!

Lily Donelson <lilydone@rams.colostate.edu> 6:25 PM (14 minutes ago)
to me

That is more than ok - I'm excited it will be out there in the world! Thanks for thinking of asking too, very thoughtful :)

I'm doing well; I like this job but might want a change? I know that's kind of crazy but its very official and not too creative. I like my coworkers and the benefits are good, but Im looking around at what else is out there too.

How was summer staff training?? Was pingree beautiful?

Lily Donelson
Colorado State University
Fine Art • Graphic Design
lilydone@rams.colostate.edu
(719) 338-2227

Sent from my phone; please excuse any errors.

Table 6

Women, People of Color and People with Disabilities in Science and Engineering Degree Programs in 2012

	All fields				All science & engineering majors				
Demographic catagory	AA	BA/ BS	Masters	Doctorate	Declaired major	AA	BA/ BS	Masters	Doctorate
All races (US Citizan and Permanent Resident)	98.33	96.71	no data	72.82	39.20	42.37	95.95	no data	35.86
Women*	61.54	57.60	91.32	49.60	33.50	57.63	50.50	16.17	41.10
White	58.10	64.70	62.70	67.13	37.00	42.44	62.70	60.90	68.53
Women*	60.69	56.10	57.00	no data	30.60	57.56	48.30	13.28	no data
Asian	4.57	6.80	6.00	7.51	52.70	38.51	9.70	8.90	9.82
Women*	58.27	54.40	4.82	no data	45.40	61.49	48.90	21.43	no data
Black	13.01	9.90	11.30	8.96	36.40	43.65	8.80	10.00	5.12
Women*	67.83	65.70	11.79	no data	35.40	56.35	63.60	14.66	no data
Latin@	14.73	10.10	7.50	5.98	41.60	49.44	10.30	7.90	5.96
Women*	62.17	60.90	7.09	no data	37.10	50.56	56.20	15.73	no data
American Indian or Alaska Native	0.98	0.60	0.50	0.51	33.00	49.93	0.60	0.50	0.45
Women*	63.72	61.10	0.47	no data	28.20	50.07	56.20	15.96	no data
Unidentified race, mixed race	8.61	8.00	12.00	9.91	no data	53.44	7.90	11.80	10.11
Women*	58.21	57.80	10.58	no data	no data	46.56	51.90	15.04	no data
People reporting 1+ disabilities	no data	no data	no data	no data	no data	41.49	no data	no data	5.40
Women*	no data	no data	no data	no data	no data	58.51	no data	no data	no data
Temporary Residents	1.67	3.29	no data	27.18	no data	1.89	4.05	no data	37.05
Women*	58.36	50.2	no data	no data	no data	39.14	42.60	no data	no data

*Percentages for women are calculated as the percent of women within the specified subgroup

Table 6 (continuted)

Women, People of Color and People with Disabilities in Science and Engineering Degree Programs in 2012

	Sciences								
	Agricultural				Biological				
Demographic catagory	AA	BA/BS	Masters	Doctorate	Declaired major	AA	BA/BS	Masters	Doctorate
All races (US Citizan and Permanent Resident)	37.23	98.51	no data	60.66	12.90	66.33	97.13	no data	72.98
Women*	62.77	53.70	4.29	47.20	14.30	33.67	59.30	9.62	53.10
White	37.23	79.50	78.30	74.78	11.80	66.45	60.20	62.70	67.64
Women*	62.77	52.30	6.37	no data	13.20	33.55	58.30	10.62	no data
Asian	36.39	4.40	4.40	4.90	20.30	65.26	16.10	14.00	11.73
Women*	63.61	60.90	2.95	no data	22.50	34.74	57.20	17.26	no data
Black	43.90	2.90	3.20	5.48	12.50	64.72	7.30	6.60	4.68
Women*	56.10	61.10	1.26	no data	15.00	35.28	70.30	5.87	no data
Latin@	44.00	5.70	5.90	5.91	12.90	68.81	9.20	6.60	5.77
Women*	56.00	57.70	3.49	no data	14.10	31.19	61.50	8.16	no data
American Indian or Alaska Native	51.65	0.90	0.70	1.30	12.00	69.21	0.60	0.50	0.58
Women*	48.35	56.30	5.00	no data	10.90	30.79	62.70	9.41	no data
Unidentified race, mixed race	45.33	6.60	7.60	7.64	no data	69.70	6.70	9.60	9.61
Women*	54.67	56.50	2.47	no data	no data	30.30	58.10	7.95	no data
People reporting 1+ disabilities	32.80	no data	no data	6.40	no data	64.23	no data	no data	4.80
Women*	67.20	no data	no data	no data	no data	35.77	no data	no data	no data
Temporary Residents	0.51	1.49	no data	39.34	no data	2.32	2.87	no data	27.02
Women*	38.46	58.60	no data	no data	no data	61.29	59.60	no data	no data

*Percentages for women are calculated as the percent of women within the specified subgroup

Table 6 (continuted)

Women, People of Color and People with Disabilities in Science and Engineering Degree Programs in 2012

	Sciences								
	Computer				Earth, atmospheric, & ocean				
Demographic catagory	AA	BA/BS	Masters	Doctorate	Declaired major	AA	BA/BS	Masters	Doctorate
All races (US Citizan and Permanent Resident)	21.44	95.07	no data	48.46	6.00	33.01	98.02	no data	67.57
Women*	78.56	18.00	9.17	21.40	1.90	66.99	39.10	1.37	43.30
White	21.41	59.40	51.50	64.22	2.60	33.66	82.00	81.70	81.12
Women*	78.59	14.70	4.00	no data	2.00	66.34	38.10	0.94	no data
Asian	20.25	8.70	13.60	15.75	2.80	31.58	3.40	2.30	4.02
Women*	79.75	22.10	13.75	no data	2.50	68.42	42.00	0.04	no data
Black	21.91	10.60	12.20	4.76	1.60	33.33	2.10	2.20	3.01
Women*	78.09	30.10	7.74	no data	1.50	66.67	49.60	0.02	no data
Latin@	28.88	9.20	7.00	3.17	1.60	11.65	5.60	4.80	3.61
Women*	71.12	18.80	4.94	no data	1.10	41.67	42.70	0.06	no data
American Indian or Alaska Native	19.48	0.50	0.40	0.24	1.70	41.67	0.80	1.00	0.40
Women*	80.52	21.70	5.79	no data	0.50	58.33	38.30	0.01	no data
Unidentified race, mixed race	29.76	11.60	15.30	11.84	no data	33.33	6.20	8.00	7.83
Women*	70.24	20.50	7.29	no data	no data	66.67	46.30	0.11	no data
People reporting 1+ disabilities	19.86	no data	no data	5.40	no data	50.00	no data	no data	6.20
Women*	80.14	no data	no data	no data	no data	50.00	no data	no data	no data
Temporary Residents	1.20	4.93	no data	51.54	no data	1.94	1.98	no data	32.43
Women*	23.98	20.60	no data	no data	no data	0.00	35.30	no data	no data

*Percentages for women are calculated as the percent of women within the specified subgroup

Table 6 (continted)

Women, People of Color and People with Disabilities in Science and Engineering Degree Programs in 2012

	Sciences									
	Mathematics & statistics					Physical				
Demographic catagory	Declaired major	AA	BA/BS	Masters	Doctorate	AA	BA/BS	Masters	Doctorate
All races (US Citizan and Permanent Resident)	3.10	31.33	90.46	no data	51.02	43.71	95.27	no data	59.03
Women*	1.40	68.67	43.10	4.25	28.20	56.29	40.60	2.65	31.50
White	2.80	30.98	70.10	65.90	74.65	44.27	66.10	72.20	72.28
Women*	1.20	69.02	42.80	1.52	no data	55.73	36.80	1.20	no data
Asian	5.60	32.18	10.50	12.80	8.45	39.12	12.10	8.30	8.90
Women*	2.90	67.82	41.40	0.35	no data	60.88	46.20	0.16	no data
Black	3.20	35.15	5.40	4.60	2.46	45.24	6.70	5.60	2.92
Women*	1.40	64.85	48.20	0.12	no data	54.76	61.20	0.13	no data
Latin@	2.90	19.67	7.10	5.90	4.58	66.92	7.30	5.00	4.87
Women*	1.30	80.33	45.80	0.13	no data	33.08	45.70	0.10	no data
American Indian or Alaska Native	0.80	31.91	0.30	0.30	0.00	45.82	0.50	0.40	0.22
Women*	1.30	68.09	36.20	0.00	no data	54.18	43.70	0.01	no data
Unidentified race, mixed race	no data	22.73	6.50	10.60	9.86	48.78	7.30	8.50	10.82
Women*	no data	77.27	37.90	0.25	no data	51.22	40.00	0.13	no data
People reporting 1+ disabilities	no data	18.95	no data	no data	6.40	34.08	no data	no data	5.30
Women*	no data	81.05	no data	no data	no data	65.92	no data	no data	no data
Temporary Residents	no data	5.62	9.54	no data	48.98	8.05	4.73	no data	40.97
Women*	no data	37.21	45.50	no data	no data	37.28	41.90	no data	no data

*Percentages for women are calculated as the percent of women within the specified subgroup

Table 6 (continuted)

Women, People of Color and People with Disabilities in Science and Engineering Degree Programs in 2012

	Sciences								
	Psychology					Social			
Demographic catagory	Declaired major	AA	BA/BS	Masters	Doctorate	AA	BA/BS	Masters	Doctorate
All races (US Citizan and Permanent Resident)	10.40	76.81	98.17	no data	93.51	73.33	96.07	no data	69.17
Women*	12.00	23.19	76.70	30.08	72.60	26.67	54.70	36.40	48.70
White	9.40	76.74	61.10	59.90	67.32	73.42	59.40	57.70	67.64
Women*	10.50	23.26	76.20	17.22	no data	26.58	51.10	16.96	no data
Asian	9.00	76.87	6.40	4.00	5.89	73.13	7.90	5.50	6.78
Women*	10.50	23.13	71.30	1.10	no data	26.87	54.30	1.84	no data
Black	11.60	65.27	11.80	13.40	6.58	64.83	11.00	14.10	7.79
Women*	14.30	34.73	80.80	4.09	no data	35.17	65.40	5.61	no data
Latin@	14.10	80.77	12.40	9.20	9.46	78.28	11.80	8.60	6.08
Women*	17.20	19.23	78.20	2.76	no data	21.72	60.60	2.83	no data
American Indian or Alaska Native	9.90	77.42	0.70	0.50	0.61	70.70	0.70	0.60	0.44
Women*	10.60	22.58	74.50	0.14	no data	29.30	60.20	0.21	no data
Unidentified race, mixed race	no data	81.82	no data	13.00	10.15	70.47	9.20	13.40	11.28
Women*	no data	18.18	75.90	3.81	no data	29.53	58.50	4.27	no data
People reporting 1+ disabilities	no data	75.81	no data	no data	5.80	76.96	no data	no data	6.30
Women*	no data	24.19	no data	no data	no data	23.04	no data	no data	no data
Temporary Residents	no data	0.79	1.83	no data	6.49	1.49	3.93	no data	30.83
Women*	no data	86.49	77.60	no data	no data	67.33	51.70	no data	no data

*Percentages for women are calculated as the percent of women within the specified subgroup

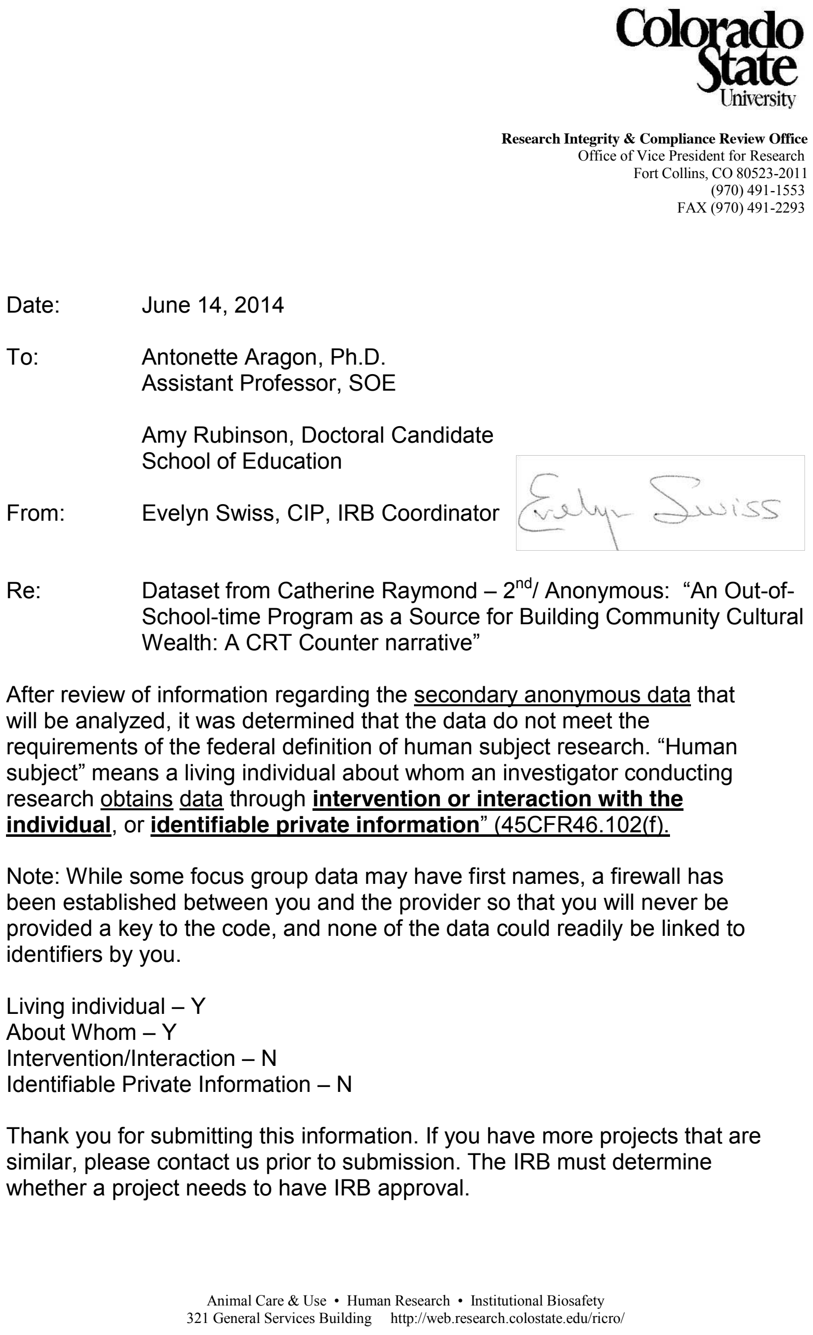
Table 6 (continuted)

Women, People of Color and People with Disabilities in Science and Engineering Degree Programs in 2012

		Engineering				Non-STEM			
Demographic catagory	Declaired major	AA	BA/BS	Masters	Doctorate	AA	BA/BS	Masters	Doctorate
All races (US Citizan and Permanent Resident)	10.30	13.82	92.40	no data	44.25	1.67	97.07	no data	43.03
Women*	3.90	86.18	19.20	15.54	22.60	38.46	60.70	84.00	60.80
White	10.40	13.64	68.10	62.60	66.02	41.90	65.60	63.10	65.77
Women*	3.70	86.36	17.40	4.75	no data	39.31	59.70	49.00	no data
Asian	15.00	10.98	12.00	15.00	14.65	95.43	5.40	5.30	5.27
Women*	7.00	89.02	23.00	1.61	no data	41.73	59.10	3.79	no data
Black	7.50	20.34	4.20	4.90	4.46	86.99	10.40	11.60	12.68
Women*	3.20	79.66	26.80	0.59	no data	32.17	66.60	10.07	no data
Latin@	10.10	14.83	9.30	7.80	4.87	85.27	10.00	7.40	6.00
Women*	3.40	85.17	22.50	0.82	no data	37.83	63.20	5.98	no data
American Indian or Alaska Native	8.60	19.43	0.40	0.40	0.28	99.02	0.60	0.50	0.57
Women*	4.90	80.57	22.30	0.05	no data	36.28	63.30	0.39	no data
Unidentified race, mixed race	no data	31.03	6.00	9.40	9.73	91.39	8.00	12.00	9.71
Women*	no data	68.97	19.80	0.85	no data	41.79	60.50	8.99	no data
People reporting 1+ disabilities	no data	14.29	no data	no data	4.80	no data	no data	no data	no data
Women*	no data	85.71	no data	no data	no data	no data	no data	no data	no data
Temporary Residents	no data	6.78	7.60	no data	44.25	98.33	2.93	no data	14.10
Women*	no data	16.25	20.60	no data	no data	no data	55.20	no data	no data

*Percentages for women are calculated as the percent of women within the specified subgroup

Appendix C: IRB Exemption Letter for Study 1



Colorado State University

Research Integrity & Compliance Review Office
Office of Vice President for Research
Fort Collins, CO 80523-2011
(970) 491-1553
FAX (970) 491-2293

Date: June 14, 2014

To: Antonette Aragon, Ph.D.
Assistant Professor, SOE

Amy Rubinson, Doctoral Candidate
School of Education

From: Evelyn Swiss, CIP, IRB Coordinator Evelyn Swiss

Re: Dataset from Catherine Raymond – 2nd/ Anonymous: "An Out-of-School-time Program as a Source for Building Community Cultural Wealth: A CRT Counter narrative"

After review of information regarding the secondary anonymous data that will be analyzed, it was determined that the data do not meet the requirements of the federal definition of human subject research. "Human subject" means a living individual about whom an investigator conducting research obtains data through **intervention or interaction with the individual**, or **identifiable private information**" (45CFR46.102(f).

Note: While some focus group data may have first names, a firewall has been established between you and the provider so that you will never be provided a key to the code, and none of the data could readily be linked to identifiers by you.

Living individual – Y
About Whom – Y
Intervention/Interaction – N
Identifiable Private Information – N

Thank you for submitting this information. If you have more projects that are similar, please contact us prior to submission. The IRB must determine whether a project needs to have IRB approval.

Animal Care & Use • Human Research • Institutional Biosafety
321 General Services Building http://web.research.colostate.edu/ricro/

Appendix D: Focus Group Guidelines, Study 1

2 groups of 10 students/group, 45 min each group, quiet, private room. Select students systematically. Wed, 7/31 (9th/10th) and Tues, 7/30 (11th/12th). At RSMAS.

Introduction: overview of evaluator and evaluation, purpose of focus group, audio taping, ground rules (voluntary participation, no right or wrong answers, confidentiality), obtain verbal consent

1. How did you find out about UBMS? (new students only)

2. Tell me about your experiences this summer in UBMS.

Probe for:
- What did they expect? (new students)
- What, if anything, surprised them about the program or their participation this summer?
- What were the most important thing(s) they learned this summer?
- What did they like best about the program this summer? What was most helpful to them?
- What types and characteristics of relationships were developed with program staff/mentors?

3. How can the program best assist you prepare for college?
- Probe for parental involvement strategies

4. What recommendations or other thoughts would you like to share today?

Throughout, probe for predictors of success:
- Academic preparation
- Academic support
- Personal support (parents, peers, other adults, mentors)
- Self-confidence (self-efficacy/self-concept)
- Financial aid
- Self-motivation
- Awareness of college life and academic work

Throughout, probe for feedback on program components:
- Academic preparation and skills building
- Academic support
- Hands-on experiences “doing” science; using technology
- Training in study skills; stress and time management
- Career exposure – scientists at work
- PSE exposure – college tours
- Role models – observing people like me in STEM careers
- Mentoring/Coaching – positive feedback/encouragement
- Positive peer group interested in STEM
- Parental engagement
- Confidence building (self-efficacy; self-concept)

- Relationships with IMPACT staff
- Culturally relevant curriculum
- Increased my interest in STEM
- Helping me to set and achieve my goals (high expectations)
- Assistance with college and financial applications

Appendix E: Survey Instrument Used for Studies 2 and 3

Goals of the research:

- Provide the Museum program staff with suggestions to improve participants' experiences in the Museum youth program(s)
- Increase the college graduation rates for program alumni
- Increase the percent of program alumni who graduate with STEM (science, technology, engineering, and mathematics) degrees

The survey has five sections:

- Your identity and background: The questions in this section are personal. I am asking them to try and understand your complete story-what your life was like growing up. The information you provide will help me to understand how others treat you, and how that has affected your life. Lastly, I am interested in how your family has supported your education.
- Academic accomplishments and aspirations: This section is to help me understand what you have accomplished and what you hope to accomplish academically. I also inquire about any obstacles you have faced through your educational journey.
- STEM experiences: Through this section, I strive to understand what has influenced your opinion of STEM from your childhood through the current day.
- Museum youth program(s) experiences: These questions are intended to help me understand the who, what, when, and why of your time in the program(s). Specifically, I want to understand your motivations to start, continue and stop the program(s).
- Lasting program influences: These questions address how your participation in the program(s) has influenced you as an adult and your career/academic choices after high school. I am also interested to learn about how you think the program(s) could have better helped you in reaching your academic/professional goals.

All of your responses are anonymous, and I am the only person who will have access to the responses. Please be honest and thoughtful in your responses to help me improve our youth program.

This survey may be completed from a mobile device or computer. You may also close the window and come back to complete the survey at a different time. I anticipate the full survey taking between 30-45 minutes.

Please direct any questions or comments to Amy Rubinson am.rubins@gmail.com or 786-385-8895.

By continuing with the survey and responding to the questions, you are consenting to participate in this survey.

Here is the link to the survey: http://survey.az1.qualtrics.com/SE/?SID=SV_5bQ9hU1B5rI8OUd

Your Identity and Background

Q2.2 How would you describe your social identity? In the space below, please: Pick 1 or more words to describe how you identify in each category in the blank text boxes (examples are provided, but do not include all identities). If you would rather not share your identity, please continue to part two. Select how often you are aware of your identity, using the multiple choice options. Please consider positive and negative times of awareness.

	Never (1)	Very rarely (2)	Rarely (3)	Occasionally (4)	Frequently (5)	Always (6)
Age (ex: teenager, young adult, middle-age adult)	○	○	○	○	○	○
National Origin (this may be the same as your ethnicity; ex: Peurto Rico, Antigua, Nicaragua, United States)	○	○	○	○	○	○
Sex (ex: Female, Male, Intersex)	○	○	○	○	○	○
Gender (ex: Man, Woman, Transgender, Gender Queer)	○	○	○	○	○	○
Religion or Belief System (ex: Hindu, Christian, Atheist, Agnostic, Jewish)	○	○	○	○	○	○
Socioeconomic Class (ex: upper class, middle class, working class, poor)	○	○	○	○	○	○
Physical appearance (ex: underweight, healthy weight, overweight)	○	○	○	○	○	○
Ethnicity (ex: Haitian, Lakota, Anglo, Jewish, Chican@, Japanese)	○	○	○	○	○	○
Race (ex: White, Black, Latin@, Asian/Pacific Islander, Native American, Multiracial)	○	○	○	○	○	○
Sexual Orientation (ex: Heterosexual, Bisexual, Lesbian, Gay, Queer, Questioning)	○	○	○	○	○	○
Physical/psychological/mental/learning ability (ex: able bodied, living with a disability, living with a chronic disease)	○	○	○	○	○	○

Q2.3 Indicate... How often you have experienced the statements below over the course of your lifetime, and In the text box, record which component(s) of your social identity you suspect provoked this negative treatment. Because of my identity...

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Very often (5)	All of the time (6)
I have been treated unfairly by teachers, administrators, or other staff at my school or university	○	○	○	○	○	○
Others have thought I couldn’t do things or handle a job	○	○	○	○	○	○
Others have threatened to hurt me (ex: said they would hit me)	○	○	○	○	○	○
Others have actually hurt me or tried to hurt me (ex: kicked or hit me)	○	○	○	○	○	○
Policeman or security officers have been unfair to me	○	○	○	○	○	○
Others have threatened to damage my property	○	○	○	○	○	○
Others have actually damaged my property	○	○	○	○	○	○
Others have mademe feel like an outsider who doesn’t fit in because ofmy dress, speech, or other characteristics related to my identity	○	○	○	○	○	○
I have been treated unfairly by co-workers or classmates	○	○	○	○	○	○
Others have hinted thatI am dishonest or can’t be trusted	○	○	○	○	○	○
People have been nice to my face, but said bad things about my behind your back	○	○	○	○	○	○
People who speak a different language have made me feel like an outsider	○	○	○	○	○	○
Others have ignored me or not paid attention to me	○	○	○	○	○	○
My boss or supervisor has been unfair to me	○	○	○	○	○	○
Others have hinted that I must not be clean	○	○	○	○	○	○

People have not trusted me	○	○	○	○	○	○
It has been hinted that I must be lazy	○	○	○	○	○	○

Q2.4 Do you have a child/children?

- ○ yes (1)
- ○ No (0)

Answer If Do you have children? yes Is Selected

Q2.5 How old were you when you had your first child? How did your child influence your educational pursuits or aspirations?

Q2.6 Did you work or do an internship during high school and/or college (any associates or bachelor's degree programs)? Do not consider school breaks in your response.

	No (-1)	Yes, an average of less than 15 hours/week (1)	Yes, an average of 15-30 hours/week (0)	Yes, an average of more than 30 hours/week (-1)	NA-have not attended college (99)
High school	○	○	○	○	○
College	○	○	○	○	○

Answer If Did you work or do an internship during high school and/or college? (Do not consider school break... - Yes, an average of less than 15 hours/week Is Greater Than or Equal to 1 Or Did you work or do an internship during high school and/or college? (Do not consider school break... - Yes, an average of 15-30 hours/week Is Greater Than or Equal to 1 Or Did you work or do an internship during high school and/or college? (Do not consider school break... - Yes, an average of more than 30 hours/week Is Greater Than or Equal to 1

Q2.7 Overall were your job(s) related to your major?

- ○ Yes (1)
- ○ Somewhat (0)
- ○ No (-1)

Q2.8 During high school, were you eligible for free/reduced lunch?

- ○ Yes, for all four years (-1)
- ○ For some of the time (0)
- ○ Not at all (1)

Q2.9 How many different addresses did you live in while you were enrolled in high school (NOT including school breaks)?

Q2.10 In high school, did your parent/ guardian(s)...

	Yes (21)	No (20)
Rent a home/apartment	○	○
Own a home/apartment	○	○
We (I) stayed with family or others	○	○
We were (I was) homeless	○	○
I rented or owned my own place	○	○

Q2.11 During high school, which of the following would have best described the RULES and STRUCTURE of your home environment? If multiple options apply or you lived in multiple environments, select the one that felt the most dominant.

	Yes (21)	No (20)
Strict rules, established by the adults	○	○
Rules and life guidelines, established by adults	○	○
Minimal rules or structure	○	○
Rules and life guidelines, established by adults AND children	○	○

Q2.12 During high school, which of the following would have best described what happened in your house if the RULES were BROKEN?

	Yes (21)	No (20)
The adult explained why the action was wrong and the proper way to act	○	○
The adult's typical explanation was "because I said so!" or something similar	○	○
I was on my own, there typically weren't adults involved in my life	○	○
I never got corrected for my behavior by my family	○	○
I got a spanking or beating	○	○
I got a privilege taken away or a chore/responsibility added	○	○

Q2.13 Answer the questions below.

	never (-2)	rarely (-1)	occasionally (1)	sometimes (2)	frequently (3)	significantly (4)
How often did your parent/guardian(s) place on value on getting an education while you were growing up?	○	○	○	○	○	○
How often was your parent/guardian(s) involved in your school and school-related activities or helping with homework?	○	○	○	○	○	○
Overall during high school, how often did you feel secure that you had the basic necessities to live?	○	○	○	○	○	○

Q2.14 Answer the questions below.

	never (-2)	rarely (-1)	occasionally (1)	sometimes (2)	frequently (3)	significantly (4)	NA-have not attended college (99)
How much did your parent/guardian(s) support you EMOTIONALLY while in college?	○	○	○	○	○	○	○
How much did your parent/guardian(s) support you FINANCIALLY while in college?	○	○	○	○	○	○	○

Q2.15 When you started high school, what was the highest level of education your parent/guardian(s) had?

Parent/ guardian 1	○ Less than 8th grade (1)	○ Some high school (2)	○ High school diploma/ GED (3)	○ Some college (4)	○ Associates degree (5)	○ Bachelor's degree (6)	○ Graduate degree (7)
P ent/ guardia 2	○ Less than 8th grade (1)	○ Some high school (2)	○ High school diploma/ GED (3)	○ Some college (4)	○ Associates degree (5)	○ Bachelor's degree (6)	○ Graduate degree (7)

Q2.16 In which periods of your life did you have highly supportive people who were actively involved and engaged in your daily life?

	Yes (1)	No (0)
before age 6	○	○
during elementary school	○	○
during middle school	○	○
during high school	○	○
after high school	○	○

Academic Accomplishments and Aspirations

Q3.2 For each educational level, indicate your current academic standing and goals. If you completed the degree indicate the completion month and year in the text box below each degree name.

	I do not plan to earn this degree (1)	Attended, but left before finishing (2)	Currently earning (3)	Completed (4)	Ultimately, I would like to earn this degree (5)
High school/GED (1)	○	○	○	○	○
Trade school (2)	○	○	○	○	○
Associate degree/certificate (3)	○	○	○	○	○
Bachelor's degree (4)	○	○	○	○	○
Master's degree (5)	○	○	○	○	○
Doctoral degree (DO, Ed.D, JD, MD, PhD, PsyD, etc.) (6)	○	○	○	○	○

Answer If For each educational level, indicate your current academic standing and goals. - Attended, but left before finishing Is Greater Than or Equal to 1

Q3.3 For the degree programs that you attended, but did not complete, please explain why you did not finish this/these degree(s).

Answer If For each educational level, indicate your current academic standing and goals. - Ultimately, I would like to earn this degree Is Greater Than or Equal to 1

Q3.4 For the degrees you would like to earn, please explain why you have not earned this/these degree(s) yet.

Q3.5 Indicate the specific focus of your (anticipated) schooling. This is a required question. If none, write "none."

	Academy, major or specialization (no abbreviations please) (1)
High school/GED (1)	
Trade school/ Associate in Science/ Certificate (2)	
Associate in Arts (3)	
Bachelor's degree (4)	
Master's degree (5)	
Doctoral degree (DO, Ed.D, JD, MD, PhD, PsyD, etc.) (6)	

Q3.6 If you have had a break in your educational pursuits, please explain what factors contributed to that break?

STEM Experiences

Q4.2 Are you pursuing a STEM degree or profession?
- ○ No (0)
- ○ No, but started as a STEM major (2)
- ○ Yes (1)

Answer If Are you pursuing a STEM degree or profession?&nbsp; No, but started as a STEM major Is Selected

Q4.3 Describe the factors that influenced you to STOP pursuing STEM?

Q4.4 How have you been recognized for your actions in a STEM context? (Consider positive or negative feedback, from family, formal awards, grants, internships, instructors, mentors, peers, etc.)

○ Very negativly (-3)
○ negativly (-2)
○ Slightly negatively (-1)
○ Slightly positively (1)
○ Positively (2)
○ Very positively (3)

Q4.5 Consider the 3-5 most positive or negative influential people or experiences regarding your opinion of STEM. For each experience or person, please: Describe the experience or person in detail, and Estimate how old you were during the experience or interactions with this person. For example: In second grade, my teacher was always mean to me in math class, only in math class. She would call on me, and humiliate me when I didn't know the answers. From then on, I had low confidence in my math abilities, and I did not have much interest in trying in math. Once I got to high school, I had to do a group project in math that I found really interesting. I was applying geometry to sports! That improved my opinion of math a little bit.

Q4.6 For each statement below, please distribute 20 points among the influences presented in the top row. If you do not agree with the statement, put all 20 points in “None.” Please be sure each row of points adds up to 20. The following helped me...

	e	Museum youth program(s)	Museum mentor	chool	Other (sports, family, partner, friends, religious leader, etc.)	None-I do not agree with the statement or N/A
Feel hopeful for my future						
Imagine myself as a STEM professional in while in high school and/or college						
Perform well in my science, math, computer or other STEM–related classes during high school and/or college						
Feel confident in STEM related activities or responsibilities						
Feel like I belonged in the STEM community						

Succeed ACADEMICALLY in college						
Succeed SOCIALLY in college						
Learn skills I need to live independently (consider finances, cooking, etc.)						
Develop positive STEM role models						
Have opportunities and experiences related to STEM						

Museum Youth Program(s) Experiences

Q5.2 Initial reason(s) for participation:

	Strongly Disagree (-3)	Disagree (-2)	Somewhat Disagree (-1)	Somewhat Agree (1)	Agree (2)	Strongly Agree (3)
My parent(s)/ guardian(s) made me	○	○	○	○	○	○
My teacher(s)/ school administrator(s) suggested I participate	○	○	○	○	○	○
I enjoyed interacting with mentors/ peers in the program	○	○	○	○	○	○
I liked learning about STEM	○	○	○	○	○	○
I wanted to go to college)	○	○	○	○	○	○

Q5.3 Reason(s) for CONTINUING the Museum youth program(s):

	Strongly Disagree (-3)	Disagree (-2)	Somewhat Disagree (-1)	Somewhat Agree (1)	Agree (2)	Strongly Agree (3)
My parent(s)/ guardian(s) made me	○	○	○	○	○	○
I enjoyed interacting with mentors/ peers in the program	○	○	○	○	○	○
I liked learning about STEM	○	○	○	○	○	○
I wanted to go to college	○	○	○	○	○	○

Q5.4 How did you decide which activities to participate in during your time in the Museum youth program(s)?

	Strongly Disagree (-3)	Disagree (-2)	Somewhat Disagree (-1)	Somewhat Agree (1)	Agree (2)	Strongly Agree (3)
Everything I was able to do	○	○	○	○	○	○
The activities that sounded beneficial to me	○	○	○	○	○	○
The activities that my friends were doing	○	○	○	○	○	○
The activities that I knew would have food	○	○	○	○	○	○
The required activities	○	○	○	○	○	○
As little as I could, while staying in the program	○	○	○	○	○	○
The STEM-related activities	○	○	○	○	○	○
The college-readiness activities	○	○	○	○	○	○

Q5.5 Which activities did you participate in during your time with the Museum youth program(s)?

	Yes (1)	No (0)
STEM-themed class	○	○
College readiness class	○	○
College entrance exam preparation	○	○
Financial literacy class	○	○
Career fair	○	○
Local college tour	○	○
Overnight college tour, including BRCE (9/10th grade)	○	○
Overnight college tour, including BRCE (11/12th grade)	○	○
STEM-related overnight trips (summer IMPACT trips)	○	○
Overnight camping trip or other trip not directly related to college or STEM	○	○
Family night	○	○
Research symposium/presentation (including interns)	○	○
6-Week Marine Science Program/IMPACT	○	○
Leadership opportunities (e.g. Youth Advisory Board or Committee)	○	○
Fund raising opportunities (hosted by the youth programs or the Museum-the Gala)	○	○
Volunteer opportunities (at the Museum and elsewhere)	○	○
Tutoring	○	○
Use of the computer and technology resources at the Museum	○	○
Shark tagging research	○	○
Group research project	○	○
Internship/job at the Museum or elsewhere (Jackson Hospital)	○	○
Senior dinner	○	○

Q5.6 Estimate how often you participated in the Museum youth program(s).

	9th grade					
	1/semester (1)	less than 1/month (2)	1/month (3)	1/week (4)	more than 1/week (5)	N/A was not enrolled/active in program (0)
Summer before	○	○	○	○	○	○
Academic-year	○	○	○	○	○	○

	10th grade					
	1/semester (1)	less than 1/month (2)	1/month (3)	1/week (4)	more than 1/week (5)	N/A was not enrolled/active in program (0)
Summer before	○	○	○	○	○	○
Academic-year	○	○	○	○	○	○

	11th grade					
	1/semester (1)	less than 1/month (2)	1/month (3)	1/week (4)	more than 1/week (5)	N/A was not enrolled/active in program (0)
Summer before	○	○	○	○	○	○
Academic-year	○	○	○	○	○	○

	12th grade					
	1/semester (1)	less than 1/month (2)	1/month (3)	1/week (4)	more than 1/week (5)	N/A was not enrolled/active in program (0)
Summer before	○	○	○	○	○	○
Academic-year	○	○	○	○	○	○

Q5.8 What did you find challenging during your participation in the program (mentally, physically, emotionally, etc.)? Please provide specific examples.

Q5.9 Were you ever informed about your performance (regarding participation, behavior, academics) in the Museum youth program(s)?

○ Yes (1)
○ No (0)

Answer If Were you ever informed about your performance (regarding participation, behavior, academics) in the Museum youth program(s)?&nbsp; Yes Is Selected

Q5.10 How were you informed about your performance (academic, participation, behavior, etc.) in the program?

Q5.11 Reason(s) for STOPPING the Museum youth program(s): (Select all that apply)

	Yes (1)	No (0)
I am still in the program	○	○
I graduated high school	○	○
I needed a job	○	○
I participated in extracurricular activities	○	○
I had family/ home responsibilities	○	○
I had religious responsibilities	○	○
I did not have time	○	○
Transportation/ distance from the Museum was too difficult	○	○
The program was too much like school	○	○
I did not learn anything from it	○	○
I did not have fun there	○	○
I did not fit in	○	○
I was asked not to return	○	○
I got in a fight with/ did not like a staff person or peer	○	○

Lasting Program Influences

Q6.2 Do you still actively reach out or communicate with mentors or peers from the Museum youth program(s)? (Following someone on social media does not count as actively communicating. Consider those you have actually had a conversation with verbally or messaging.)

○ no (-2)
○ no, but I feel I could if I needed something (-1)
○ with mentors only (1)
○ with peers only (1)
○ yes, with both (2)

If no Is Selected, Then Skip To Participating in the Museum youth...

Q6.3 How often do you still actively reach out or communicate with mentors or peers from the program?

	1/year or less (1)	1/every 3 months (2)	less than 1/month (3)	1/month (4)	1/week (5)	more than 1/week (6)
Mentors (1)	○	○	○	○	○	○
Peers (2)	○	○	○	○	○	○

Q6.4 Participating in the Museum youth program(s) has MADE ME FEEL:

	Strongly Disagree (-3)	Disagree (-2)	Somewhat Disagree (-1)	Somewhat Agree (1)	Agree (2)	Strongly Agree (3)
Like I belonged somewhere	○	○	○	○	○	○
Emotionally safe	○	○	○	○	○	○
Like someone believed in me	○	○	○	○	○	○
Stressed because of the high academic expectations	○	○	○	○	○	○
Physically safe	○	○	○	○	○	○
Stressed because of the high time and commitment expectations	○	○	○	○	○	○

Q6.5 Participating in the Museum youth program(s) LED ME TO:

	Strongly Disagree (-3)	Disagree (-2)	Somewhat Disagree (-1)	Somewhat Agree (1)	Agree (2)	Strongly Agree (3)
Want to go to college	○	○	○	○	○	○
Do better in school (high school, college, etc.)	○	○	○	○	○	○
Deal with my daily stresses better	○	○	○	○	○	○
Learn from my mentors	○	○	○	○	○	○
Learn from my peers	○	○	○	○	○	○
Learn professionalism	○	○	○	○	○	○
Miss out on doing some other activities	○	○	○	○	○	○
Have new experiences	○	○	○	○	○	○
Learn more about myself	○	○	○	○	○	○
Learn about life	○	○	○	○	○	○
Become a better person	○	○	○	○	○	○
Be aware of my strengths and weaknesses	○	○	○	○	○	○
Take on leadership roles	○	○	○	○	○	○

Q6.6 Participating in the Museum youth program(s) IMPROVED MY ABILITY TO:

	Strongly Disagree (-3)	Disagree (-2)	Somewhat Disagree (-1)	Somewhat Agree (1)	Agree (2)	Strongly Agree (3)
Interact with my peers (1)	○	○	○	○	○	○
Interact with (older) adults (2)	○	○	○	○	○	○
Think about how my actions affect others (3)	○	○	○	○	○	○
Work as part of a team or group (4)	○	○	○	○	○	○
Share my thoughts and ideas with others (5)	○	○	○	○	○	○
Think critically as I make decisions or solve problems (7)	○	○	○	○	○	○
Interact with those who are different than me (8)	○	○	○	○	○	○
Plan and carry through short or long-term goals (9)	○	○	○	○	○	○

Q6.7 How has the Museum youth program(s) contributed to who you are as a person? Please provide examples.

6.7 What additional activities could the Museum youth program(s) add that would help the participants succeed in college and in STEM fields?

Appendix F: Key Participants' Quotes Informing Analyses

Familial Capital

1. The program can continue to build familial capital in participants by having regular events that involved families in the program activities, as one participant articulated:

> More, but separate, family integration. That way the member(s) of the family that do care about their kid can come find out more about how they can better support and help not only their child but the [program]. If family, student and programs were all on one team, there would be a significant difference in the results. This will also serve as a dual purpose to find out what parents are: A) too busy, because they may want to help and simply have no time to do so or get involved; B) they don't understand, because if they don't reply or show up that may indicate that they personally don't know about the school stuff as long as their kid gets good grades; and C) they don't care or want their kid succeeding, that's the least likely option, but it does happen a lot where the parent doesn't want their kid to do well and that truly destroys a student. If the program can somehow figure out which of these three brackets the parents can be in, they can greatly figure out how to better the student and even themselves because sometimes these parents are the wrenches in the mentor & student's plans.

This participant clearly articulates some potential reasons why parents may not be involved in their children's educations and how the youth program can serve as a bridge between the participants' parents and the education system.

2. Showing how participants' families were involved, one participant described, "We would have family night and trophies and we could bring our family and friends to see the show."

3. Many STEM-persistent participants indicated deep connections to the program mentors and peers, describing the program to be "like family." They also showed appreciation for the skills the program helped them to build and giving credit to the program for their academic and professional accomplishments. This participant is earning his DPT (Doctorate in Physical Therapy):

> The [program] has been an integral part of my success as a college student. My mentors and peers are like family and have helped with advice, applications, and have spent time getting to know me as a person. If it were not for the [program], I do not believe that I would be a candidate for a doctoral-level degree.

4. Peers were motivated by being surrounded by other high achieving students and seeing alumni come back to visit and share some of their experiences with the group, as one participant explains:

> I have warm memories of my time at the [program]. Even ten years later, while still working at the [program] (in a different department) I feel a strong bond with all mentors and all the new generations of participants. Working with many of them made me feel proud of having that link of responsibility and aspiration which I felt was shared amongst all participants throughout the years. Seeing older groups come back, just to say hello, even though their peers had long graduated and likely their mentors had moved on, let me know that I was not alone in feeling this continued support from the [program].

Potential harm for participants who do not feel familial capital.

1. Some participants felt generalized and confronted with biases through their interactions at the program. One participant described this pain:

> Certain kids are given expectations and others are basically left in the dust. The last thing I needed as an angry teenager who was going through all kinds of psychological, mental health stuff was to witness mentors talking or seeing me negatively. I know dealing with at risk kids can be tough, but please if you are not ready to deal don’t. And don't hire people who can't. It not okay and it's not fair.

Aspirational Capital

1. Having new experiences built aspirational capital in youth participants, allowing participants to dream and widen the possibilities of future options, as one participant succinctly stated: “The program gave me perspective into others who aren't like me as well as new opportunities for discovering my future.”

2. This participant describes the most influential moments in his life regarding his interest in STEM, and the beginning of his career in Computer Engineering.

> Probably the most influential of all and what got me into the career I'm pursuing now, at the age of 13-14, the summer before 9th grade I was the class as part of the [Name] program with professor [Name] where I was introduced to the world of 3D graphics for entertainment using Maya and SecondLife. This single class has been the foundations of everything I have done after in STEM and where all my efforts towards achieving a bachelor's in the field of Computer Engineering started. . . . Later in High School I watched videos from GDC (Game Developers Conference) where the greatest people in the industry would teach how to be successful in the industry with the available tools. The entire conference was very influential but there were specific people that were interviewed such as Gabe Newell that left me wishing I could do what they were doing. . . . In College at the age of 18, meeting with the Game Developer group locally in [City Name] allowed me to meet people who enlighten me in all the possibilities within the field of game development once I achieve the necessary computer knowledge, in my STEM career, to be part of it. All the meetings, discussion, and events were very influential.

This participant took the initiative to enroll in this specially offered course and continued to describe ways in which he sought opportunities later in his life to support his intellectual and professional development.

3. These examples of CCW are directly from the data and representative of ways in which participants built and used their strengths to persist their academic aspirations. One participant explains his experience at the program:

> It help me grow to become better. A better person, and role model to youth kids now. If it wasn't for this program I would of (sic.) stayed the same and not grow (sic.) in my weaknesses. It's an opportunity to become aware of your future.

Navigational Capital

1. The program also prepared the participants to navigate the world by teaching participants life skills that benefited them in different contexts as they entered adult life. One participant explained: "[The program] has shaped me academically and professionally. I owe all my school and work successes to the [program]. It helped me to develop a strong sense of work ethics and computer skills."

Multiple Forms of Support

1. One participant describes the immense amounts of support he felt from many sources around him:

> It was because of the people around me that showed me what my true potential was. Many of the professional staff members at the [program] became my inspiration and my mentors. My family always believed in me. My father was a single parent and he has always empowered me to follow my dreams. . . . Additionally, my closest friends provided endless support for me. They volunteered their time to take me to work, testing sites for those early SAT/ACT mornings and simply just encourage me to not give up.

2. Those who had earned or were earning a graduate degree mostly had parents who were involved in the college application and decision-making process, and the participants learned about education beyond high school from many different sources, as one participant describes:

> I would engage in this topic of college readiness and future plans fairly often, major topic of communication toward junior and senior year. Communication with family was very encouraging, communication of this topic with school guidance counselor was discouraging to unhelpful. The [program] provided me the knowledge I needed for college.

Contemporary redundancy related to college.

1. The group who was earning or had earned at least a four-year degree spoke differently about their experiences during high school. Many of them said that they were influenced by contemporary redundancy (repetition of the same message in multiple forms) beginning in high school or younger. One participant explained:

> There was verbal discussion of college multiple times. . .one of my high school's goals was actually to make sure at least every senior had been accepted to Miami Dade at the very LEAST. And that was clarified at 10th grade for the PSAT's, and then once I stacked [the program] on that it was very evident how adamant I was about college, as well as a lot of the faculty and staff that was in my every day scholarly life as of 2010.

STEM Persistent

1. One participant describes her major choice, as influenced by her mentor from the youth program:

> I picked my major (microbiology) because my mentor had taken me to [university name] a couple of times to her Microbiology classes and I fell in love with it. She had told me that just picking Biology as a major might hinder me and that going the microbiology route might be more beneficial.

NonSTEM Persistent

1. One program alumni described the major events leading up to her changing her major away from STEM:

> In college I had a wonderful physics teacher who offered to tutor me personally. . . There were only 2 other women in the class and I believe the professor wanted to make sure that we stayed in the class. I also had a bad experience in college. My calculus 1 & 2 professor would call on his students to answer questions. I did not understand the questions and often was flustered when he asked me questions. I did not do well in calculus 2. I changed my major shortly after that class.

Not Belonging in the Higher Education and STEM Environments

1. Regarding institutional discrimination, participants indicated feeling challenged by navigating the academic systems and that they "did not belong" in higher education or STEM fields. People of color feeling as though they do not belong in STEM has been supported by prior research, specifically related to the various fields (Johnson, 2007; Malone & Barabino, 2009; Ong, 2005; Tate & Linn, 2005). One participant described how he experienced and responded to this:

> I used to be the only black kid in some my classes. My peers would always think I did not belong in advanced courses with them because of my race. In some classes, like AP physics or calculus, other students had assumed I had the lowest grade in class or I did not know what I was doing because I was black. I never let that bother me, because I knew I was able to do the work just like them

> and even received better grades than them. So, I don’t let people intimidate me or make me feel like I'm inferior because I'm black when I was high school.

Signs of Resiliency

1. One participant described her resilience beyond a negative teacher:

> I have always excelled in Math. Science and technology required more effort on my ends but nonetheless, I have always attained an A or B in those courses. In the 10th grade, I had one math teacher who said "you're just not an A math student" after I confronted him about my grade and his teaching method or lack thereof. Fortunately, by that age, I had so many others building my academic confidence that I knew enough to challenge him on those words. I made sure to hold him accountable since then to teach and concluded the course with an A.