UNDERSTANDING INDUSTRY-HBCU PROGRAMS TARGETED AT INCREASING DIVERSITY IN STEM CAREER FIELDS

by

GLEN D SPENCER, JR

(Under the Direction of Gregory C. Wolniak)

ABSTRACT

Industry-university partnerships aimed to prepare students for careers have become increasingly important in higher education. Equipping students with specific skills while simultaneously providing companies with the ability to align industry needs has yielded the expansion of industry-university partnerships. In an effort to fully understand the phenomenon of industry-university partnerships, this research examines critical elements of HBCU-industry partnerships focusing on STEM from the perspectives of program administrators, students, and industry partners.

A basic interpretive, qualitative methodological approach was used for this research, including a series of interviews and document analysis of program websites. Analysis of interview and program website data exposed four major themes: (a) passionate program administrators: “I’ve always had this feeling I wanted to make a difference”; (b) mentoring: “You cannot be what you cannot see”; (c) students need a shot; and (d) competing priorities: “This program has a reputation of getting students jobs and I want one!”

The core finding from this study is that HBCU-industry partnerships have a unique ability to prepare students professionally and personally, which can accelerate industry diversity efforts. This unique ability centers on learning environments and focuses on STEM mentorship that provides students with the motivation, encouragement, and support needed to establish a career in a STEM-related field. My research can serve as a foundation to further explore the impact of HBCU's on the STEM industry, particularly in industries that have publicly acknowledged the need for diversity in their workforce.

INDEX WORDS: Science Technology Engineering Math, Historically Black Colleges and Universities, Critical Race Theory, UnderRepresented Minorities

UNDERSTANDING INDUSTRY-HBCU PROGRAMS TARGETED AT INCREASING DIVERSITY IN STEM CAREER FIELDS

by

GLEN D SPENCER, JR

BA, Morehouse College, 2000

MBA, American InterContinental University, 2003

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF EDUCATION

ATHENS, GEORGIA

2019

UNDERSTANDING INDUSTRY-HBCU PROGRAMS TARGETED AT INCREASING DIVERSITY IN STEM CAREER FIELDS

by

GLEN D SPENCER, JR

Major Professor:	Gregory Wolniak
Committee:	Libby Morris
	Erik Ness

Electronic Version Approved:

Ron Walcott
Interim Dean of the Graduate School
The University of Georgia
December 2019

DEDICATION

This dissertation is dedicated to:

My crooked smiling, always supportive, sometimes irritating, extremely intelligent, and lovely wife, Dr. Kelli D. Spencer. I thought I properly celebrated you when you achieved the task of writing your dissertation. I failed horribly. This was hard and not possible without your love, patience, and support. Thank you!

My children, Glen "Tripp" Spencer, III, Wyatt Leigh Spencer, and Isabella Dean Spencer. Thank you for the patience that you displayed daily as I committed to this journey. Each of you gave me something different along this journey that served as inspiration. Thank you, Tripp, for the confidence that you had in me when I struggled to see it in myself. Thank you, Wyatt, for your unwavering positive attitude regarding completion. "You can do it Daddy" is forever stuck in my head. Thank you, Isabella, for showing me how to have a graceful disposition under pressure. If you were old enough to say, "Never let them see you sweat Daddy," you would have said it! Your eyes did all of the encouraging. Lastly, thank you to my children who I never got a chance to meet because of miscarriage. Each of you had an impact on my life during the 3-year doctoral process that your Mom ultimately conquered. You deserve to be mentioned because you taught us so much.

My sister for mastering the ability to understand me. We have our good days and bad days, but you always seem to have an inner peace that I long for in this lifetime. I will continue to try my best to be a big brother to you.

My loving and supportive parents, Glen D. Spencer, Sr. and Brenda Spencer. For as long as I can remember, I always wanted to make you both proud. Words cannot express the degree of appreciation, respect, and love that I have for you. Your relationship started over 40 years ago by defying the odds. Teenage pregnancy, products of single parent homes, and unstable living conditions did not stop either of you from breaking barriers. Thank you!

My grandmothers, Veneta Harris and Leola Wofford (deceased). The thought of you two gossiping, playing cards, and cracking open beer cans always makes me smile. The concept of friendship and all of the amazing gifts it bears is what you both will always represent in my heart. I hope you are proud.

My mother- and father-in-law, Mr. and Mrs. Izard. Thank you for your support, words of encouragement, and years of laughter.

My Uncle Richard. Your drive to be better has had a huge influence in my desire to leave this world better than I found it. Thank you!

Finally, every person who has touched my life in some way during this process. If I missed someone, blame it on my mind, not my heart.

Aunt Thea, Charles and Jessica Izard, Curtis and Amber Jackson, Pastor David Kennebrew, Lem Byers, Dr. Charles Long, Dr. Lynwood Belvin, Aunt Rita, Aunt Pat, Aunt Kat, Aunt Sherry, Uncle Charles, Uncle Greg, Uncle Jessie, Uncle Junior, Bethany, Demond and Yvonne Chambliss, Kevin and Shayanna Golden, and Che and Bernard Young.

Thank you Jesus!

ACKNOWLEDGEMENTS

"The test of a first-rate intelligence is the ability to hold two opposed ideas in mind at the same time and still retain the ability to function"

F. Scott Fitzgerald

When I embarked on this journey, I knew it would be hard; unfortunately, I woefully underestimated how hard. I did not calculate the time that I would be away from my family, I did not calculate my wife having surgery, and I did not take into account the possibility of my manager moving to another division, I did not plan on moving. I did not plan on having conflict with my sister and brother-in-law, I did not plan on my father-in-law having a heart attack and most importantly, I did not plan on dedicating so much time in a pursuit that did not align with my current career trajectory. Pursing my doctorate was purely a way to inspire my children to answer the call to "do something difficult" when you feel the tides of complacency beginning in your life. As this chapter to obtain my EdD comes to a close, I would be remiss to not acknowledge the individuals who made this journey possible: the individuals who reminded me to stay the course and always finish what you start.

To my Wife:

This would not have been possible without you. You inspired me. You helped me. You encouraged me. You challenge me to be a better person and I love you dearly.

To my children:

Hard work will continue to unlock your talents. Pay attention to the details and never settle for being mediocre.

To my Mom:

You have shaped me into the caring, generous, thoughtful person I am today because I had you as a role model. You have been my biggest fan and cheerleader since Day 1. Thank you for loving me and showing me how to love.

To my Dad:

I honestly do not know where to start. I do not often find myself speechless, but as I contemplate the words to say to you, I am. I am the person I am today because of you. As Bob Marley said, "None but ourselves can free our mind." Your life exemplified this quote. You have sacrificed for your family and have shown us what it means to truly love, support, and believe in someone.

To my dissertation committee:

With a heart full of gratitude, I want to extend a resounding thank you to my dissertation committee. Dr. Gregory Wolniak, my adviser, thank you so much for everything. Your time, your patience, and the ways that you have challenged me to become the scholar and professional that I a desire to be. Dr. Erik Ness, thank you for your very straightforward feedback, it is greatly appreciated. I did not like it during the defense, but it made my research meaningful. Dr. Libby Morris, thank you for asking questions that stretched my thinking and having such an encouraging spirit.

To my professional colleagues and friends:

You got me to the finish line through your never-ending belief in me.

To my UGA Family and cohort:

You made this dissertation possible through accepting me into the UGA family. I have friends for life. Go Dawgs!

Lastly, to the readers of this dissertation:

Thank you for believing in my research and me. Please be challenged by this dissertation to make a difference, to have a courageous conversation about diversity and inclusion in industry. We have an opportunity to start a conversation that could open up so many doors for others. Let us do it right!

.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION

As a regional manager for the largest consumer electronic company in the world, there are two constant themes that have persisted throughout my professional career: race and choice of higher education institution. I am an African American male who chose to attend a Historically Black College and University (HBCU) over 20 years ago. There is not a day that goes by were I do not experience a conversation or situation about either my race or some type of reference to my alma mater. In addition, I am employed by one of the most innovative technology companies in the United States and the world. These themes motivated me to explore and understand the existing literature about the intersection of race, technology, and my experiences as a HBCU graduate.

Throughout my career at a technology company, I have been the only Black male professional in the room. This reality has afforded me an opportunity to field most questions about race and education: What school did you attend? Do you know of any Black, qualified candidates in the areas of science, technology, engineering, and math (STEM)? Are you open to participating in a group designed to discuss diversity in the company? My professional and personal experiences have led me to pursue a doctorate and ultimately explore and understand industry-HBCU programs targeted at increasing diversity in STEM career fields.

Context

American higher education institutions have always struggled with preparing students with skills that will be most relevant in the constantly changing workforce (Atkinson & Mayo,

2010). The duty of preparing students for an ever-changing workforce has created an environment for colleges and universities to develop innovative programs and career-focused degree options. The goal of these programs is to improve the gap between the needs of the workforce and the preparation of college graduates. In this context, industry-university partnerships have flourished as a way to connect the needs of the U.S. workforce with higher education's ability to produce student talent.

Mohr and Speckman (1994) described partnerships as "purposive strategic relationships between independent firms who share compatible goals, strive for mutual benefit, and acknowledge a high level of mutual interdependence" (p. 135). In the private sector, partnerships have historically served as a mechanism to improve and advance in competitive markets. Ideally, two or more organizations partner to experience benefits in areas that would not be possible without the partnering organization(s). As industries continue to identify the specific skills needed to help them compete in a global society, higher education institutions have embraced their role in providing students that meet the needs of specific industries.

Preparing students for specific career fields has become an important way for higher education institutions to equip students with skills that align with industry needs (Pertuze, Calder, Greitzer, & Lucas, 2010). Researchers have suggested racially and ethnically diverse colleges and universities provide their students with skills and experiences that positively transfer to the diverse workforce (Jayakumar, 2008). The linkage between the workforce and institutions of higher education empowers colleges and universities with the ability to provide programs and experiences that prepare students for employment.

In recent years, a promising mechanism for improving the pipeline of minorities in STEM has appeared in the context of HBCUs working in partnership with industry, specifically,

technology companies that rely on workers trained in STEM subjects. Industry partnerships with HBCUs directly aim to increase diversity in STEM-related fields by building on the past success that HBCUs have demonstrated in supporting minority pathways into STEM careers (Owens, Shelton, Bloom, & Cavil, 2012). Of the 110,580 bachelor's degrees awarded nationally to African Americans in STEM programs from 2001 to 2009, 8.6% of those degrees were from 12 HBCUs (Owens et al., 2012). Furthermore, based on data from the U.S. Department of Education (2016), HBCUs graduate 27% of the nation's African American students with bachelor's degrees in STEM. Studies have further indicated "Black students attending highly selective HBCUs had a greater rate of completing their STEM courses, thereby improving their chances of earning a STEM degree" (Gasman, Nguyen, Conrad, Lundberg, & Commodore, 2017, p. 184). HBCUs are poised to leverage their ability to produce STEM graduates.

To illustrate the importance of industry-university partnerships and HBCUs, Google and Howard University developed a multiphased program to bring together Google software developers and undergraduate students. According to Washington, Burge, Mejias, Jean-Pierre, and Knox (2015):

> This program was designed to strengthen the relationship between the university and Google, provide direct access to Black Googlers for students, infuse curriculum with real-world context, increase perception of and interest in CS, and increase the number of departmental students apply for and entering Google summer internships and full-time positions. (p. 2)

These stated goals reflect how an industry-university partnership can link an institution's unique ability to provide students to industry, with the purpose of addressing a desired industry outcome.

Bikson and Law's (1994) research on 16 corporations and 16 colleges and universities highlighted the importance of creating competencies across cultures. Their findings stated colleges and universities are failing to prepare students to "work effectively with individuals whose norms, preferences, beliefs, styles and values that are different from their own" (Bikson & Law, 1994, p. 14). These findings highlight opportunities and challenges for industries and institutions of higher education. The opportunity to strengthen the relationships between industries and universities through an improved understanding of partnerships is significant. The challenge with keeping up with various industries that change rapidly is difficult for institutions of higher education. Gumport (2000) described this as "keeping pace with the knowledge change" (p. 67). Without industry-university partnerships, institutions are at risk of graduating students who do not have the specific skills to meet industry demands. Misalignment among industry and university can lead to economic instability.

In the postindustrial era, increasing the number of minorities in STEM is critically important for United States' economic growth and its position in the global marketplace (Guess, 2008; Moore, 2006; Öztürk, 2007). According to the U.S. Census Bureau (2008), minority populations are expected to increase by 2050, comprising 50% of the U.S. population, while percentages of the White population are projected to decline. Valla and Williams (2012) stated, "Increasing the representation of women and ethnic minorities in [STEM] education and careers has been a goal of education researchers for nearly half a century" (p. 1). Researchers who have studied STEM have reinforced this premise. For example, George, Neale, Van Horne, and Malcom (2001) argued, "Building a diverse workforce in [STEM] is increasingly important to sustaining the nation's productivity and economic strength" (p. 4). In addition, Baine (2009) emphasized that a lack of diversity in STEM fields negatively affects the U.S. economy and

education system. The underlying basis for these arguments appeared in national reports, such as the National Science Foundation's (2017) *Women, Minorities, and Persons with Disabilities in Science and Engineering*, which indicated women make up 46% of the total workforce but hold only 24% of the jobs in technical or STEM fields, and that "African-Americans and Latinos each comprise 13% of the total workforce, but only 3% of the technical workforce" (Baine, 2000, p. 2). Ultimately, the underrepresentation of women and ethnic minorities in STEM fields remains a major concern of national importance.

Problem Statement

Even though our nation's 105 HBCUs make up just three percent of colleges and universities, they produce 27 percent of African Americans with bachelors' degrees in STEM fields.

HBCUs must continue to play that critical role in creating equal opportunity. And they must continue to play a critical role in meeting President Obama's North Star goal in education—that America regain its place as the nation with the highest college attainment rate in the world.

U.S. Secretary of Education Arne Duncan to the 2014 National HBCU Conference "HBCUs: Innovators for Future Success."

When U.S. Secretary of Education Arne Duncan made his statement, I was at once proud and confused. The fact that 105 HBCUs had the capacity to produce such a high percentage of STEM graduates was astonishing. Inversely, I was disappointed there was not a uniform industry strategy to tap into this statistical anomaly of STEM talent production at HBCUs. The basic problem that gave rise to this study was that HBCUs have and continue to produce STEM graduates at an astounding rate, yet there are few examples of research understanding the critical elements and narratives that are behinds these seemingly impossible achievements. Thus, there is a need to expand our understanding of what enables HBCUs to produce so many STEM graduates and specifically, how STEM-focused, industry-HBCU partnerships may be contributing to this phenomenon.

Purpose

The purpose of this dissertation is to understand the critical elements of HBCU-industry partnerships focusing on STEM. The intent of this study was to leverage a basic interpretive, qualitative methodological approach to understand the perspectives of HBCU-industry partnership program administrators, students, and industry partners.

Researchers have sought to understand the external factors that contribute to HBCU's unique ability to produce STEM graduates separately from understanding the need for diversity in STEM-related career fields. This approach has yielded a significant amount of research (Allen & Jewell, 2002; Owens et al., 2012; Palmer & Gasman, 2008) about the outcomes of HBCUs and their ability to impact diversity in industry and society. Building on past research, the present study draws from theories of academic capitalism (AC) and critical race theory (CRT) to frame a new understanding of the critical elements of HBCU-industry partnerships. The results of this study provided a narrative-based understanding of the participant's perspectives and yielded some promising areas for future research in understanding this phenomenon. The guiding research question is*:* What are the critical elements of HBCU-industry partnerships focusing on STEM, from the perspectives of program administrators, students, and industry partners?

To address this research question, I drew from Yin's (2017) suggestion that a qualitative methodology is most appropriate when seeking to understand the views and perspectives of people. According to Merriam and Tisdell (2015), conducting qualitative research seeks to "understand how people interpret their experiences, how they construct their worlds, and what

meaning they attribute to their experiences" (p. 40). For the purposes of this research, I employed a basic interpretive, qualitative design informed by the theoretical frameworks of AC and CRT.

Significance and Implications

Industry-university partnerships with HBCUs could play a vital role in enhancing education pathways for minority students (Atkinson & Mayo, 2010). However, little research exists for understanding the opportunities and challenges embedded in such partnerships or to guide the development of future partnerships. There are a number of gaps in our knowledge around the role HBCU-industry partnerships play in increasing the STEM workforce.

This research can serve as a foundation from which to further explore the impact of HBCUs on the STEM industry, particularly in industries that have publicly acknowledged the need for diversity in their workforce. As it relates to practice, the implications of this research can guide our understanding of the perspectives of underrepresented minorities (URM) interested in pursuing STEM careers. The results provide new information to guide future industry-university partnerships in STEM-related fields by providing key insights into the perspectives of students, program administrators, and industry partners. Additionally, the findings provide an understanding of the organic creation of industry partnerships with HBCUs.

CHAPTER 2

LITERATURE REVIEW

As a result of research showing an anticipated shortage of workers in STEM fields in the United States, STEM-related education programs have increased considerably (Carnevale, Smith, & Melton, 2011). Research has suggested increasing the number of STEM-educated students benefits the economy and equips the future workforce (Engberg & Wolniak, 2013; Gonzalez & Kuenzi, 2012; Kuenzi, 2008). In their research on refueling the U.S. economy, Atkinson and Mayo (2010) stated, "The number of students attaining STEM postsecondary degrees in the United States more than doubled between 1960 and 2000; however, as a proportion of degrees in all fields, STEM degree awards have stagnated during this period" (p. 11). This stagnation of STEM degree attainment, coupled with studies indicating the U.S. workforce is quickly diversifying, has led to research into understanding the connections and social implications of providing STEM education in the United States (Baine, 2009; Breiner et al., 2012; Chen, 2013; Gonzalez & Kuenzi, 2012; Kuenzi, 2008).

I have organized this chapter to provide a broad understanding of the existing literature about STEM education and the underrepresentation of minorities in STEM fields and to explore the purpose of industry-university partnerships, particularly with STEM companies with HBCUs. There is limited literature focused on understanding the connections between HBCUs and industry partnerships that increase minority representation in STEM related fields. I therefore centered this review on the following key areas: (a) defining STEM education, (b)

underrepresentation of minorities in STEM fields, (c) STEM education in HBCUs, and (d) industry-university HBCU partnerships.

In addition, this chapter addresses the relevant theoretical frameworks that shaped the methodology of this research. While there are multiple researchers (Gasman et al., 2017, Pascaerlla & Terenzini, 2005) who have added to the body of knowledge regarding HBCUs and their contributions to society from an output perspective, there is not a large body of research about the inputs that contribute to their success. Additional research is needed to understand the critical elements that contribute to HBCU's unique ability to produce STEM graduates to enter the workforce. Therefore, this chapter will provide a justification of why the theoretical frameworks of AC and CRT enhanced this research.

Defining STEM Education

Over the past 25 years, there has been a significant amount of attention focused at examining STEM education in relation to student outcomes, such as problem-solving skills, analytical reasoning, critical thinking, and economic considerations (Atkinson & Mayo, 2010). Given the numerous local, state, federal, and private sector conversations about the importance of STEM education, this remains a critical area for continued research (Gonzalez & Kuenzi, 2012). Given the broad nature of STEM education, Brown, Brown, Reardon, and Merrill (2011) noted the importance of defining this facet of the education enterprise, stating, "As STEM education becomes a greater focus for an increasing number of schools and teachers, it becomes clearer that there is a need to better define what is meant by the term STEM education" (pp. 5-6). According to Gonzalez and Kuenzi (2012):

> The term "STEM education" refers to teaching and learning in the fields of science, technology, engineering, and mathematics. It typically includes educational activities

> across all grade levels—from preschool to post doctorate—in both formal (e.g., classrooms) and informal (e.g., afterschool programs) settings. (p. 1)

STEM education is a concept that exists in the context of colleges and universities and enables STEM instructors to provide a unified learning experience for students (Merrill, 2009). Merrill (2009) suggested there are varying perceptions about what providing a STEM education includes. Some educators believe a STEM education only exists when the STEM curriculum resembles the real life of a scientist or engineer. Other educators believe providing a STEM education is about increasing course offerings in science, technology, engineering, and math explicitly to build a pipeline of workers to enhance global competitiveness (Breiner, Harkness, Johnson, & Koehler, 2012). Merrill said, "STEM teaching and learning focuses on authentic content and problems, using hands-on, technological tools, equipment, and procedures in innovative ways to help solve human wants and needs" (p. 2).

Although Merrill's (2009) research centers on teaching and learning, there remain outstanding questions among teachers, administrators, and government officials about what concepts define STEM education. Brown et al. (2011) suggested to fully understand what concepts define a STEM education, the following questions are essential: (a) is it STEM education when all four concepts are taught in separate classes? And (b) if a student takes a course in each of the four STEM areas, are they receiving a STEM education? Brown et al. (2011) concluded, "STEM education is not well understood" (p. 8), a conclusion that was based on interviews and surveys of 29 students and over 200 teachers and administrators at a single public university. The goal of the survey was to understand if students and administrators had a common definition of STEM education and its importance. The findings point to a lack of a common definition.

Ultimately, providing a STEM education is fundamentally different than understanding the individual disciplines that comprise STEM. Evidence should challenge anyone engaged in STEM-related research to provide conceptual clarity as to the underlying meaning of STEM education. The problem with most STEM education research is providing clarity beyond the acronym. STEM education is a comprehensive experience that encompasses all individual disciplines aimed to facilitate a unified experience (Brown et al., 2011). Breiner et al. (2012) summed up this problem by stating, "The acronym STEM . . . has been adopted by numerous programs as an important focus for renewed global competitiveness for the United States, but conceptions of what STEM entails often vary among stakeholders" (p. 1). Establishing an agreeable definition of a commonly used term is a difficult task. The term STEM education cannot be fully understood until it is contextualized. Researchers have assumed readers understand the concept of STEM education without contextualizing the aspect of STEM that is guiding their research (Gonzalez & Kuenzi, 2012; Merrill, 2009). The current research defines STEM education as an education that intersects with science, technology, engineering, or math.

Underrepresentation of Minorities in STEM Fields

Efforts to understand and increase minority representation in STEM fields is a widely researched topic and one that has received attention from companies, lawmakers, and universities. Understanding the demographic characteristics of students who enter STEM-related fields enables governments, institutions, and organizations to properly invest. In a qualitative study aimed at enhancing understanding of how a HBCU cultivates Black male achievement in STEM, Gasman et al. (2017) reflected that the central "challenge of educating more individuals for the STEM workforce is the unequal distribution of STEM degrees across, racial, ethnic, and gender lines in this country" (pp. 181-182). This challenge led researchers to explore and

understand the factors that contribute to STEM participation among URM. Additionally, Gasman et al. (2017) highlighted the need for additional theoretical frameworks that assist with understanding educational experiences of URMs at HBCUs in terms of participation.

George et al. (2001) concluded that to fully understand the factors that contribute to STEM participation among URM, researchers need to establish a consortium that studies the successes and failures of URM STEM experiences. George et al. (2001) stated, "Building a community of researchers who confer regularly may help to improve methodology and bring us closer to understanding factors that limit the STEM talent pool" (p. 12). In addition to developing a research consortium, George et al. (2001) suggested understanding STEM preservice teacher preparation programs that are effective in teaching URM students can ultimately positively impact STEM participation from URM.

Supported by research-based observations, such as those from Gasman et al. (2017), there has been a focus on increasing women and URM who participate in STEM undergraduate studies. Reflecting some of the evidence in this area, Chen (2009) noted:

> Students entering STEM fields was higher among male students, younger and dependent students, Asian/Pacific Islander students, foreign students or those who spoke a language other than English as a child, and students with more advantaged family background characteristics and strong academic preparation than among their counterparts who did not have these characteristics. (p. 17)

Because of this lack of diversity, Kuenzi (2008) noted, "as a proportion of degrees in all fields, STEM degree awards have stagnated" (p. 11), highlighting the need for more research in this area, specifically as it relates to strengthening and sustaining diverse student enrollments in

STEM fields. An important yet relatively under-researched area in STEM education is the role of HBCUs in the production of STEM graduates.

Understanding HBCUs and STEM

In an effort to understand the significance of HBCUs in the production of STEM graduates, researchers have sought to understand how HBCUs can assist with the "shortage of individuals trained in these areas, especially women and ethnic minorities" (Owens et al., 2012, p. 33). HBCUs have a rich legacy of producing STEM graduates (Gasman et al., 2017), where "Black students attending highly selective HBCUs have a greater rate of completing their STEM courses, thereby improving their chances of earning a STEM degree" (Owens et al., 2012, p. 184). Owens et al.'s (2012) research suggests there is significant value in understanding HBCUs' ability to create minority pathways into STEM careers.

Based on long-standing demographic patterns and a history of restricting college access of Black students, the 103 HBCUs are located in 19 southern and border states. According to Palmer and Gasman (2008), "HBCUs were created to provide educational opportunities for African American when other higher education venues restricted their participation" (p. 52). Although educational opportunities are provided at HBCUs, there has been a significant resource gap compared to predominantly White institutions (PWIs; Palmer & Gasman, 2008). Despite disparities in resources, HBCUs have maintained a strong tradition of producing some of the United States' most prolific leaders in science and technology, such as Dr. Samuel M. Nabrit, Lonnie Johnson, Dr. David Satcher, and Katherine Johnson. HBCUs have managed to construct a learning environment for African American students that produces successful graduates, regardless of previous academic preparation or social status (Allen & Jewell, 2002; Owens et al., 2012; Palmer & Gasman, 2008).

The role of HBCUs in advancing STEM education is particularly important, given that STEM disciplines have traditionally been areas of low minority representation. For example, of the 110,580 bachelor's degrees awarded nationally to African Americans in STEM programs from 2001 to 2009, 8.6 % of them graduated from 12 HBCUs (Owens et al., 2012). In a study designed to understand the significance of HBCUs in the production of STEM graduates, Owens et al. (2012) identified the top producing HBCU programs in six STEM content areas (see Table 1).

HBCUs have played a major role in supplying industry with African American STEM graduates (Owens et al., 2012). Research has indicated 40% of African Americans who graduate with a bachelor's degree in biological sciences, graduated from an HBCU (Baine, 2009), and in

Table 1

Top Producing HBCU STEM Programs 2001-2009

Content	Institution	# of Graduates	Total
Computer Science	Grambling State University	606	1,615
	Alabama State University	508	
	Florida A&M University	501	
Engineering	North Carolina A&T State University	1,132	2,374
	Morgan State University	654	
	Florida A&M University	588	
Engineering Technology	North Carolina A&T State University	630	1,430
	South Carolina State University	410	
	Prairie View A&M University	390	
Biomedical Science	Xavier University of Louisiana	1,420	2,866
	Howard University	795	
	Jackson State University	651	
Mathematics/ Statistics	Morehouse College	231	492
	Spelman College	171	
	South Carolina State University	90	

Physical Science	Xavier University of Louisiana	468	817
	Florida A&M University	177	
	Howard University	172	
Total			9,594

Note. Owens et al. (2012, p. 43).

2010, approximately 33% of all Black students who earned bachelor's degrees in mathematics and statistics attended HBCUs (Gasman & Nguyen, 2014). Between 2001 and 2009, HBCUs awarded 39% of bachelor's degrees to African Americans in STEM programming (Freeman & Cohen, 2001).

Kim and Conrad (2006) suggested HBCUs are effective at promoting educational attainment in STEM fields for URMs (Kim & Conrad, 2006). Kim and Conrad (2006) conducted analyzed national longitudinal data through hierarchical linear and nonlinear modeling. The findings of this study suggested URM students have a similar probability of obtaining a BA degree whether they attended an HBCU or PWI. Ultimately, the findings of Kim and Conrad's (2006) study supported the idea that HBCUs contribute significantly to higher education, in both public and private sectors. The ability of HBCUs to create an environment for STEM success has been attributed to experiential factors for URM offered (Perna et al., 2009). Studies have indicated African American students who attend HBCUs experience more success in STEM-related areas because their institutions focus on more social, personal, and moral issues and needs that relate directly to their students (Pascarella & Terenzini, 2005). In addition to focusing on the social and personal needs of students, industry partnerships at HBCUs have flourished in recent years because of HBCU's unique ability to produce degreed URM.

Industry-University Partnerships

Industry-based partnerships in higher education have increased as a means to leverage resources and create programs that best prepare students for a changing and increasingly global

labor market (Bastalich, 2010). Strategic partnerships enable colleges and universities to exchange knowledge with partners that have expertise in areas where colleges do not. According to Bragg (2014), partnerships create the opportunity for educational institutions to increase the capacity to bring about positive change. The best strategic partnerships produce better results than the individual organizations could have achieved independently. Sharing ideas and resources often achieves greater efficiencies and has other positive effects for the organizations and individuals who are involved or touched by the partnerships (Bragg, 2014).

Focusing on universities, Prigge (2005) stated:

> Partnerships can provide financial support for their educational, research and service missions; broaden the experience of their students and faculty; identify significant, interesting and relevant problems; enhance regional economic development; and increase employment opportunities for students. Such partnerships, however, are not without risks. (p. 221)

This perspective highlights two paths of beliefs about the value of industry-university partnerships. First, some colleges and universities are strong believers about the ability of partnerships to enhance their mission and overall student experience. Other institutions are highly skeptical about the industry serving the interest of itself over institutional mission.

In 2001, the U.S. Business-Higher Education Forum conducted an extensive study about understanding industry-university collaborations. This qualitative study sought "to understand better the issues involved [with university-industry research collaboration], to highlight best practices and lessons learned, and to provide practical guidance to those involved in such partnerships" (p. 4). The results highlighted the value of partnerships in areas of shared knowledge and resources. However, critics argued industry-university partnerships seemed to be

more concerned with fostering university-corporate relations (Basinger, 2001). Supporters of industry-university partnerships, such as Derek Bok, the former president of Harvard, suggest universities should weigh the risks and benefits of industry-university partnerships and create clear boundaries to ensure success (Bok, 2003). The opposing views about the value of industry-university partnerships reflect a need for increased communication and, as Bok suggested, a need for universities to properly weigh the risks and benefits of potential partnerships.

Partnerships in the Context of HBCUs

The anticipated demographic shift over the next 30 years, combined with the emphasis on the need for STEM skills in a postindustrial era, puts STEM-focused companies in a position to invest in the future workforce needs of their company. As STEM-related companies continue to innovate and disrupt conventional business models, the need for a traditional industrial workforce diminishes. Paap and Katz (2004) defined disruption as the "effect that some technologies appear to have on markets affected by technology-based innovation" (p. 15). Essentially, STEM-focused companies need candidates with skills that can translate work in a modern and heavily technology influenced workforce.

STEM-focused companies are working closely with HBCUs because of their unique ability to provide diverse candidates ready for STEM-related fields upon graduation. According to the U.S. Bureau of Labor Statistics 2014 STEM 101 report (Vilorio, 2014), STEM jobs are growing faster than any other U.S. sector. To simultaneously meet the current and future STEM employment demands and address diversity disparities in the STEM workforce pipeline, college-industry partnerships and initiatives that aim to increase representation from underrepresented groups have flourished (Vilorio, 2014). Specifically, James Brown, the executive director of the STEM Education Coalition in Washington, DC, said, "The future of the economy is in STEM. . .

. That's where the jobs of tomorrow will be" (Vilorio, 2014, p. 2). In addition, the U.S. Bureau of Labor Statistics (2014) supported the projection that careers in STEM-related fields will grow to more than 9 million between 2012 and 2022.

Baker, Dunnavant, and McNair (2015) pointed to how pathways to engineering affect diversity in the STEM workforce. Their research was influenced by Clough's (2004) belief that, historically, U.S. companies have been primarily composed of White males. Prompted by recent diversity data released from the top tech companies in Silicon Valley, Baker et al. (2015) argued most Silicon Valley companies employ diverse candidates at a percentage lower than the number of diverse candidates earning degrees, though exceptions exist (Baker et al., 2015). Figure 1 is a visual representation of the relationship between the average of all Blacks who earned engineering degrees in 2013 and the reported diversity data from the top tech companies in Silicon Valley.

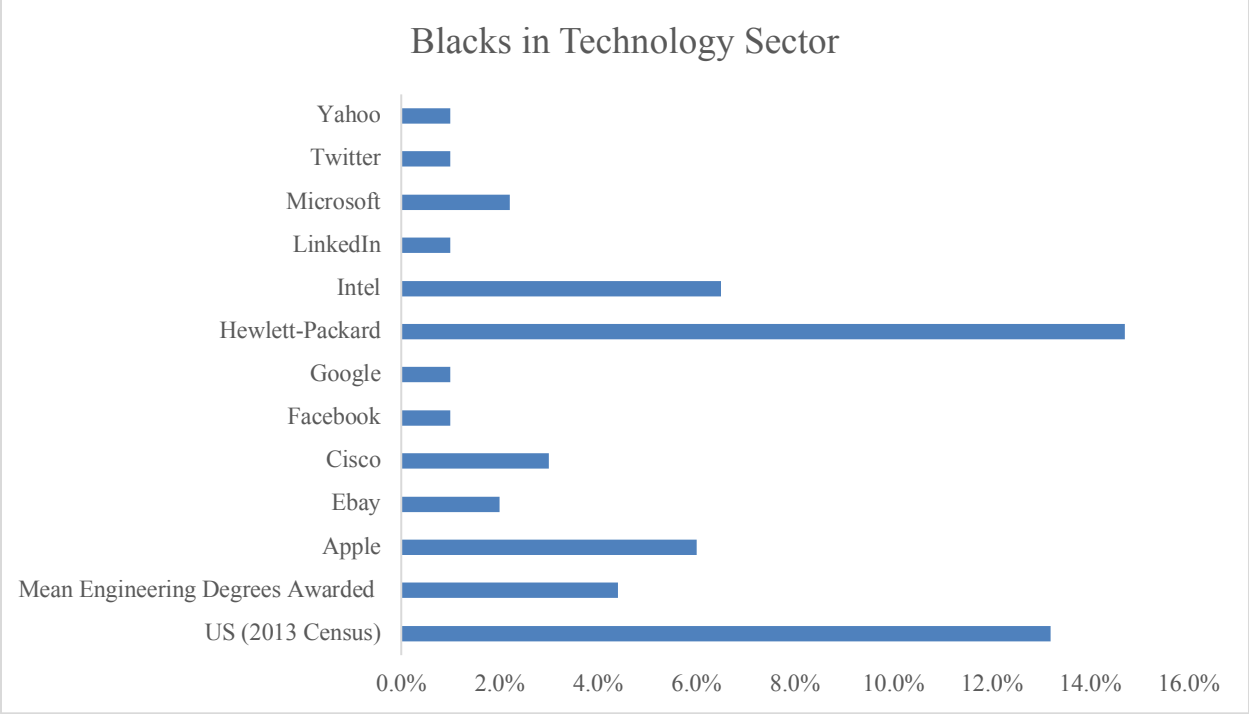

Figure 1. Comparison of all African Americans who earned engineering degrees in 2013 and those employed in technology jobs in Silicon Valley. Adapted from How the

pathway to engineering affects diversity in the engineering workforce: A Silicon Valley case study by C. E. Baker, J., Dunnavant, & J. McNair, 2015.

Two specific industry-HBCU partnerships illustrated how such partnerships explicitly aim to increase minority participation in STEM fields. The first example is from Howard University. In an effort to improve undergraduate student performance in computer science at Howard University, researchers (Washington et al., 2015) sought to understand the Googler-in-Residence industry-partnership program. Originally, Google piloted the Googler-in-Residence program at Howard University in 2013-2014. According to Washington et al. (2015), Google created the program to establish relationships between Howard University students and Black employees who work for Google. The specific stated goals of the program are to "infuse curriculum with real-world context, increase perception of and interest in computer science, and increase the number of departmental students that apply for and enter Google summer internships and full-time positions" (Washington et al., 2015, p. 2). According to Washington et al. (2015), the results of the industry partnership, "have been successful in not only instructing and retaining students, but also increasing interest in [computer science] from external departments" (p. 4).

The second example is from Savannah State University. The goal of Savannah State University's industry partnership is to build a diverse and innovative ocean workforce through collaboration that integrate research and education. According to Gilligan et al. (2007), the coastal location of Savannah State University presented an opportunity for a collaboration that could increase diversity in the geoscience professions. Gilligan et al. (2007) stated that since 1998, there has been:

> an increase in the percent of graduates from SSU's Bachelor of Science in Marine Science program who had a significant research experience, from 25% before 1999 to 66% percent afterwards, and an increase in the number of graduating with honors from 30% prior to 1999 to 41% after 1999. (p. 531)

Prior literature has established that HBCUs are uniquely poised to provide a personal learning experience that produces STEM graduates at a higher rate relative to the number of total HBCUs versus non HBCUs in the United States. It also demonstrated industry-university relationships serve as a vehicle to enhance both industry diversity efforts and university differentiation. However, several gaps exist regrading understanding the critical elements of HBCU-industry partnerships focusing on STEM, from the perspectives of program administrators, students, and industry partners.

Theoretical Framework

While there is a substantial body of research focused on HBCUs, prior studies have not focused on industry partnerships. As a result, no prior research has explicitly provided a theoretical basis to understand industry partnerships at HBCUs. With the purpose of understanding industry-university partnerships at HBCU's aimed to increase diversity participation in a STEM career field, the study will incorporate key tenets from relevant theoretical frameworks to inform underlying phenomena. Specifically, I drew from two distinct yet complimentary theories—AC and CRT—in forming a lens through which to understand industry partnerships at HBCUs.

Academic Capitalism

Slaughter and Leslie (1997) described the current business-like influence in higher education as *academic capitalism*, defined as "market and market-like behaviors on the part of

universities and faculty" (p. 11). Ylijoki (2003) added colleges and universities are increasingly engaging in AC as a result of decreased funding. Lack of funding has created an environment in which colleges and universities are trying to attract external revenue streams and build stronger relationships with industry partners. Forming industry partnerships is one way that colleges and universities are seeking to address decreases in funding and leverage outside expertise. Slaughter and Leslie (1997) suggested competition in higher education has fundamentally changed the landscape and brought colleges and universities closer to a business-like environment. In such an environment, there are winners and losers. As a way to remain competitive, universities have used partnerships with industry to differentiate themselves from competitors and generate revenue. Industry-based partnerships in higher education are on the increase as a means to leverage resources and to create programs that best prepare students for a changing labor market that is increasingly global in nature (Bastalich, 2010).

Although colleges and universities have widely adopted the concept of AC, there are opposing views among researchers. Ylijoki (2003) stated, "There are conflicting views concerning the effects of the growth market pressures on the internal functioning of academia" (p. 310). Anderson (2001) added that AC has created a complex relationship between industry and the academy based on the idea that industry and academia have competing missions and will only create more tension. These views reflect the skepticism about how AC will impact traditional academia, specifically in balancing public and private interests. In spite of the contrasting views on the market-based influences affecting higher education, there is a shared view that colleges and universities may benefit from industry expertise. Therefore, I am seeking to understand the intersection of industry and academia.

The theory of AC guides inquiry into how institutions are positioning their industry-university partnerships amidst a changing environment in U.S. higher education. The theory suggests that as structural shifts occur in the university policy environment, universities change organizational form and adapt new behaviors (Slaughter, 2014; Slaughter & Leslie, 1997; Slaughter & Rhoades, 2004).

The benefit of using AC as a lens to understand industry-university partnerships is in its ability to explain and understand an environment that is constantly experiencing change. Since their inception, HBCUs have been under constant scrutiny for a variety of reasons. As mentioned above, Palmer and Gasman (2008) stated, "HBCUs were created to provide educational opportunities for African Americans when other higher education venues restricted their participation" (p. 52). Although educational opportunities for URMs who choose HBCUs were provided by the institution, there was a significant resource gap between HBCUs and PWIs (Palmer & Gasman, 2008). Because of resource gaps, HBCUs have historically existed in an environment of persistent change. In this research, AC will be engaged as a theoretical framework because of its aptness at explaining dynamic change in institutions. AC encourages researchers to understand which actors and organizations are situated in a field or industry in relation to business-like influences (Slaughter & Leslie, 1997).

Critical Race Theory

Critical race theory emerged in the mid-1970s from the field of legal studies, as the legal system was experiencing difficulties understanding and addressing issues surrounding race. Critical race theory conceptually draws from the fields of sociology, history, ethnic studies, and women's studies, to explain and understand the intersection of education with issues such as affirmative action and racism (Delgado & Stefancic, 2012). Scholars (Delgado & Stefancic,

2012; Solorzano & Yosso, 2002) consider CRT an oppositional theory because of its ability to challenge narratives generally held by dominant or ruling classes, and in seeking to deconstruct truths generally held by dominant classes and create space for narratives from underrepresented populations. According to Delgado and Stefancic (2012), the goal of CRT is "not only to understand our social situation but to change it, setting out not only to ascertain how society organizes itself along racial lines and hierarchies but to transform it for better" (p. 8).

Critical race theory has five tenets: (a) the permanence of racism, (b) a critique of liberalism, (c) Whiteness as property, (d) the interest convergence dilemma, and (e) counter-storytelling and narratives (Solorzano & Yosso, 2002). The tenets that most directly guide understanding of industry-university partnerships at HBCUs are the concepts of *interest convergence dilemma* and *counter storytelling and narratives*. Milner (2008) described the interest convergence dilemma in stating, "racial equality and equity for people of color will be pursued and advanced when they converge with the interests, needs, expectations, and ideologies of whites" (Milner, 2008, p. 33). This tenet further explains the connection between HBCUs' ability to produce graduates from underrepresented populations in STEM-related careers that are primarily dominated by Whites. In addition, the focus on counter storytelling and narratives points to the experiential knowledge of URM that desire to purse a STEM career. Critical race theory is applicable to the present study in providing a critical lens through which to understand the original institutional environments that led to the establishment of industry-university partnerships at HBCUs, and in examining factors associated with the partnerships' goals of increasing diversity in STEM careers.

Conclusion

The amount of existing literature on STEM education, underrepresentation of minorities in STEM fields, and HBCU-industry partnerships with STEM companies reflects an interest among researchers seeking to understand and create new knowledge in these critical areas. The literature in these areas also reflect the need for additional research that connects STEM education, HBCUs, and industry partnerships. Understanding these areas in a single framework may prove to uniquely inform policies, institutional practice, and the role of HBCUs in the 21st century.

There is a substantial amount of literature about the factors that contribute to STEM success at HBCUs, and HBCUs have a unique ability to provide a successful STEM educational experience and help to curb the shortage of minorities working in STEM related areas. Literature suggests that programs "operating at minority-serving institutions provide extensive mentoring and instruction . . . yet they lack the research facilities and projects to give students the strong scientific background they need to be successful" (Greene, DeStefano, Burgon, & Hall, 2006, p. 54). This view has served as a foundation of why industry partnerships are essential at HBCUs. Continued efforts among researchers to understand the formation, impact and success of HBCU-industry partnerships stand to benefit URM in STEM fields and the larger economy.

CHAPTER 3

METHODS

The purpose of this study was to understand different facets of STEM-focused HBCU-industry partnerships through the experiences and reflections of individuals directly involved. I designed the study to ultimately obtain a narrative-based understanding of those involved in these types of partnerships.

This chapter discusses the methods used in identifying and selecting research sites, and for collecting and analyzing the data. Additionally, this chapter goes into detail regarding why a basic interpretive qualitative design was used (Merriam, 2002). Because HBCU-industry partnerships are not a part of formal national, regional or state system and tend to form organically, and have not previously been examined by researchers, the study was well-suited for a basic interpretive qualitative design. The chapter includes the following sections: research design, site selection, participant sample, data, analysis, validity and reliability, researcher positionality, and limitations.

Research Design

To address the research question, I followed Yin's (2017) suggestion that qualitative methods are most appropriate when seeking to understand the views and perspectives of people. According to Merriam and Tisdell (2015), conducting qualitative research is to seek to "understand how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences" (p. 40). According to various scholars, qualitative research assumes more than one reality, where the world is composed of subjective phenomenon and thus can be interpreted differently rather than just simply measured (Bogdan & Biklen, 2003;

Merriam, 1998; Patton, 2002). These realities are often rooted in personal perceptions, such that each individuals' point of view is critically important (Merriam, 1998).

In the broad tradition of qualitative research, I specifically followed a basic interpretive qualitative design. Merriam (2002) described:

> A basic interpretive and descriptive qualitative study exemplifies all the characteristics of qualitative research . . . [whereby] the researcher is interested in understanding how participants make meaning of a situation or phenomenon. This meaning is mediated through the researcher as instrument, the strategy is inductive, and the outcome is descriptive. (p. 6)

Relative to other qualitative approaches, the basic interpretive qualitative designs are often broader, flexible, and are continuously evolving (Bogdan & Biklan, 2003). The data are usually descriptive and derived from either small or theoretical samples to include field notes, people's own words, and artifacts collected using observations or interviews.

Given my focus on understanding the perspectives of program administrators, students, and industry partners associated with a STEM-focused, HBCU-industry partnership, I was interested in learning about the specific experiences and perspectives of individuals directly involved in the partnerships. Employing a basic interpretive qualitative approach benefits this specific research because it allowed for important themes to emerge from participants' personal experiences with an HBCU-industry partnership program aimed at increasing STEM participation among URM.

Site Selection

This study employed a purposeful sampling strategy to identify the research sites (Bogden & Biklen, 2003). To guide the selection of potential research sites, Coyne (1997) suggests purposeful sampling as a means to identify participants or sites that possess certain traits or qualities. This sampling method considers the goals of the research and selects the sites accordingly. Additionally, Higginbotham (2004) suggests that maximum variation is critical in purposeful sampling. Therefore, the research site selection process included assessing the following criteria: location, diversity of longevity of STEM industry-university partnership, and having an online presence for the partnership. After evaluating the existing STEM industry-university partnerships at HBCUs across the United States according to specific selection criteria, I chose three research sites, as described below.

Selecting sites required developing a criterion to assist with identifying the specific sites chosen for this study. The criterion included location, online presence and diversity of longevity of the sites. To ensure these criteria were met, I used program specific data from NSF's website www.pathwaystoscience.org to aid in the selection process. Specifically, the pathways to science data has "connected underrepresented students with STEM funding and research opportunities and has provided program administrators with tools and resources to help promote the positive factors that keep underrepresented students on the STEM pathway into successful STEM careers."

At the time of this research, there were 103 HBCUs located in the United States. As reflected in Figure 2, the vast majority of HBCUs are primarily located in the southeast United States. As a result of HBCU STEM partnerships being campus specific, I relied heavily on the program information available on the pathways to science website. This source allowed me to

narrow programs by the criterion of location and the existence of a STEM industry-partnership. On the pathways to science website, I filtered by the following states because they represented the highest concentration of HBCUs: Georgia, Texas, North Carolina, Mississippi and Alabama. This process reduced the available research sites to 60. After filtering by location, I cross referenced the 60 institutions with a specific search on the pathways to science website for institutions that had STEM HBCU industry-partnerships. After applying the partnership search and cross-referencing geography, I narrowed the possible research sites to 20 institutions. I included two other institutions that were not matched geographically but had very public information about their HBCU STEM partnerships (U. S. News and World Report, 2020). Of those 22 institutions, I reviewed the available program websites and realized that not all of the HBCU STEM partnerships had an online presence. Additional criteria included the diversity of longevity of site based STEM industry-university partnerships. The pathways to science website detailed the length of each program and allowed me to narrow the possible number of sites. So, I focused on the criteria of online presence and longevity. There were six schools I identified that had an online presence and a diversity of the length of the programs. These six HBCUs represented the schools that I would engage to participate in this research. Of the six HBCUs, three responded to my request to participate in this research. Those who demonstrated willingness to support the research within their institution were deemed eligible.

The schools listed in Table 1 represent the top six schools based on maximum variation in purposeful sampling for this study (Higginbotham, 2004; Coyne, 1997). As Higginbotham (2004) suggested maximum variation was employed when choosing programs based on longevity. Program lengths are indicated in Tables 2, 3 and 4.

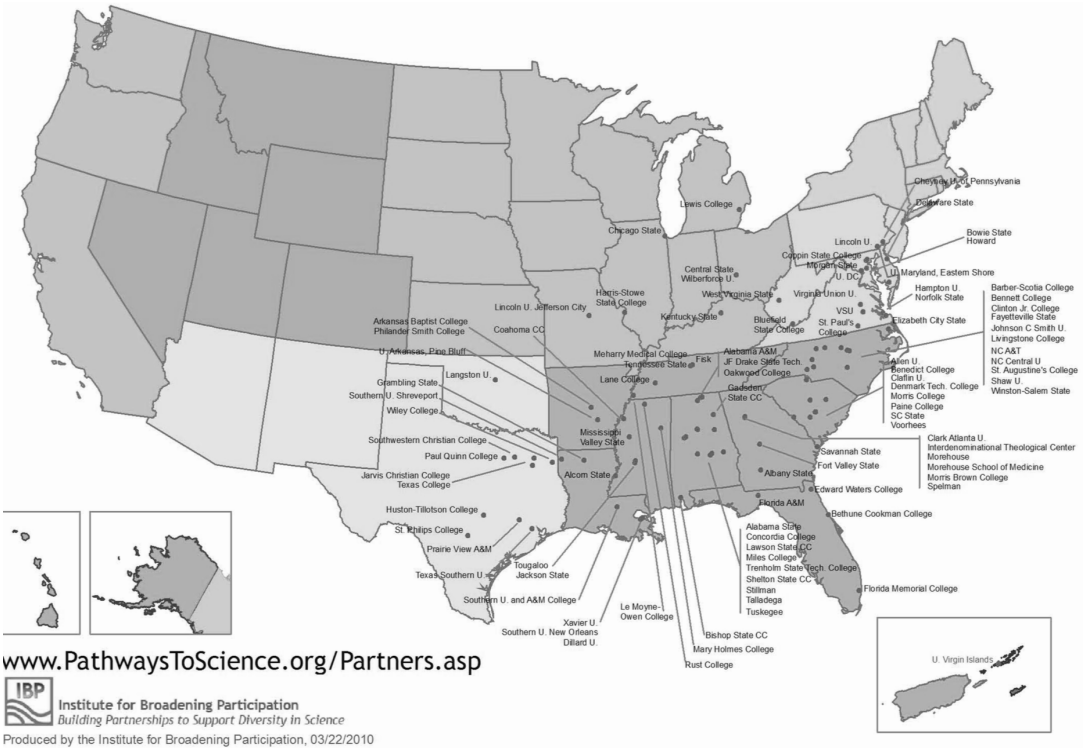

Figure 2. U.S. Map of HBCUs. Adapated from Institute for broadening participation: Building partnerships to support diversity in STEM. (n.d.). Retrieved from: *www.pathwaystoscience.org*.

Table 2

HBCU STEM Partnership Site Consideration

School Name	Partnering Organization(s)	STEM Discipline Focus
Florida A&M University	National Science Foundation	All STEM Disciplines
Howard University	Google	Computer Science
Morehouse College	Verizon	All STEM Disciplines
Morgan State University	NASA	Math and Science
Bennett College	Indiana University	All STEM Disciplines
	Shell, Exxon Mobile, BP	
Fort Valley University	Conoco Phillips	Science and Engineering

From the above list, the three sites I ultimately selected are Fort Valley University, Florida A & M University, and Morehouse College. Because there is no formalized HBCU-industry partnership organization, each partnership has nuances that are unique to the

partnership. The length of the programs and the spectrum of partnering organizations highlight the broad nature of HBCU-industry partnerships.

Tables 3, 4, and 5 reflect the research site profiles that includes school information, partnering company, program details and the program length. Among the three partnerships, Fort Valley University's program is the oldest, formed in the early 1980s, while Morehouse College's program is relatively young, founded in 2012. The nationwide alliance partnership program at Florida A & M University was created in 1992. Although each of these partnerships have a mission to influence minority participation in STEM career fields, each of them has unique program characteristics. For instance, Fort Valley's program focuses on the recruitment and placement of minorities in the energy industry, while Morehouse's program focuses on minority males exclusively. Florida A&M University's partnership program is a collaborative effort of 14 universities in the state of Florida and one in Georgia. This collaborative partnership has a mission to significantly increase the number of underrepresented minority students statewide who complete undergraduate degrees in STEM fields.

Table 3

Fort Valley University Research Site Profile

School Information	Partnering Company	Program Details	Length of Program

The mission of Fort Valley State University is to advance the cause of education with emphasis upon fulfilling commitments that our community members have undertaken collectively. Fort Valley University is Georgia's top producer of African Americans with bachelor's degrees in mathematics and statistics. Fort Valley University is Georgia's #3 producer of African Americans with bachelor's degrees in engineering technologies and engineering-related majors.	CDEP has formed alliances with many energy companies and governmental agencies. An alliance with CDEP occurs when an energy corporation or governmental agency participates in CDEP's internship program or provides financial support or a combination of both.	CDEP focuses on the recruitment and placement of academically talented minorities and females into professional level careers in the energy industry and other STEM-related industries.	The CDEP was founded on July 1, 1983.

Note. CDEP stands for the Cooperative Developmental Energy Program. Adapted from Fort Valley State University: Cooperative developmental energy program. (n.d). Retrieved from: http://www.fvsu.edu/about-fort-valley-state-university/academics/college-of-arts-and-sciences/cooperative-developmental-energy-program/about-cdep/.

Table 4

Morehouse College Research Site Profile

School Information	Partnering Company	Program Details	Length of Program
Morehouse College was founded in 1867 and located in Atlanta, Georgia. The mission of Morehouse College is to develop men with disciplined minds who will lead lives of leadership and service. Morehouse College is a private historically Black liberal arts college for men.	Verizon	The Verizon Innovative Learning for Minority Males STEM program was designed to provide innovative hands on learning for middle school male students who do not have technology or access to succeed in a digital world. Minority males are severely underrepresented in STEM fields and are less likely than Caucasian peers to graduate from high school on time and pursue college. In recent years much more attention has been paid to empowering girls in these subject areas, but very few programs exist that specifically work with boys to spark their interests in STEM disciplines. Verizon identified this need and created a new program to focus specifically on minority middle school boys, giving them an opportunity for a	The Verizon Innovative Learning program was founded in 2012.

	bright future in these high demand fields.

Note. Adapted from Morehouse College mission. (n.d). retrieved from: https://www.morehouse.edu/about/mission.html and Verizon innovative learning, (n.d). Retrieved from: https://www.verizon.com/about/responsibility/verizon-innovative-learning

Table 5

Florida A&M University Research Site Profile

School Information	Partnering Company	Program Details	Length of Program
Florida Agricultural and Mechanical University was founded as the State Normal College for Colored Students, and on October 3, 1887. FAMU's vision is to provide students with an educational experience that allows them to compete in the 21st century global economy.	National Science Foundation	Florida Georgia Louis Stokes Alliance for Minority Participation (FGLSAMP). FGLSAMP is a collaborative effort sustained by a coalition of 14 colleges and universities throughout Florida (13) and Georgia (1) with a mission to significantly increase the number of underrepresented minority students statewide who complete undergraduate degrees in science, technology, engineering, and mathematics fields (STEM).	Florida Georgia Louis Stokes Alliance for Minority Participation is part of a nationwide alliance that began in the fall of 1992.

Note. Adapted from Florida Georgia Louis Stokes alliance for minority participation. (n.d.). Retrieved from: http://stage.breakingcorporate.com/blog/about/overview/ and Florida Agricultural and Mechanical University. (n.d). Retrieved from: https://www.famu.edu/index.cfm?AboutFAMU&AboutFAMU.

Participant Sample

The most appropriate sampling technique for this qualitative study was purposeful sampling. As Bogdan and Biklen (2003) explained, purposeful sampling is the intentional selection of information rich cases whereby the researcher can learn about the dynamics most important and relevant to the purpose of the research. Because HBCU-industry partnerships are not formal systems and are created through organic means, what was most important for this research was to capture the perspectives of individuals participating in the actual partnerships.

The individuals included as participants in the study were students, administrators, and partners. This research was not intended to evaluate or assess one specific partnership, but rather to capture participants' perspectives on general aspects of HBCU-industry partnerships. Consistent with a basic interpretive qualitative design, it was not essential to have the same types of participants or perspectives captured from in each institutional site, and I remained flexible to adapt to unique circumstances of each institutional and industry partnership context (Bogdan & Biklen, 2003).

Additionally, students' and industry partners' contacts were obtained through a snowball sampling technique in which program directors recommended the other participants to be interviewed for this research (Bogdan & Biklen, 2003; Miles & Huberman, 1994). Each potential research site has some form of program director or administrator for collaborative STEM partnerships.

Data

This study drew from two sources of data. One source was obtained through a total of nine interviews, including four students, three program administrators, and two interviews from a single industry partner. Table 6 reflects the number of interviews by type of participants, in each research site. Table 7 reflects how I conducted the interviews (the mode used) per site.

Table 6

Interview Data

Research Site	Total Interviewed	Students	Industry Partner	Program Director
Fort Valley State University	5	4		1
Morehouse College	3		2	1
Florida A&M	1			1

Table 7

Interview Type

Research Site	Interview Type
Fort Valley State University	5 interviews conducted, 2 were conducted face to face, 3 were conducted over the phone.
Morehouse College	3 interviews conducted, all conducted over the phone.
Florida A&M	Phone interview

The goal of each interview was to create a dialogue for participants to describe their perspective of the industry-university partnership. The interviews allowed for themes to emerge and reduce a narrow perspective of the industry-university partnerships. The interview questions were semi-structured (see Appendices B, C, and D for the interview protocol). Creswell (2007) suggested semi-structured interviews create an environment for respondents to authentically provide their worldview on topics. This interview strategy was essential for understanding multiple perspectives. In addition, I sent structured interview questionnaire forms to participants who were interviewed over the phone. This time-sensitive approach created a broad and rich based phone interview with the participants.

The second data source stemmed from examining program websites. When examining program websites, I looked for program descriptions on program goals and student and industry partner testimonials. The scope of the documented evidence varied from institution to institution and included brochures and partnerships' marketing materials. In my document analysis, I reviewed the stated mission of the partnership and how the partnership was established, and the primary target audience for each website and how interested candidates in the partnerships would show their interest and participate in the partnership. Altogether, the data I analyzed included transcribed interviews from students, program administrators, and industry representatives, and a document analysis of HBCU-industry partnership program websites.

Analysis

As the researcher, I was "the primary instrument of data collection and analysis . . . striving to derive meaning from the data" (Creswell, 2007, p. 85). Employing a basic interpretive, qualitative approach to observe and gather information on participants' perspectives, I focused on understanding the experiences of students, program administrators, and industry representatives in their own words. More specifically, I sought to make sense of the key themes and narratives of HBCU-industry partnership participating individuals by inquiring about experiences in their respective positions as students, administrators or partners, and their expectations for the program.

I recorded each interview via a mobile device, uploaded the interview as audio files into NVivo Qualitative Software (Version 12.5.0) and transcribed each interview. Analysis of the transcribed interview data allowed me, as the researcher, to "gain insight into lived experiences, learn the perspectives of individuals participating in a study, and discover the nuances in stories" (Jacob & Ferguson, 2012, p. 1). Following Creswell's (2007) suggestion that analysis be conducted simultaneously while data are being collected, I thoroughly read through the transcripts and listened to the recorded interviews to identify any statements that were unclear or required additional analysis because of the software's lack of ability to pick up emotional responses. Using NVivo allowed me to code the transcripts to identify emerging themes.

Specifically, I employed a comparative analysis strategy to identify themes that emerged from in the data. Because the goal of comparative analysis is to "compare one unit of information with the next, looking for recurring regularities in the data" (Creswell, 2007, p. 269), I took notes in the margins of the transcribed interviews and program documents. I coded the data that emerged as relevant to my research question. According to Creswell (2007), "Assigning

codes to pieces of data is how you begin to construct categories" (p. 273). The rigorous coding process consisted of evaluating word frequency and coding comparisons. Lastly, I used the comparative analysis strategy to identify emergent themes is inductive. The analysis based on the core tenets of AC and CRT is a deductive approach. According to Fereday and Muir-Cochrane (2006), a hybrid process of inductive and deductive coding is most appropriate for this study because of the interview data and the program website analysis data.

Consistent with the study's theoretical framework, I viewed the interview data through the lens informed by CRT. Critical race theory suggests truth is subjective and created by an individual or a group. The primary tenet of CRT is that racism exists in every aspect of American society and it exists in common, everyday experiences (Delgado & Stefancic, 2017). The second tenet of CRT is to challenge dominant, deficit grounded ideologies of meritocracy and colorblindness and fight against White privilege that restricts freedom of others, while also encouraging and rewarding assimilation to White culture (Yosso, Smith, Ceja, & Solorzano, 2009). The third tenet is the centrality of experiential knowledge, which recognizes that it is critical for people of color to have the opportunity to story their lived experiences through sharing narratives, counter narratives, and family histories (Yosso et al., 2009) to challenge dominant discourse. The fourth tenet is to explore race and racism from an interdisciplinary approach, considering both historical and contemporary contexts (Yosso et al., 2009). The fifth tenet of CRT is a commitment to social justice action, highlighting interest convergence. Interest convergence is defined as policies that support the mobility of Black people are only passed when those in power will also benefit (Delgado & Stefancic, 2017). The tenets of CRT assisted greatly in understanding the narratives of program administrators, students and industry partners at HBCU-industry partnerships focusing on STEM.

For the document analysis, I reviewed program websites, brochures, and partnerships' marketing materials, which Bowen (2009) noted can be applied to "both printed and electronic (computer-based and Internet-transmitted) material" (p. 27). The range of documents available per institution varied significantly. Some of the documents were detailed accounts of program history and the program founder. Some of the documents included video testimonials from students and industry partners. The videos were particularly valuable in proving a direct view of information in the voices of key participants. Each partnership had a dedicated website, but each served different purposes depending on the mission and goal of the partnership. Therefore, the document analysis process consisted of a thorough review of all content available on each of the program websites, followed by analysis of the documents and triangulation of emergent themes with those uncovered from the in-depth interviews with students, program administrators, and industry representatives.

To analyze the interview and document data, I employ both inductive and deductive approaches. The inductive approach benefits this research because there is little to no literature on this research topic and the deductive approach assist with testing the existing theories of academic capitalism and critical race theory. I used a comparative analysis strategy to identify themes that emerged from within the data. Because the goal of comparative analysis is to "compare one unit of information with the next, looking for recurring regularities in the data" (Creswell, 2007, p. 269), I took notes in the margins of the transcribed interviews and program documents. The data that emerged as relevant to my research question were then coded. According to Creswell (2007), "Assigning codes to pieces of data is how you begin to construct categories" (p. 273). The rigorous coding process consisted of evaluating word frequency and coding comparisons. I also employed a deductive coding approach based on the core tenets of

academic capitalism and critical race theory. Consistent with the study's theoretical framework, I viewed the interview data through the lens informed by CRT. CRT suggests that truth is subjective and created by an individual or a group. The primary tenet of CRT is that racism exists in every aspect of American society and it exists in common, everyday experiences (Delgado & Stefancic, 2017). The second tenet of CRT is to challenge dominant, deficit grounded ideologies of meritocracy and colorblindness and fight against White privilege that restricts freedom of others, while also encouraging and rewarding assimilation to White culture (Yosso, Smith, Ceja, & Solorzano, 2009). The third tenet is the centrality of experiential knowledge, which recognizes that it is critical for people of color to have the opportunity to story their lived experiences through sharing narratives, counter narratives, and family histories (Yosso, Smith, Ceja, & Solorzano, 2009) to challenge dominant discourse. The fourth tenet is to explore race and racism from an interdisciplinary approach, considering both historical and contemporary contexts (Yosso, Smith, Ceja, & Solorzano, 2009). The fifth tenet of CRT is a commitment to social justice action, highlighting interest convergence. Interest convergence is defined as policies that support the mobility of Black people are only passed when those in power will also benefit (Delgado & Stefancic, 2017). The tenets of CRT assisted greatly in understanding the narratives of program administrators, students and industry partners at HBCU-Industry partnerships focusing on STEM.

In addition, given my study's focus on university-industry partnerships, I was also informed by Slaughter and Leslie's (1997) framework of academic capitalism to enhance my understanding of the market like behavior the partnerships represent. Academic capitalism enabled me to understand the blurred boundaries between market forces, like the need for diversity in STEM related fields, and how HBCUs are responding to market forces (Slaughter &

Leslie, 1997). The relationship between the market influence and the unique attributes of HBCUs indicate a possible shift in how higher education institutions leverage their unique strengths to engage with industry.

Validity and Reliability

Qualitative research, while prone to questions about validity and trustworthiness, requires high standards of rigor among researchers because the research is based on assumptions about reality (Creswell, 2007). To ensure trustworthiness, I incorporated several strategies aimed to limit researcher bias and ensure research reliability and validity. The following section describes the process I employed while collecting data and conducting analysis to ensure that this qualitative research was valid and reliable.

Based on Yin's (2014) suggestion, I created and maintained a case study database that included interview transcripts, observational notes, and document analysis notes. The database is a method of improving the reliability and quality. Merriam (2009) noted the importance of an audit trail which will only strengthen the validity and trustworthiness of the findings.

According to Merriam (2009), "Concerns of validity and reliability can be approached through careful attention to a study's conceptualization and the way in which the data are collected, analyzed, and interpreted, and the way in which the findings are presented" (p. 210). To ensure validity and reliability, I used a digital device to record participant interviews and software to transcribe the interviews. I made the transcripts available to the interviewees as a means to allow them to confirm their responses. In addition, throughout the data collection process, I kept an electronic research journal documenting the interview process and stored the data to ensure I kept a detailed account of the research process.

Researcher Positionality

As the first college-educated member of my family, I have always felt an enormous sense of responsibility to my community. This altruistic position has led me to develop a sense of loyalty to those who have invested in my personal and professional pursuits. In the spring of 2000, I graduated from a Historically Black College. Over the last 18 years, I have developed a deep appreciation for the skills I obtained through my HBCU experience. In addition, I am currently employed by the world's leading consumer electronics company.

As a researcher, I can be overly empathetic for my community, given the unique educational experiences I have been afforded. I enter this research understanding I have a bias for uncovering positive narratives that enhance the perceptions of HBCUs. This love for institution and community is a source of great pride. Understanding this notion enables me to understand that I had to put measures in place to balance out my personal positive views in pursuit of being an objective researcher. I fully realize that I am an advocate for all cultures and traditions associated with HBCUs. Specifically, I am interested in understanding the students', college administrators', and industry partners' perspectives on programs aimed at increasing minority participation in STEM fields.

Limitations

Although this research sought to understand the critical elements of HBCU-industry partnerships focusing on STEM, from the perspectives of program administrators, students, and industry partners, it does not provide a comprehensive view of all HBCU-industry partnerships. As such, the findings are limited based on relatively few participants overall and from each site. If I were able to interview more people including more industry partners, the data would have reflected more perspectives that would inform my analysis. While trying to secure the industry

partner perspective, there was reluctance for participation in this study because of how the findings could be interpreted. In the case of one potential site for this study, while the program administrator was socializing the possibility of participation in the study with the industry partner, the industry partner advised the program administrator to not participate in the study because of the possibility of bad publicity. Among the 103 HBCUs, there is a significant amount of institutional diversity. Size, gender-specific, and control are all dimensions that distinguish the institutions in this group, and the study does not account for the variety of industry partnerships across all HBCUs. A long-term analysis of students, program administrators, and industry partners would be needed to identify more rich data to describe industry-university partnerships over time.

CHAPTER 4

FINDINGS

"Without diverse representation, the long-term effects include; misrepresented cultural awareness, unrepresented needs, unrepresented ideas, lack of view, and an overall complete neglect of a vast population's consumer awareness. . ."

-Industry Partner at Morehouse College

HBCUs have a rich legacy of producing STEM graduates (Gasman et al., 2017): "Black students attending highly selective HBCUs have a greater rate of completing their STEM courses, thereby improving their chances of earning a STEM degree" (Owens et al., 2012 p. 184). This quote highlights the importance of understanding how HBCUs contribute to lessening the deficit of URM in STEM careers. My purpose in conducting this study was to understand key perspectives of those involved with HBCU-industry partnerships focused on STEM and to address the central research question: What are the critical elements of HBCU-industry partnerships focusing on STEM, from the perspectives of program administrators, students, and industry partners?

Based on a trove of relevant documents and interviews with nine participants in industry partnerships at three HBCUs, I organized this chapter by the themes that emerged from the interviews to provide a snapshot of the interviewees' perspectives pertaining to their experiences. The four major themes are: (a) Passionate program administrators: "I've always had this feeling I wanted to make a difference"; (b) mentoring is "You cannot be what you cannot see"; (c) students need a shot; and (d) competing priorities: "This program has a reputation of getting students jobs and I want one!" In this chapter, I present a discussion of the major themes that emerged from interviews with students, program administrators, and the industry partner.

Passionate program Administrators: "I've Always Had This Feeling I Wanted to Make a Difference"

While interviewing program administrators, it was clear there was a relationship between program administrator passion and students. All of the program administrator interviews included stories of passion and dedication to increasing minority representation in the STEM field. In one particular interview, I attempted several times to redirect the conversation until I realized that their personal passion was woven into their professional pursuits. It was impossible to separate their personal interest from their professional responsibilities as a program administrator. In one very compelling case, a program administrator also served as the program director and founder. He was a HBCU graduate and well respected across campus. During my interview with him, former students and faculty who just wanted to say thank you and shake his hand interrupted multiple times. The stories of passion and dedication to increasing minority representation in the STEM field was evident when a program administrator said:

> Our students just need an opportunity to succeed. They have all of the skills! In most cases, they just need someone to say they believe that they are capable of great things. These kids are smart . . . . I mean they can do the work. They just need guidance and someone to help the talent come out. The student that just walked out was in this program last year. Every week, former students stop by just to say thank you. I don't think they are stopping by because of the actual work we required of them when they were in the program. I think they are just grateful that someone believed in them and they are showing gratitude.

His personal passion encompassed his professional pursuits; it was impossible for him to separate his personal interest from his professional responsibilities.

Reflecting on that personal passion, another program administrator said:

> I've always had this feeling I wanted to make a difference. Not for myself. . . . When it came to me and my family, personally, I just wanted to make enough money so that I'm comfortable. I got a house, I got a home, I got a car, I'm sending these kids to school. Those are some basic things that I—the rest of my life, I wanted to try to make an impact on other people. So that's kind of this thing that, it's just there. And so, whenever this. . .When I latched onto this, that's just how I latched onto it. Like, "Okay, I could make a difference." And so, it was much easier to have a program to make a difference.

Another program administrator shared:

> The people that were important in helping me guide through the meaningful experiences that helped prepare me for my current role are my supportive parents and extended family members. Also, intrusive advisors/mentors at my HBCU. These experiences put me in my current position, and I want to do my part to help others.

The comments of the program administrators reflect a personal motivation and passion to perform in their current role. The visible passion that program administrators showed during the interviews was electric. They described a personal interest in impacting STEM participation among URM. One program administrator simply said, "I love what I do!"

In response to inquiring about the personal interests that support building an HBCU STEM industry program, one program administrator commented:

> You have to love what you do to be successful in a position like this—This isn't work to me. I am providing the help and assistance that I never received. Ultimately, I just want this program to help these kids achieve their goals.

This may seem obvious, but their passion extended beyond their job title. Their program was a tool to impact change.

The perspectives of program administrators were a major voice, apparent in the document analysis process. Prior to conducting my interview with a program administrator, I noticed the program website had a dedicated section for their founder and program administrator. This section proudly illustrated the biography and accomplishments of the program administrator. Program administrators clearly expressed passion for their students and the program as in their testimonials viewed in the document analysis process. The program administrators appeared to have a personal passion for the success for the program. It was clear that the success or failure of this program was singularly dependent on the program administrator's passion. Furthermore, according to their website, the program administrator has received national recognition for innovation and creativity in STEM program creation.

All of the program administrators I interviewed graduated from HBCUs. One program administrator started the discussion by saying, "I am a proud graduate of *the* Florida A & M University!" (speaker's emphasis). Although this comment set the tone for the interview and displayed the very strong loyalty and sense of pride that the program administrator had for their HBCU. During my interviews, each of the program administrators took the time to walk me through the kinds of experiences their respective students had in the program. Coincidentally, they spent more time describing the hard to describe magic that happens when you nurture URM interested in STEM careers in a diverse environment. Program administrators felt strongly about the unique environment that HBCU STEM industry programs offered. They referred to this unique environment as a "safe learning place." This concept of displaying passion around a safe learning space was echoed by the students as well. One student commented:

> I learn better here. This program is known for getting students jobs and that's what I want, you know. My professor [the program administrator], cares about how well I do in my classes and how I will represent the school. They just care.

These comments reflect a perceived personal passion among the students from the program administrators.

In summary, the relationship between the passion of the program administrators and students reflects important nuance. This passion-based relationship is critical for understanding the perspective of students and program administrators as it relates to STEM-industry partnerships.

Mentoring is "You Cannot Be What You Cannot See"

Program administrators often highlighted mentorship as key to for URM's success in STEM. A program administrator explicitly stated, "You cannot be what you cannot see." Whether it is program administrators soliciting alumni to serve as mentors or students expressing the value of mentorship as a part of the program, it is clear that the benefit of seeing someone that resembles you professionally is extremely important. A student emphasized the importance of mentorship by saying, "I am grateful for my program director and founder. I didn't have any connections, now I do!" In response to asking a student about why they decided to attend an HBCU, they said:

> I decided to go to an HBCU because of the learning environment and I could be taught by minority professors. I wanted more personal attention and a smaller school. I grew up with folks that went to HBCUs and always noticed the pride they had from going to an HBCU.

My interpretation of the importance of mentorship was directly related to the fact that students and program administrators knew that skills alone were not enough for URMs interested in career opportunities in STEM. Students and program administrators spoke about mentorship as an essential component for URM. A program administrator commented, "Structured peer mentoring and intrusive advising assists *our* students greatly. Underrepresented students become interested in STEM careers when they see persons like them in these fields" [speaker's emphasis). This concept aligned with the literature about HBCUs and learning environments. In response to inquiring about the impact of their HBCU-industry partnership versus the impact of the HBCU, a student said:

> I am very grateful to [my program administrator] for providing this opportunity and giving me the exposure to make a career in STEM. None of this would have been possible without the attention and support provided. . . . My current success would not have been achievable had it not been for the experiences provided by this program.

Students seem to have more benefit from the program when they have a social connection with the experience by way of a mentor.

In response to my inquiry about the intersection between HBCUs, STEM careers, and mentorship, all of the program administrators agreed URM needed programs with early and often mentorship components. For example, one program administrator said, "From Day 1 of our program, we emphasize career awareness through program activities, mentorship opportunities and internship opportunities. "Another program administrator added, "The world is becoming more diverse and students become interested in STEM careers at HBCUs when they see persons like them in these fields." These comments reflect an understanding of the role that HBCUs can play in accelerating a well-documented underrepresentation of minorities in STEM fields. Each

of the program administrators expressed an intentionality with actively engaging URM in STEM fields. According to the findings, for most students, this intentionality began much earlier than college.

In the case of one specific HBCU-industry partnership, while discussing the importance of mentorship, the program administrator mentioned that a key component of success for African American students in STEM was the exposure to STEM partnerships and mentors while in high school. Specifically, the administrator said, "For the most part, our students' interest in STEM did not occur in this program. These students have been exposed to STEM in high school and in some cases before high school." This comment reflects students being exposed to a routine of mentorship prior to being affiliated with a HBCU-industry partnership. In addition, this program administrator said:

> You have to work with others when developing these types of programs. It's a journey. The development of my STEM program was a collaborative effort that included upper-level administrators, faculty, and undergraduate students. The first STEM program was geared towards high school students interested in STEM careers. The second program was focused on precollege students, 11th and 12th graders that were accepted to [the college] interested in STEM. The third program is our current partnership program that focuses on incoming freshman majoring in STEM disciplines.

The others to whom this program administrator was referring are mentors who have impacted their students prior to be involved in their HBCU-industry partnership. While speaking to a student about mentorship and how they heard about their program, they said, "I learned about this program in ninth grade because they had a feeder program that my mother knew about. My mom was a high school teacher and she told me about the program." This response reflected an

understanding of the role that HBCU-industry partnerships play in collaboration with other programs that focus on increasing STEM participation with URM. Additionally, the comments show students who are involved in STEM partnership programs and STEM programs prior to college are prepared and understand the impact of these programs on achieving their goal of employment in STEM related fields.

Additionally, the students I interviewed consistently articulated the belief that there is a necessary relationship between exposure to a STEM program prior to college and participating in a STEM program while in college. One student said, **"**I knew I wanted to be an engineer because I loved math, but I was not sure which discipline. This program helped me explore the engineering disciplines and learn more." The student is referring to the mentorship aspect of the program that assisted with identifying engineering as a viable option for their career. One of the program websites focused on the importance of faculty mentoring and weekly student seminars to increase the likelihood of students being successful in degree completion in STEM and securing employment beyond college.

Another student provided this explanation to support the program administrator's comments about student's STEM interest prior to entering their partnership program and mentorship:

> I would highly recommend students interested in a STEM career, to participate in a STEM related program that can help develop them through their collegiate years. I also found it valuable when I participated in STEM related activities in the middle and high school years. These experiences cultivated my interest at a higher level. I attended a summer engineering program at Virginia Tech for 3 years while in high school and I became aware of [the college's] STEM program my senior year of high school. During

> my middle school years, I struggled with my grades in mathematics. I was able to get some assistance from a tutor whose profession was engineering. I gained an interest in his job as a potential profession in the future. Afterwards, I attended a STEM camp and did some STEM activities in school, which peaked my interest in this field. This led me to attend a STEM high school that specialized in engineering. The curriculum was heavy in math and sciences as opposed to a typical high school curriculum. Everything I learned during this time helped maintain my interest and focus in a STEM field.

Although the student used the term "tutor," being exposed to mentorship is what they are describing. According to this student's program website, structured mentoring was an aspect of the program experience that the student was explaining. The program "uses professionals in various fields to mentor students and help them understand how their chosen majors prepare them for sustainable careers and professional fulfillment."

The theme of mentorship was also consistent across all of the program websites. For example, one of the program websites focused on industry mentorship from research-oriented companies and government. In one student video testimonial on the program website, the student emphasized she "chose [the program] because of the mentorship connections that it offered. . . . Both mentorship opportunities have given me a lot of valuable experience that will help me become a great electrical engineer after I graduate." Another program website provided information on key strategies for increasing the quality and quantity of minority students who successfully complete degrees in STEM disciplines and pursue careers, the site stated, "Effective strategies include strong faculty mentoring, early introduction to research, holding weekly seminars that require student attendance, participation in a research internship that takes place both domestically and abroad."

In summary, HBCU-industry partnerships share the common goal of increasing URM that participate in the STEM field in some shape or form, and mentorship is a critical element that can fuel this goal. Program administrators understand that providing mentorship to URM in the STEM field gives their students opportunities and a better probability of being employed in the STEM field postgraduation.

Students "Need a Shot"

All interviewees emphasized the importance of industry exposure for URMs. To emphasize this point, one student said, "I like this stuff [STEM]! I just need an opportunity to show a company what I got." As I interviewed students, I observed their professionalism and determination to get a job and build a career in the STEM field. Although this was an interview for a research study, the students presented themselves as if interviewing for an actual job. Specifically, some students dressed in suits and spoke very formally during the interview.

Industry partners expressed difficulty in identifying STEM talent from underrepresented backgrounds. As a result, these industry partnerships at HBCUs served a mutual goal for industry and the partnering institution. An industry partner expanded on this concept of opportunity and students need a shot because the lack of diversity in the field would limit the growth of the STEM field. Although the industry partner's comments do not explicitly say that this industry partner is singularly interested in providing URM with opportunities, the comments allude to the impact of diversity on their business.

Strategic partnerships enable colleges and universities to exchange knowledge with partners that have expertise in areas where they do not. According to Amey and Eddy (2015), partnerships create the opportunity for educational institutions to increase the capacity to bring about positive change. The best strategic partnerships produce better results than the individual

partners could have achieved independently. Sharing ideas and resources often achieves greater efficiencies and has other positive effects for the organizations and individuals who are involved or touched by the partnerships (Amey & Eddy, 2015). The positive effect that occurs with HBCU-industry partnerships centers on providing opportunities for students to work in the STEM field who otherwise might not have had the exposure. A program administrator said:

> I have first generation students in my program and they need a shot. They need a shot at it. They don't have the key contacts in the field and my program provides them the exposure needed to break into these fields.

In summary, the phrase *students need a shot* reflected the need for something more than just a degree in a STEM field. As mentioned in the literature review, the role of HBCUs in advancing STEM education is particularly important given that STEM disciplines have traditionally been areas of low minority representation. Of the 110,580 bachelor's degrees awarded to African Americans in STEM programs nationally from 2001-2009, 8.6 % of them graduated from 12 HBCUs (Owens et al., 2012). This information is highly relevant to understanding the relationship between having an opportunity and being qualified. The need for students to possess something other than being qualified, prepared and participants of an HBCU-industry partnership is reflected in the student and program administrator comments. The data reflect that HBCUs produce a significant number of STEM graduates, yet there is a sense among students and program administrators that they need something else for an opportunity to work in the STEM field.

Competing Priorities: "This Program Has a Reputation of Getting Students Jobs and I Want One!"

The participants prioritized individual self-interests based on benefits they directly received, or anticipated receiving, from the partnership—except for program administrators. Program administrators prioritized the interest of the program, the students, and the industry partner. If these differing priorities are in conflict with one another, or if they are complimentary, they create an environment of possible winners and losers. This reality emphasizes the importance of weighing the risks and benefits associated with of HBCU-industry partnerships. The following subsections describe the unique interests across the different viewpoints.

Industry Partner

Before discussing the perspective of the industry partner, it is important to recognize the difficulty experienced in gaining access to an industry partner. This was the most difficult portion of the entire research process. Industry partners represent possible funding, internships, and mentorship opportunities for program administrators and students. Therefore, program administrators fiercely protect these relationships because they represent the core of their programs. I had to build trust with the program administrators over several meetings to develop a relationship where they felt safe in providing me contact information for the industry partner. Fortunately, I was able to speak to two industry partners both of whom were associated with one of the HBCUs included in my sample. Unfortunately, after several attempts, I did not receive access to speak to the two additional industry partners. In one case, I had an initial phone conversation to describe my research and goals. After the initial phone conversation, the industry partner never returned my follow-up calls. The second industry partner expressed discomfort with participating in this research through communication with the program administrator. It

may be that the reluctance among industry partners to participate in this study is a prime example of competing priorities; participating in the interview process wasn't viewed as directly benefiting the partner and therefore wasn't given a priority.

From the perspective of the one industry partner I interviewed, the primary goal for their partnership was to expose URMs to STEM. Specifically, the industry partner said, "The initial expectation was to expose students to STEM experiments, experiences, and open their eyes to career exploration." During the interview, I inquired about the importance of diversity in STEM from the perspective of the industry partner. They said, "Digital inclusion is about ensuring the benefits of technology is for everybody." This industry partner's view was not only echoed in the interview, it was visible in the program documents associated with this program. The program documents stated:

> Right now, millions of under-resourced students here in the U.S. are lacking the connectivity, technology and skills required for success in today's digital economy. That's why since 2012, we have been working to help foster digital inclusion through our transformative program.

The unique benefits for the industry partner emerged through the individual words the industry partner used to describe the partnership. In the following response from an industry partner, words such as, cultural awareness, consumer awareness, unrepresented needs, and unrepresented ideas, described some of the things that are important to them:

> Without representation the long-term effects include: misrepresented cultural awareness, unrepresented needs, unrepresented ideas, lack of view, and over complete neglect of a vast population's consumer awareness. In all fields, diversity is the platform to any successful venture. Diverse minds, diverse experiences, diverse perspectives are what

makes creation come to life.

Program Administrators

The commitment to prioritizing the success of students who participate in these partnerships was a shared goal among all of the program administrators. One program administrator said, "They [our students] don't have the key contacts in the field and my program provides them the exposure needed to break into these fields." Another program administrator said, "I didn't have a program like this when I was coming up, that's why I work so hard to help these kids out!" These comments supported the enthusiasm and pride that program administrators displayed when prioritizing the interest of their students.

While interviewing program administrators, there was a reluctance to provide industry partner contact information. After much persistence, only one program coordinator agreed to provide me access to their industry partner. I interpreted this overall reluctance as indicative of a sense of risk the program coordinators perceived being associated with the possibility of losing an industry partner if negative research findings were to emerge.

According to the program administrators, the primary source of funding for the industry partnerships come from grants, contributions from corporate foundations, and the fundraising efforts of program administrators. According to the program administrators that I interviewed, their programs were not significantly funded through their home universities, they were either created through a grant, or an award, or sustained by the fundraising skills of an individual. In response to my inquiry about funding, a program administrator said, "My university has a moderate interest in supporting program efforts. We receive minimal to no support from upper administration, which led to changes in support activities for students." Another program administrator commented:

> Yeah, you want to take your kids to [University of Nevada, Las Vegas]. Yeah, you want to work with [Pennsylvania State University]. Yeah, you want them to do this. Yeah, you want to be able to keep your scholarships going for all the kids here and at the other schools. So, it means that you're busy. It means that all of your time—most of my time is spent at, essentially, establishing relationships, or writing proposals. We're looking at about something like $6.8 million [total operations for the program]. You're obviously impacted by where you're able to raise money.

This quote highlighted how program administrators managed multiple tasks including writing grants and serving students which makes it difficult to maintain and grow STEM-industry partnerships on their campuses. Although this program administrator expressed that funding is critical to sustaining their program, they are limited to the amount of time that they can focus on it because of their busy schedules.

Students

While interviewing students, the shared benefit of participating in a STEM HBCU-industry partnership was in the program's ability to help students get a career in STEM. One student said, "This program has a reputation of getting students jobs and I want one!" When asked about the expectations of participating in their program, a student replied saying, "This program gave me an opportunity. . . . I interned with the government." Underrepresented minorities interested in careers in STEM and participate in these types of programs have a link to successful careers in STEM with participating STEM partnerships programs.

As long as students, program administrators, and industry partners achieved the goals that support their participation in the partnership, the notion of competing priorities was not a huge issue. However, if there were a conflict with competing priorities among students, program

administrators, and industry partners, that conflict had the potential to create a problematic partnership that could create an environment where competing priorities could prevent a student, program administrator, or industry partner from achieving their goals of participating in the partnership. Basinger (2001) voiced that critics of industry-university partnerships seemed to be more concerned with fostering university-corporate relations. Therefore, it is critical that all program participants are aware of the separate interests of others so that they can weigh the risks and benefits of participating in a HBCU-industry partnership.

Summary of Findings

This chapter presented the themes that represent the critical perspectives of HBCU-industry partnerships. The four major themes were: (a) Passionate program administrators: "I've always had this feeling I wanted to make a difference"; (b) mentoring is "You cannot be what you cannot see"; (c) students need a shot; and (d) competing priorities: "This program has a reputation of getting students jobs and I want one!" The narratives that emerged provided evidence for better understanding the key individuals who make up these industry-university programs. I sought to gain rich and broad perspectives from the study's participants. In summary, by better understanding these partnerships, students, program administrators, industry partners, and HBCUs may be better equipped to create more—or more intentional—partnerships across multiple HBCUs and STEM focused companies. The findings suggested HBCU-industry partnerships are important and essential from the perspective of the students, program administrators, and industry partners, but lack the uniformity across the institutions' needs which makes it difficult to research and gain a holistic understanding. These findings represent the critical elements of HBCU-industry partnerships focusing on STEM, which include passionate program administrators, mentoring, student career opportunities, and competing priorities.

CHAPTER 5

DISCUSSION AND IMPLICATIONS

This final chapter provides a concise review of the study and reports four key findings from the thematic analysis of interviews and document analysis. Additionally, this chapter offers recommendations for future research to add to the body of knowledge about understanding industry-HBCU programs targeted at increasing diversity in STEM career fields. Atkinson and Mayo (2010) suggested industry partnerships with HBCUs could play a vital role in providing education pathways for minority students. However, little research exists for understanding the opportunities and challenges embedded in such partnerships or to guide the development of future partnerships. This research serves as foundational understanding of how industry partnerships at HBCU's can strategically support diversity efforts among industries and companies that see the value of a diverse workforce.

The purpose of this study was to understand critical elements of HBCU-industry partnerships focusing on STEM, from the perspectives of program administrators, students, and industry partners. I sought to understand the perspectives to build on prior research that has sought to understand the external factors that contribute to HBCUs' unique ability to produce STEM graduates separately from understanding the need for diversity in STEM-related career fields. Literature has suggested industry-university partnerships have the potential to leverage unique expertise and industry needs of universities. Although HBCUs have been historically underfunded compared to other institutions, HBCUs have a distinctive history of STEM preparation among URM. Often, studies seeking to understand STEM production at HBCUs

concentrate only on HBCUs' unique ability to graduate a significant number of STEM graduates (Gasman & Nguyen, 2014; Gasman et al., 2017; George et al., 2001). Of the 110,580 bachelor's degrees awarded nationally to African Americans in STEM programs from 2001 to 2009, 8.6% of those students graduated from only 12 HBCUs (Owens et al., 2012). Furthermore, based on data from the U.S. Department of Education (2016), HBCUs graduate 27% of the nation's African American students with bachelor's degrees in STEM.

My intent in conducting this research was to gain a better understanding of the key participants that make up industry-university partnerships, and to uncover the critical elements of HBCU-industry partnerships focusing on STEM, from the perspectives of key participants. In this final chapter, I connect the study's findings to the prior literature in order to advance our understanding of industry-HBCU partnerships, I discuss the implications of the findings in terms of theory and research, and I provide concluding remarks.

Discussion

The major conclusions that emerged point to the critical elements of HBCU-industry partnerships that focus on STEM. The central research question sought to understand the perspectives of program administrators, students and industry partners affiliated with these partnerships. The four findings that emerged as critical elements of HBCU-industry partnerships were (a) passionate program administrators: "I've always had this feeling I wanted to make a difference"; (b) mentoring is "You cannot be what you cannot see" (c) students need a shot; and (d) competing priorities: "This program has a reputation of getting students jobs and I want one!" These findings serve as a foundation to begin to understand the intersection of HBCUs, diversity representation in STEM related fields, and industry-based partnerships.

Although industry-based partnerships in higher education are on the increase as a means to leverage resources and to create programs that best prepare students for a changing and global labor market (Bastalich, 2010), this research responded to the need to understand the perspective of those involved in these industry-based partnerships. According to researchers, (Allen & Jewell, 2002; Owens et al., 2012; Palmer & Gasman, 2008) HBCU-industry partnership programs provide a unique experience that cultivates URM. This research provides a better understanding of the uniqueness that researchers have sought to understand. My findings provide a narrative to begin to understand why HBCUs produce successful STEM graduates. This unique experience was expressed as something that the students, program administrators and industry partners would not occur if not associated with a HBCU STEM industry-university partnership program. Understanding the potential impact of partnering with niche colleges has the ability to accelerate economic changes, specifically closing gaps among underrepresented groups in STEM fields.

As URM continue to express an interest in STEM careers, findings suggest interest and qualifications alone are not enough to transition into the STEM workforce. Professional connections and participation in industry-university partnerships play a significant role in breaking into the STEM careers field. The following sections continue a discussion around the four key findings of this research.

Passionate program Administrators: "I've Always Had This Feeling I Wanted to Make a Difference"

The majority of participants in this research were either HBCU students or graduates of HBCUs who currently work as a program administrator. These participants appeared to possess a purposeful engagement that lead back to several discussions about their own personal HBCU

STEM experiences. Furthermore, the participants who were not graduates of an HBCU reflected a sense of responsibility to the overall mission of the partnership programs. Having a passionate program administrator in an HBCU-industry partnership is a critical element in these STEM programs.

The data I collected supported the literature that indicates HBCUs are significantly effective at promoting educational attainment in STEM fields for URM (Kim & Conrad, 2006). The ability for HBCUs to create an environment for STEM success has been attributed to experiential factors for URM offered specifically by HBCUs (Perna et al., 2009). Additionally, the student interview data reflects a unique relationship between HBCU students and program administrators that are graduates of an HBCU. This relationship aligned with findings of Perna et al. (2009) about the unique environment at HBCUs. Having the ability to develop an authentic relationship with an administrator seemed to serve as a dual source of motivation for students and program administrators. The needs of the STEM workforce and industry seemed to be beneficiaries of this strong bond that HBCUs facilitated between students and administrators.

Mentoring Is "You Cannot Be What You Cannot See"

Regardless of talent and skill, having a connection with a STEM related company was a key message that the majority of students expressed during the interview process. Mentorship and connections were on par with skill and talent. The literature has indicated underrepresented students who attended HBCUs experienced more success in STEM-related areas because of their institutions focus on more social, personal, and moral issues and the needs that related directly to their students (Pascarella & Terenzini, 2005). It appeared URMs interested in STEM widely accepted this concept because of their lack of connections in the STEM industry. HBCU-industry

partnership programs filled the gap needed in route to their employment. Focusing on mentoring is a critical element of HBCU-industry partnerships focusing on STEM.

Specifically, HBCUs have managed to construct a learning environment for African American students that produces successful graduates, regardless of previous academic preparation or social status (Allen & Jewell, 2002; Owens et al., 2012; Palmer & Gasman, 2008). In response to my inquiry about what makes these programs unique, program administrators responded by listing the advantages of minorities currently working in STEM that mentor aspiring students. The advantages included networking and a pipeline of new recruits into the STEM field. Underrepresented minorities who attend HBCUs experienced more success in STEM-related areas because their institutions focus on more social, personal, and moral issues and the needs that relate directly to their students (Pascarella & Terenzini, 2005).

Students Need a Shot

Another of the findings of this research was the fact that academic success was not enough for underrepresented minority students interested in a STEM career. Program administrators believed that they needed to assist these prepared and qualified students for a shot at being successful in a STEM career. Additionally, students believed that in addition to having the academic credentials, they needed to participate in a HBCU-industry partnership program to get a shot at starting a career in a STEM-related field.

According to the literature, George et al. (2001) concluded that to fully understand the factors that contribute to STEM participation among URM, researchers need to establish a consortium that studies the successes and failures of URM STEM experiences. George et al.'s research identified this as the central factor needed to better understand what contributes to STEM participation among URM's. Additionally, George et al. stated, "Building a community of

researchers who confer regularly may help to improve methodology and bring us closer to understanding factors that limit the STEM talent pool" (p. 12). Career assistance beyond academics—giving students a shot—is a critical element of HBCU-industry partnerships that focus on STEM.

Competing Priorities: "This Program Has a Reputation of Getting Students Jobs and I Want One!"

Competing priorities among students, program administrators, and industry partners, has the potential to create a problematic partnership. If partnership participants do not individually weigh the risks and benefits of participating in the partnership and do not completely understand the landscape of competing interests from the perspective of others involved in the partnership, conflict is possible. As an example, the lack of funding is a reality for HBCUs. Although HBCUs have a documented success for creating a STEM friendly environment that consistently produces some of the nation's top STEM graduates, there is a significant resource gap between HBCUs and their PWIs (Palmer & Gasman, 2008). A pervasive lack of funding has created an environment that suggest that you should fiercely protect your funding sources. If HBCU program administrators began to protect their industry partners in fear of losing funding, programs are at risk of having an imbalanced partnership that favors industry partners. Prigge (2005) stated:

> Partnerships can provide financial support for their educational, research and service missions; broaden the experience of their students and faculty; identify significant, interesting and relevant problems; enhance regional economic development; and increase employment opportunities for students. Such partnerships, however, are not without risks. (p. 221)

Evaluating the risks and benefits that Prigge (2005) outlined is necessary for all of the program participants.

Implications

This dissertation sought to understand industry-university partnerships at HBCUs with the aim to increase diversity participation in a STEM career field. The core findings from this study are the critical elements that enables HBCU-industry partnerships to professionally and personally prepare students to accelerate industry diversity efforts. Understanding the perspectives of program administrators, students, and partners provides a foundation for future industry-university partnerships at HBCUs to build upon. Future HBCU-industry partnerships can properly weigh the risks and benefits of partnerships and build effective partnerships that considers the perspectives represented through the findings of this research.

The mentorship aspect of HBCU-industry partnerships, creates an environment that makes students aware of opportunities and provides them with mentors to assist with navigating their careers. Essentially, HBCU-industry partnerships are operating as a professional guide for URM interested in pursuing STEM careers. This process is less about academic preparation and focuses more on the personal journey of an underrepresented minority interested in STEM. This understanding has the ability to accelerate diversity in the modern STEM workforce. While there is an exhaustive amount of scholarly and opinion articles, labor statistics, and lecture series on the importance of STEM (Freeman & Cohen, 2001; Kuenzi, 2008 & STEM 101, 2014), little research is focused on the effectiveness of STEM college–industry partnerships and initiatives at HBCUs. My research provides useful foundation for future understanding of HBCU-industry partnerships and the basis for further efforts to address key questions, such as how can these partnerships support industry diversity efforts? How can these partnerships connect with K-12

STEM interest efforts? How can these partnerships impact other URM? How can these partnerships impact the mission of HBCUs, HSI's and other majority minority serving institutions?

Implications for Theory

In conducting this study, I relied on two distinct yet complimentary theories: AC (Slaughter & Leslie, 1997) and CRT (Delgado & Stefancic, 2012). These theories enabled me to observe the industry-university partnerships from a corporate view while simultaneously being aware of the cultural narratives.

Academic capitalism. Viewing this research through the lenses of AC created a need to understand the connections between HBCU industry-university partnerships and all of the other individuals involved in the partnership. One of the major tenets of AC is the blurred boundaries between organizations. For example, Slaughter and Rhoades (2005) described the use of state resources to create interstitial bodies that attract corporations to universities, providing a conduit between private and public sectors, and manage the flow of resources. Applied to my research, this concept highlighted the connectivity between the goals of industry partners and the unique ability for HBCUs to produce prepared STEM graduates. The theory of AC emerged in the finding of prioritization of interests. While describing the prioritization of interests, a program administrator stated, "So, it means that you're busy. It means that all of your time . . . . Most of my time is spent at, essentially, establishing relationships, or writing proposals." Industry partners prioritized their own corporate interests and used partnerships as a means to enhance their business needs. This finding suggests HBCU-industry partnerships are conduits between the institution and industry. This position allows industry and the institution to leverage these partnerships to accomplish their separate goals. These blurred lines of engagement are addressed

through the lenses of AC. The risks and benefits of these partnerships are dependent on the synergy between partners.

HBCUs' ability to produce and market resources specifically to assist with the diversification efforts of industry is a behavior that is very market like. Slaughter, Rhoades, and Fainholc (2005) provided seven points intended for researchers to rethink traditional views associated with the academic profession. The findings from my research support three of the main points presented by Slaughter et al. (2005) that focused on the ability of industry-university partnerships to prepare students while simultaneously meeting the needs of a changing workforce, as follows:

1. Academic capitalism is defined as the pursuit of market-like activities to generate external revenues. Academic capitalism becomes possible once universities are integrated into the new economy; that is, once they have embraced the idea of knowledge-as-a commodity. Relative to this research, the HBCU STEM industry partnerships have realized that there is a market-like demand for URM students qualified and prepared to enter the STEM workforce. This realization positions HBCUs to leverage this unique ability to attract and generate external revenues.
2. Students are viewed as consumers. This view of students permits institutions to become involved in a vigorous competition to market themselves to those consumers. Relative to this research, HBCUs recruit students to their programs through their program websites where they highlight that their programs equip students with the necessary skills to be successful in a STEM related career. My research findings reflect that the relationship between program administrators and students far exceeds the concept of a consumer based relationship. The student relationship with the program administrators served as a

foundation to encourage and provide students with the confidence necessary to establish a career in a STEM field.

3. When students graduate, they represent output-products that will contribute to the new economy. Relative to this research, there is a relationship between the publicly stated need for diversity in the STEM workforce and HBCUs ability to fill this need through the output of providing diverse, qualified students.

Critical race theory. The underpinnings of this research was to understand individual perspectives of programs that seek to impact URM interested in STEM careers. Viewing this research through the lenses of CRT allowed me to understand the narratives of individuals that acknowledged the need for a partnership to improve minority representation in a STEM career field.

In Chapter 2, I referenced literature suggesting that diverse and inclusive representation in all ranks of STEM-related companies prevents homogenous control over a rapidly evolving heterogeneous society. Racial and ethnic population change in the United States continues to reshape U.S. identity and the composition of its workforce (Allen-Ramidial & Campbell, 2014). Therefore, cultivating diverse STEM talent through the U.S. higher education system is essential for future economic stability.

Critical race theory provided a framework to guide the interview question creation process for the individuals associated with these partnerships. Critical race theory emerged in the finding "students respond to passionate program administrator." Without the lens of CRT, this critical theme would not have emerged. The student interview data reflected a unique relationship between HBCU students and program administrators that are graduates of an HBCU. Underrepresented minority student's ability to develop an authentic relationship with an

administrator seemed to serve as a dual source of motivation for students and program administrators. This research finding confirmed the two tenets of CRT as outlined by Daniel Solórzano (1997, 1998): (a) the intercentricity of race and racism and (b) the challenge to dominant ideology. My findings highlight the need for more researchers to integrate CRT into their research to uncover aspects of race to include networking among URM in STEM areas and the impact of second generation HBCU STEM graduates on first generation STEM students.

All of the individuals associated with the HBCU-industry partnerships I examined shared a common theme of opportunity, which emerged as the "students need a shot" theme. In response to my inquiry about the intersection between HBCUs, STEM, and STEM careers, all of the program administrators agreed URM needed programs to assist them with the successful transition from STEM interest to STEM careers. The data reflect an understanding of the role that HBCU's can play in accelerating a well-documented underrepresentation of minorities in STEM fields.

In summary, this research uncovered the need for two major considerations for expanding the frameworks of AC and CRT. First, AC focuses on traditional views associated with the academic profession and the evolution of how higher education institutions operate. This research supports the need to expand on the basis of the influence of institutions building out cultural competencies. As indicated in the literature, increasing the number of minorities in STEM is critically important for the United States' economic growth and its position in the global marketplace (Guess, 2008; Moore, 2006; Ozturk, 2007). Expanding the framework of AC to consider cultural competencies in higher education has the potential to yield some substantive findings about the influence of culture on organizations with an emphasis on industry partnerships that have a cultural aspect to the partnership.

The second consideration centers on CRT. Currently, CRT focuses on narratives from underrepresented members of society that accept the fact that there are dominate and recessive social classes. The findings of this study emphasized the importance of CRT in contemporary academic research. The use of CRT as a theoretical lens has the opportunity to produce new knowledge about issues pertaining to race and class in higher education.

Implications for Research

There are a number of gaps in our knowledge around the role HBCU-industry partnerships play in increasing STEM participation. My research can serve as a foundation to further explore the impact of HBCU's on the STEM industry, particularly in industries that have publicly acknowledged the need for diversity in their workforce. The following research areas would benefit these industry sectors.

First, we need in-depth exploration of how HBCU-industry partnerships impact corporate diversity initiatives. Quantitative research could serve as true assessment of the ability of HBCUs to provide industry ready talent and simultaneously measure the success of corporate diversity initiatives.

Second, more qualitative studies are needed to further understand issues of race that focus on how URM anticipate issues of race and how they equip themselves accordingly. This line of research would contribute to better understanding how URM network among each other to position themselves for upward professional mobility.

Third, more qualitative examination of the experiences and perspectives of second-generation STEM administrators on first generation STEM undergraduate minority students is needed. Such a focus would contribute important new understandings of the influence of STEM exposure through the hierarchal multigenerational lens.

Implications for Practice

As it relates to practice, the implications of this research can guide our understanding of the perspectives of URM interested in pursuing STEM careers. Furthermore, this research has implications on the ever-evolving roles of HBCUs and their intersection with industry partners. Industries developing formal relationships with HBCUs could be a start to accelerate the corporate and government goals of diversifying the STEM talent pool. As I have discovered through this research, the success of HBCU-industry partnerships are heavily dependent on the relationship between the program administrators and students. Additional implications center on understanding how HBCUs align their ability to produce qualified and diverse talent with the diversity needs of corporate America. If these connections are not established, I fear that industry diversity initiatives will be perceived as largely rhetoric and HBCUs will never tap into their true differentiator, culture.

Conclusion

Even though our nation's 105 HBCUs make up just three percent of colleges and universities, they produce 27 percent of African Americans with bachelors' degrees in STEM fields.

HBCUs must continue to play that critical role in creating equal opportunity. And they must continue to play a critical role in meeting President Obama's North Star goal in education – that America regain its place as the nation with the highest college attainment rate in the world.

U.S. Secretary of Education Arne Duncan to the 2014 National HBCU Conference "HBCUs: Innovators for Future Success"

This research ends where it began. In Chapter 1, I referenced statistics about the contribution of HBCUs on the STEM economy in the United States from the Thurgood Marshall College Fund: HBCUs account for just 3% of 4-year nonprofit colleges; their alumni account for approximately 80% of Black judges and 50% of Black lawyers and doctors, and their students

account for 25% of Black undergraduates who earn degrees in STEM. These statistics served as motivation to conduct this research. As the only Black middle manager in a large consumer electronic company's higher education division, on several occasions I have been asked to assist with diversity initiatives. While deeply appreciative to assist my company with issues relating to diversity, I was also troubled that my company could not seem to locate the diverse talent that surrounded me. When I first embarked on this study, I considered myself an outsider to academic research because of my nontraditional route into a doctorate program. However, after analyzing the narratives of program administrators, industry partners and students who were affiliated with STEM industry-university partnerships at HBCUs, I discovered the "why" for contributing to this desperately needed area of research. The why is simply that the findings of this research can significantly impact others who look like me.

The importance of understanding the role of industry-university partnerships at HBCUs cannot be understated. As a graduate of an HBCU and middle manager in the largest consumer electronics company in the world, I learned one major lesson I did not think I would learn prior to embarking on this study. The lesson was my underestimation of the difficulty attempting to qualitatively understand the motivation of underrepresented minorities. Understanding concepts that intersect with diversity and inclusion requires listening intensely. I learned that concepts of diversity and inclusion are difficult to understand because every perspective is deeply personal and attempting to carve out race and class to discuss a specific phenomena is not an easy task. Simply, every aspect of reality for an URM intersects with diversity and inclusion and that perspective will always impact their experience to some degree. Reflecting on these learnings, I hope my research contributes to advancing our understanding of the nuanced and contextual

dynamics at play in HBCU STEM-industry partnerships, and ultimately influence opportunities for others.

References

Abell, C. H., Alexander, L. J., & Bragg-Underwood, T. (2014). A partnership to enhance community health education for RN to BSN students. *Kentucky Nurse*, *62*(4), 9.

Allen, W. R., & Jewell, J. O. (2002). A backward glance forward: Past, present and future perspectives on historically Black colleges and universities. *The Review of Higher Education*, *25*(3), 241-261.

American Psychological Association. (2013). *Women, minorities, and persons with disabilities in science and engineering: 2013 (558442013-001)* [Data set]. doi:10.1037/e558442013-001

Anderson, M. S. (2001). The complex relations between the academy and industry: Views from the literature. *The Journal of Higher Education*, *72*(2), 226-246.

Atkinson, R. D., & Mayo, M. (2010). Refueling the U.S. Innovation Economy:, 178.

Baine, C. (2000). Women and Minorities in STEM Careers Advancing our World, 5.

Baker, C. E., Dunnavant, J., & McNair, J. (2015). How the pathway to engineering affects diversity in the engineering workforce: A Silicon Valley case study (pp. 26.862.1-26.862.16). Presented at the 2015 ASEE Annual Conference & Exposition, Seattle, WA. Retrieved from https://peer.asee.org/how-the-pathway-to-engineering-affects-diversity-in-the-engineering-workforce-a-silicon-valley-case-study

Bastalich, W. (2010). Knowledge economy and research innovation. *Studies in Higher Education*, *35*(7), 845-857.

Bikson, T. K., & Law, S. A. (1994). Global Preparedness and Human Resources: College and Corporate Perspectives.

Bogdan, R., & Biklen, S. (2003). Data analysis and interpretation. *Qualitative Research for Education: An Introduction to Theory and Methods*, *4*.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, *9*(2), 27–40. doi:10.3316/QRJ0902027

Breiner, J. M., Harkness, S. S., Johnson, C. C., & Koehler, C. M. (2012). What is STEM? A discussion about conceptions of STEM in education and partnerships. *School Science and Mathematics*, *112*(1), 3–11.

Brown, R., Brown, J., Reardon, K., & Merrill, C. (2011). Understanding STEM: Current perceptions. *Technology & Engineering Teacher*, *70*(6), 5–9.

Carnevale, A. P., Smith, N., & Melton, M. (2013). STEM: Science, technology, engineering, mathematics. Retrieved from http://hdl.handle.net/10822/559306

Charmaz, K. (2000). Grounded theory objectivist and constructivist methods. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research,* (2nd ed., pp. 509-535). Thousand Oaks, CA: Sage.

Chen, X. (2013). *STEM attrition: College students' paths into and out of STEM fields* (Report No. 2014-001).

Clough, G. W. (2004). *The engineer of 2020: Visions of engineering in the new century*. Washington, DC: National Academies Press.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches*. US: Sage.

Delgado, R., & Stefancic, J. (2000). *Critical race theory: The cutting edge*. City, ST: Temple University Press.

Delgado, R., & Stefancic, J. (2017). *Critical race theory: An introduction*. New York, NY: University Press.

Engberg, M., & Wolniak, G. C. (2013). College student pathways to the STEM disciplines. *Teachers College Record, 115*(1), 41.

Freeman, K., & Cohen, R. T. (2001). Bridging the gap between economic development and cultural empowerment: HBCUs' challenges for the future. *Urban Education*, *36*(5), 585-596.

Gasman, M., & Nguyen, T. H. (2014). Historically Black colleges and universities (HBCUs): Leading our nation's effort to improve the science, technology, engineering, and mathematics (STEM) pipeline. *Texas Educational Review, 2*(1), 75-89.

Gasman, M., Nguyen, T. H., Conrad, C. F., Lundberg, T., & Commodore, F. (2017). Black male Success in STEM: A case study of Morehouse College. *Journal of Diversity in Higher Education*, *10*(2), 181–200. doi:10.1037/dhe0000013

George, Y. S., Neale, D. S., Van Horne, V., & Malcolm, S. M. (2001). In pursuit of a diverse science, technology, engineering, and mathematics workforce. In *American Association for the Advancement of Science* (pp. 1–24).

Gilligan, M. R., Verity, P. G., Cook, C. B., Cook, S. B., Booth, M. G., & Frischer, M. E. (2007). Building a diverse and innovative ocean workforce through collaboration and partnerships that integrate research and education: HBCUs and marine laboratories. *Journal of Geoscience Education*, *55*(6), 531–540. doi:10.5408/1089-9995-55.6.531

Glaser, B. G. (1992). *Basics of grounded theory analysis: Emergence vs forcing*. Sociology Press.

Gonzalez, H. B., & Kuenzi, J. J. (n.d.). Science, Technology, Engineering, and Mathematics (STEM) Education: A Primer, 38.

Grant, C., & Osanloo, A. (2014). Understanding, selecting, and integrating a theoretical Framework in dissertation research: Creating the blueprint for your "house." *Administrative Issues Journal*, *4*(2), 4.

Greene, J. C., DeStefano, L., Burgon, H., & Hall, J. (2006). An educative, values-engaged approach to evaluating STEM educational programs. *New Directions for Evaluation*, *2006*(109), 53-71. doi:10.1002/ev.178

Guess, A. (2008). Challenging conventional wisdom on STEM supply. *Inside Higher Ed*.

Gumport, P. J. (2000). Academic restructuring: Organizational change and institutional imperatives. *Higher Education*, *39*(1), 67-91. doi:10.1023/A:1003859026301

Jayakumar, U. (2008). Can higher education meet the needs of an increasingly diverse and global society? Campus diversity and cross-cultural workforce competencies. *Harvard Educational Review*, *78*(4), 615-651. doi:10.17763/haer.78.4.b60031p350276699

Kim, M. M., & Conrad, C. F. (2006). The impact of historically Black colleges and universities on the academic success of African-American students. *Research in Higher Education*, *47*(4), 399-427.

Kuenzi, J. J. (2008). Science, Technology, Engineering, and Mathematics (STEM) Education: Background, Federal Policy, and Legislative Action, 35.

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation*. City, ST: Wiley & Sons.

Merriam, S. B. (1998). *Qualitative Research and Case Study Applications in Education. Revised and Expanded from" Case Study Research in Education."* ERIC.

Merriam, S. B. (2002). Do all these people have to be here? Reflections on collecting data in another culture. In S. B. Merriam & Associates (Eds.), *Qualitative research in practice: Examples for discussion and analysis* (pp. 58–61). San Francisco, CA: Jossey-Bass.

Merrill, C., & Daugherty, J. (2009). The future of TE masters degrees: STEM.

Milner, H. R. (2008). Critical race theory and interest convergence as analytic tools in teacher education policies and practices. *Journal of Teacher Education*, *59*(4), 332–346. doi:10.1177/0022487108321884

Mohr, J., & Spekman, R. (1994). Characteristics of partnership success: Partnership attributes, communication behavior, and conflict resolution techniques. *Strategic Management Journal*, *15*(2), 135-152. doi:10.1002/smj.4250150205

Moore, J. L. (2006). A qualitative investigation of African American males' career trajectory in engineering: Implications for teachers, school counselors, and parents. *Teachers College Record*, *108*(2), 246.

Owens, E. W., Shelton, A. J., & Bloom, C. M. (2012). The significance of HBCUs to the production of STEM graduates:, 15.

Öztürk, M. (2007). Global competition: America's underrepresented minorities will be left behind. *Teachers College Record*, *109*(6).

Paap, J., & Katz, R. (2004). Anticipating disruptive innovation. *Research-Technology Management*, *47*(5), 13–22.

Palmer, R., & Gasman, M. (2008). "It takes a village to raise a child": The role of social capital in promoting academic success for African American men at a Black college. *Journal of College Student Development*, *49*(1), 52–70. doi:10.1353/csd.2008.0002

Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students: A third decade of research (Vol. 2)*. ERIC.

Patton, M. Q. (2002). Two decades of developments in qualitative inquiry: A personal, experiential perspective. *Qualitative Social Work*, *1*(3), 261–283.

Perna, L., Lundy-Wagner, V., Drezner, N. D., Gasman, M., Yoon, S., Bose, E., & Gary, S. (2009). The contribution of HBCUS to the preparation of African American women for STEM careers: A case study. *Research in Higher Education*, *50*(1), 1–23. doi:10.1007/s11162-008-9110-y

Pertuzé, J. A., Calder, E. S., Greitzer, E. M., & Lucas, W. A. (2010). Best practices for industry-university collaboration, 10.

Slaughter, S. (2014). *Academic capitalism in the age of globalization*. City, ST: JHU Press.

Slaughter, S., & Leslie, L. L. (1997). *Academic capitalism: Politics, policies, and the entrepreneurial university.* ERIC.

Slaughter, S., Slaughter, S. A., & Rhoades, G. (2004). *Academic capitalism and the new economy: Markets, state, and higher education*. JHU Press.

Solórzano, D. G., & Yosso, T. J. (2002). Critical race methodology: Counter-storytelling as an analytical framework for education research. *Qualitative Inquiry*, *8*(1), 23-44.

Valla, J. M., & Williams, W. M. (2012). Increasing achievement and higher-education representation of under-represented groups in science, technology, engineering, and mathematics fields: A review of current K-12 intervention programs. *Journal of Women and Minorities in Science and Engineering*, *18*(1), 21-53. doi:10.1615/JWomenMinorScienEng.2012002908

Vilorio, D. (2014). STEM 101: Intro to tomorrow's jobs (Occupational Outlook Quarterly). *Washington, DC: Bureau of Labor Statistics*.

Washington, A. N., Burge, L., Mejias, M., Jean-Pierre, K., & Knox, Q. (2015). Improving undergraduate student performance in computer science at historically Black colleges and universities (HBCUs) through industry partnerships. *Proceedings of the 46th ACM Technical Symposium on Computer Science Education - SIGCSE '15* (pp. 203–206). Kansas City, Missouri, USA: ACM Press. doi:10.1145/2676723.2677277

Yin, R. K. (2017). *Case study research and applications: Design and methods*. City, ST: Sage.

Ylijoki, O.-H. (2003). Entangled in academic capitalism? A case-study on changing ideals and practices of university research. *Higher Education*, *45*(3), 307-335.

APPENDIX A

CONSENT FORM

UNIVERSITY OF GEORGIA
CONSENT FORM

Understanding Industry-HBCU Programs Targeted at Increasing Diversity in STEM Career Fields.

Researcher's Statement
I am a Doctoral student working under the guidance and direction of Dr. Gregory Wolniak. We are asking you to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. This form is designed to give you the information about the study, so you can decide whether to be in the study or not. Please take the time to read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information. When all your questions have been answered, you can decide if you want to be in the study or not. This process is called "informed consent." A copy of this form will be given to you.

Principal Investigator
Dr. Gregory Wolniak | Institute of Higher Education, University of Georgia | gwolniak@uga.edu

Purpose of the Study
The purpose of this dissertation is to understand industry-university partnerships at two HBCUs that aim to increase diversity participation in a STEM career field. Using a qualitative case study design, the study focusses on understanding the value of these partnerships from the institutional and partnering company's perspective, as well as understand how these partnerships are established and sustained.

Study Procedures
If you agree to participate, you will be asked to …

- Participate in an interview, approximately one hour in length. The interview will be recorded for future analysis by the researcher.
- During the interview, you will be asked questions about your experience with faculty retention either from the perspective your administrative position or as a faculty member who has been involved in retention negotiations.
- If needed, follow-up clarification may be sought via email, phone or possibly an additional meeting.

Risks

Participants will be asked to speak in confidence about details surrounding how these partnerships are established and sustained. Participants will not be identified by name, specific title, or specific institution.

Benefits
Participants may benefit by receiving an aggregated report of the findings, which may help inform future institution decision making around the formation, success and sustainability of industry-university partnerships that aim to increase diversity participation in STEM career fields.

Audio/Video Recording
The interview will be recorded for analysis by the researchers only and will be destroyed at the conclusion and submission of the research results. Please provide initials below if you agree to have this interview audio recorded or not. You may still participate in this study even if you are not willing to have the interview recorded.

_____I do not want to have this interview recorded.

_____I am willing to have this interview recorded.

Privacy/Confidentiality
Researchers will not release identifiable results of the study to anyone other than individuals working on the project without your written consent unless required by law. In the reported findings interviewed subjects will not be identified by name, specific title, or specific institution. Participants will be identified with a pseudonym to describe their role in general terms, either administrator 1, 2, 3, etc.; or faculty member 1, 2, 3, etc. The coding system will be kept in a secure file during data collection and will be destroyed following full completion of the study and acceptance of the dissertation.

Taking part is voluntary
Your involvement in the study is voluntary, and you may choose not to participate or to stop at any time without penalty or loss of benefits to which you are otherwise entitled. If you decide to withdraw from the study, the information that can be identified as yours will be kept as part of the study and may continue to be analyzed, unless you make a written request to remove, return, or destroy the information.

If you have questions
The main researcher conducting this study is Glen Spencer, a graduate student at the University of Georgia. Please ask any questions you have now.

If you have questions later, you may contact Glen Spencer at glen.spencer@uga.edu or Dr. Gregory Wolniak at gwolniak@uga.edu. If you have any questions or concerns regarding your rights as a research participant in this study, you may contact the Institutional Review Board (IRB) Chairperson at 706.542.3199 or irb@uga.edu.

Research Subject's Consent to Participate in Research:

To voluntarily agree to take part in this study, you must sign on the line below. Your signature below indicates that you have read or had read to you this entire consent form and have had all of your questions answered.

_____	_____	_____
Glen Spencer	Signature	Date

_____	_____	_____
Name of Participant	Signature	Date

Please sign both copies, keep one and return one to the researcher.

APPENDIX B

INDUSTRY PARTNER INTERVIEW PROTOCOL

1. Please tell me about yourself. Who are you?
2. What are some important experiences in your life that helped lead you to your current position?
3. Describe a meaningful experience that you have had that lead you to your current position?
4. What people were important in helping to guide you through these experiences?
5. Are you aware of how the industry-university partnership created?
6. How are these industry-university identified?
7. What were your initial expectations of this partnership?
8. Tell me your thoughts about the importance of diversity in STEM related fields.
9. What are the challenges associated with underrepresented minorities participating in STEM fields?
10. What are the opportunities associated with underrepresented minorities participating in STEM fields?
11. How often do you add or remove partnering universities?
12. Why have you chosen to partner with an HBCU?
13. What have been the main strategies to strengthen the quality this partnership?
14. How supportive is your company in your efforts to create industry-university partners?
15. Have other HBCUs engaged you about your industry-university partnerships?
16. What are some of the success stories that you have experienced since you have been associated with this program?
17. What are some of the failures that you have experienced since you have been associated

with this program?

18. Describe a situation when you had to defend the value of your industry-university partnership that challenged one of your core values? How did you deal with the conflict?

19. Are partnerships necessary to accrue these benefits?

20. Is there anything else you want to share?

APPENDIX C

STUDENT INTERVIEW PROTOCOL

1. Please tell me about yourself. Who are you?
2. Why did you choose to attend an HBCU?
3. When did you become aware of this STEM program?
4. What benefits do you think are associated with participating with this program?
5. What are some important experiences in your life that helped lead you to being interested in a STEM field?
6. What people were important in helping to guide you through these experiences?
7. Are you aware of how the industry-university partnership created?
8. Would you recommend for other students that are interested in a STEM career to participate in similar program?
9. Do you believe that this program has positioned you for employment in STEM related career?
10. Is there anything else that you would like to share?

APPENDIX D

PROGRAM ADMINISTRATOR INTERVIEW PROTOCOL

1. Please tell me about yourself. Who are you?
2. What are some important experiences in your life that helped lead you to your current position?
3. Describe a meaningful experience that you have had as an administrator while serving at an HBCU?
4. What people were important in helping to guide you through these experiences?
5. How was the industry-university partnership created?
6. How are these industry-university partnerships funded?
7. What were your initial expectations of this partnership?
8. Tell me your thoughts about the importance of diversity in STEM related fields.
9. What are the challenges associated with underrepresented minorities participating in STEM fields?
10. What are the opportunities associated with underrepresented minorities participating in STEM fields?
11. Have any aspects of your industry-university partnership been significantly modified since its inception?
12. How often do you add or remove industry partners?
13. What have been the main strategies to strengthen the quality of industry-university partners?
14. How supportive is your University in your efforts to create industry-university partners?
15. Have other HBCUs engaged you about your industry-university partnerships?
16. What are some of the success stories that you have experienced since you have been associated with this program?

17. What are some of the failures that you have experienced since you have been associated with this program?

18. Describe a situation when you had to defend the value of your industry-university partnership that challenged one of your core values? How did you deal with the conflict?

19. Are partnerships necessary to accrue these benefits?

20. Is there anything else you want to share?

APPENDIX E

RECRUITMENT E-MAIL

Dr.,

I am a doctoral student at The University of Georgia and hope you may be willing to speak with me regarding my dissertation. I am currently in the IRB approval process and I wanted to establish contact with you as soon as possible.

The working title of this qualitative case study is "Understanding Industry-HBCU Programs Targeted at Increasing Diversity in STEM Career Fields." The purpose of this research study is to better understand industry-university partnerships at two HBCUs that aim to increase diversity participation in a STEM career field. Using a qualitative case study design, the study focusses on understanding the value of these partnerships from the institutional and partnering company's perspective, as well as understand how these partnerships are established and sustained. The Google in Residence program (GIR) meets all of my research criteria and I would love to connect with you to better understand your program.

Once I receive IRB approval, I am hoping you might be willing to meet with me to discuss the details of the project and your own participation in a one-on-one interview sometime in April. I know you are a very busy person and in the interest of time, we would ideally discuss the project and then conduct the interview during the same meeting, if possible.

Additionally, and with your consent, the interview will be audio-recorded for future transcription, at which point, you will be assigned a pseudonym in order to protect your identity.

Thank you for your consideration and please let me know if you might be willing to meet with me to discuss and/or participate in this research. I have attached my resume for you to review my professional and educational background as you consider this request. Finally, please do not hesitate to contact me at the email or phone number below should you have any questions.

Thanks,

Glen D. Spencer, Jr.
Doctoral Student
Higher Education Management
Institute of Higher Education
The University of Georgia
http://ihe.uga.edu/people/glen-d.-spencer/
glen.spencer@uga.edu
404-234-4545