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An Investigation of How Black STEM Faculty at Historically Black Colleges and Universities  
Approach the National Science Foundation Merit Review Process

A dissertation submitted in partial fulfilment of the requirements for  
the degree of Doctor of Philosophy at Virginia Commonwealth University

by

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I wish to thank the study participants for their time and efforts, both toward this study and toward the HBCU mission. I admire each of them and hope they and their colleagues are able to find the happiness, health, and strength needed to continue their work.

Finally, I thank my committee both for their support and for allowing me to embark on this particular study. Rather than require me to propose a tidy study that closely followed the guidelines for dissertation research, they trusted me to dive into a problem with no clear path toward a solution. While my work may not have led to a succinct answer to a well-posed question, this experience did teach me a great deal about myself and the people who inhabit the world around me. I wish that every student might be so lucky.

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## List of Abbreviations and Terms

- Black/African American – I have chosen to rely on “Black” as a racial/ethnic description throughout this dissertation. I have done so both because I consider myself Black and I bristle at what I see as a qualification of my citizenry in the label “African American.” Similarly, I prefer the use of “people of Color” over “racial minorities” when referring to non-White Americans. While I understand the numerical logic in the term “minority,” I interpret the label as an implicit attempt to minimize the stature and power of non-White members of our democratic society. I understand not all will agree my choices (and I reserve the right to evolve my understanding of race and ethnicity in the future), but I hope that my decisions do not distract readers from appreciating the value of what the study participants shared with me throughout this inquiry.
- Broader impacts – National Science Foundation merit review criteria encompassing “the potential to benefit society and contribute to the achievement of specific, desired social outcomes.” (National Science Foundation, 2016d, p. III-2)
- EHR – Education and Human Resources Directorate; Directorate within National Science Foundation responsible for supporting “excellence in US STEM education at all levels, in all settings for the development of a diverse and well-prepared workforce of scientists, technicians, engineers, and mathematicians and educators and a well-informed citizenry.” (National Science Foundation, 2016a)

- HBCU – Historically Black College or University; a group of approximately 100 institutions of higher education recognized by federal law as colleges or universities “established prior to 1964, whose principal mission was, and is, the education of Black Americans.” (Higher Education Act of 1965, 2013, sec. 322 (2))
- HBCU-UP – Historically Black Colleges and Universities Undergraduate Program; A National Science Foundation program within the EHR Directorate “committed to enhancing the quality of undergraduate STEM education and research at HBCUs as a means to broaden participation in the nation's STEM workforce” (National Science Foundation, 2016c)
- Intellectual merit – National Science Foundation merit review criteria encompassing, “the potential to advance knowledge” (National Science Foundation, 2016d, p. III-2)
- NSF – National Science Foundation; an independent federal organization established by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; [and] to secure the national defense” (National Science Foundation Act of 1950, 1950). NSF supports non-medical fundamental research in all science and engineering disciplines and in FY 2017 was the funding source for nearly one quarter of all federally supported basic research conducted at US institutions of higher education (National Science Foundation, n.d.).
- PI – principal investigator; the individual responsible for the management and implementation of NSF grant-funded activities.
- PWI – predominantly White institution
- Social identity: my use of "social identity" throughout this work aligns with Tajfel's definition, as provided in Hogg (1988); i.e. "the individual's knowledge that he [*sic*]

belongs to certain social groups together with some emotional and value significance to him of the group membership" (p. 24). I use the term "social identity" to refer to participants' self-categorization of themselves within socially-constructed groups of people that are distinguishable from other groups of people.

- STEM – science, technology, engineering, and mathematics

## Abstract

### AN INVESTIGATION OF HOW BLACK STEM FACULTY AT HISTORICALLY BLACK COLLEGES AND UNIVERSITIES APPROACH THE NATIONAL SCIENCE FOUNDATION MERIT REVIEW PROCESS

By Falcon Rankins, PhD

A dissertation submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

Virginia Commonwealth University, 2017

Director: Rosalyn Hobson Hargraves, PhD  
Associate Professor, School of Education

This qualitative inquiry explored the ways in which US-born, Black faculty member participants in science, technology, engineering, and mathematics (STEM) disciplines at Historically Black Colleges and Universities (HBCUs) interact with the National Science Foundation (NSF). Eight Black HBCU STEM faculty members with a range of involvement in NSF-related activities were individually interviewed. Topics of discussion with participants included their prior experiences with NSF, their understanding of the merit review process, and their understanding of their personal and institutional relationships with NSF and the STEM community. Two broad findings emerged from the conversations. The first was that issues of communities and social identity

were important to the participants' work as research scientists. Participants prioritized advancing people and communities over advancing the knowledge of ambiguous, disembodied scientific disciplines, and some participants were motivated by interests in social justice. However, participants maintained strong identities as scientists and the discussions provided no evidence that other social factors influenced their application of the scientific method. The second major finding dealt with the role participants perceived their institutions playing in their involvement with NSF. All participants described challenges associated with pursuing research in HBCU environments and, in some cases, the institutional challenges served as the motivation for participants' projects, with varying consequences. The participants' discussions about their institutions also raised important questions about how well-aligned participants' visions are with the visions of their institutional leadership, regarding how research should be incorporated into the HBCU mission. Finally, this study developed and refined a theoretical framework for explaining the underrepresentation of HBCUs in NSF funding streams. In developing this framework, a brief history of the origination of HBCUs, NSF, and the NSF merit review process is presented.



## **CHAPTER I. INTRODUCTION**

### **Statement of the Problem**

Over the past five years, I have worked with over a dozen faculty members at a handful of mid-Atlantic Historically Black Colleges and Universities (HBCUs) on the development of research grant proposals to the National Science Foundation (NSF). With few exceptions, the faculty proposed activities related to improving educational outcomes for students engaged in higher education science, technology, engineering or mathematics (STEM) learning. The proposed activities took myriad forms - some projects targeted students directly whereas others proposed faculty development activities; some projects focused on implementing evidence-based practices whereas others proposed inquiries into the ways in which students learned – but all were written with a shared fate in mind: undergoing the NSF merit review process.

Much of my time spent on these activities overlapped with my PhD studies, and as my skills and awareness of research and evaluation developed, I began to recognize that my perception of how some of the faculty members approached NSF projects was often not aligned with my own approach to these projects. I most frequently engaged in these activities as the external evaluator for the proposed project, working closely with the STEM faculty member who intended to serve as the project's Principal Investigator (PI). In the early stages of proposal development, I often served the STEM faculty member as a resource for how to formulate and conduct educational research. My duties largely involved helping articulate program theory and

identifying and addressing threats to the internal validity of proposed interventions. Eventually, I came to believe my professional contribution to the preparation of the project's proposal involved subjecting the proposed activities to sufficient critique to help ensure the project rests atop a sound and rigorously-developed foundation. The need for this critique was never surprising. Peer review is an essential part of research development and the practice of science. It is also expecting a great deal of a STEM researcher to be well-versed both in their discipline *and* in the nuances of educational measurement and research. However, the process of critique frequently led to a particular discussion with PIs that did surprise me: *what does the National Science Foundation mean by intellectual merit?*

All NSF proposals are evaluated against two sets of criteria: intellectual merit and broader impacts. I discuss the criteria in more depth in Chapter 2, but briefly: the former provides criteria for judging the proposed project's potential to advance knowledge, while the latter considers the degree to which a proposal supports NSF efforts to address greater societal issues (National Science Foundation, 2016d). Discussions with PIs about the broader impacts criteria tended to be less contentious. The projects were to take place on HBCU campuses, and any positive outcomes related to the projects would likely impact Black students. Hence, the projects' contributions to broadening participation in STEM – an important aspect of the broader impacts criteria - were usually readily apparent.

Intellectual merit, however, tended to be more difficult to agree upon. I interpret both merit review criteria as being in the service of a greater STEM-related community. To me, the intellectual merit of STEM education projects relates to the abilities of those projects to generate relevant knowledge that can be generalized, transferred, or otherwise rendered useful to others participating in the STEM education enterprise. But often, I understood the PIs with whom I

worked to view their projects through a much more local lens. They seemed concerned more with student outcomes (e.g., persistence or graduation rates and correlates like participation in undergraduate research opportunities) or with the programmatic details. Often, they spoke of intellectual merit in terms of intellectual gains for the students they served. The project's potential to advance STEM education, as a field, was usually seen as a secondary benefit, as opposed to the project's primary purpose.

Through a process of reflection and an inquiry conducted as part of a class project, I came to see how this might be a rational approach for HBCU STEM faculty. While I never attended an HBCU, I am deeply familiar with the culture at two of these institutions and have seen firsthand how caring an environment HBCUs can provide for students. Some HBCUs even incorporate the provision of a nurturing environment for students into their mission statements<sup>1</sup>. Therefore, I don't find it surprising to see faculty's concern for students expressed through every stage of the grant development process. Similarly, the institutional obstacles HBCU STEM faculty regularly face (i.e., limited time, limited resources, and limited administrative understanding of the resources STEM research and education require) may lead them to propose projects better adapted to withstanding the rigors of their institutional environments than the rigors of scientific scrutiny.

The question of how higher education faculty go about developing and proposing grant-funded research has not been extensively studied, and little scholarship exists on the relationship between federal funding agencies, their reviewers, and the higher education faculty who pursue grant funding. Nevertheless, the power asymmetries inherent in the funder-fundee relationship

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<sup>1</sup> See for instance, *Virginia Union University Strategic Plan: 2012-2015*, accessible at: <http://www.vuu.edu/sites/www/Uploads/files/VUUStrategicPlan20122017.pdf>

are readily apparent, and it is clear that misaligned expectations of the relationship can have non-trivial consequences for potential PIs. If reviewers and the PI have different evaluation criteria in mind, the PI's proposal will likely be scored low and rejected. Further, if the reviewers fail to recognize that the PI has prepared the proposal to a different set of criteria, the reviewers may respond with misaligned or misguided feedback that hampers the PI's ability to revise and resubmit the proposal. This study therefore sought to address the large gaps in knowledge concerning the relationship between higher education faculty and funding agencies by examining how Black HBCU STEM faculty develop and propose NSF-funded research projects.

### **Significance of Problem**

As a group, HBCUs offer a compelling case to study, in that they excel at producing Black STEM graduates, yet remain underrepresented in the federal funding streams intended to support STEM research and STEM education research. Improving the understanding of how HBCU STEM faculty understand their position in the NSF research grant enterprise – both in the context of STEM education and particular STEM disciplines – represents an important step in redressing HBCUs' marginalized participation in these aspects of the STEM enterprise.

### **HBCUs' Success in Addressing National Concerns about STEM Diversity**

Since the 1940s, the highest levels of federal policymaking have been influenced by an understanding that developing talent to support the STEM workforce is critical to ensuring national security and the economic and environmental well-being of the United States and its citizenry (Blanpied, 1998; Bush, 1945). The call for supporting domestic STEM workforce development has only intensified in recent years as advancements in information technology have globalized human capital markets and shifted jobs, wealth, and technological prowess from the United States to other countries (Augustine, 2005). Further, STEM research and development

is widely recognized as enabling the development of quality jobs and STEM education is seen as a means of ensuring Americans maintain access to those quality jobs (Augustine et al., 2007). To that end, wide-reaching policies such as the America COMPETES Act and American Recovery and Reinvestment Act emerged in the first decade of the 21<sup>st</sup> century to bolster STEM research and development spending and promote STEM education (Augustine et al., 2010).

Despite these efforts to widen the pipeline to STEM careers, recent estimates predict that meeting STEM workforce demands will require awarding one million more STEM degrees than previously anticipated (President's Council of Advisors on Science and Technology, 2012). Worryingly, significant portions of the US population that could be drawn upon to help address the deficit remain steadfastly underrepresented in the STEM workforce. Black Americans, for instance, comprised 13.1% of the US population aged 18-64 in 2013 (U.S. Census Bureau, 2014), but only 4.8% of scientists and engineers employed in science and engineering fields that year (National Science Foundation, 2015b, Table 9-6). Holding all else constant, over 542,000 additional scientists and engineers would have been added to the workforce that year if Black scientists and engineers had been represented at rates commensurate with Black representation in the U.S. population.

While boosting the percentage of Black scientists and engineers to representative levels would make a significant contribution to addressing projected shortfalls within the STEM workforce, doing so remains a challenge. In 2013, raising the representation of Blacks in the science and engineering workforce to 13.1% would have required adding two additional Black scientists and engineers to the STEM workforce for every Black scientist and engineer employed that year. However, postsecondary STEM education is far from able to meet such demands. National Center for Education Statistics (NCES) Integrated Postsecondary Education Data

Table 1

*Fall enrollment at all four-year degree-granting Institutions of Higher Education (IHE) comparing all majors to STEM majors.*

Year	Total Enrollment			STEM Enrollment		
	All undergrads	Black or African American	% Black or African American	All undergrads	Black or African American	% Black or African American
2004	8,456,032	971,514	11.5%	907,052	79,138	8.7%
2006	8,816,799	1,027,579	11.7%	960,811	87,070	9.1%
2008	9,417,766	1,151,108	12.2%	1,050,046	91,001	8.7%
2010	10,243,455	1,326,294	12.9%	1,178,627	100,054	8.5%
2012	10,298,627	1,337,913	13.0%	1,299,705	105,661	8.1%

System (IPEDS)<sup>2</sup> data suggest that, while the percentage of Black students in the undergraduate student population has grown to nearly representative levels<sup>3</sup> in recent years, STEM majors have not kept pace with these enrollment trends, Table 1. Further, despite little difference in the aggregate rates at which Black and White freshmen report an intention to major in science and engineering fields<sup>4</sup>, Table 2 shows that only 5.6% of the 872,652 bachelor’s degrees in STEM fields awarded between 2010 and 2013 ultimately went to Black recipients (National Science Foundation, 2015b). This supports the notion of a leaky STEM pipeline

<sup>2</sup> NCES data on student enrollment presented throughout this chapter were downloaded from <http://nces.ed.gov/ipeds/> in November, 2015.

<sup>3</sup> According to ACS 5-year estimates, 15.4% of the population aged 18-24 reported being Black or African American, alone in 2013.

<sup>4</sup> According to Table 2-8 of the 2015 Women, Minorities, and Persons with Disabilities in Science and Engineering Digest, 36.4% of Black first-year students and 37.0% of White first-year students intended to major in a science and engineering (S&E) field in 2014. However, the conclusion that Black and White first-year students show similar interest in STEM is presented with the caveat that it masks the role of gender. White women intended to pursue S&E fields at much lower rates (35.3%) than White males (44.0%), suggesting a more substantial difference between interest in STEM between Black first-year students and White male first-year students.

Table 2

*Bachelor’s degrees awarded at all four-year degree-granting Institutions of Higher Education (IHE) comparing all majors to STEM majors.*

Year	Total Bachelor’s Degrees Awarded			STEM Bachelor’s Degrees Awarded		
	All graduates	Black or African American	% Black or African American	All graduates	Black or African American	% Black or African American
2010	1,666,287	151,916	9.1%	200,802	11,351	5.7%
2011	1,733,889	160,630	9.3%	209,898	11,591	5.5%
2012	1,813,798	173,300	9.6%	224,635	12,382	5.5%
2013	1,863,487	179,769	9.6%	237,317	13,165	5.5%

commonly discussed in STEM education literature (for instance, Allen-Ramdiel & Campbell, 2014).

While the higher education community, on the whole, has had difficulty increasing Black participation in STEM, HBCUs have long made a disproportionately positive contribution to diversity in STEM fields. Eighty-nine (89, 2.7%) of the 3,240 four-year, degree-granting institutions of higher education in the 2012 IPEDS database were HBCUs, and total HBCU undergraduate enrollments were reflective of this proportion: Table 3 shows that, between 2004 and 2012, HBCUs enrolled an average of 2.5% of all degree-seeking undergraduate students at four-year institutions each year. Among degree-seeking undergraduates enrolled in Biological Sciences/Life Sciences, Mathematics, Physical Science, or Engineering majors (STEM majors), HBCUs enrolled a marginally higher percentage of students, averaging 2.9% of all degree-seeking undergraduates. However, much larger differences in representation become apparent when considering only Black undergraduate enrollment. Table 4 shows that, despite declining trends of enrollment, HBCUs enrolled an average of 17.7% of all Black degree-seeking undergraduate students annually during the same period, and 29.5% of Black undergraduates

Table 3

*Fall undergraduate enrollment at all four-year degree granting Institutions of Higher Education (IHE) and Historically Black Colleges and Universities (HBCUs), comparing total enrollment to enrollment in STEM majors.*

Year	Total Fall Enrollment			Fall Enrollment in STEM Majors		
	All IHEs	HBCUs	% at HBCUs	All IHEs	HBCUs	% at HBCUs
2004	8,456,032	234,097	2.8%	907,052	29,278	3.2%
2006	8,816,799	230,727	2.6%	960,811	30,081	3.1%
2008	9,417,766	233,263	2.5%	1,050,046	31,459	3.0%
2010	10,243,455	239,875	2.3%	1,178,627	33,268	2.8%
2012	10,298,627	229,700	2.2%	1,299,705	33,598	2.6%

Table 4

*Fall undergraduate enrollment of Black and African American students at all four-year degree-granting Institutions of Higher Education (IHE) and Historically Black Colleges and Universities (HBCUs), comparing total enrollment to enrollment in STEM majors.*

Year	Total Fall Enrollment			Fall Enrollment in STEM Majors		
	All IHEs	HBCUs	% at HBCUs	All IHEs	HBCUs	% at HBCUs
2004	971,514	206,441	21.2%	79,138	25,852	32.7%
2006	1,027,579	201,727	19.6%	87,070	25,906	29.8%
2008	1,151,108	202,142	17.6%	91,001	26,848	29.5%
2010	1,326,294	206,778	15.6%	100,054	28,725	28.7%
2012	1,337,913	194,791	14.6%	105,661	28,488	27.0%

majoring in STEM fields. In summary, these 89 schools serviced less than 3% of the total undergraduate enrollment between 2004 and 2012, but their enrollments accounted for approximately 29% of all Black undergraduates who had declared STEM majors during that time.

Similar trends are apparent in degrees awarded. Across all of higher education, Black graduates are significantly underrepresented among STEM completers and STEM degrees are



Table 5

*Bachelor’s degrees awarded to Black and African American students at all four-year degree-granting Institutions of Higher Education (IHE) and Historically Black Colleges and Universities (HBCUs), comparing all majors to STEM majors.*

Year	Total Bachelor’s Degrees Awarded			STEM Bachelor’s Degrees Awarded		
	All IHEs	HBCUs	% HBCUs	All IHEs	HBCUs	% HBCUs
2010	151,916	26,897	17.7%	11,351	3,162	27.9%
2011	160,630	27,539	17.1%	11,591	3,205	27.7%
2012	173,300	28,944	16.7%	12,382	3,310	26.7%
2013	179,769	28,277	15.7%	13,165	3,415	25.9%

less prevalent within the pool of Black graduates; at HBCUs, the opposite is true. Between 2010 and 2013, 5.6% of all Bachelor’s degrees awarded in Biological Sciences/Life Sciences, Mathematics, Physical Science, or Engineering majors went to Black students, whereas 10.0% of Bachelor’s degrees in all other fields were awarded to Black students, Table 2. Black completers were also less likely, overall, to receive their degree in a STEM major: 12.3% of all Bachelor’s degrees awarded by four-year IHEs from 2010 to 2013 were in STEM majors, whereas only 7.3% of Bachelor’s degrees awarded to Black students were in STEM majors. However, during the same period, 11.7% of Bachelor’s degrees HBCUs awarded to Black students were in STEM majors. Further, comparing Table 1 and Table 5 shows HBCUs – which accounted for less than a tenth of Black undergraduate enrollment in STEM - were responsible for more than a quarter (27%) of all degrees awarded to Blacks in these STEM fields between 2010 and 2013.

**Concerns about HBCU Participation in STEM Research and STEM Education Research**

Despite their success in contributing to the diversity of the STEM workforce, HBCUs play a much more limited role in other aspects of the STEM enterprise. The relative importance of STEM education to HBCUs – STEM enrollment accounted for 14.6% of Fall 2012 undergraduate enrollment at HBCUs, vs. 12.6% at non-HBCUs – might imply HBCUs would be

heavily engaged in STEM research as a means of supporting undergraduate STEM education. However, there is evidence HBCUs are not well-represented within federal funding streams that support STEM research and STEM education research at institutions of higher education. In FY 2013, HBCUs received 3.7% of the \$36 billion in federal funding awarded to institutions of higher education for activities other than student financial assistance (U.S. Department of Education, 2015), but only 1.3% of the \$29 billion in federal obligations to support science and engineering at colleges and universities (National Science Foundation, 2015a). HBCUs represented just 1.7% of all FY 2013 NSF obligations - with the average award size for HBCUs only 25.7% that of the average non-HBCU award<sup>5</sup> - and HBCUs accounted for 0.8% of both federal and NSF obligations earmarked for science and engineering *research and development* activities at colleges and universities.<sup>6</sup>

HBCUs' success in educating Black students in STEM fields also suggests these schools have developed and utilize a body of knowledge concerning how to effectively educate Black students in these fields; however, there is little evidence of efforts to articulate that knowledge and share it within the academic journals most valued by the majority of the STEM community. HBCUs are largely absent from the scholarly discussion on how to best address the disparate educational outcomes of Black students in higher education STEM fields: in recently reviewing a random sample of 39 (approximately 25%) citations from the year 2014 from *Journal of Engineering Education*, *CBE – Life Sciences Education*, and *Physical Review Special Topics –*

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<sup>5</sup> The 5% trimmed mean is compared here to reduce the impact of the largest (\$100+ million) awards to non-HBCU institutions.

<sup>6</sup> FY2014 data is also available for all categories except total federal funding to IHEs. HBCU shares of federal obligations increased by less than .15% in each category from FY2013 to FY2014.

*Physics Education Research*, I found only one article with authors affiliated with an HBCU. At the time of review (Fall, 2015) these three journals held the highest impact factor among all peer-reviewed, American STEM education journals.

Increasing federal funding to support STEM research and STEM education research at HBCUs may be vital to the continued existence of these schools. Such funding could be used to better support STEM education programs and ward off worrisome trends within the STEM (and general) enrollment data. While the data discussed above suggest HBCUs make a disproportionately positive contribution to the production of Black talent, they also show that HBCUs have not shared in recent gains in Black undergraduate enrollment seen throughout higher education. Declining Black student enrollment poses an existential threat to HBCUs, as enrollment and graduation statistics are among the few justifications able to withstand scrutiny from detractors who question the need for HBCUs in a post-civil rights era (e.g., Wenglinsky, 1996). Greater participation in STEM research might also lend HBCUs greater legitimacy in the eyes of detractors who continue to question the purpose and value of HBCUs. Finally, findings from STEM education research conducted at HBCUs might lead to interventions better adapted for implementation at other HBCUs and also prove informative to majority-serving institutions seeking ways to provide more inclusive STEM education programs.

### **Statement of Purpose**

This study sheds light on how an underrepresented and understudied population within higher education interacts with the NSF research grant enterprise. It also provides insight into how the perceptions, beliefs, and actions of HBCU faculty are shaped by the culture of those institutions. In-depth inquiries into the experiences of HBCU faculty are relatively scarce in the literature, and future researchers may find this study useful when comparing and contrasting the

experiences of Black and/or non-Black faculty at HBCUs and/or other institutions of higher education. Similarly, future work may build upon this inquiry by exploring the diversity of experiences *within* HBCUs. Such work might be greatly beneficial to efforts to remedy the otherwise monolithic-treatment of HBCUs in scholarly literature (Brown, 2003; Brown & Freeman, 2002). Finally, despite its importance to research in higher education, studies examining the grants enterprise are scarce, and before conducting this study, I had not encountered a published inquiry into how higher education faculty approach or interpret the peer-review process when applying for research grants.

This work was influenced heavily by critical race theory (CRT), and particularly by the efforts of this body of scholarship to add necessary context to situations in which the supposed objectivity of positivist methods might otherwise work to marginalize certain racial subgroups (Ladson-Billings, 1998). CRT's sensitivity to interest-convergence (Bell, 1980; S. R. Harper, Patton, & Wooden, 2009) also motivates me to explicitly state that I do not endorse the use of the work or its findings as part of efforts to further marginalize the contributions of Black HBCU STEM faculty. This inquiry is not intended to support efforts to alter the ways Black STEM faculty approach grant development or develop interventions that strip away anything that might be considered a unique influence of HBCU environments. Rather, this inquiry aims to better inform NSF personnel of how Black STEM faculty at HBCUs experience the research grant development process and understand the nature of their relationships with NSF. Broadening participation of underrepresented populations is important to NSF, and this study may suggest ways in which NSF can enhance broadening participation efforts by adopting a more expansive, inviting, and inclusive approach to funding science.

## **Research Questions**

This inquiry explored the ways in which HBCU STEM faculty participants interacted with NSF and the STEM enterprise, in general. However, the way in which the study ultimately explored this interaction changed as the study progressed. The study was originally proposed as focusing on the NSF research grant development processes of HBCU STEM faculty. I intended for the study to advance understanding of how HBCU STEM faculty assessed the merit of their proposed STEM and STEM education research projects and how they interpreted the NSF merit review criteria. The inquiry was also to consider whether there were institutional factors unique to HBCUs that affected the way in which the faculty approached their projects and what consequences these influences may have had on their experiences with NSF merit review.

In exploring the ways in which HBCU STEM faculty approached the development and proposal of NSF-funded research projects, I proposed the following guiding research questions:

1. What criteria do participants consider when developing research proposals to the National Science Foundation?
2. How do participants interpret National Science Foundation merit review criteria?
3. What - if any - aspects unique to HBCU environments impact the manner in which participants prepare their NSF grant proposals?

However, as the study progressed, it became apparent that understanding how and why participants wrote proposals to NSF required first understanding their motivations and interests as scientists. It also required understanding the challenges they faced at the institutions they had found themselves drawn to. As discussed at the beginning of Chapter 4, I came to understand that this study had answered a broader research question: What factors are important to participants' understandings of their relationships with the National Science Foundation?

## **Summary of Study**

There is little scholarly literature examining the ways in which higher education faculty experience the grant writing and review processes. Therefore, much of the literature review for this inquiry was devoted to constructing a conceptual framework that articulates my constructed understanding of how HBCU STEM faculty interact with the NSF merit review process. This framework guided the study while also justifying the legitimacy and significance of the research questions posed in this work. The conceptual framework adopted the marginalization of Black education in the United States as a starting point and then developed three potential theories to explain why HBCU faculty were underrepresented participants in NSF-funded activities. An overview of NSF's origins and its merit review process is provided to orient the reader to the landscape of federal grant funding of STEM and STEM education research. A history of HBCUs and an examination of how racism has impacted their development is also presented to provide necessary context for understanding the development of the theories at work in the conceptual framework.

In this study, I interviewed eight Black HBCU STEM faculty members with a range of involvement in NSF-related activities. Topics of discussion with participants included their prior experiences with NSF, their understanding of the merit review process, and their understanding of their personal and institutional relationships with NSF and the STEM community. Two broad findings emerged from the conversations. The first was that communities and social identity were important to the participants' work as research scientists. The second was that their institutional environments played significant roles in their NSF research grant procurement efforts. These findings are discussed in depth in Chapter 4. Individual cases are also examined as part of this discussion. The theoretical framework posed in Chapter 2 is revisited in light of the

study findings in Chapter 5. The findings also serve as the basis for recommended actions NSF can take to increase HBCU faculty participation and funding. These recommendations, along with recommendations for future research, are presented in Chapter 5.

## **CHAPTER II. CONCEPTUAL FRAMEWORK**

### **Introduction**

In the course of reviewing literature, I encountered little exploration of the ways in which postsecondary faculty researchers experience the process of pursuing research grant funding or interpret funder guidelines. Similarly, I found little empirical scholarship dealing with the potential impacts of HBCU culture on HBCU participation in STEM research vis-à-vis faculty pursuing research funding. Without a strong line of previous literature to establish a way forward, this study necessarily became exploratory in nature.

This chapter provides a conceptual framework to help guide that exploration. The framework articulates my system of assumptions, expectations, beliefs, and theories and presents my constructed understanding of how Black HBCU STEM faculty interact with NSF (Finlay, 2002; Maxwell, 2013) prior to entering the field. In summary, the conceptual framework adopts the historical marginalization of Black Americans and Black education as a central premise and postulates three plausible theories that might explain why HBCUs are disproportionately underfunded by NSF:

- HBCU faculty and NSF reviewers have similar conceptualizations of how NSF grant proposals should be evaluated, but HBCU faculty produce objectively poorer grant proposals than other proposers as a legacy of marginalized Black education;
- HBCU faculty and NSF reviewers have similar conceptualizations of how NSF grant



proposals should be evaluated, but reviewers' scores are biased by racism directed either at HBCUs or PIs from HBCUs; and/or

- HBCU faculty and NSF reviewers differ in their views on how NSF grant proposals should be evaluated and HBCU faculty's views are marginalized in the peer review process resulting in lower scores for HBCU PIs.

This study sought to engage Black HBCU STEM faculty to help refine, prune, or expand this rudimentary theoretical framework using their experiences proposing NSF grants as a guide.

This chapter uses empirical evidence and theoretical justification from relevant literature to develop the conceptual framework. The chapter begins by orienting the reader to the landscape of federal STEM research and education funding and establishing the critical role of scientific peer review within that enterprise. As the chapter proceeds, scientific peer review is progressively developed: first it is treated in an idealized manner as part of an objective, disinterested approach to knowledge development. Here, a brief history of the marginalization of Black higher education is presented, and the legacy of this marginalization is considered as a means of explaining how HBCU faculty might underperform in a fair, racially-blind review system. Next, peer review is conceptualized as occurring at the bounds of science and politics. Politics mandate NSF reviewers consider social concerns in their judgments of proposals, and in doing so, may invite the racial-bias present in society into those judgments. Finally, peer review is viewed as occurring at the bounds of differing interpretations of NSF's mission and approach to evaluating proposals. Empirical evidence suggesting close ties between race-based service and the STEM identities of Black scientists is discussed as a guiding illustration for how HBCU faculty might come to judge the merit of scientific endeavors in ways that don't align with popular conceptions of science. The position of Black scientists at the margins of the scientific

community is then considered as a potential explanation for why their interpretations and approaches may not be valued by dominant members of the scientific community.

### **Origins of the National Science Foundation and Merit Review**

For the past 60 years, STEM research and STEM education at institutions of higher education have been closely tied to sources of government funding. While the federal government began a sharp expansion of services in the 1930s as a response to the Great Depression, it was World War II that prompted increased government involvement in technological research and development. The advancements in engineering and physical sciences that supported the war effort highlighted the role technology played in ensuring national security, and basic and applied scientific research were recognized as vital to the development of future technologies (Mazuzan, 1994). To policymakers of the day, publicly and privately supported colleges and universities were “uniquely qualified” to become the centers at which such research could be conducted. Institutions of higher education were free from the pressures of “convention, prejudice, or commercial necessity,” that limited such research in industry and direct support of scientists at these institutions was therefore in best interests of the nation (Bush, 1945). As a result, the resulting postwar push to increase US technology infrastructure was operationalized as a system of government financial support to increase research opportunities and provide sufficient compensation to attract talent from industry and into university research positions. In return, university researchers would hold the dual responsibilities of publicly disseminating their research results while training the next generations of scientists and engineers (Lane, 2008).

The National Science Foundation is one of several federal organizations that arose from this push. The National Science Foundation Act of 1950 established the foundation (consisting of a director and a National Science Board) with a mandate to support basic research in non-nuclear

science and engineering disciplines, provide scholarships for students in science and engineering, and foster a national policy for promoting research and education in the sciences. NSF's scope has changed since its founding in response to shifts in legal, funding, and technological climates (Mazuzan, 1992), and currently, NSF supports research in all non-medical fields of fundamental science and engineering (National Science Foundation, n.d.). NSF also invests in research related to education in those fields. This includes both basic research into STEM-related learning and cognition as well as the development of approaches, technologies, and materials for teaching STEM in formal (K-12 and postsecondary) and informal environments (U.S. Department of Education, 2013).

The first NSF officials elected to provide funding through grant mechanisms – as opposed to contracts - as a means to efficiently support basic, (i.e., open-ended) research (Mazuzan, 1992; Rothenberg, 2010) while protecting the interests of the scientific community. Federal contracts, which commit researchers to delivering a predetermined product in return for funding, were seen as serving the interests of the funder, while grants were seen as more supportive of the academic freedom of researchers and the scientific community (Mazuzan, 1992) and better protected against the dangers of indirect control and “too strict adherence to scientific ‘orthodoxy’”(Government Printing Office, 1952, p. vii). Accordingly, grant funding provides PIs a higher degree of flexibility and control: the NSF Grant Proposal Guide (2014) explains that grants are intended for situations requiring "minimal NSF involvement" (pp. II-3 – II-4), and the Principal Investigator (PI) and host organization are solely responsible for accomplishing project objectives and managing project funds.

NSF issues grant awards primarily at the program level, the smallest unit within the hierarchy of directorates, divisions, and programs. NSF officials at the program level – i.e.,

program officers – are also responsible for informing the scientific community of funding opportunities available through the foundation. The means of communication and the expectations for how PIs respond to funding opportunities vary: some programs issue open-ended requests for proposals that align with the general program goals, whereas other programs issue solicitations with deadlines and specific guidelines on what types of proposals should be submitted, what overarching research questions they should examine, and what populations they should study, etc.

The first call for grant proposals was issued in late 1951, and the overwhelming response from the higher education community<sup>7</sup> immediately highlighted the need for a well-designed selection process based on clear selection criteria (Rothenberg, 2010). The NSF grant proposal process continues to be a competitive one, as STEM programs, research activities, and PhD production at universities have all grown substantially over the past 60 years (Howard & Laird, 2013). While NSF currently appropriates almost \$7 billion for research and education activities (National Science Foundation, 2016b), the percentage of proposals funded by NSF stands below 20% for most programs (Howard & Laird, 2013).

### **National Science Foundation Merit Review Criteria**

As of January 2016, all proposals to NSF are evaluated on the basis of two main criteria: intellectual merit and broader impacts. The former "encompasses the [project's] potential to advance knowledge" (National Science Foundation, 2016d, p. III-2), and the latter "encompasses the [project's] potential to benefit society and contribute to the achievement of specific, desired societal outcomes" (III-2). The merit review criteria are published in myriad NSF media

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<sup>7</sup> Grant applicants requested \$13 million in funding in response to the first NSF solicitation. However, NSF's budget only allowed for \$1.1 million of grant funding that year.

(National Science Foundation, 2016d) - including all program solicitations - alongside guidance on how to employ and interpret the criteria. NSF states that both criteria are to be given full consideration and that proposals must address both criteria fully. NSF also provides five questions for reviewers to pose when evaluating a proposal against the criteria. The first question deals with the proposal's potential to meet the two merit criteria and the remaining questions suggest ways to help reviewers answer the first, asking about the originality of the work, the soundness of rationale underpinning the activities, the quality of the personnel, and the availability of resources needed to carry out the proposed work. The merit review criteria are also presented alongside a set of guiding *merit review principles* intended to better articulate the intent of the merit review criteria (National Science Foundation, 2016d, p. III-2). These principles arise directly from NSF's mission of "nurturing and supporting excellence in basic research and education," (III-1) and dictate that all NSF-funded projects must "have the potential to advance...the frontiers of knowledge" and "contribute to achieving broader societal goals" (III-1). The principles also require all funded projects either be assessed and evaluated using appropriate metrics or contribute to an aggregated evaluation of similar programs conducted at the NSF program level. This establishes an expectation of accountability for both grant recipients and program officers.

Proposers are required to respond explicitly to both merit review criteria. All proposals require a one-page summary that describes activities and articulates the intellectual merit and broader impacts of those activities. Additionally, the 15-page project description, which details the work to be undertaken, must include a section describing the broader impacts of the proposed activities in further detail. In providing guidance for preparing this section, NSF advises that projects can accomplish broader impacts either through the primary research efforts of the

project or through activities directly related to that research. NSF also provides proposers examples of what constitutes societally-relevant outcomes for a project, including “full participation of women, persons with disabilities, and underrepresented minorities in STEM,” and improving STEM education and educator development at any level (II-10).

Since its earliest days, NSF has evaluated proposals and made funding decisions in collaboration with the greater scientific community, relying upon the “wise judgment...[of] those most competent and respected in their various fields” (Government Printing Office, 1952, p. vi). This process is referred to as *merit review* (National Science Foundation, 2014)<sup>8</sup>, and while certain aspects have evolved throughout time, the process is structurally unaltered from the early days of NSF. Once a proposal is submitted, program officers are responsible for making a funding recommendation to the division director, who then makes a final funding decision. Program officers – who typically have extensive academic experience in relevant STEM fields – base their recommendations on their own expert review of the proposal along with the input of at least three external peer reviewers. External reviewers are known to and recruited by the program officer on the basis of their expertise in a disciplinary field and ability to help judge the scientific and technical merits of a given proposal. At the program officer’s discretion, opinions are solicited either independently by mailing or transmitting proposals to *ad hoc* reviewers, or in a group setting by bringing multiple reviewers to NSF for panel discussions of groups of proposals (National Science Foundation, 2016d).

### **Scientific Peer Review**

NSF merit review is a multi-level form of peer review; in that it involves the systematic

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<sup>8</sup> NSF provides a detailed description of the merit review process online ([http://www.nsf.gov/bfa/dias/policy/merit\\_review/](http://www.nsf.gov/bfa/dias/policy/merit_review/), accessed April, 2016) and in print (National Science Foundation, 2016d).

use of judges drawn from within a particular discipline to rate the merit of a given work. Peer review is a longstanding<sup>9</sup> evaluative tool utilized in Western conceptualizations of science, and within the grants enterprise, peer review serves as one of multiple means available for allocating scarce resources (namely, money, time, facilities, and the career capital generated by these resources) to potential researchers (Hackett & Chubin, 2003). Within the realm of federal funding of STEM research, the potential merit and soundness of research proposals is typically central to peer review judgments (the potential, experience, or previous success of particular researchers, while important, are not usually the *primary* focus of evaluation) and peer review often operates in highly<sup>9</sup> selective contexts with the intention of weeding out flawed or insignificant work (Berezin, 1998).

The competitive peer review process is generally regarded as key to the success of the nation's federal research enterprise (Lane, 2008), with proponents of peer review pointing to theoretical and empirical evidence that the critical review of peer scientists and engineers is the most effective way of vetting scientific proposals (Bornmann, 2011). However, it is important to consider that peer review does not simply function to render judgments on the merit of scientific proposals, alone. Peer review can be seen as facilitating a rich and complex dialogue within scientific communities, with the evaluative aspects comprising one component of that dialogue. Other important communicative functions enabled by peer review include (Hackett & Chubin, 2003):

- providing proposers feedback and advice from experts to support efforts to refine and improve ideas,

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<sup>9</sup> See Zuckerman and Merton (1971) and Lee, Sugimoto, Zhang and Cronin (2013) for discussions on the origins and institutionalization of peer review in science.

- serving as a “flywheel” that stabilizes research in areas of particular interest to the community while also ensuring resources are awarded in a manner that balances desires for novelty and innovation against concerns about practicality,
- circulating cutting-edge research ideas to key members of a field and signaling to the community when particular areas are to be avoided (in order to prevent duplication of effort) or pursued, and
- functioning as a space that reaffirms the professional authority of experts by excluding the criteria, values, rules, and judgments of those who are not members of the field.

Peer review plays an analogous role in the service of science, in general. The National Research Council (2002) considers the process of subjecting new knowledge claims to the professional scrutiny of peers as one of six guiding principles of science, concluding that the objectivity of science arises from the transparent enforcement of self-regulating norms established within scientific communities. This tenet suggests an ontological stance in which universal standards for objectivity do not exist against which to measure the efforts of individual researchers or the merits of particular methodologies. Rather, terms like “objective” or “scientific” are defined through community consensus, and peer review helps serves as a communication channel through which consensus is negotiated.

In Merton’s (1973) conceptualization of the sociology of science, peer review also provides a means for individual scientists to fulfill their fundamental needs of recognition and acceptance. To Merton, scientists are ultimately motivated by the pursuit of reassurance that “what they know is really so” (p. 339), and scientists can only gain confidence in the merit of their work after it has undergone the critical judgment of other like-minded scientists. Further,



only the most respected members of the scientific community (i.e., those who have been recognized as adhering most closely to the norms of the community) are capable of providing the most valuable forms of reassurance.

Respect within the community is earned by adherence to the norms and standards comprising the “ethos of science,” which Merton (1973)<sup>10</sup> articulates using the four “institutional imperatives”: universalism, communism, disinterestedness, and organized skepticism<sup>11</sup>. The first, universalism, dictates that knowledge stand apart from those who develop it, and that judgment of knowledge claims be made independent of judgments concerning personal, social, or cultural attributes of those making claims. Communism stresses that the collaborative nature of science not only affords, but necessitates, ownership of scientific knowledge by the entire community, since knowledge cannot be advanced if scientists do not disseminate their work and share their discoveries with others. Disinterestedness values the ability to pursue the development of new knowledge without pursuing self-interests or the interests or motives of institutions with non-scientific aims. Finally, organized skepticism demands knowledge claims to be scrutinized at all times. These “standards” for judging knowledge claims – and by extension, those making the judgments - then become a central component of peer review.

In summary, NSF merit review is treated within this conceptual framework as a process that engages various members of the NSF community in a discussion vital to the function of science and the advancement of knowledge through scientific means. Further, NSF merit review is seen as supporting the efforts of the scientific community to objectively scrutinize knowledge

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<sup>10</sup> See Merton (1973), Chapter 13, “The Normative Structure of Science.”

<sup>11</sup> Mulkay (1969) also considers the valuing of originality – which serves as a key component throughout Merton’s sociology - as a normative component of science.

claims in a universal, disinterested manner. Rendering judgments on the merit of proposals is a component of merit review; however, NSF merit review also facilitates a discussion about more philosophical aspects of the process, including the means by which proposals are evaluated and the aims and goals of NSF. The former component will serve as the focus of the first two theories developed within the conceptual framework, and the latter view of NSF merit review will be central to the development of the third theory.

### **HBCUs as Participants in an Idealized Peer Review System**

To the extent NSF's merit review process embodies the "ethos of science" and engages the scientific community in a democratic manner, it could be seen as capable of rendering objective judgments on the quality of scientific proposals that are blind to social biases. Reviewers adhering to principles of universalism and disinterestedness would judge proposals based on the quality of the scientific content, alone, without regard to their race- or gender-based preconceptions of the proposer. Further, communist ideals would encourage reviewers to welcome and value contributions from all members of the scientific community. Such an approach might be blind to race and current social biases; however, it might simultaneously be blind to historical factors that have inhibited the growth of HBCUs and restricted these schools' abilities to build infrastructure necessary to compete for federal STEM funding.

### **The Historical Marginalization of Black Higher Education in the United States**

Historically, efforts to provide equal opportunity for Black Americans to engage in higher education have been hampered by various forms of institutional racism. The enterprise of higher education in the United States predates the nation's 1776 founding by more than a century, but, with a handful of exceptions, it did not become available to the Black populace until after the American Civil War in the 1860s. Further, many of the Black-serving schools that

would eventually be designated HBCUs arose during a period of US history in which Blacks were systematically excluded from participation in the dominant educational system through a doctrine of “separate but equal.” This exclusionary principle - legalized by the 1896 *Plessy v. Ferguson* Supreme Court decision – took precedent from the Second Morrill Act of 1890. The 1890 Morrill Act denied federal matching-funds to support land-grant institutions (established through the Morrill Act of 1862) “where a distinction of race or color is made in the admission of students” (Second Morrill Act, 1890, p. 418); however, it also permitted states the alternative of establishing and maintaining comparable colleges for Black students. In doing so, the Morrill Act established the federal support of Black public higher education as an activity separate from White public higher education and opened the door to a segregated system of education in the Southern states. In response, 17 southern states established 19 public Black colleges rather than open the doors of white-serving institutions of higher education to all citizens (Albritton, 2012; J. M. Lee & Keys, 2013).

Private HBCUs also share a history of marginalization. With little wealth or education, the post-Civil War southern Black community was largely dependent on White philanthropic organizations to support its private institutions of higher education (Anderson, 1988). While these groups provided educational opportunities that would otherwise not have been available to the Black population, the schools they established often reflected the racist and self-vested interests of their benefactors and forced the Black community to cede much control of the direction of their education. Missionary societies recognized the academic and scholarly potential of Blacks and advocated for the liberal education of Black leadership; however, many arguably adopted a paternalistic approach that sought to redress moral and social deficiencies perceived among the newly-freed population and ultimately protect the United States from the

“menace” of uneducated Blacks (Anderson, 1988; Gasman, Lundy-Wagner, Ransom, & Bowman, 2010). The schools the northern missionaries established largely omitted Blacks from the administration and faculty ranks and gave Blacks limited say in the determining the curricula of these schools (Anderson, 1988; S. R. Harper et al., 2009). Nevertheless, the Black intelligentsia these schools created quickly came to be viewed as a threat to Southern status quo, and many missionary schools lost their endowments as a result (B. M. Gordon, 1990). The industrial philanthropists who filled the void as missionary funding waned early in the 20<sup>th</sup> century generally supported segregation and initially promoted vocational training in an effort to maintain a subjugated Black working class (Anderson, 1988; Gasman et al., 2010). While the industrial philanthropic organizations eventually became more progressive and began to support liberal education opportunities for Blacks, they continued to maintain a tight rein on the institutions and ensured the schools’ leadership supported segregationist policies until the mid-20<sup>th</sup> century (Gasman et al., 2010).

### **Financial Ramifications for HBCUs**

Despite provisions in the Morrill acts mandating states match federal funds on a one-to-one basis and distribute those funds to all schools in a “just and equitable” manner (7 US Code § 323), many states never provided equitable funding to their land-grant HBCUs throughout the 19<sup>th</sup> and 20<sup>th</sup> centuries (Allen & Jewell, 2002; Gasman et al., 2010). Conversely, southern White land-grant institutions received disproportionately more state support, which helped many evolve into flagship public institutions (e.g., University of Maryland, College Park, University of Florida, etc.) or premier private institutions (i.e., Massachusetts Institute of Technology, Cornell University (Albritton, 2012). Land-grant HBCUs continue to be chronically underfunded well into the 21<sup>st</sup> century (J. M. Lee & Keys, 2013), with recent evidence suggesting states paid only

50 cents to HBCUs for every dollar of federal funding (B. E. Harper, 2007) and allocated funds to HBCUs at significantly lower per-student rates relative to predominantly white institutions (PWIs) (S. R. Harper et al., 2009).

The legacy of institutional and societal racism that worked to oppress Black education also continues to impact HBCUs' abilities to compete for NSF funding in other ways. Decades of segregationist policies beginning in the late 19<sup>th</sup> century condoned the severe underfunding of Black public education at state and local levels (Payne, 1994), to which HBCUs responded by devoting considerable resources to secondary education and college-preparatory activities (Allen & Jewell, 2002). This compounded the financial difficulties HBCUs faced and likely sapped them of resources that could have otherwise been devoted to scientific research infrastructure. Desegregation of higher education did little to help in this regard, as larger White institutions began to attract high-achieving and affluent Black students away from HBCUs. The resulting shift in enrollment left HBCUs, as a group, with higher concentrations of low-income Black students who are predominantly products of public education systems that continue to face de-facto racial segregation and chronic underfunding (Allen, 1992; Allen & Jewell, 2002).

The modern association of HBCUs with low-income and academically-underserved students continues to place a financial burden on HBCUs. Attending to academically-underserved students requires HBCUs to continue committing valuable resources to remedial education (Allen & Jewell, 2002). Further, low-income students are particularly vulnerable to changes in tuition costs or financial aid availability<sup>12</sup> (B. E. Harper, 2007), restricting HBCUs' ability to raise tuition at the same rate as PWIs (Gasman, 2009). This, combined with less access

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<sup>12</sup> Note that federal assistance for low-income students provided through Pell Grants covered less than half of the typical costs of attending a four-year institution in the early 2000's (B. E. Harper, 2007)

to endowments, resulted in HBCUs suffering during the Great Recession in the first decade of the 21<sup>st</sup> century. Many HBCUs reacted by downsizing faculty and staff, occasionally in ways that damaged institutions' atmospheres of cohesiveness and collegiality (Gasman, 2009). Such downsizing limits the amount of time remaining faculty can devote to research and further reduces the amount of institutional infrastructure available to support pursuing funding opportunities (Coleman & Matthews, 2010). Yet, despite making fewer resources available, HBCUs and accrediting bodies continue to place an ever-increasing emphasis on faculty research productivity without making corresponding decreases in teaching<sup>13</sup> and service expectations (Johnson & Harvey, 2002).

This leads to the first potential theory explaining HBCU's relative lack of NSF funding: **historical marginalization and underfunding of Black education has stunted the development of HBCUs in ways that have left HBCUs without the resources necessary to compete for NSF funding on equal terms with other institutions of higher education.** In this theory, the NSF merit review process is largely fair and devoid of racial bias; however, the limited success of HBCU faculty is related to the lack of resources (including time) to sufficiently support their grant writing efforts.

### **Race and the NSF Merit Review Process**

The principle of universalism embedded in Merton's "ethos of science" suggests scientific peer review can render judgments on the quality of scientific proposals without giving consideration to the characteristics or backgrounds of the individuals who developed the proposals. However, this ideal is troubled by multiple empirical studies suggesting racial- and/or

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<sup>13</sup> Johnson and Harvey (2002) interviewed 17 faculty in the soft sciences and humanities at four diverse HBCUs and reported average teaching loads of four courses (12-16 credit hours) per semester.

gender bias within scientific peer review across a myriad of venues (Bornmann, 2011), including NSF merit review. In 1994, the General Accounting Office (1994) examined the issue of race and NSF merit review by reviewing 100 randomly-selected NSF proposals (50 successful and 50 unsuccessful) to various science directorates. The study found White PIs received scores 20% higher than non-White PIs, on average<sup>14</sup> and that race persisted as an explanatory factor in a regression model predicting proposal scores even after controlling for various aspects of perceived applicant status, applicant age and gender, and proposal budget and duration. The report concluded that, although differences in scores could reliably reflect differences in proposal quality, racial bias (along with gender bias) also posed a plausible explanation.

The NSF director at the time rejected the assertion that racial bias played a role in NSF proposal scoring, stating that “We disagree strongly...with the [GAO report’s] implication that minority applicants generally receive lower scores...” (Burd, 1994), and the issue does not appear to have been extensively revisited since. However, a more recent study of the National Institutes of Health (NIH) peer review process found Black investigators were ten percentage points less likely to receive NIH research funding than White investigators between FY 2000 and FY 2006, even after controlling for applicant educational background, publication record, and employer characteristics (Ginther et al., 2011). When considered alongside studies demonstrating racial bias in simulated hiring decisions (Dovidio & Gaertner, 2000) and peer valuation predictions (Sauer, Thomas-Hunt, & Morris, 2010), the prospect of racial bias within peer review working against Black proposers warrants further consideration.

To understand how racial bias might enter the NSF merit review process, I employ

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<sup>14</sup> The GAO report converted proposal scores to a scale of 1 to 5, with 1 representing the highest score. The mean score for proposals with White PIs was 2.0. The mean score for proposals with non-White PIs was 2.8. Standard deviation was not reported.

Hackett and Chubin's (2003)<sup>15</sup> conceptualization of peer review as a *boundary process* that exists at the intersections of multiple social domains. Specifically, peer review's position at the bounds of science and policy is examined here to highlight the task NSF reviewers face in considering both the interests of the scientific community as well as political interests that have increasingly exerted pressure on NSF to attend to societal concerns. However, forcing reviewers to consider non-scientific, social concerns that lay outside their realms of disciplinary expertise may also invite them to bring their social biases into the review process.

This section provides a brief overview of the evolving relationship between science and policy within NSF to explain how the latter is operationalized in the merit review process and to establish its importance to merit review. This overview will also aid the reader in the subsequent section of this Chapter, which deals more with the broader impacts criteria. The public perception of HBCUs is then considered as a means to understand how reviewers might be influenced to believe proposals from these institutions are weaker.

### **NSF Merit Review at Boundaries of Science, Policy, and Society**

As a political entity within the executive branch of US federal government led by a Presidentially-appointed director, NSF has always existed at the boundary of science and government. However, the relative influence of both domains has shifted drastically throughout NSF's history. Frodeman and Briggie (2012) argue that the men responsible for establishing NSF intended for the organization to leverage its role within the government to facilitate science's ascendancy to a leadership role in relation to policy and society. Believing in a doctrine of "what is good for science is inherently good for society" (p. 6), they expected policy to work to accommodate scientific activity (Blanpied, 1998) and social change to arise naturally as a

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<sup>15</sup> See, also, Chubin and Hackett (1990).



product of NSF's efforts to advance science (Frodeman & Briggie, 2012)<sup>16</sup>. This idealized vision of science alone leading the way never seems to have been fully realized: even in the earliest days of the organization, NSF personnel gave consideration to political and social factors alongside scientific merit when making funding decisions (e.g., the degree to which proposed work contributed to national interests and the potential impact of funding on the fairness of geographic and institutional distribution of funds) (Rothenberg, 2010). Moreover, subsequent decades made it apparent the scientific community's authority to affect social change would not go unchallenged as political influence increasingly worked to question national research interests, challenge conceptualizations of fairness in distributing funds, and define the societal goals NSF would have to consider (Frodeman & Briggie, 2012; Mazuzan, 1992).

More recently, the Government Performance and Results Acts (GPRA) have sought to hold NSF more accountable by enacting legislation requiring federal agencies to articulate strategic goals and report annually on the degree to which those goals were attained using quantifiable measures. Evidence of direct political influence is also apparent in NSF's current funding legislation (America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Reauthorization Act of 2010, 2011), which mandates the agency 1) ensures federally-funded STEM research impacts "problems that are of the utmost importance to society at large" (§ 519, b, p. 35), and 2) applies the broader impact criteria in a manner which achieves eight goals, one of which is the "increased participation of women and underrepresented minorities in STEM" (§526, a, p. 38).

As the socially-relevant criteria used to judge proposals evolved in response to political

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<sup>16</sup> Refer also to Bush's (1945) *Science, the Endless Frontier*.

influence in the decades following the founding of NSF<sup>17</sup>, the agency also increasingly shared the responsibility for evaluating proposals on the basis of these criteria with external reviewers. The “scientific consultants and advisory panels” (Government Printing Office, 1952, p. 16) comprising NSF’s external peer review elements of the 1950s were initially tasked with judging only the proposed project’s scientific merit, the competence of project staff, and whether the project represented an undesired duplication of work in the field. A decade later, reviewers were also asked to consider the educational value of proposed work. As scientific research became more complex and diversified, external reviewers were also increasingly asked to consider the impact of proposals on scientific infrastructure. NSF’s adoption of the “merit review” moniker in 1986 was intended to acknowledge the longstanding inclusion of a wide-range of non-scientific criteria in the peer review process (Rothenberg, 2010), and in 1997 – possibly in response to GPRA and government pressure for increased assessment, accountability, and transparency (Frodeman & Briggles, 2012) - all non-scientific criteria were consolidated under the umbrella term “broader impacts criteria” and formally made part of the external peer review process.

### **Societal Factors Contributing to Bias Against HBCUs**

Current NSF guidelines guarantee social concerns are part of the proposal review process by requiring proposers and reviewers to give full consideration to *both* intellectual merit and broader impacts criteria for all proposals (National Science Foundation, 2016d). Further, race is central to NSF’s politically-mandated social goal of broadening participation in STEM. Therefore, proposers from HBCUs may find the issue of race inescapable when engaging in the NSF merit review process: even proposals with strictly scientific research aims can still be seen as benefiting the institution’s ability to contribute to the pipeline of Black STEM professionals.

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<sup>17</sup> Refer to Rothenberg, 2010 for a history of the merit review criteria from 1950-2007.

In this way, the fact that a proposal comes to NSF *from a HBCU* becomes a salient issue for the reviewer, which then opens the door for the reviewer to make judgments about the proposal on the basis of the institution from which it came.

Proposers from HBCUs may then find themselves fighting against negative NSF reviewer perceptions of HBCUs. As discussed previously, HBCUs arose as a result of longstanding societal efforts in the US to exclude Blacks from higher education opportunities available to Whites, and the racist narratives that rationalized and perpetuated these efforts persist today (Brown, 2013). As a result, the sentiment that HBCUs are inferior – or at least academically less rigorous – remains widespread, as evidenced by the remarks of United States Supreme Court Justice Antonin Scalia in 2015:

There are those who contend that it does not benefit African Americans to - to get them into the University of Texas where they do not do well, as opposed to having them go to a less-advanced school, a less -- a slower-track school where they do well. One of -- one of the briefs pointed out that -- that most of the -- most of the black scientists in this country don't come from schools like the University of Texas. (*Supreme Court, 2015*)

The perception of HBCUs as inferior is aided by the lack of research focusing on these schools. HBCUs are understudied environments, and inquiries undertaken without a full appreciation of the history and culture of Black education have contributed to a fallacious understanding of these schools (Brown, 2003). Along similar lines, the increased association of present-day HBCUs with lower academic performance and financial difficulties can be interpreted as a failure on the part of these schools when examined without regard to the longstanding institutional and societal racism that worked to marginalize Black education. HBCUs' unique success in educating students who have been underserved by other means of education is largely ignored by those questioning the need for HBCUs (e.g., Riley, 2010). Further, misconceptions about HBCUs are propagated by the treatment of HBCUs in literature

and media as a single, homogeneous institutional group (Simms & Bock, 2014). Such treatment facilitates sweeping public generalizations that fail to account for the differences between these schools: for instance, researchers have shown that the failure of individual HBCUs can lead the media to call into question the vitality and purpose of *all* HBCUs (Gasman, 2007).

Given the public perception and limited understanding of HBCUs, peer reviewers who have a cursory understanding of HBCUs based on popular media, political discourse, or anecdotal evidence may be biased in ways that lead them to question the competence and responsibility of HBCU faculty. The possibility of peer reviewers being influenced in such ways should not be readily dismissed in light of evidence that non-meritocratic, institution-level factors (i.e., prestige) associated with the schools from which faculty candidates graduated can predict faculty hiring decisions across a range of disciplines (Clauset, Arbesman, & Larremore, 2015). Also, experiments by Sauer, Thomas-Hunt, and Morris (2010) showed the financial valuation predictions of expert peer reviewers could be influenced by subtle suggestions that a presenter attended an institution with affirmative action recruitment policies, further suggesting that NSF decisions might be influenced by reviewers' perceptions of proposers' home institutions.

More broadly, peer reviewers are drawn from a society that continues to face challenges in viewing the academic potential of Blacks as equal to Whites. The 2008 General Social Survey of approximately 1,500 Americans reported nearly one-quarter of White respondents believed Whites were more intelligent than Blacks (down from over 50% in 1990), and more than 40% of White respondents believed Blacks were lazier than Whites (Bobo, Charles, Krysan, & Simmons, 2012). Similarly, in a 2016 national survey, 52% of Black adults with at least some college education felt someone had treated them as if they weren't smart because of their race or

ethnicity during the prior year (Pew Research Center, 2016).

Finally, while PIs' races/ethnicities are not provided to NSF peer reviewers, this may not be sufficient to protect PIs from racial bias. The GAO report (General Accounting Office, 1994) that found an association between PI race and NSF reviewer scores also acknowledged that withholding demographic information about PIs from reviewers was not sufficient to provide a racial/culturally-blind review process. This is because reviewers may know PIs personally, know PIs by reputation, or be able to glean clues about racial identity from the PI's name, institutional affiliation, or two-page biographical sketch.

This evidence suggests the need to expand the theoretical framework to account for the potential of racial bias operating within the NSF merit review process itself, leading to the second tentative theory: **By opening the door to social and political concerns, NSF may also allow racial bias against Black institutions and/or Black faculty to enter the merit review process and impact judgments on the merit of proposals.** Political influence over NSF mandates reviewers step out of the bounds of their STEM-discipline expertise and also consider how proposals might impact society. In doing so, reviewers are brought face-to-face with issues of race when judging proposals and may render harsher judgments on proposals from HBCUs based on a limited or fallacious understanding of HBCU environments and HBCU faculty.

### **Peer Review at Paradigmatic Boundaries**

To this point, the conceptual framework has assumed both proposers and reviewers hold similar views on the aims of the NSF merit review process and the judgment criteria. However, fundamental disagreements among members engaged in the NSF merit review process may have non-trivial consequences for those seeking funding, and may, in part, explain the underrepresentation of HBCU faculty in NSF funding. In this section, I consider how cultural

orientations toward race-based service and student care might play a role in shaping Black HBCU faculty's approach to NSF merit review in ways that do not meet the expectations of other members of the NSF community.

First, it must be established that there is diversity among the ways in which members of the NSF community approach the merit review process and interpret the merit review criteria. I rely again on Hackett and Chubin's (2003) social boundary process conceptualization of peer review, which also serves as a useful lens for elucidating philosophical differences that may be encountered between reviewers and proposers:

Calling peer review a boundary process...directs attention to the mix of communities, purposes, evidential standards, argumentative procedures, ethical precepts, theoretical frameworks, epistemic cultures, principles of fairness and the like that mingle and collide in the review process. (Hackett & Chubin, 2003, p. 8)

This conceptualization of peer review suggests members of the scientific community may hold differing views on the processes of justifying and evaluating scientific proposals. Further, these differences may arise as a result of each individual's cultural background (both individual and institutional), preparation, and previous life experiences. Accounting for the role of culture in peer review aligns with other scholars' views of knowledge and knowledge production as culturally-bound (E. W. Gordon, Miller, & Rollock, 1990; Scheurich & Young, 1997; Stanfield, 1985). It also raises the possibility that cultural dominance and marginalization play a role in determining whose philosophical views of peer review are seen as legitimate.

This view of peer review extends the conceptual framework by positioning NSF merit review at the boundaries of community interpretations of concepts including NSF's mission, how the merit review criteria should be balanced, or what constitutes "advancing knowledge." On one side of the boundary may be those who envision NSF as pursuing research-intensive projects in a purely "scientific" manner, with societal goals (i.e., broader impacts) derived as a consequence

of the work. On the other side might be those who place relatively greater value on broader impacts or, alternatively, place greater value on ways of advancing knowledge that do not strive to align perfectly with the majority's view of science.

As discussed in the following sections, HBCU STEM faculty work in institutional environments that emphasize student care and may naturally incorporate student-oriented concerns into their approach to NSF grants. As a result, HBCU faculty may focus their projects more on education and student success related activities rather than STEM discipline-specific research. Project goals and objectives may then be viewed as better aligned with NSF's broader impact criteria (particularly the broadening participation aspects) than intellectual merit criteria. However, there is evidence the NSF community, as a whole, places less value of broader impacts, which may make such projects less appealing to reviewers. Alternatively, Black members of the STEM community may interpret "advancing knowledge" in a broader manner that gives consideration to race-based service and Black community values. This interpretation may be unfamiliar to other members of the NSF community and outside the bounds of what is considered "good science." In either case, as a marginalized group, Black HBCU faculty might have a limited voice in re-negotiating the rules of NSF merit review; either placing greater value on broader impact criteria or extending the bounds of intellectual merit. The resulting misalignment between Black HBCU faculty proposers and NSF reviewers may then result in lower scores and lower funding rates for HBCUs.

### **Problematizing a Universal Vision of "Good Science"**

NSF guidelines dictate proposals be judged on their potential to advance knowledge and urge reviewers to consider whether plans for proposed projects are "well-reasoned, well-organized, and based on a sound rationale" (National Science Foundation, 2016d). However,

NSF does not articulate an epistemological or methodological stance that one should adopt when making such judgments. Rather, NSF relies on the proposers' and reviewers' respective disciplinary communities to define those stances and set standards by which proposed approaches to advancing knowledge can be judged. This is intended to empower and support the academic freedom of the scientific communities (Mazuzan, 1992); however, with the exception of education research (U.S. Department of Education, 2013), it is not clear that any disciplinary community has issued extensive guidelines on how to judge the merit of a NSF proposal.

The reliability, and hence validity, of NSF judgments then largely depends on all participants being aware of and agreeing upon a set of implicit norms and standards for their respective communities (Arkes, 2003). However, even in disciplines characterized by high levels of consensus (i.e., "hard" sciences), the particular manner in which NSF reviewers and proposers interpret the merit criteria plays a significant role in the NSF merit review process. Cole, Cole, and Simon (1981) demonstrated this empirically by replicating the NSF merit review process to re-evaluate 150 recently-reviewed proposals submitted to chemical dynamics, economics, and solid-state physics NSF programs in 1977. Mock project officers were selected to recruit experts from relevant fields to serve on mock review panels. When comparing the recommendations of the mock panel to those of the actual NSF panel, the authors determined the mock panel and actual panel would have reversed a substantial number of each other's decisions. Moreover, differences in funding decisions were not limited to proposals near the cut point, as might be expected. Instead, between one-fifth and one-quarter of proposals with NSF scores in the top quintile would not have been funded by the mock review panel. The authors concluded NSF grant funding decisions in the late 1970's were determined by roughly equal combinations of 1) proposal and principal investigator characteristics and 2) "luck of the draw," related to the



selection of reviewers. This “luck” can be conceptualized as the odds that reviewers who agree with a given PI on the merit of a particular proposal are selected from a pool of eligible reviewers that is characterized by diversity of opinion on what constitutes “good science” (p. 885).

Cole, Cole, and Simon’s findings were complicated by a NSF merit review system that, at the time, instructed reviewers to judge proposals based on the merit review criteria they felt were most relevant to the proposal being considered (see, for instance, National Science Foundation, 2010). NSF has since revised the review process in response to questions about the reliability and validity of a process that empowered reviewers to exclude certain criteria (Arkes, 2003). Currently, NSF reviewers and proposers are instructed that proposals must satisfy both merit review criteria, and that neither criteria, alone, is sufficient to justify an award (National Science Foundation, 2016d).

The ways in which reviewers and proposers interpret and apply the merit review criteria under the latest guidance has not been extensively studied; however, a 2011 National Science Board report on the NSF community’s perception of the merit review criteria provides reasons to believe the NSF community, in general, still holds differing views on what constitutes “good science.” After an extensive survey of the NSF community<sup>18</sup>, the report concluded the intellectual merit criteria were “well defined and clearly understood across all [NSF] stakeholder groups” (p. 8). Favorable survey findings along with quotations such as, “Everyone understands the Intellectual Merit criterion because it is a scientific and technical thing,” (p. 40) were

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<sup>18</sup> Surveys were sent to 815 active NSF Program Officers, Division Directors, Deputy Division Directors, and NSF Advisory Committee members, along with 8,000 NSF principal investigators randomly-selected from the pool of 100,509 individuals who had received a decision on at least one NSF research proposal or served as a reviewer between 2009 and 2010 (National Science Board, 2011).

presented as evidence of community-wide agreement on the interpretation of the intellectual merit criteria. However, the report also contained evidence that the interpretation of intellectual merit might be a contested issue between proposers and reviewers. Over a third (35%) of PIs who had never served as NSF reviewers felt “about half” or less of reviewers sufficiently understood the intellectual merit criteria (p. 187), and 22.6% of PIs who *had* served as reviewers responded similarly. Only a quarter of all PI respondents reported feeling that all or almost all of the reviewers had a sufficient understanding of either criteria. These results stood in contrast to the opinions of NSF Officials and Advisory Committee members, which were decidedly more supportive of the reviewers’ understanding of intellectual merit and broader impact criteria (93.4% and 70.2% of respondents indicating reviewers had a “very high,” “high,” or “moderate” understanding of the respective criteria).

The report also concluded that a majority of NSF stakeholders believed intellectual merit was - and should be – weighted more heavily as a review criterion relative to broader impacts (National Science Board, 2011). This follows an apparent tradition of broader impacts constituting a secondary concern within the NSF merit review process<sup>19</sup> (Rothenberg, 2010). However, even here there was evidence of disagreement within the NSF community. In contrast to quotations characterizing broader impact criteria as “mysterious”, “fuzzy,” (National Science Board, 2011, p. 34) or burdensome, several quotations were presented from respondents at small institutions and minority-serving institutions who suggested broader impacts were *more important* than intellectual merit in student-oriented environments. Some respondents even

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<sup>19</sup> As an illustration, the NSF director issued a 1986 staff memorandum in response to the adoption of the “merit review” moniker (a change made to acknowledge NSF had always evaluated proposals using a wide range of scientific and non-scientific criteria) to assure the scientific community that criteria associated with intellectual merit “had always served as the primary criteria for selection of research projects” (Rothenberg, 2010, p. 193).

questioned the appropriateness of intellectual merit in evaluating proposals to scholarship programs NSF offers.

In summary, different approaches to the NSF merit review process can significantly impact judgments on proposals, and it should not be taken for granted that all members of the NSF community approach the merit review process in a similar manner. There is evidence proposers disagree with reviewers' understanding of how to judge whether a project has potential to advance knowledge (i.e., intellectual merit). Also, while the majority of the NSF community places less value on meeting broader impact criteria, proposers from certain institutions find these criteria worthier of pursuit.

### **HBCUs, Service, and STEM**

The 2011 National Science Board report on NSF merit review provides a great deal of insight into how the STEM community, as a whole, perceives the application of NSF's merit review criteria. However, it provides limited understanding of how institutional setting might relate to differences in perception. While HBCUs were visited during the study, the degree to which HBCU researchers are represented in the survey data is not clear. Further, only aggregated survey results are available, making it impossible to examine whether institutional or demographic subgroups have varying perceptions of the merit review criteria.

One clear finding from the study is that the greater NSF community prioritizes intellectual merit over broader impacts as criteria by which to judge proposals. This may prove problematic to HBCUs' engagement in NSF merit review, as there is reason to suspect Black HBCU faculty are inclined to pursue activities that enable them to serve their communities and care for their students. Further, there is evidence Black scientists integrate race-based service into their approach to STEM. As discussed in this section, these acts are intentional and part of a

longstanding tradition within the culture of Black education.

The concept of service is deeply entrenched in HBCU history and has roots in the public debate between Booker T. Washington and W.E.B. Du Bois over the nature of early HBCU curricula. The latter advocated for liberal arts educational opportunities to provide continuing support to the *talented tenth*, Du Bois's description for the small group of educated and gifted leaders capable of uplifting a population recently emerged from enslavement. Du Bois made clear that these leaders should be educated in ways that develop "intelligence, broad sympathy, [and] knowledge of the world that was and is," (p. 33), and placed less emphasis on developing technical skills or pursuing money. It is a message of sacrifice and service (du Bois, 1948), and one that clearly elevates these concepts as virtues worthy of pursuit and necessary to the progression of the Black community.

One of the consequences of the role of service to the Black higher education community may be that HBCUs, as a group, adopt institutional orientations that express concern for students and provide supportive environments that promote the academic achievement and success of Black students (Fleming, 1984; Perna, 2001). While the supportiveness of HBCUs is typically studied from the student perspective, Hirt, Strayhorn, Amelink, and Bennett (2006) provide evidence that HBCU personnel purposefully work to ensure the success of students. In their qualitative study of 70 administrators across 25 HBCUs, the authors found HBCU administrators to have a strong devotion to ensuring student success and a sense of obligation of service to the community. Shaw, Cole, Harris, and Laird's (2012) analysis of the 2009 and 2010 Faculty Survey of Student Engagement also suggested HBCU faculty believed their institutions were more supportive of students than PWI faculty. Theoretically, researchers have employed *othermothering* as a conceptual framework to help explain the supportive relationships that

HBCU faculty (Guiffrida, 2005; Mawhinney, 2011) and HBCU student affairs administrators (Hirt, Amelink, McFeeters, & Strayhorn, 2008) develop toward their students. “Othermothers” refer to the family members, fictive kin, and members of the neighboring community who assist biological mothers with childrearing responsibilities in the Black community (Collins, 2013). Othermothering is a longstanding process in the Black community originating during slavery, and HBCUs are seen as institutionalizing this cultural tendency toward community-based care of children<sup>20</sup>.

Other evidence is consistent with the inference that service is important to Black faculty outside of HBCUs. Bellas and Toutkoushian (1999) examined a sample of 14,000 responses from full time faculty at two- and four-year institutions of higher education to the 1988 National Survey of Postsecondary Faculty and concluded Black faculty devoted a higher percentage of their working time to service activities compared to White faculty. Their analysis also led the authors to conclude “faculty of color may be more responsive than Whites to requests for unpaid work both within and outside their institutions” (p. 378), suggesting Black faculty may prioritize their teaching, research, and service duties in a different manner than White faculty. Chandler and Swanston (2012) also recognized the desire to be role models for students of Color as a perceived benefit of being a faculty member in a small sample of Black nursing students.

**Incorporating service into academic and STEM career goals.** Two qualitative inquiries built upon these statistical studies by exploring ways in which Black faculty and Black scientists merge service to their communities with their professional goals. Gibbs and

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<sup>20</sup> Mawhinney (2011) provides anecdotal insight into the faculty perspective on othermothering through her autoethnographical exploration of the relationships she developed with students as a HBCU faculty member. The maternal role she adopted became so pervasive that she provided personal funds to ensure students had access to a summer bridge program.

Griffin (2013) provided evidence of the importance of service to Black scientists in their primarily qualitative investigation of the process of career-interest formation vis-à-vis the pursuit of academic faculty positions in biomedical science disciplines. The study included 28 biomedical scientists who received their PhDs within a four-year period immediately prior to the study, and nearly half the participants were from racial/ethnic backgrounds typically underrepresented in biomedical sciences. Gibbs and Griffin concluded that personal values were the primary driver for pursuing a faculty career, regardless of racial, ethnic, or gender backgrounds. However, there were sharp differences in what values were expressed across racial/ethnic and gender lines. Whereas males from majority backgrounds valued aspects of intellectual freedom inherent in academic research faculty positions, the female participants and participants of Color discussed more “externally focused values” (p. 718) related to improving the conditions of their respective communities. To the scientists in the latter group, faculty positions afforded the opportunity to conduct research into health issues relevant to communities about which they were concerned. Faculty positions also provided the opportunity to serve as role models that could facilitate the success of future students.

Baez (2000) provided evidence that the focus on service persists among Black higher education faculty in a qualitative study of how 16 faculty of Color (including 11 Black faculty) at a prestigious, predominantly White, research-intensive university understood, experienced, and interacted with the promotion and tenure process. The faculty in this study made clear distinctions between *general service* to their institutions and *race-related service* that the faculty perceived as benefitting their racial or ethnic communities. Baez describes the faculty as feeling “compelled or driven to participate” (p. 374) in the latter in spite of the potential consequences to the careers of faculty who focused more heavily on service than either research or teaching. In

Baez's words, the faculty found race-related service to be significant because of its potential to "represent and advance the interests of traditionally-subordinated social groups" (p. 380).

Significantly, Baez's study also pushes beyond the typical conceptualization of race-related service as a *cultural tax* imposed on faculty of Color by PWIs (see, for instance, Shavers, Butler, & Moore, 2015) by viewing the faculty's pursuit of race-related service as acts of personal agency. Baez considers that faculty of Color may not simply be *forced* into conducting race-related service by institutional systems looking to take advantage of minority faculty; but rather that they *actively choose* to do so to satisfy personal needs and the perceived needs of their racial/ethnic communities. To support this point, Baez highlights several instances of the faculty research participants relating race-related service to choices they actively made as part of negotiating their promotion and tenure processes.

### **Obstacles to Incorporating Service into NSF Activities**

To the extent Black HBCU STEM faculty incorporate service and student concerns into their NSF proposals, they may find themselves in a blind spot arising from a *communicentric bias*, or "tendency to make one's own community the center of the universe and the conceptual frame that constrains all thought" (E. W. Gordon et al., 1990, p. 14), on the part of the greater NSF community. Separate studies conducted by Monahan (1993) and Boyer and Cockreil (1997) highlight how blindness to student-focused criteria might operate in the grants enterprise. Both studies pursued descriptive assessments of the degree to which higher education faculty perceived 15 factors as motivating and 15 factors as obstructive in their research grant writing efforts. All the potentially motivating factors related to the advancement or support of the PI, and the only three motivating items referring to students cast the students in roles supporting the PI's personal work. The only items related to student education activities (i.e., advising students and

teaching loads) were presented as potential barriers to writing grants. If this survey is representative of the scientific academy's views, it suggests students are not given much consideration as motivation to pursue research grants through NSF.

Returning to the conceptualization of peer review as a community dialogue, the HBCU community might be seen as able to negotiate the inclusion of service and concern for students into the NSF merit review process; i.e., the greater NSF community would recognize these concerns as vital to HBCU faculty's views of how to advance knowledge or society and incorporate them accordingly. However, while NSF merit review might facilitate a community dialogue to establish consensus on the aims of NSF research grants, this dialogue occurs in a context of stratified power and the communities engaging in this dialogue do not hold equal stature. The marginalization of Blacks and Black education in greater society may also work to marginalize Black voices in the scientific community's dialogue about what science or NSF's aims *could* be. This may be another consequence of institutional racism, in that there are insufficient numbers of Black scientists to influence the direction of the community.

Alternatively, Black voices in the community dialogue about how to best advance knowledge might be marginalized by epistemological racism (Scheurich & Young, 1997), or a devaluing of schools of thought that don't reinforce the preferred narrative of the culturally dominant community. Racism can exist at an epistemological level because knowledge and knowledge production are both culturally-bound, and as such, most prominently reflect the traits, attitudes, and beliefs of dominant members of a society stratified by socially-constructed power (E. W. Gordon et al., 1990; Scheurich & Young, 1997). Extending this further, Stanfield (1985) argues that empiricism and positivism gained privileged status in modern society not because of an inherent superiority to other ways of knowledge development, but rather because they better



served elites within the social order – first within an expansionist European hegemony, and later within capitalist Western societies – in their efforts to rationalize and reinforce their positions of power. Indeed, science has proven an effective tool for marginalization and oppression<sup>21</sup> throughout US history, and its strong ties with cultural dominance may make it difficult for marginalized cultures to bring forth alternative means of knowledge development as legitimate. This is partly because, by granting science a privileged status among other means of knowledge development, the dominant culture is able to fend off any attempt by marginalized communities to legitimize an alternative means of knowledge development simply by labeling it “unscientific.” This argument may provide an added dimension to any reluctance on the part of the NSF community to accept race-based service or student concern as valuable criteria in judging proposals.

This leads to the third theory to be examined in this study: **Black STEM faculty at HBCUs are inclined to incorporate concerns about service and student well-being into their interactions with NSF; however, their approaches are not well-received by a scientific community that either does not value seemingly “non-scientific” concerns or does not value the contribution of Black scientists, in general.** This theory acknowledges a degree of disagreement exists within the NSF community about how to approach merit review, and that this disagreement may have potentially significant consequences to proposers. It also contends that the ability of peer review to acknowledge the values of Black scientists when considering

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<sup>21</sup> Social science, in particular, provides a means by which members of a dominant community can define groups of “others” in socially meaningful ways (e.g., race, gender, sexual preference, etc.) and selectively measure aspects of those groups in ways that can be interpreted as deviant or deficient when compared to benchmarks established in the dominant community. In this manner, science has a significant role in the oppression and mischaracterization of Black Americans and other non-White races and cultures in the US (E. W. Gordon et al., 1990).

how knowledge should be advanced is impeded by the marginalization of Black Americans at institutional and epistemological levels.

### **Conclusion**

The conceptual framework with which I approached the study adopted the marginalization of Black education as a starting point and considered various ways in which this marginalization might explain the underrepresentation of HBCU faculty as NSF award recipients. In addressing how participants understand their relationships with NSF, this study also seeks evidence to support or falsify the three plausible theories I identified as arising from the conceptual framework. These theories are revisited in Chapter 5 in light of study findings.

## **CHAPTER III. METHODOLOGY**

### **Introduction**

This inquiry employed a qualitative case study methodology (Flyvbjerg, 2011) to explore how Black HBCU STEM faculty members understood their relationships with NSF and the STEM research enterprise. The overall structure of the proposed inquiry followed Maxwell's (2013) interactive research design, which groups key design-related decisions into five interrelated categories: goals, research questions, conceptual framework, methods, and validity. The research goals and questions were discussed in Chapter 1 and the conceptual framework was developed in Chapter 2. This chapter deals with decisions relevant to the methods of participant selection, data collection, and data analysis undertaken in this study. It also gives consideration to the issue of validity. Figure 1 summarizes the five components.

Maxwell's (2013) model of research design advocates for flexibility and interrelatedness between the components and recognizes that the research questions, while central to the design, are not always a fixed "starting point" for the inquiry. I found this approach useful for the study, as it provided freedom to explore interesting and unanticipated avenues. As discussed in Chapter 4, when the study's focus on the NSF merit review process began to feel restrictive in the interviews, the flexible nature of the design allowed me to pursue related topics of conversation the participants found to be more interesting within the interviews. Ultimately, this necessitated a broader research question to improve alignment of all aspects of the study.

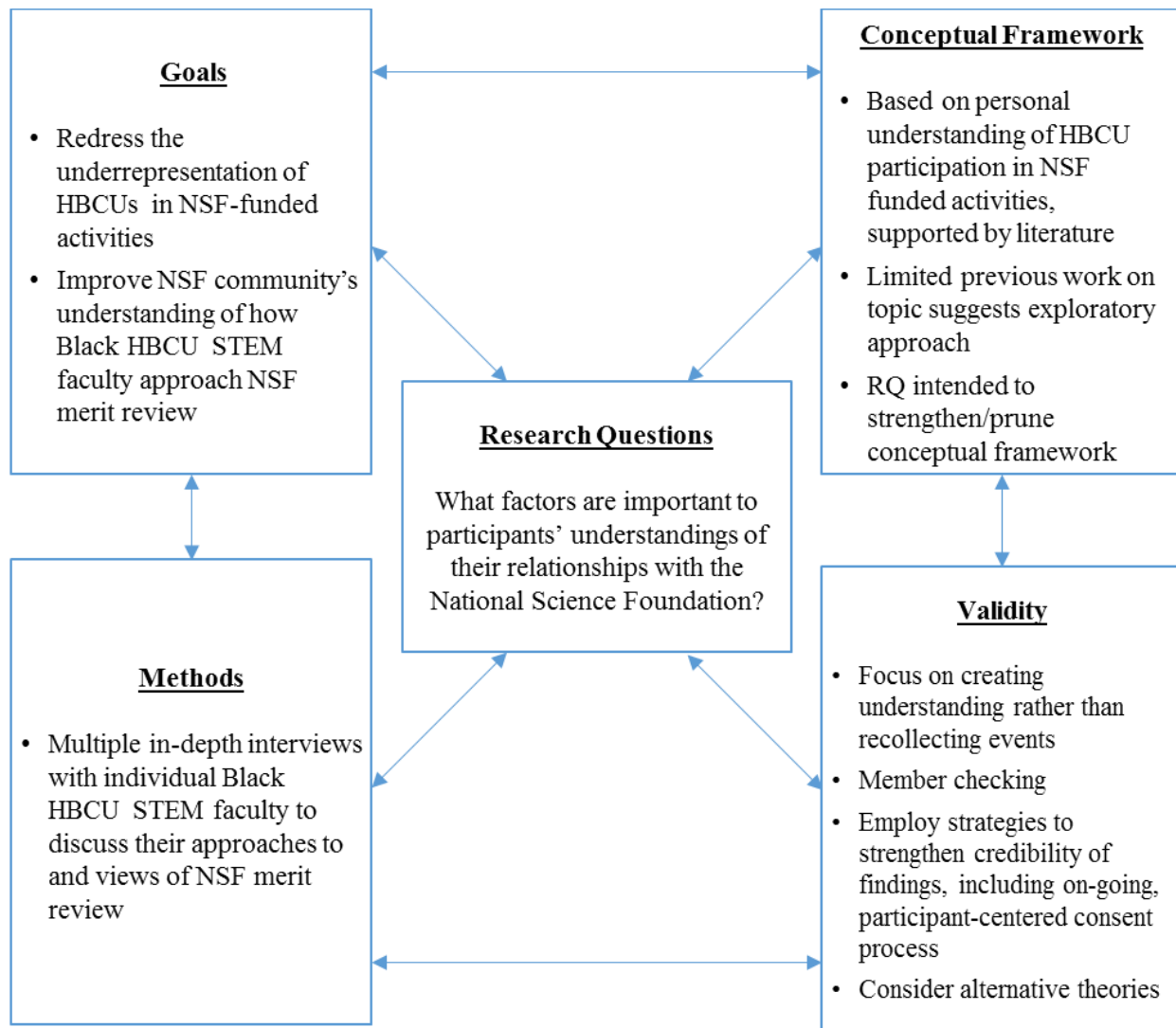


Figure 1. Study design map.

As a final note on the study methodology, I explicitly adopt Flyvbjerg's (2006) stance that social science should not necessarily hold as its most valuable goal the pursuit of predictive theories that attempt to understand human behavior independent of the context in which that behavior takes place. Despite railing against the sentiment when I first read it, I've come to appreciate Flyvbjerg's (2011) claim that, "Social science has...nothing else to offer than concrete, context-dependent knowledge" (p. 301). Further, I am motivated by the works of critical race theorists (Ladson-Billings, 1998) to place the voices, stories, experiences, and

thoughts of people of Color at the center of this work. Accordingly, the proposed methodology places an emphasis on understanding and reconstructing the beliefs and attitudes of the individual participants rather than seeking to make claims that could be generalized to broader populations. Through this work, I hope to present context-rich exemplars useful to others looking to deepen their understanding of how these particular participants interact with NSF and the STEM enterprise.

### **Research Relationships**

I began this inquiry with the understanding that building trusting relationships with research participants would be important to ensuring I was able to gain and maintain access to the field setting (Maxwell, 2013; Yin, 2011). I expected trusting relationships with participants would be necessary in order to 1) resolve concerns HBCU faculty may have participating in the research, and 2) to overcome STEM-social science interdisciplinary barriers. With regards to the former, it was important to note that the proposed work dealt with HBCU faculty's difficulties in procuring NSF funding, and I was concerned participants would find this a sensitive topic for several reasons. They may have perceived the inquiry as primarily focusing on what they or their colleagues were doing "wrong" when writing grant proposals. As HBCU faculty, participants may also have been wary of being misrepresented by researchers not familiar with their institutional environments (Brown, 2003). Participants may have been sensitive to the ways in which social science can misconstrue the experiences of people of Color (E. W. Gordon et al., 1990). Similarly, faculty committed to their institutions may have been reluctant to air dirty laundry to an outsider and unwilling to share certain aspects of their experiences.

I also expected trust would be critical to ensuring the STEM faculty members fully engaged in a social science exercise they may perceive as uncomfortable, tedious, or of little

value to them personally. I intended to engage participants in a critical reflection of their views of science, the evaluation of their NSF proposals, and NSF's merit review process. These discussions would involve questions to which there is no right, wrong, or optimal answer; indeed, I purposefully sought multiple perspectives on particular issues through these discussions (Yin, 2011). As professionals in disciplines known for exhibiting high levels of consensus, STEM faculty may not see value in such discussions (Borrego, 2007)<sup>22</sup>. Further, I was also concerned faculty not accustomed to having their logic and beliefs challenged might find the inquiry process offensive and react in an unexpected manner.

To build trust and encourage full participation, I remained mindful of presenting myself to participants as a credible researcher and articulated my views on how their full participation was valuable and would benefit other HBCUs and Black faculty. I also expected aspects of my identity to facilitate a rudimentary trust between participants and myself – I am a Black male with ties to HBCUs that I believe have imbued me with a sense of empathy and care toward HBCU faculty. As I entered the field, I hoped my appearance, my demeanor, and my way of talking to the participants would naturally help counter their views of me as an outside researcher from a predominantly White institution. However, I remained prepared to address any participant concerns about my trustworthiness by disclosing my personal ties to HBCUs and raising my motivations for the study as a subject for discussion during the interviews, if necessary. I was also prepared to leverage my background in engineering if I felt it would help – as I've transitioned to becoming a researcher in education, I've noticed that my degrees in engineering have granted me a certain legitimacy with some STEM faculty that seem to encourage them to

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<sup>22</sup> This concern was also based on previous conversations I have had with STEM faculty and a recollection of my own engineering mindset as a student a decade prior to this study.

take my education-related questions more seriously.

### **Selection Decisions**

I entered the field assuming all US-born Black HBCU STEM faculty who had recently undertaken the NSF proposal process were capable of making a meaningful contribution to the study. The selection decision to recruit HBCU STEM faculty interested in NSF funding for research aligned with the statement of problem and conceptual framework presented earlier. The decision to require participants be US-born and Black was intended to further align the methods with the theoretical framework under the assumption that participants with these demographic characteristics would be most likely to tap into the culture of service discussed in Chapter 2. Finally, I did not view any metric of success or experience as a grant writer, researcher, or faculty member as affecting the credibility of a participant's understanding of their relationship with either NSF or the NSF merit review process<sup>23</sup>.

Beyond these broad choices, my selection decisions were driven by a desire to find participants who were willing to fully engage in the inquiry and provide the most insight into their approach to the NSF merit review. This approach stood in contrast to one seeking participants representative of any specific, pre-defined subpopulation I might have targeted. When proposing this inquiry, both I and my committee found this approach unsettling, but necessary. I found it difficult to propose selection decisions beyond the broad choices described above. While I could have chosen to focus on a particular institutional type (e.g., research intensive vs. teaching intensive), faculty demographic (e.g., successful vs. unsuccessful grant

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<sup>23</sup> In declaring the personal experiences and understandings of all US-born Black HBCU STEM faculty with experience submitting NSF proposals salient to the development of an overall understanding of the NSF merit review process, I have explicitly assigned all members of this group what Holstein and Gubrium (1995) describe as “narrative competence.”

writers, males vs. females, etc.), or NSF program (e.g., science directorates vs. EHR) I could find no compelling theoretical reason (based in the literature or otherwise) to favor one decision over the other. There were also no obvious “gaps in the literature” to fill, since I had not been able to find any other published work that dealt with the proposed topic. Finally, I was uncertain of how many responses I could expect to my study invitation, and was wary of committing to rejecting any potential participants because they didn’t meet certain preset demographic, disciplinary, or institutional criteria.

While the selection decisions made for this study were limited, they were nevertheless purposeful. The following sections discuss the selection decisions (with expected consequences) regarding the research participants and the institutional environments in which they worked.

### **Institutional setting**

HBCUs are far from a homogenous set of institutions (Blacknall & Johnson, 2011; Brown, 2013; Gasman & Bowman, 2011; Simms & Bock, 2014), so an understanding and description of each participant’s institutional setting provides context necessary for readers to better interpret and utilize study findings. When reporting results, institutions were described in terms of public vs. private status, advanced degree offerings, and enrollment levels. This decision was guided by Simms and Bock (2014), who concluded these factors explained nearly all variability between HBCUs’ average student GPAs, percentages of STEM enrollment, and percentages of degree completion. Additionally, institutional emphasis on research versus learning also appeared to play a role in how faculty approach grant writing and research (Johnson & Harvey, 2002). Therefore, Carnegie research classification was reported for participants’ institutions.

Out of practical concerns, the study was restricted to HBCUs in Virginia, North Carolina,



Table 6

*Comparison of all HBCUs to HBCUs targeted in this study, based on Fall, 2014 data collected from the National Center for Education Statistics Integrated Postsecondary Education Data System (<http://nces.ed.gov/ipeds/>).*

	All HBCUs	Regional HBCUs <sup>1</sup>	Regional % of total
Total number of schools	99	22	22.2
Number of NSF-funded schools <sup>2</sup>	55	15	27.3
Total NSF funding <sup>2</sup>	\$87,893,100	\$33,301,900	37.9
Undergraduate enrollment	256,557	80,413	31.3
Graduate enrollment	37,048	14,893	40.2
<i>Institutional control</i>			
Public	50	9	18.0
Private	49	13	26.5
<i>Highest degree awarded</i>			
Associates	11	0	0
Bachelors	30	3	10.0
Masters	25	4	16.0
Doctoral	33	15	45.5

<sup>1</sup>HBCUs located in Virginia, North Carolina, Maryland, Delaware, and the District of Columbia

<sup>2</sup>FY 2014 Science and engineering obligations only, derived from (National Science Foundation, 2016e)

Maryland, Delaware, and the District of Columbia (i.e., regional HBCUs). Table 6 compares the regional HBCUs to all HBCUs, in terms of control, degree offerings, enrollment, and NSF funding. HBCUs in these states accounted for almost one-quarter of all HBCUs at the time of the study. While the percentage of NSF-funded regional HBCUs was comparable to the overall percentage of NSF-funded HBCUs in FY 2014, the regional HBCUs did receive a higher amount of NSF funding that year (there was not a statistically significant difference in funding between regional and non-regional schools, though). Regional HBCUs also had larger average undergraduate and graduate enrollments, and nearly half of all doctorate-awarding HBCUs – but none of the community college HBCUs – were located in the targeted states (differences in

average enrollment between regional and non-regional HBCUs were statistically significant). Therefore, the sampling frame for the study was more likely to contain larger HBCUs with a greater institutional emphasis on research activities.

### **Faculty Participants**

Eligible participants were US-born, Black faculty members associated with a STEM-related department at an HBCU who submitted a proposal to any NSF program within five years prior to the study. They were asked to be willing and able to discuss their experience with conceptualizing, proposing, implementing, and evaluating their projects. Faculty with whom I had existing relationships were excluded from the study (although two were engaged in pilot testing).

Participants were recruited using a simple sampling scheme from a purposefully-chosen sampling frame (Onwuegbuzie & Collins, 2007). I assembled the initial sampling frame February 1, 2017 by using the NSF award database (<http://www.nsf.gov/awardsearch/>) to search for the names, email addresses, and organizational affiliation of all PIs with active awards or awards that expired after January 1, 2016<sup>24</sup>. Only targeted states were included in the search. The total list of PIs comprised 5,899 entries. I then compiled a list of 22 HBCUs and 1 HBCU-affiliated research center and used Microsoft Excel to filter all non-HBCU organizations from the list of all awards. Once filtered, the list comprised 298 awards to 223 unique PIs. I excluded 28 of the individuals on the basis of previous or ongoing professional and personal relationships and emailed study invitations (Appendix D) to the remaining 195 PIs. I sent reminder invitations ten days after the initial invitation.

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<sup>24</sup> This cutoff date was arbitrarily selected to expand the sampling frame to include potential participants who were not currently active with NSF projects, yet had recent NSF experience.

At the outset, it was difficult to estimate how the community would respond to the invitations. Therefore, several alternate recruitment strategies were planned, including: expanding the sampling frame to include Co-PIs; contacting the Office of Sponsored Programs directors at the regional HBCUs (contact information is typically available on the institutions' websites) to request contact information for faculty who have submitted proposals to NSF in the past five years; leveraging my existing contacts with HBCU faculty and staff at five of the regional HBCUs in hopes they could connect me with peers who would consider participating in the proposed study; and expanding my recruitment efforts to other states. As reported in Chapter 4, I utilized two of these alternate strategies during recruitment. One participant was also recruited through snowball sampling.

The requirement that faculty be US-born and Black posed technical and ethical challenges for the recruitment process. I did not have access to any dataset linking NSF awards and PI's self-identified racial/ethnic backgrounds. Further, I had no desire to impose my racial lens on others by assuming potential participants' races/ethnicities using names, pictures, or other publicly-available information. Therefore, the recruitment strategy relied on participants "opting-in" to the study by self-identifying their race. I clearly stated in recruitment material that the inquiry sought US-born Black STEM faculty, and those interested in participating were routed to an intake survey (Appendix E) that asked them to provide basic background information and confirm their eligibility.

I entered the field intending to recruit between five to ten participants and collect between 10-15 hours of interview data. The final number of participants was determined during the data collection process (Robinson, 2014). After eight interviews, the decision to stop collecting data was made in consultation with the committee chair and another committee member. My

preliminary analysis at that stage suggested several strong themes were present across multiple interviews. It also appeared I had collected a sufficient volume of data to complete the study. Details on the recruitment and selection process are included with the findings in Chapter 4.

### **Data Collection Methods**

Qualitative research relies on multiple methods of data collection to strengthen the credibility and trustworthiness of findings (Yin, 2011) and gain additional information about the topic of inquiry (Maxwell, 2013); to that end, the study employed multiple individual interviews and made extensive use of memos to document my analytical process and any changes I make to the research design throughout the study.

#### **Faculty Interviews**

Data collection relied primarily on 60-90 minute semi-structured individual interviews with participants. Interviews were considered ideal for this study in that they enabled a deep exploration of participants' beliefs, perceptions, and behaviors and allowed participants to reconstruct and make meaning of their own experiences, realities, and cognitive processes in their own words (Brenner, 2006; Holstein & Gubrium, 1995; Yin, 2011). The semi-structured nature of the interviews guided my attempts to answer this project's research questions while better enabling participants to insert their own theories into this work. Interviews took place in private at a location of the participant's choosing (in most cases, their offices on campus). I audiotaped interviews with the full consent and knowledge of each participant. I also encouraged each participant to contact me after the interview if they had any questions or wished to continue discussing relevant issues from the initial interview.

In developing the interview guide, I adopted an approach that was partly deductive and partly inductive (Brenner, 2006). I brought a strong conceptual framework into the data

collection process, however, I did not intend to test, confirm, or falsify any parts of the framework in a straightforward, hypothetical-deductive manner. I intentionally selected interview questions that did not directly invoke the theory to better allow participants to insert their own constructed understanding into the study. However, I remained interested to see if certain topics with which the theory dealt (e.g., race-based marginalization, HBCU faculty commitment to serving students, etc.) arose organically in the conversation. Tracing how these topics emerged - or trying to understand why they didn't emerge as expected –became part of the data analysis. I also took advantage of the opportunities the semi-structured nature of the interview afforded to present parts of the study's theoretical framework to participants. This gave them opportunities to interact with the theory, expand upon it, dispute it, or even ignore it in lieu of their own theory.

The interview guide was structured in three parts. Each part shifted the interview progressively from episodic interview questions to a more generalized, dialectical discussion. This was intended to encourage participants to engage the topic from various perspectives (Holstein & Gubrium, 1995) and enable a type of triangulation capable of providing a deeper understanding of the topic of inquiry (Maxwell, 2013). In line with the research questions, each part sought evidence useful in determining 1) the criteria participants personally saw as important when judging NSF proposals, 2) the criteria participants perceived as important to NSF's judgement of proposals, and 3) the impact of the institutional environment on the participant's approach to proposing NSF projects.

In the first part of the interview, I asked the participant to recall their prior involvement in a NSF grant-funded project. Doing so was intended to ease participants into the conversation and establish rapport by allowing them to talk about something with which they are deeply familiar.

This section of the interview focused on elucidating the criteria participants perceived as important to judging NSF projects and proposals from a personal perspective. It sought the following information from the participant:

- What was the participant's motivation for pursuing the project?
- What goals and objectives did the participant set for the project?
- Who were the intended beneficiaries of the project activities?
- To whom and in what ways did the participant feel the project was important?

In the second part of the interview, I asked participants to discuss their prior NSF project within the context of NSF merit review. This section served as a transition between discussing the participant's own criteria for judging NSF proposals and the participant's perceptions of NSF's criteria for judging proposals. This section sought answers to the following questions:

- How did reviewer feedback compare to the participant's evaluation of project?
- What does the participant remember doing to make their idea "fit" into what NSF wanted/expected?
- How did the participant determine the project had intellectual merit and/or made broader impacts?

The final section of the interview was intended to move the focus of the conversation away from the participant's project and toward a general discussion of NSF merit review and the participation of HBCU faculty in the merit review process. This section focused primarily on the participant's perception of NSF's judgement criteria and their understanding of how HBCU faculty generally engage in the NSF merit review process. Information I sought included:

- What aspects of intellectual merit and broader impacts emerge as most salient in the participant's definitions of the merit review criteria?

- Does the participant believe one set of criteria is more important than the other, and if so, how does the participant determine which set of criteria is more important?
- Who are the intended beneficiaries of a project's intellectual merit and/or broader impacts, and who does the participant see as determining which audiences should benefit?
- What is the participant's process for writing intellectual merit and broader impact statements in project summary?
- How does the participant explain the lack of funding HBCUs receive from NSF?

The original interview guide is included in Appendix A. The interview guide was pilot tested in discussions with two former HBCU faculty members with whom I have worked closely before to ensure all questions were clear and relevant.

### **Document Review – Participant Proposals**

When proposing this study, I intended to ask faculty participants to share a copy of one or more recent NSF proposal submissions along with reviewer notes. I expected the proposals would provide insight into participants' approaches to NSF merit review from a different perspective than the interview setting. I also intended to search for any tension that may have been present between a participant's verbal statements and written proposal.

This method of data collection was abandoned because I was not able to consistently collect proposal material from all of the participants. Some participants declined to provide material and others did not respond to requests.

### **Document Review – NSF Documents**

The proposed inquiry explicitly focused on the NSF merit review process *from the faculty member perspective*. Nevertheless, an understanding of NSF's position on relevant issues was

useful in interpreting and relating participant's views on the process. NSF documents - including the Proposal and Award Policies and Procedures Guide (National Science Foundation, 2016d), relevant program solicitations (National Science Foundation, 2016c, for instance)<sup>25</sup>, Dear Colleague Letters, and other means by which NSF officially communicates with the scientific community – represented the voice of NSF in this study.

### **Field Notes and Research Memos**

I took brief notes during the interviews and more extensive field notes immediately following each interview to capture additional contextual data and highlight areas of interest for analysis (Maxwell, 2013; Yin, 2011). Following Maxwell's (2013) advice, I also regularly wrote memos throughout the course of the inquiry. These memos served multiple purposes. I used *methods memos* kept as part of a research diary (Friese, 2014) to document changes made to the selection, data collection, and data analysis processes throughout the course of the study. I used *relationship memos* to reflect upon my relationships with participants and the impact my presence may have had on the ways in which each participant responded. Finally, I used *analytical memos* to capture and facilitate analytical thinking about the data I collected (Maxwell, 2013, p. 105).

### **Ethics (Protection of Human Research Participants)**

Each participant provided consent to participate by signing an informed consent form (Appendix B) prior to any data being collected from them. Participants retained the ability to withdraw consent at any time prior to publication of their data. This project presented minimal risk to participants; however, breach of confidentiality could potentially result in embarrassment

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<sup>25</sup> Editions of these documents that are current as of the time of writing are cited here; however, older versions will be used when necessary to better reflect NSF's position on an issue at the time in which a participant's experience with NSF merit review took place.



or have professional consequences for participants. My personal experiences with HBCUs and discussions with several faculty suggested some HBCUs maintain institutional climates that are not tolerant of criticism. This increased concerns about confidentiality should any participants feel institutional aspects play a negative role in the issues addressed here. Further, participants may have wished to conceal their identities from NSF program officers or potential NSF reviewers out of concern for retribution in future funding decisions.

The task of ensuring participant confidentiality was complicated by the limited number of HBCU STEM departments and the relatively limited number of Black STEM faculty within those departments. Combinations of key identifying information such as gender and rank and/or departmental affiliation may enable deductive disclosures (Kaiser, 2009) of participant identities. Similarly, reporting participants' institutional characteristics using the factors discussed previously could reveal institutional affiliation under certain circumstances.<sup>26</sup> Further, the close-knit nature of the HBCU STEM community and the use of snowball sampling raised the risk of internal breaches of confidentiality (Tolich, 2004), wherein participants would be able to identify other participants based on the presentation of their data.

To maintain participant anonymity, both external and internal to the study, I remained diligent about confidentiality and mindful of not revealing any indications of who other participants might be during or after the interviews. This included participants' institutional affiliations, department affiliations, faculty ranks, or research projects in which participants were involved. To minimize the potential for breaches of internal confidentiality, I neither confirmed nor denied the identities of other participants to each other either when asked during the course

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<sup>26</sup> For instance, if I were to report that a participant worked at a private, master's degree-awarding regional HBCU, it would be apparent the participant is faculty at Johnson C. Smith University, the only regional HBCU matching those characteristics.

of the interviews. I will continue to do so when engaging them socially or professionally in the future. I also used discretion in handling snowball sampling recommendations. I provided non-committal statements to recommenders regarding whether I intended to follow up with a recommendation, and I included a clear statement on all recruiting and informed consent material stating that I acquired the potential participant's contact information from another individual who may or may not be a faculty member at their institution.

Since the study involved few participants, I expected to be able to engage each participant in a more involved, ongoing discussion about confidentiality. I also intended to use the opportunity to grant participants additional control over how their data would be presented. Following the approach described by Kaiser (2009), each participant was to receive a post-interview consent form (Appendix C) providing them various options for how their data would be associated with potentially identifying information (Kaiser, 2009). Options would range from obfuscation of identifying information to complete disclosure of the participant's identity. This approach was intended to show respect for the participants by providing them a better understanding of how their data would be used and allowing them to exercise more control in the process. It was also intended to garner trust from the reader, who would benefit from the inclusion of additional contextual detail and a 'thicker' description (Tracy, 2010) of the interviews.

However, in the course of analyzing data, I became increasingly concerned about the risks associated with allowing participants to reveal their identities and abandoned the post-interview consent process. This dissertation was prepared in the early stages of the Trump administration, which raised two concerns for me, personally. First, this study took place in a period in which federal funding of science was under heavy scrutiny and facing substantial cuts.

I therefore had reason to expect the NSF merit review process to become increasingly competitive. Second, at the time of writing, I sensed a palpable change in the way issues of race and fairness were discussed in society, post-Obama administration. With these two reasons in mind, I no longer felt comfortable revealing the identities of any participants in this study. My fear was that even participants who had nothing to say about race and fairness might be condemned by a (hypothetical) NSF program officer or government official offended by something another participant had said. Such condemnation would then, in turn, limit the participant's access to future research funding. While the risk of this happening seemed slight, it was not a risk I was willing to assume.

Therefore, all participants were assigned a pseudonym I believed reflected their gender as reported on intake surveys, and their institutional and disciplinary affiliations were reported in a manner I felt sufficiently protected their identities. Participants were given the opportunity to review their transcripts along with the identifying information that would be associated with their data.

### **Data Analysis**

Data analysis aligned with Miles and Huberman's (1994) three-component model of data reduction, data display, and conclusion drawing and verification. Each analytical step is described separately, below; however, all three steps took place concurrently and informed each other through a recursive process.

*Data reduction* comprised all decisions made in the process of converting the experiences of the interviews into a manageable dataset useful in later portions of the analysis. While in the field, this included taking field notes to document potentially relevant observations about study participants and their institutional settings. During the interview, I also took notes to highlight

potentially important points in the discussions, such as recurring assertions, contradictory statements, points of confusion, or statements relevant to the project's theoretical framework. I transcribed the audio recording of the interview after each interview was complete, recognizing that transcription is an important analytical component (Brenner, 2006). I created near-verbatim transcriptions, neglecting only minor and occasional stutters, pauses, or misspoken words, while attempting to remain sensitive to instances of "problematic conversation" (Holstein & Gubrium, 1995, p. 79) (e.g., confusion, contradiction, ambiguity, etc.) that signaled occasions where respondents were expending extra effort to make meaning of the topics at hand.

Transcriptions, field notes, and research memos were stored and organized in ATLAS.ti v7.5 (Friese, 2013). Using ATLAS.ti, I employed an inductive approach (Friese, 2014; Miles & Huberman, 1994) to fracture and categorize interview data using emic codes that remained close to the data. While the approach was relatively grounded in the data, it was not a purely grounded-theory approach, as the codes I selected were often strongly influenced by my theoretical framework for the study. As codes were developed, they were annotated within ATLAS.ti to help ensure consistent use and to enable external review of my coding rationale. As analysis progressed, I continuously revisited transcripts and revised codes to arrange them into a coherent structure. I also generated thematic codes that connected multiple lower-level, descriptive codes that emerge throughout the analysis.

The *data display* stage assisted in the development and refinement of the more conceptual codes. In this stage, I employed the query tools and network mapping tools available in ATLAS.ti to better understand how codes and chunks of data related to each other (Friese, 2014).

Finally the *conclusion drawing and verification* stage involved examining the data in the

context of the research questions (Friese, 2014). In this study, the conclusion drawing stage was extensive and led to substantial revisions of the research questions. Much of the work in this stage took place in analytical memos. In some memos, I would choose parts of the interviews I found interesting to write as vignettes. In others, I would start writing about an overarching theme that connected various cases. I also wrote summaries of each participant's NSF efforts. However, the final conclusions presented in this study emerged only as Chapter 4 was written. The process of merging the separate analytical memos, vignettes, themes, and blocks of data into a coherent chapter served as the ultimate verification process for the study. As each block of analytic text was added to the chapter, I had to determine whether the text warranted a new subject heading or if it fit under an existing heading. As the conclusions began to solidify, though, it also became apparent that they were not well-aligned with the original research questions. The research questions were then revised, as discussed at the beginning of Chapter 4.

### **Validity**

For this study, I adopted Maxwell's (2013) concept of validity as, "the correctness or credibility of a description, conclusion, explanation, interpretation, or other sort of account" (p. 122). Since the inquiry focused more on creating understanding than on recalling details of specific events, I placed greater emphasis on implementing strategies to interpret and recreate participants' thoughts and beliefs in ways the participants would perceive as valid. Once each interview was transcribed, I engaged the interviewee in a *member checking* process to provide them an opportunity to review their transcript and ensure I had a trustworthy and complete representation of the interviews. When sharing interview transcripts with participants, I provided clear instructions that:

- reminded participants they retained control over their data, and could redact any portion

of the interview they did not wish to be shared as part of the research findings;

- encouraged participants to clarify their thoughts or any points of discussion captured in the interview transcripts; and
- discouraged participants from making superficial style edits or being overly concerned with “cleaning up” or “correcting” what they said (Carlson, 2010).

When reporting, I relied on *thick description*, which Tracy (2010) describes as "one of the most important means for achieving credibility in qualitative research" (p. 843). When possible, I used detailed descriptions and verbatim transcripts to *show* rather than *tell*, and allow the reader to better understand how I reached my own conclusions, or even allow the reader to reach their own conclusions (Tracy, 2010). In a less technical fashion, my attempts in Chapters 1 and 5 to lay bare my motivations and personal connections to this research are intended to benefit readers who wish to judge the quality of this study based on my credibility as a researcher (Patton, 1999) or sincerity (Tracy, 2010). I also presented a summary of my previous experience working with HBCU faculty in Chapter 1 in hopes of assuring readers that I was familiar with STEM HBCU environments and less likely to draw unwarranted, uninformed conclusions from the data I collected. Finally, throughout the analysis stage, I searched for rival explanations or negative cases (Maxwell, 2013; Patton, 1999)- i.e., assertions or behaviors that didn't fit the general conclusions of the study. I committed to presenting these findings, too, in hopes that doing so would provide evidence that I attempted to view and assemble data in more than a single, confirmatory fashion.

## **CHAPTER IV. FINDINGS**

### **Introduction**

For this inquiry, I interviewed eight Black HBCU STEM faculty members with a range of experience in NSF-related activities. As discussed in Chapters 1 and 3, I entered the field intending to engage participants in a discussion about their prior experiences with NSF, the criteria they employed to determine the merit of their NSF proposals, their interpretation of the NSF merit review criteria, and the impact of their institutional environments on their approaches to proposing NSF projects.

However, once the interviews began, the focus on NSF quickly began to feel restrictive and overly constraining. The participants would tolerate questions about intellectual merit and broader impacts and would struggle to remember what they were thinking when they wrote a proposal, but it was clear they wanted to discuss other things. Some came alive talking about their students; others reveled in the opportunity to share what they thought was wrong with their universities or with society, in general. Meanwhile, they often portrayed their personal relationships with NSF as straightforward, and in some cases, almost unworthy of examination.

The interviews sometimes advanced in unexpected ways, and I was often content to allow them to do so. I took opportunities to return the conversations back to the topic of HBCUs and NSF when possible, but I did not consider any of what the participants shared to be irrelevant. All of the transcripts were utilized in analysis. The interviews advanced in unexpected ways for

some participants, too. At the end of one interview, a participant admitted to having expected the interview to only be questions about how many grants they had written. The participant later wrote a blog post reflecting on the issues we had discussed in the interview. Similarly, Vernon thought I had come seeking “facts,” but quickly realized I was seeking “truth.”

As I analyzed the data, I struggled to fit all the pieces together in a way that provided defensible answers to the research questions I originally posed. More precisely, I was able to arrange parts of the data in ways that answered those questions, but in doing so, I felt I had left too many other parts out. Some of the leftover data was contradictory, and some parts simply seemed too important to ignore. Understanding how and why the participants wrote proposals to NSF required first understanding why they were interested in science and the challenges they faced at the institutions they had found themselves drawn to. Ultimately, the inquiry became less about what I was interested in discovering through this process, and more about understanding what they wanted to tell me.

Two major topics emerged from the discussions. The first concerned participants’ use of social identity<sup>27</sup> in constructing their personal roles in the STEM enterprise. Racial, gender, and

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<sup>27</sup> I use the term “social identity” to refer to participants’ self-categorization of themselves within socially-constructed groups of people that are distinguishable from other groups of people. I acknowledge the existence of a vast body of literature on self-concept, social identity theory, and identity theory that has not been incorporated into this inquiry’s theoretical framework. However, I feel my intended use of “social identity” aligns with Tajfel’s definition, as provided in Hogg (1988); i.e. “the individual’s knowledge that he [*sic*] belongs to certain social groups together with some emotional and value significance to him of the group membership” (p. 24). I also feel it is useful to point to Hogg’s distinction between social and personal identities, defining the former as “self-descriptions deriving from membership in social categories (nationality, sex, race, occupation...)” and the latter as “grounded in relationships with specific individuals or objects” (p. 24) I encountered no instances of the latter during the interviews. Finally, I note that, in some cases, the social identities participants discussed were more readily defined by embodied attributes (i.e., race and/or gender), and in others, by roles (i.e., scientist, educator, mother, etc.); however, I recognize that the distinction between such categorizations and their relative importance to self-concept is the subject of scholarly debate (Stets & Burke, 2000).



scientific identities were major parts of the conversations, and some participants' interests in social justice and uplifting communities played important roles in their actions as research faculty and their NSF-related activities. Further, participants generally prioritized the advancement of the members of the social groups or communities to which they belonged over the advancement of scientific disciplines, and these interests were reflected in the research agendas they pursued. But, while the aims and goals of their work were clearly influenced by their non-scientific social identities, this influence did not extend to the methods they utilized to address their concerns. All of the participants maintained strong identities as scientists, upheld principles of empiricism, and expressed desires to be part of the scientific community.

The second major topic of discussion dealt with the role participants perceived their institutions playing in their involvement with NSF. As anticipated, all participants described challenges associated with conducting research and pursuing research grants in HBCU environments. Participants consistently pointed to the advantages<sup>28</sup> they believed PWI faculty held when defining these challenges. In some cases, the institutional challenges served as the motivation for participants' projects, with varying outcomes for participant's grant procurement efforts. The HBCU mission to educate Black Americans was also important to the participants

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<sup>28</sup> I originally used the term "privileged" to describe the way participants spoke about PWI environments and their faculty. I gravitated to this term because I associated it with advantages not typically realized, understood, or acknowledged by their holder (e.g., McIntosh, 1988). However, during my dissertation defense, my committee encouraged me to better define several terms I used in my writing, and in defining privilege as a "right, advantage, or immunity granted to or enjoyed by an individual, corporation of individuals, etc., beyond the usual rights or advantages of others" (OED Online 2017b), I came to realize that I had not fully appreciated "privilege" as denoting something *granted*. Nor had I fully considered the consequences of using a word commonly associated with advantages "unearned" by their holder (e.g., Rothman, 2014). In reexamining the data, I do not believe there was sufficient evidence in most cases to claim participants considered the advantages PWIs held over HBCUs specifically as something either *granted* to PWIs or *unearned* by PWI faculty. Therefore, I decided to substitute the term "advantaged," to avoid unwarranted inferences about the source of the advantage.

and central to each participant's decision to join their institutions. However, some participants discussed their administrations' difficulties balancing research aspirations with the education mission. Multiple participants also called for approaches to the education mission that placed greater value on their individual research contributions. Finally, participants shared their beliefs that NSF needs to be made more aware of the HBCU institutional context and the impact of HBCU efforts in order for reviewers to render fairer judgements in the merit review process.

### **The Participants**

As discussed in Chapter 3, the sampling frame included 223 individuals at 22 regional HBCUs with active or recently-expired NSF awards. I excluded 28 of the individuals on the basis of previous or ongoing professional and personal relationships and sent email invitations to the remaining 195 PIs. I received 29 responses. One individual requested to be removed from the contact list and 20 other individuals indicated interest, but did not meet study inclusion criteria. Of the eight respondents that met study criteria, two neither responded to subsequent contact nor completed intake surveys. The remaining six eventually participated in the study, although the sixth individual did not respond to the original invitation until after the other five had been interviewed. After the first five interviews were complete, I emailed directors of sponsored programs offices at two HBCUs to inform them of the study, but received no reply. The remaining two participants were recruited through other means. One of the first participants shared contact information for one individual. The final participant volunteered after we encountered each other at a conference.

Table 7 reports participant gender and discipline. The table also shows that participants received their undergraduate degrees at a mixture of PWIs and HBCUs; however, all but one participant received their PhD from a research intensive PVI. The group of participants included

Table 7

Participant pseudonyms and gender, professional discipline, and training attributes.

Pseudonym	Gender	Discipline	Undergraduate Training	Graduate Training
Adele	female	Social/Behavioral Sciences	PWI	R1 PWI
Denise	female	Biological Sciences	HBCU	R2 HBCU
Dorian	male	Natural Sciences	PWI	R1 PWI
Dwayne	male	Biological Sciences	PWI	R1 PWI
Julissa	female	Biochemistry	HBCU	R1 PWI
Terrence	male	Engineering	PWI	R1 PWI
Vernon	male	Biological Sciences	PWI	R1 PWI
Walter	male	Social/Behavioral Sciences	HBCU	R1 PWI

Note: HBCU = Historically Black College or University. PWI = Predominantly White Institution, R1 = Doctoral University: Highest Research Activity; R2 = Doctoral University: Higher Research Activity

full, associate, and assistant professors, and all were full-time tenured or tenure-track faculty at public institutions with either Master’s Colleges and Universities or Doctoral Universities Carnegie Classifications. The smallest school had a total Fall, 2015 enrollment of approximately 4500 students, and undergraduates comprised 75%-90% of each institution’s enrollment.<sup>29</sup> Additional details about the participants and their institutions have been intentionally omitted to help maintain participant anonymity.

All participants reported having submitted at least two NSF grant proposals within the five years prior to the interviews. Dwayne, Vernon, Walter, and Terrence reported submitting more than five proposals during that time period. All participants except Adele reported having served as an external reviewer for NSF. Finally, one participant served as a NSF program officer

<sup>29</sup> National Center for Education Statistics (NCES) Integrated Postsecondary Education Data downloaded from <http://nces.ed.gov/ipeds/> in June, 2017.

in the EHR Directorate; however, the individual will not be named.

### **Data Analysis**

The eight interviews resulted in a total of eight hours and forty minutes of audio recordings. I transcribed the audio recording of each interview and used ATLAS.ti v7.5 (Friese, 2013) to organize the transcript files and code the interview data. Figure 2 contains sample codes and code groupings illustrative of the hierarchical coding scheme I employed during the data reduction and conclusion drawing phases of analysis. In addition to analytic codes to capture my interpretation of quotations, I also created codes to contain:

- instances of participants defining specific terms (e.g., four instances of respondents discussing the creation of replicable models for institutional practice as part of the broader impacts criteria were coded `bic_defn :: models for other institutions`)
- keywords that were commonly used by various participants (e.g., Research I schools, PWIs, etc.)
- events that occurred during the interviews (e.g., `+interruption`; `+interaction with student(s)`)
- my perceptions of the participant's attitude toward the question (e.g., `~disinterest in question`)

I also generated several network diagrams to better organize codes as components of larger concepts or themes. Samples of network diagrams are presented as Figure 3 and Figure 4. Figure 3 shows the network diagram of codes related to grants, and Figure 4 shows the diagram of codes and memos related to burdens participants discussed facing as HBCU faculty members.

Throughout the analysis, I revised, combined, and grouped codes when possible; however, my decision to allow participants more control in the directions the interviews took – rather than strictly enforcing my interview protocol - complicated the data reduction process. Each interview developed in a unique fashion, and I found it difficult to code all the data without using a relatively large number of codes. Ultimately, I generated 234 codes that were applied to more than 2 chunks of data. As coding progressed, it became apparent to me that much of the

Code label	Code group contains discussion on...
BETTER_PROPOSALS	Ways to make proposals stronger
better_proposals :: clear, focused and detailed	
better_proposals :: innovative	
HBCU_ADMIN	HBCU administrations/administrators
HBCU_admin :: lost sight of the mission	
HBCU_admin :: supporting projects	
HBCU_MISSION	HBCUs' educational mission
HBCU_mission :: adhering to the mission	
HBCU_mission :: not valued or prioritized	
PART_CP	Participants' career paths
part_cp :: coming back home	
part_cp :: previous experiences at other HBCUs	
STUDENTS	Participants' descriptions of HBCU students
students :: our students benefit from having us	
students :: providing affirmation (soul fulfilling)	

Figure 2. Sample of codes and code hierarchical structure developed during data analysis

data focused on the participants' understandings of the role their institutions played in their grants and research efforts. Data in this category informed the second major finding presented in this Chapter. However, it was less obvious to me how to arrange and understand the remaining data. Many of the codes I used to describe this data were attached to one or two chunks of data, alone, and I found it difficult to combine codes or group them under unifying headers or into broader themes. This prevented me from effectively moving the codes from a *descriptive* level to a *conceptual* level<sup>30</sup>.

To progress, I began writing brief descriptions of each participant's project as research memos. When summarizing the projects, I also began to examine how the participants chose to

<sup>30</sup> At this stage, I found myself in what Friese (2014) describes as the "code swamp."

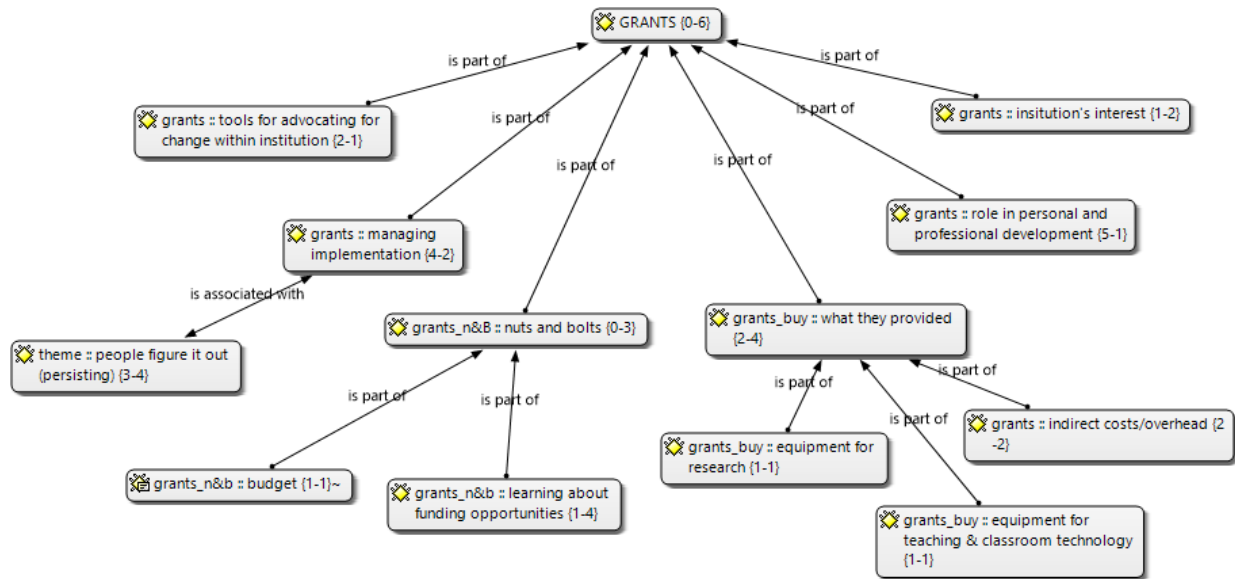


Figure 3. Network diagram of codes utilized to describe ways in which participants spoke about grants.

talk about their projects and the perspective they adopted when discussing their project. Some participants, for instance, focused on the intended audience of their project when discussing their grant activities. Others focused on the role the grant played – or was to play – either in the participant’s career plans or their institutional setting. When writing, I also realized that several participants made a particular impression on me that I felt warranted presenting. These impressions developed into the short descriptions of the participant and interview, which I’ve included, below.

As the memos evolved, I began to see an important connection between all the cases: when the participants weren’t talking about their institutions, they were talking about how their work impacted people. Further, they didn’t speak about the people they sought to impact in broadly general terms. Instead, they often identified specific groups of people in terms of race, gender, and socioeconomic status. Given the importance that these markers of social identity played in the conversations I had with the participants, I decided to present the data in a way that

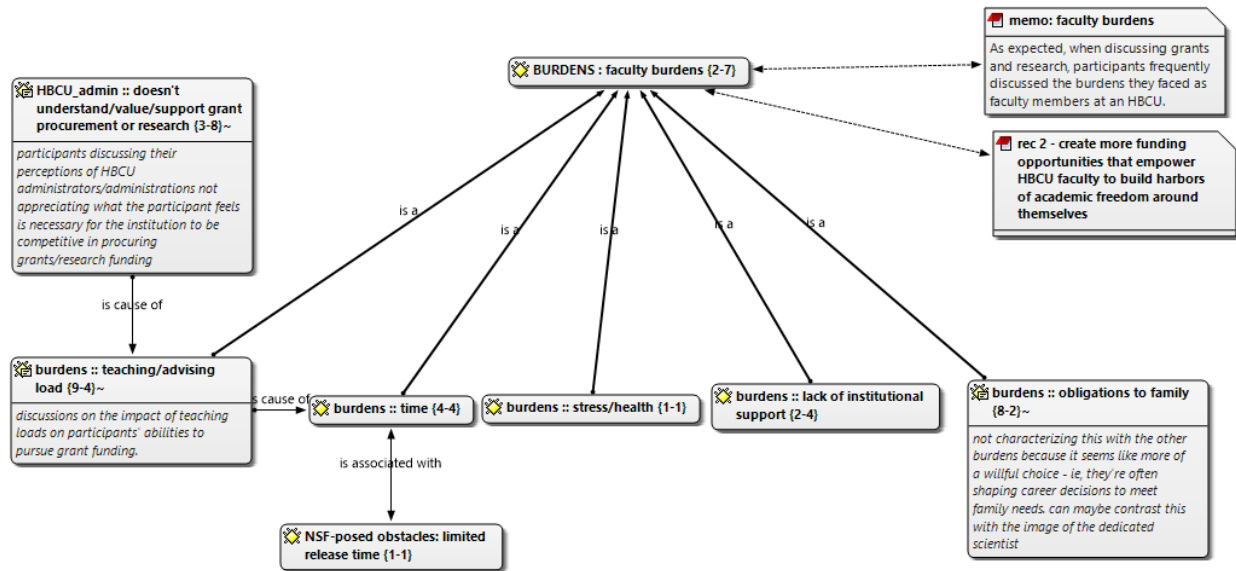


Figure 4. Network diagram of annotated codes and memos related to issues of burdens participants described encountering as HBCU faculty.

explored the various roles social identity played in the participants' NSF-related work. These findings are developed in the following section.

## Exploring the Roles Social Identity in Participants' Interactions with the STEM

### Enterprise and NSF

This section examines how social identity – i.e., the ways in which participants categorized themselves and others into socially-constructed groups of people distinguishable from other groups of people - influenced participants' interactions with the STEM enterprise. When possible, the participants' interactions with NSF are highlighted. The role of participants' institutions in these interactions are examined later in the chapter.

In summary, I found the participants to be concerned with impacting the lives of people more than advancing the knowledge of abstract, disembodied disciplines. The people whose lives

they specifically sought to impact were members of communities<sup>31</sup> bound together through various forms of social identity. Further, the participants all expressed some connection to the communities they sought to serve. Racial identity was particularly salient in defining most of the communities participants discussed, and some participants found themselves morally obligated to serve these communities and address issues of social justice. Participants also saw a need for social diversity within the STEM enterprise, but their social identities as scientists remained important to all of the participants. While the actions they undertook as scientists were clearly influenced by other aspects of their social identities, they drew bounds around how those factors influenced their application of science.

The various aspects of how social identity and communities arose in the interviews are summarized below. Individual cases are then presented to show the variety of ways social identities were intertwined with each participant's behavior and understanding of their role in the STEM enterprise.

### **Recognizing the Social Identities**

Issues of social identity were central to many of the discussions with participants. Participants frequently discussed issues related to race, gender, and socioeconomic status (SES) and used these constructs to define their social groups or communities of interest and establish their own personal ties with those groups. Throughout the discussions, participants also deconstructed their own personal identities into distinct components. Two particularly salient components were their racial identities and their identities as scientists. These various aspects of their identities appeared to play integral roles in defining and shaping their personal motivations

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<sup>31</sup> In this work, I have chosen to use “community” to describe a body of people distinguished by shared circumstances and sharing common interests, pursuits, occupations (Oxford English Dictionary, 2017a).



and career paths. Further, some participants specifically spoke to the difficulties of disentangling issues of race, gender, and social justice from their actions undertaken as “educators” or “scientists.”

### **Participants Research Efforts Emphasized People over the Abstract**

In discussing their research efforts, all of the participants prioritized work that directly impacted the lives of people who were members of various social groups. In doing so, they placed a greater priority on advancing communities than on studying abstract concepts or advancing the knowledge of disembodied disciplines. Each participant shared at least one aspect of their social identity with the community they sought to serve. In all but one case, the participants were connected to their community of interest by race and/or gender.

Six of the participants’ NSF projects involved communities of STEM learners. More specifically, each project involved activities that targeted or sought to impact groups of predominantly-Black, predominantly-underserved students at various stages in the STEM pipeline. While the other two researchers did not focus their research efforts on humans, they and their projects could still be understood as serving communities. This is developed further, below. The emphasis on doing work that impacted people’s lives extended beyond just the participants’ NSF efforts. It is evident in Denise’s discussion about her dissatisfaction with the incremental pace of her biological science research, and Dwayne’s and Julissa’s declarations of disinterest in conducting research that financially benefits large corporations. It can also be seen in Walter and Julissa wishing to leave legacies of impact on society and students more than contributions to scientific fields.

### **Social Justice Was Important Motivator for Some**

For some participants, the emphasis on impacting communities of interest could more

precisely be seen as attempts to redress issues of social marginalization facing their community of interest. Adele, Dwayne, and Walter all explicitly described their work as academic research scientists as contributing to social justice<sup>32</sup> efforts. Each identified a population as unjustly marginalized and set their professional activities (including their NSF projects) toward improving conditions for that population. Further, while their efforts were all related to broadening participation in STEM, the goals of their projects were not narrowly focused on immediate educational outcomes or easily quantifiable metrics like retention. Their goals were loftier, and addressed broader societal concerns. Walter and Adele sought to ensure academically underserved students would eventually be able to fully participate as citizens in a democratic society, and Dwayne worked to upend a society he felt was fundamentally unjust.

### **Participants Served Multiple Communities**

Participants generally recognized a need to simultaneously attend to the interests of multiple communities. Some, like Julissa and Walter, described their NSF projects as helping address their moral obligations to serve the Black community. Yet they were also able to clearly articulate those same projects as generating generalizable knowledge and making desired societal impacts, demonstrating their attendance to the interests of the NSF community. In some cases,

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<sup>32</sup>Note that a thorough definition of “social justice,” itself, is complex and beyond the scope of this inquiry. The term was also not explicitly defined in the interviews. At the time of the interviews, I intended it to refer to a process of considering both present and historical issues of oppression based on socially-constructed groupings when rendering judgments of fairness or equality. I also acknowledge that, at the time of the interviews, my thinking was strongly biased toward social justice along racial lines – particularly regarding the relative condition of Black and White Americans - and largely in the context of providing equitable education. In the interviews with Walter and Adele, I was the first to use the expression “social justice” in describing the issues they were discussing. Both adopted the term with no apparent objection. Dwayne was the first to use the expression in our discussion, and did so in his final dialogue just before the end of the interview. In reviewing these cases, below, I have left large passages of the transcripts intact to allow the participants to better provide their own definitions of social justice.

the emphasis on advancing people came at the expense of advancing knowledge of sufficiently broad communities, however all the participants understood the need to articulate their efforts in a manner that appealed to NSF reviewers. Multiple participants also discussed findings ways to attend to the interests of the academic community or their families throughout their careers.

### **Social Diversity in the STEM enterprise**

Participants recognized functions for social diversity within the STEM enterprise. Multiple participants pointed to the need for underrepresented scientists to have a ‘seat at the table’ when research questions are being posed. Denise pointed to the need for additional focus on medical issues prevalent within the Black community. Dwayne felt it was important for socially marginalized groups to help reframe certain research questions and contribute to an objective analysis of data regarding health and education issues. Without the presence of marginalized groups, he believed socially dominant groups would continue to pose questions and design research in a manner that facilitated conclusions that reinforced their dominance. Terrence believed that diversity of thought – unrelated to race – also contributed to intellectual merit by better enabling multiple answers to be posed to a given scientific question. As discussed later in the chapter, participants also felt HBCU faculty should be better represented on NSF review panels to help the scientific community better understand the value of the contributions HBCUs make through their work.

### **Placing Bounds of the Roles of Identities**

While the participants’ various “non-scientist” components of their social identities were deeply integrated into the actions they undertook as research faculty, participants held those aspects of their identities separate from the process they employed to address particular scientific problems. Each participant clearly upheld the value of empiricism and the scientific method to

their work. Some, like Dwayne and Dorian, even defined the scientific method as immune from social influences. This was not a surprising finding, considering that all of the participants were research scientists. However, it posed an interesting contrast to the socially-rooted moral obligations and “callings” that inspired some of the participants’ NSF projects and led them to their institutions.

### **Examining the Individual Cases**

A closer examination of each participant’s discussions on issues of community and social identity follows. The cases are presented in no particular order.

**Adele.** My interview with Adele started late, squeezed in between a meeting with a group of female students that had run over and a departmental meeting. Adele, a faculty member in a social/behavioral science field, arrived at her HBCU less than a decade earlier intending to continue her career as an active and accomplished laboratory researcher. However, during the two years it took the institution to complete construction on her lab, her scholarly focus shifted from research in animal models to finding ways to better address the needs of a student population she saw as academically underserved, underprepared, and holding a “severe science aversion.”

Upon setting out to revamp her teaching to better serve her students, she came to the realization that academically underserved students were excluded from the scholarly dialogue on education. As a scientist, she saw this as an opportunity to contribute to the field of STEM education. She also recognized the issue as one of social justice, and her motivations to improve educational outcomes for these students merged with larger goals of better enabling them to contribute to society:

Adele: There is a paucity of work for this population of students: I'm talking students who come from schools that would routinely test in the bottom quartile

of standardized testing. There's a lot of information about those few students who make it, and we can get to the cream of the crop and they go on to get PhDs, but the ninety percent that are left? Who's doing research on them? Who's actually creating a body of knowledge to help us understand them? And as the - as our education in the United States becomes more and more polarized and defined by zip code, this becomes an important question. Are we not going to provide a literature or research on, like, a vast portion of the American educational population?

INT: How would you describe that - that motivation? What would you describe that as? Is that...still a scientific motivation? Is it more of a political motivation? Is it more of a social justice...?

Adele: I think it's all of the above, honestly. I honestly do. The social justice piece because I believe that it is a moral imperative for us to provide equal education for citizens of the United States. I believe that's important for the continuation of a democracy. And we do not do that. So, in that regard it is social justice. But my particular contribution to that is not necessarily protesting or doing grassroots efforts. My contribution to that is creating, in the body of literature. Future researchers will be able to learn something from my experience in how we were successful in teaching science to this population of students.

Exactly how the interests arose was less obvious to Adele. During the interview, I wondered whether her interests as a scientist or her interests in social justice ever took precedence over one another, which led to the following exchange:

INT: is there an order? Does one come before the other? Does the...social justice-appeal come before the appeal as scientist to these kinds of - you know, when you think about the kind of work that you're doing? Is it a fair question to even ask: does one come before the other? You know, does your identity as a scientist resonate first and then you want to figure out how to address your social justice...desires? Or is it maybe the other way around where you see the inequity first and then you try to figure out how to use your toolset as a scientist? Is that even a fair question to ask, if one comes before the other? And if so, which one would you- is there a directionality to it?

Adele: I don't know how to answer that because I don't understand always how one separates science identity from who I am as a human being.

Adele then went on to explain how her identity as a scientist had often interacted with her racial and gender identities. She spoke of having “benefited from programs aimed at underrepresented minorities” and women throughout her graduate training and academic career, and how the social

support she received through those programs had helped her to see herself “as a scientist.” As a faculty researcher at a HBCU, she also faced a conflict between her desires to “go into my lab and...just focus on what’s happening in the laboratory” and her recognition that the students around her were “struggling” as a result of social inequities.

Adele’s identity and interests as a scientist coexisted with her identity as a Black woman and her social justice interests. She clearly referred to herself as a scientist and spoke of the importance of understanding her work in the context of scholarly literature and contributing to that literature:

...because my training as a- if I'm bench scientist - is that always your question should lead to another question. This is just the scientific enterprise. So I should never be involved in a research project that does not have output, that does not have scholarly product. And when that happens, it will, on its own, create a next set of questions.

However, at the time of our conversation, she had reached a point in her life in where she was more interested in making a significant impact in the lives of students than she was in continuing to incrementally advance a scientific discipline. When asked if she missed being in the lab more often, she responded:

There are some parts I miss about it. Yeah. I mean, it was like play. It was like going to work to play in the lab. So, I still have an affinity for it. However, over these - as I keep getting these significant birthdays, I have come to not, so much, want to be killing animals. Cause I've killed a lot of rats in my day, and to reconcile that with what am I getting at the end of the day? I wasn't going to win a Nobel Prize. I mean, I'm okay with that - I've made peace with that. [laughs] So it wasn't like I was going do some groundbreaking-kind of work. And I'd have to go through a lot of blood to get there.

This [STEM education research]? I feel like I'm actually doing something that is groundbreaking. Cause if I can get a student to appreciate their own way of learning and open them up to all that science can be - and just the ability to teach yourself how to do it, is important, I think. Cause we're always going to be faced with new learning challenges. We can't run away from them just because at first they look hard, without - you know, how do I teach myself to go through that challenge? And so, this feels more important. Like I'm leaving something more valuable [behind].

Our conversation also gave insight into the struggle some Black scientists face in reconciling their multiple identities and commitments to various communities. Adele's personal view was one that embraced diversity within the scientific enterprise:

Well, um...I think science is- if it really is an investigation into what is true, if that really is it, then having a particular view of what it must look like does not serve us. Because a different vantage point gives a whole different perspective to a particular question

However, she did not believe that the science community shared her idealized view. Instead, Adele understood the scientific community to largely expect the full attention of its members. This focus on science would necessarily come at the expense of allegiance to any other community to which any member might claim membership ("you're asked to divorce part of yourself in order to 'play'"). Adele saw this expectation as posing an unappealing choice for Black scholars entering STEM: either become "estranged from the Black community" and be "left there, to deal with your demons," or be denied full access to opportunity within the STEM enterprise.

She associated the latter option with the label of "Black scientist," a term she recognized as pejorative, at least when used by majority members of the scientific community:

this thinking of a 'Black scientist' - and when you said that term it just kinda all came back to me, gosh - there is this, even if unvoiced, less-than interpretation. Like, [condescendingly asking] 'this is the best they can do?' And I have sensed that.

In Adele's understanding, "the best they can do" did not relate to any particular technical or methodological aspect of science. Instead, it related to the ability of marginalized members to commit more of themselves to science, or "to focus primarily on this task of this research, this body of work, this conducting this research." She saw them as judged negatively for their unwillingness to turn away from other social interests. Black HBCU faculty, then, would similarly be judged negatively by reviewers who see them as distracted by their concerns for

students and unable to focus on the matter of advancing science.

Yet, for Adele, the option of assimilating completely into the scientific community represented a false promise. She reflected on her feelings of exclusion during her time spent focusing on research as a graduate student and faculty member at PWIs. She had seen others attaining a level of acceptance in scientific environments that she had not experienced prior to her move to a HBCU:

In the science community, that is what I saw: at [her graduate institution, a research intensive PWI] there is a group - they were all men, they were all White men - but they were a community, and they appreciated and affirmed each other. ... I see more of that [appreciation/affirmation] at an HBCU than when I was trying to cobble it together in an environment that sometimes felt hostile.

Adele continued by saying that she felt more integrated into the community of STEM education researchers, but when recalling her time spent focusing on STEM research, she seemed to face her own 'demons' for a moment:

But I don't know if I'd even want to go back to the wet-lab, as much as I thought it was 'play' because of that sense of isolation. Applying for grants for [research] and then I go to meetings where I don't feel affirmed or appreciated. [Pauses] I've never actually thought about it until this moment, but- that really is true, if I'm honest with myself.

**Dwayne.** I met with Dwayne in his spacious office, housed in a modern research center and within sight of rows of computers and graduate students busy conducting their research. Of all the participants, Dwayne most projected the identity of a prototypical academic research scientist. Throughout our conversation, he conveyed an impression of confidence and an air of formality unique among the participants. He seemed at ease describing himself as "recognized as being one of the top researchers in my field, long before I came to an HBCU" with "scholarship widely known across the country." He also touted his "track-record of being a successful researcher in both NSF and NIH venues." Unlike the other participants, he never inquired about my research or my interest in HBCUs. Instead, he remained focused on the task of the interview



and poised to provide instantaneous, well-reasoned responses to my questions. Those responses came in the booming, unflappable manner of someone accustomed to having their thinking interrogated by others. Dwayne's project examined the evolutionary mechanisms of bacterial resistance. When speaking about the project, Dwayne focused on describing the genomic changes his research team observed as bacteria reproduced in the presence of particular toxins and shared theories as to why the bacteria evolved resistance to two of the toxins at differing rates. As I probed Dwayne's motivations for the work, his initial responses described how the work attended to questions relevant to the discipline and how his previous work in insect evolution had prepared him for the current project.

Presenting himself as a scientist contributing to his field was clearly important to Dwayne. However, he saw no conflict in simultaneously attending to other interests, including interests with racial and gender components. When I remarked that other participants had focused more on STEM education projects and asked whether he saw STEM research and STEM education research as divergent paths, he drew a direct connection between his research and his students, whom he explicitly identified in terms of race and gender:

I don't see them as divergent, at all, because I also hold grants that do STEM education...I do research and training of students. So, right now I have five African American female graduate students. And, the way that I drive their training is by having research grants. Because the university doesn't give us money to support these students. So, for example, right before you walked in, I was in a meeting with one of my grad students and her research topic is related to my overall research. And the only way she can do that is because I have a research grant. If I didn't have a research grant, there'd be no money to support her work.

Further, Dwayne portrayed the research opportunities he provided to graduate students as part of his longstanding commitment to involve more "underrepresented minorities" (URMs) in STEM:

I have been working to increase the representation of - particularly - underrepresented minority scientists in science, my entire career. ... I was doing it even before I had a PhD. I was a graduate student [and] I was mentoring

undergraduate students. When I was an undergraduate student: I was mentoring freshman and sophomores when I was a senior. It goes with the territory when you are the first or one of very few [Black students in a discipline]. So, I've been committed to this my entire career. I've sent more URM students to graduate school than whole departments have. So, this was just another step in what was a lifelong commitment to this work.

It also became apparent that his research efforts, in general, were part of a broader long-term commitment to social justice and "...seeing human beings being conserved and uplifted." In the following exchange, Dwayne discusses his commitment to social justice and his desires to improve the human condition as motivating all of his efforts and dictating his research path. While doing so, he also deconstructed his own identity; however, Dwayne did not clearly articulate a preference to any particular aspect of his social identity (instead, he ascribed "foremost" and "most important" status to two seemingly different aspects of his identity at the beginning of this exchange). This echoed Adele's difficulties in separating one aspect of her social identity (i.e., scientist) from who she felt she was "as a human being." Later in the exchange, Dwayne also discussed how he utilized his identity as a scientist in contexts outside of higher education. Finally, he concluded the conversation by alluding to the intertwined nature of his identity and goals, suggesting that his choice of science, as a profession, both satisfied his personal interests (i.e., wanting to attend to social issues and wanting to solve problems) and aligned well with his perceived skillset ("I'm just good at science").

INT: How do you identify yourself?

Dwayne: Okay. I identify myself, first and foremost, as a critical thinker. Okay? And, if your question is 'how do I identify myself by socially-defined standards?' I identify myself as African American. Okay. And then I have other aspects of my identity, too, but at the end of the day, the most important aspect of the identity that I maintain is one that is committed to social justice. I've always been in this to make the world a better place. So, I don't work on research that develops engines of mass destruction. I won't do it. Simply will not do it. I don't work on research to try to make corporations capable of selling products that make them richer. Won't do it. I'm trying to develop people who can think and who can ask questions about how we're living and whether how we're living is

just and whether how we're living is sustainable. I've already come to the conclusion that the way we live isn't just and is not sustainable, and if we continue doing this, it's going to lead to the end of this species on this planet. And so, folks in the government don't agree with me. They think that the way we're living is fine. Which is why the structures that they have in place support the way this society has always operated, which I think is fundamentally racist, and- in addition to classist and sexist and anti-gay. It's all of those things. And that's the society I'm trying to overturn.

INT: That's a big task.

Dwayne: Well, I mean, it's not a task that I expect to see accomplished in my lifetime. And what I'm focusing my work on now is trying to develop a new generation of people to carry on. Cause, you know, I won't be here a whole lot longer. I mean, I'd like to be, but I know I'm not gonna be.

INT: ... If you could do it a different way - if you could achieve that goal in a way that didn't involve this [laboratory] and your research, would you choose to do that? Or-

Dwayne: I don't know what that different way would have been.

INT: I mean, you could be in front of people talking. You could be doing a million other things than science.

Dwayne: Well- but, I do. I'm in front of people talking all the time. What I do is I talk as a scientist. I write editorials to the local newspaper. I speak at people's churches. I speak to kids in elementary school. I talk to students across the nation at various centers of higher education and learning. I've spent a great deal of time trying to get these messages out. And I think, as a scientist I've been able to do that.

INT: Is that why you're a scientist?

Dwayne: Well, I told you, I'm a scientist because I want to solve problems. That's my fundamental reason for being a scientist. And I want to solve problems that make the world a better place. And science can help do that. But, yeah, I could have been a lawyer. I could have been that, you know, but I'm just good at science. But, at the end of the day, I want to make the world a better place.

While Dwayne viewed society as structured in a “fundamentally racist” manner, it is important to recognize boundaries and nuance in how race functioned within his relationship with the scientific enterprise. For instance, he held racial identity as separate from the methods he employed as a scientist:

I'm not sure that there's an ethnic-racial orientation to general science questions. So, you know, there was a time when people were arguing that there was a Black science and there was a White science. I don't agree with that at all.

In clarifying, he gave insight into a personal epistemology devoid of social influence and well-aligned with postpositivist thought:

At the end of the day, scientists start with the basic assumption that the universe itself is the universe. Okay? It's objective. It is what it is. Therefore, what we're trying to do is, come up with a method of understanding how that universe works. Now, over the centuries, that method has been codified as what we call the scientific method. Scientific method starts with observations. You formulate hypotheses. You test those hypotheses, and then you think about what those hypotheses mean in terms of a grand, unifying paradigm. Now, I don't think that that's Black or White. That's a method, and if you utilize that method objectively, then we are capable of advancing what we know about the way the universe works.

However, Dwayne called into question whether the scientific method was always utilized objectively. He pointed to the presence of a strong racial ideology within the scientific enterprise that he believed contributed to the continued oppression of marginalized social groups. He explained this as, “a long history of non-objective scholarship, in which individuals started out with a set of socially-developed biases, and then used those biases to examine the data on human biological diversity and [come] to various conclusions that supported their initial bias.” In his view, the unchecked ability of socially dominant groups to both pose and answer questions better enabled them to draw various conclusions that validated their supremacy in health and education contexts. Dwayne believed his presence within the scientific community helped address such issues: “What I like to think I've brought to that discussion is an objective examination of the data.” Presumably, he intended for the underrepresented students he trains to also contribute objectivity to the examination of scientific questions. However, even here he made clear that the objectivity he sought was not entirely dependent on racial diversity. He did this by naming White scientists - starting with his former advisor and tracing back four generations of his academic

lineage - whom he felt contributed similar objectivity to scientific examinations involving race and biological diversity.

It is also important to recognize that Dwayne's interests either in social justice or science were not neatly aligned with race, alone. In the following quote, he expressed an interest more in addressing broader issues of social inequality that encompassed other social differences like race or gender. The quote also reiterates his interest in impacting the lives of people, in particular:

I think conservation biology is important - don't get me wrong - but I don't think it's the most important thing we could be doing. And, quite frankly, I don't have a whole lot of interest in that. Cause my interest is mainly in seeing human beings being conserved and uplifted, whereas some people may have interest in making sure that an obscure species of salamander doesn't get taken out by, you know, a dam. So, that's an orientation I think comes from being socially-dominant. When you're socially dominant, you have time to worry about stuff like that. But when you're not socially dominant - when you're worried about what kind of food access people have in the inner city - now that might be an NIH<sup>33</sup>-type proposal - but again, how you approach it is very different depending on whether you're a member of a socially dominant group or you're a member of a socially subordinated group. And, now, again, I wouldn't consider that Black or White - I would consider that social dominance versus social subordination, and in the United States, most African Americans tend to be from socially subordinated communities.

**Walter.** Walter was the first participant I interviewed in this inquiry. He was the longest-served of all the participants, but little about his appearance, movement, or speech suggested his actual age. He also remained an active and prolific member of his scientific community at the time of our interview, and appeared to still be heavily engaged with his students. Our conversation took place in his graduate student lab (in the presence of a student engrossed in her work) and we were interrupted twice by students seeking him out. Throughout the interview, he maintained an enviable mixture of qualities. He was knowledgeable, composed, even-keeled, and serious, yet simultaneously relaxed, warm, and inviting. He was, simply put, a cool guy to be

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<sup>33</sup> National Institutes of Health

around.

Walter discussed two projects, one at his university that engaged first-year undergraduates interested in STEM majors and a larger, multi-institution project that engaged K-12 students. Both projects focused on mathematics education. He described his motivation for pursuing the K-12 project as a sense of obligation on his part to attend to those in need. In doing so, he also established an expectation that his university contribute to addressing problems in the local community:

“So, I guess the initial motivation was just to see the need. I mean, we're in a university adjacent to a failed school district. And, you know, thinking about how we might be able to bring some of the resources to that situation.”

In discussing the importance of the project to him, Walter clearly described race and socioeconomic status as having roles in education inequities. He also connected education to larger social issues, describing it as a means by which impoverished cities could be revitalized. Finally, he expressed his frustrations with the situation, as he saw it:

I do believe that quality education is the civil rights issue of our day. This is, pretty much, a carryover from the Jim Crow era. And now, what used to be racial politics is now combined with class, so you have this class-race amalgam creating these situations in the inner-city school districts. But, until we address education, I can't see how there can be any hope for cities like [the city surrounding Walter's institution], cause nobody's going to come in there to move if the schools are in bad shape. And I think it's a national disgrace that we've allowed these conditions to be there, in schools all over the country. And particularly in urban environments.

Walter, whose training is in a social and behavioral science discipline, also portrayed his focus on mathematics education, in particular, as attending to issues of social justice. He described mathematics as an essential skill, explaining that fluency in algebra “is as important now to be able to succeed in this country as being able to read and write was at the beginning of the 20th century.” Further, he connected access to quality mathematics education with access to STEM careers and a fuller participation in society:

[it] is important to be able to reclaim these students that...would be marginalized, otherwise, in terms of [STEM] workforce development. These are the folks who are going to have to be manning the workforce. And they have to be ready for 21st century reality, in terms of technology. ... And so, if you have millions of kids who never even get exposed to higher level math, you're automatically cut off from any kind of career in STEM fields, as well as being able to function well in this technological society.

Similar to Dwayne and Adele, Walter did not clearly articulate whether there was a priority or order to his interests in science or social justice when approaching a problem of relevance to NSF. He ultimately concluded that his “social justice side” was ever-present in his actions as a scientist:

INT: ...do you take this sort of wide view of your approach as starting with the broader impacts - your personal connection to the broader impacts - and then you start from there and go towards building a proposal for NSF? Or do you find an interesting scientific problem and then realize 'oh this also lines up with things I'm interested in' and then- ?

Walter: Yeah, I think that the latter is a better description of the way it works. That...well I don't know, as I say that- [taps on desk, before starting over] It's like basic research versus applied research. You have a question that you might be interested in answering and you think this might be an interesting question for the field, and then as you're developing that inquiry, you recognize the applications that this could have. So that feels more like the process I go through. But, it's not as separated as that - it's like the social justice side of me is integrated into the whole thing, so it's there as I'm formulating every research question.

Just as Walter’s “social justice side” was ever-present, so, too, was Walter’s identity as a research scientist. While he was personally driven by a moral obligation, Walter also recognized such motivations as insufficient when justifying his work to the scientific community. He described writing good NSF proposals not as a matter of making appeals to civil rights or social justice, but rather one of presenting well-organized arguments in a manner that is responsive to the solicitation. Further, intervention models needed to be scientifically proven as efficacious before all else, because “otherwise, people won't be interested, if it's not showing some effects.”

Finally, while Walter wasn't entirely clear how his science and social justice interests

interacted when approaching a new problem, he was clear on wanting to leave a legacy of having impacted society more than science:

INT: Okay, when you think about your role as a faculty member here, do you think that one of the criteria - intellectual merit versus broader impacts - do you feel that one of them is more important than the other? Especially considering what you do?

Walter: Yeah, I mean, in terms of my mission as a faculty member at an HBCU, I guess the broader impacts is what I'm most interested in. So...it's one of those things: do you like your son or your daughter better? [chuckles] I mean, they're both important. And they're both a little different. But I guess, ultimately, when I retire, I would hope that some of the things I did had some broader impacts. I think that would be more important to me than any particular intellectual discovery within the narrow field would be.

*Examining the consequences of attending to social justice issues on NSF merit review.*

Walter's case also illustrated how PIs who decide to work with marginalized populations in impoverished environments can face additional challenges when implementing and proposing NSF research activities. His K-12 project, in particular, faced implementation challenges that extended beyond the difficulties social/behavioral scientists engaged in community-facing projects can expect to face relative to clinical researchers working under controllable conditions. Walter alluded to the added complexity of working with impoverished public-school students and described his targeted students as facing significant challenges related to their poverty, including post-traumatic stress disorder, health and nutrition issues, and cognitive developmental issues. Further, Walter shared how his project also had to coordinate the efforts of multiple community stakeholders and navigate political landscapes within low-performing public school systems beset by high turnover and budgetary concerns.

In addition to the implementation issues, Walter's case also raised the possibility that PIs pursuing NSF funding to work with marginalized populations may encounter additional challenges in the proposal stage. Walter's projects went beyond efforts to simply provide



additional resources or interventions to help underprivileged students perform better within existing frameworks of educational assessment, such as standardized state testing or the SAT. His projects were inspired by civil rights activism taking place outside of higher education and adopted similar aims seeking to disrupt and rebuild societal norms and structures that contributed to social inequities. For instance, his projects supported pedagogical interventions that challenged fundamental norms by teaching the algebra-through-calculus mathematics sequence in a non-traditional order. The projects also utilized non-cognitive interventions that directly targeted students, such as mindfulness training and near-peer mentoring, with the intention of improving their academic engagement and performance.

While NSF values innovation, participants attempting to broaden STEM participation by disrupting the norms and structures that have served to exclude certain social groups from the STEM pipeline may first have to overcome those same norms and structures within the merit review process, itself. This possibility becomes apparent when examining Walter's interpretation of "one really bad review" he received on a NSF proposal:

...the bad review came from a person who, I think, didn't believe in the concept. That cognitive training could produce any kind of far-transfer to academic performance. ... It wasn't that they were criticizing the proposal in terms of not being well-put together or anything, but they didn't have faith in the efficacy of the intervention we were doing. ... [They were] prejudiced against the possibility that this kind of training could improve cognitive function.

Later in the discussion, he expanded on what he understood to be widespread beliefs about the nature of intelligence at the root of the reviewer's prejudice, and pointed to the potential for conflict to arise when proposing interventions that did not subscribe to these beliefs:

And, in terms of what I was mentioning before about cognitive training, you still have this belief that cognitive ability is innate and it's intractable. So you're kind of born with your level of intelligence and you're pretty much stuck with that. Even though you can improve some things about your functioning, your innate intelligence is fixed. And that's a deep prejudice in - not just in [social and behavior science disciplines], but in society, I think. And so, if you are saying,

“well maybe there might be some things we can do that help to build that skillset” - we have to fight against that prejudice.

Walter also recognized how norms and beliefs related to the purpose and methods of education could result in similar biases:

And I think [NSF reviewers] are impacted by the environment that they were trained in. For example, you find a lot of people who believe that calculus should be the mechanism for weeding out the people who aren't intellectually capable of moving on to have a PhD in science, versus the idea - kind of a literacy model - that this is a skill that can be acquired, it just might take a little bit of extra effort. So, people bring those kinds of biases with them. ... Everybody assumes that the way they were trained was *the* way that you have to be trained, and if you do anything else you're watering it down. Or that kind of thing.

Walter never portrayed any of the norms or beliefs he discussed as having a racial or socioeconomic orientation. However, he did draw a connection between the prejudicial adherence to these norms and beliefs (the “it” in the quotation below) and the participation of students who have not found success in educational systems based on these norms and beliefs:

It catches this issue of minority participation in science - even though it'd apply to anybody - it disproportionately affects the kids coming from these places where they haven't had the [math/science] background. And so, how do we catch them up? It's not just a matter of remediation. There's a whole...attendant kind of cognitive array that they also need to develop to be able function. And how do we get them that? And is that a worthwhile endeavor?

In choosing to use the word “prejudice,” Walter envisioned a merit review process in which PIs pursuing novel interventions to broaden participation may be faced with additional burdens of undoing certain preexisting biases in the minds of reviewers. Further, when considered in the context of my entire discussion with him, I interpreted Walter’s asking, “is that a worthwhile endeavor?” as implying such proposals also force reviewers to consider not just intellectual merit or broader impacts, but also moral questions about the value of providing vast resources to marginalized populations.

**Vernon.** Vernon greeted me in his cinder block-walled "little lonely basement office"

with a barrage of questions about my research. Throughout our discussion he remained enthusiastic and excitable, demonstrating a tendency to capitalize on my meaningful pauses as opportunities to pose his own questions about my studies and family. I also found him to be quick-witted and equally comfortable quoting the Bible, Black historical figures, or Plato to make a point. The latter trait seemed illustrative of his apparent ease in bridging his multiple worlds and identities. His demeanor and speech left me little doubt that he was the son of southern farmers and that he took pride in continuing his family's humble connection to the fields. But that same demeanor and speech also made equally clear to me that he was a faculty member at a research-intensive institution with a biology PhD and experience working at two federal science agencies. Further, in this professional role, he clearly took pride in making a difference in the lives of Black students and helping them reach their full potential.

Just as Walter had, Vernon alluded to an institutional mission for HBCUs that extended beyond educating enrolled students and involved the physical communities surrounding the schools. This belief served as the basis for his NSF project. Vernon's project "[broke] down the ivory towers of the university" and engaged children at neighborhood-based venues, like the Boys and Girls Club, where the children felt "loved and appreciated." Like Julissa's project, Vernon sought to "build a national model to be more inclusive of underrepresented students in science." Further, these models were intended for use by other HBCUs, nearly all of which Vernon understood to be centrally-located in high-poverty, high need areas.

My discussion with Vernon spent little time directly exploring his understanding of the role of social identity in the work he did. Ultimately, Vernon was more focused on sharing "some truth" about how HBCU leadership impacted the ability of HBCU faculty to compete for research funding, both at his institution and others. This will be discussed later in the chapter.

However, he briefly explained that researchers needed to focus less on self-efficacy and more on better understanding the role of student identity in order to impact STEM persistence and retention. He also confirmed his interests in advancing the condition of students over advancing the knowledge of a field. Earlier in the conversation, he had classified students into three categories: those who might fail without his help, those needing no help to succeed, and those beyond his ability to help. Here, he compared service to students in the first category (i.e., his preferred “type”) to the objectives of more traditional research:

I wasn't interested [in more traditional aims of bench research] - I did that at [a federal science agency] for years, [publishing in] some obscure journal, you know. Again, it goes back to my three students: on the rope, looking down; on the rope looking up; or letting go. And my type- I like students who are on the rope, but they are looking down - so just to change their attitude or change their altitude. Yeah, I see value in that for me. I see worth.

**Denise.** Like Adele, Denise<sup>34</sup> also arrived at her HBCU intending to conduct research in her scientific discipline, but without start-up funds to build out lab space for her biology research, she shifted her focus to STEM education research. In Denise’s case, focusing her research efforts on students and STEM education rather than lab work also enabled her to better attend to both her family-related interests and her interests as an active member of the academic scientific community:

Denise: It...personally rewarding, satisfying? Um, on the home front, yes. Because, I'm able to be married and have my children and spend some time with them, versus - so my spouse works in a research lab, and if they have an experiment going, it's crazy hours. You stay until 12[am], you go in seven days a week, it's a three-month stretch. And it is...be it tissue cultures or rats, whatever you're doing, you got to be there. And it's...not that it can't be done, but often times, women have to make a choice. They just have to make a choice about their priorities at that point in time.

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<sup>34</sup> The NSF proposal Denise chose to discuss with me sought to serve students by providing faculty development to ensure quality instruction in technology-rich classes. It is discussed further later in the chapter.

INT: So then, the focus on the STEM education research, you feel better enables you to -?

Denise: [sighs] Find that balance. [laughs] To find a balance that I feel like I'm still making a scientific contribution to my department [and] university. But I am still able to maintain some degree of family life.

This balance had not come easily, though. Throughout our conversation, she recalled encounters with sexist colleagues, questioned her own commitment to the field, and grappled with her realization that she couldn't make the contribution to the scientific field that a younger version of herself had set out to make. In doing so, she echoed Adele's theory in which the science community judges its members on their willingness to divorce themselves from aspects of their social identity that don't align well with the White male identity. Helping her students better understand the choices they would eventually have to make in order to balance the conflicting needs of their own multiple social identities also seemed important to Denise. This knowledge would help students make "informed choices" that would get them closer to career paths they were passionate about. Parental responsibilities were of particular concern to Denise, given her personal experiences as an academic researcher:

INT: How satisfied have you been with [the decision to focus on STEM education research]?

Denise: it's a delicate dance...in that - I often tell my students that (maybe these aren't the right, choice words) but science is still a white man's world. And...there are students that still question: how can I be successful in STEM, be at medical, graduate, professional school and have a family, you know? I want to get married, I want to have children - how can I do that and be successful in this career? It is - for me, you know - after I had my second son - I wanted to get married, I wanted to have children, but I think every woman in this department who is married and/or has children can say to you that they've experienced some type of discrimination or some type of off-color remark when they've made a choice. So, after my second son was born, to have a female faculty say to me if I want to be taken seriously as a future administrator or if I want to excel within the department, I should not have any more children: it also speaks to [discrimination]. Some of my colleagues, when they were pregnant, their PIs are

saying we want you to do this experiment and it's only ethidium bromide<sup>35</sup>. It's only working with some x-rays or some beta mercaptoethanol - and you're thinking [laughs] this is probably not the best thing for me to do.

When I asked if she would choose to work in the lab if it were somehow possible to maintain her work-life balance, she remained hesitant. Eventually, she questioned whether she was sufficiently passionate about her biology research to make the commitment necessary to being successful in the field (note, in the following, that she remains confident in her capability as a scientist):

It takes a special type of individual to give that level of commitment. So, I think being a bench scientist requires a level of commitment - perhaps a deeper level of commitment because there's a time commitment that I wasn't willing to give up. ... So, while I've been trained in my research, can I unequivocally say, 'oh I was passionate about eukaryotic gene transcription'? No. And, um, so what would have- how hard would I have worked in that area of research? So, it's not so much the capability, but perhaps the level of commitment and the amount of passion that I had for that area. And, again, life changes - life changes one's path when it comes to: this was important to me in my twenties, but this was more important to me in my thirties...

While Denise had come to appreciate being able to train dozens of students to conduct research, the pace of basic research wasn't as appealing to her:

[I] guess, what frustrated me with basic research: it takes so long. Like, ten, fifteen years long to come up with....and it's - there's publications every year, but it takes ten years to say, "Okay, we've identified this pathway, this transcription pathway from..." And then it's like, well, okay what does this mean? Because we've tested in a rat model, and we can extrapolate out to-, but it's still going to take another ten years to move it to a cow model. And after you do that...okay, do we want to edge on to clinical trials?

She reiterated her dissatisfaction with the incremental nature of basic scientific research later in the conversation:

Being faculty here, teaching students, I see in them, what I saw [in myself] coming out of high school into college - eighteen, nineteen, twenty [years old] -

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<sup>35</sup> Ethidium bromide is a compound used in molecular biology lab work that is widely – but somewhat controversially - believed to be mutagenic.

you're thinking, "I want to cure cancer. I want to solve this problem. I want to figure out what triggers Alzheimer's. Like, I want to solve it. Or I want to play a part in solving this." And then you get to your graduate work, and it's almost like: you study just a very small piece of the bigger picture and...at some point, for me, it's just like - I'm not demeaning or trivializing that this is all I'm going to do - but it's like: this could take forever. And reality sits in. "I'm not going to be able to cure cancer. I might be able to do some additional research on this gene that causes this cancer, but...I'm not going to be able to cure this disease." And I hate to say- that's a pessimistic view for those who are going through the disease or through the - whatever - existing condition, but it is - it is going - it may or may not be in my lifetime that...this contribution - will it have made a difference? Yes, but again, the more I learn, there are pre-disposing factors and...all these other layers start coming in and it's like: could I better utilize my time doing something...else?

**Julissa.** Julissa greeted me with a broad smile and a deluge of questions about my research and my interest in HBCUs. Once the focus of the conversation shifted back onto her, it quickly became apparent that family played an important role in Julissa's life and career. She weaved in stories about her mother (an educator) and her newlywed husband (also a STEM faculty member at a different HBCU). She spoke about the students as part of her family, declaring, "My philosophy is this: I'm going to treat my students like I would want someone to treat my child," and "You gotta see these kids as *your kids*. You gotta be willing to give them a hug and tell them congratulations or 'I'm proud of you'." And sometimes, the students literally were part of her family, as I learned when we were briefly interrupted by a student Julissa recently discovered to be her cousin. She also spoke of the "heavy load" of raising a son with a neurological condition as a single parent (prior to meeting her current husband). This experience had led her to face a significant decision earlier in her career: "did I want to be a stellar career researcher and applying for grants and teaching and service and all that...or did I want to make sure that my son could be able to take care of himself, but still do something as far as a career in science?"

Julissa's project involved exposing children from impoverished, academically-underserved communities to innovative projects in biological sciences as a means of increasing

their STEM interest and their awareness of STEM's relevance to their lives. She described the project's intellectual merit as adding to knowledge of the effectiveness of various educational tools and models. She also stressed the importance of recognizing racialized and gendered identities in the context of STEM education, and felt that her identity as a Black female scientist gave her advantages in sparking the STEM interests of Black children, relative to non-Black scientists:

So, what we noticed about our [project] versus others...[sighs]...unless you look like me, and have been where I've been, how are you going to understand how to reach someone who's there now? So, the difference with us is, okay, I can go to the YMCA [nearby] and I can - a little Black girl: I can go talk to her and tell her what I do, show her what I do, and she'd be like, 'oh, I can see myself.' But someone who's not - that doesn't look like her? She might listen to them for a little bit, but she can't see herself. And same thing with a little Black boy. He can - anybody can be your mentor, if they're willing to share - and that's always been the case. But it really helps to see someone that looks like you, that's passionate and enthusiastic about what they do; and [the child] realizes 'oh, I like doing this, too. I can see myself.'

She also found her contributions to STEM education research more fulfilling than more traditional pursuits in STEM research:

Science education research is just as important as discovering some molecule or the interactions that this molecule might have - I'm a pharmacologist by training. So, it's important, yeah, for me I can make a drug discovery or whatever the case may be, but big-pharma's doing just fine without me.

While she did not explicitly frame her project as a social justice effort, she spoke of having a responsibility to help students understand the importance of STEM as well as their potential to succeed in STEM fields. This is evident in the following exchange:

INT: Okay. So, you talked to me about what you proposed as the intellectual merit of the project. So, slightly different question, but how did you know, when you looked at the proposal for this - like, how'd you know that this project had merit? That this was a project worth-

Julissa: Fitting my heart and soul into?

INT: Yeah.



Julissa: How did I know? By being a professor for [over fifteen] years (and that includes a post doc) and seeing the attitudes of students change, and the fear of science or math that they have. And to hear people say, "Oh, I don't like math." And this is not just non-majors, but these are [STEM] majors saying stuff like this, and it's like, 'you don't get it.' And so, you recognize that there's a need and you have a responsibility to meet that need in some way.

Soon after this exchange, she reiterated her feelings of responsibility, declaring, "I don't have a right to sit here in my office and not try to do something to change their attitude."

Julissa's obligation to educate and care for her students could also be seen as a tradition passed down through multiple generations of community members. Her role as part of this tradition was to groom the next group of students to succeed her and go on to educate others:

...we need people who - I need someone to come behind me that's going to take my place. And if I don't do something to help that, it's not going to happen. So, that's what drives me. I need somebody, because I'm retiring in twelve years. The mortgage will be paid! Me and my husband, we've already said it: we are retiring, we are traveling, and we are going to do what we want to do! And I tell my students now - the ones that are in college and that I'm mentoring: I don't know who it's going to be, but one of y'all is going to come back here and take my place.

She also credited the teachers who had come before her and inspired her to become a scientist (while noting the importance of their social identities):

I had four math teachers, all of them female. And of the females, three out of the four females were African American. So, I saw myself. My AP Chemistry teacher was a Black female. So, I saw what I could be.

This generational obligation extended outside the context of education. Towards the end of our conversation, she shared a story that provided insight into other personal experiences that led her to feel responsible for ensuring the success of the next generation. The story recounted learning about injustices perpetuated against her great-great-grandfather, who founded the church she still attended:

This past weekend, we went to the little small church that I belong too - like I said, great-great-grandfather [founded it] - I went to see his grave. And - it's not at the site of the church we go to now, but...it's at the old site of the first church,

and when you start learning the history and the dirt that was done [trails off]. So, the church was sitting on top of a hill. Beautiful area! There was a road that led across the [stream] and led up to the church that sat up on the hill. You can still see the white stones that lined the pathway that led up to the church. Come to find out from the historian that the state decided to stop funding all state roads that led to property owned by Black folks. So - and you can still see the outline of the road - so when I go and learn about stuff like that - and you can record [this] - that pisses me off. Okay? And so, it makes me realize even more why my value - what I value - is important and significant. And why I don't really need to give a damn about what anybody else thinks about anything anymore. I don't care about NSF [laughs]. I care! But, I'm not worried about it.

The end of the story, in particular, also speaks to the way in which she had come to reconcile the multiple interests of her identities at this point in her career. Earlier in the discussion, she had put it more plainly:

Once I made tenure I decided I was going to do what I wanted to do... you gotta be true to yourself. So, for me, [what do I] value? My legacy - I want to leave a legacy. My legacy is mentoring, basically.

**Dorian.** My discussion with Dorian took place in his un-airconditioned office on an unseasonably warm day. Posters related to objects from his discipline adorned the wall and spoke to a passion for the field that took hold of him "somewhere in junior high school." I found Dorian to be unfailingly earnest and prone only to finding occasional humor in some of the "asinine" logic of the stories he recounted. There was a curtness to Dorian's responses that, after studying the transcripts, I came to interpret as his reluctance to conjecture or deal with questions that couldn't readily be treated through empirical means. However, Dorian was never rude. In person and by email, he was friendly and seemed sincerely interested in helping my study. He was also gracious with his time during my visit, sitting for the longest interview of all participants. Further, he seemed most comfortable when able to adopt a role of caretaker. Twice during the interview, he expressed concern that the wind howling through the open window would ruin my audio recording, and whereas other participants ignored my occasional admission that "this question just occurred to me as we were talking," he immediately advised I write the

question down so I would remember to ask it of the other participants. He leaned further into the role of academic advisor later in the discussion, proposing that a "large survey" asking faculty, "what motivates you to write a science proposal?" and "why don't you write more of them?" might be a more fruitful way for me to find answers to my research questions.

Dorian also seemed more willing to talk when he was able to shift the focus away from himself and his thoughts and onto the institution around him. Therefore, much of our conversation focused on his understanding of his institutional environment and HBCUs, in general. However, our conversation still gave insight into how issues of social identity and social justice had shaped his career and interactions with the STEM enterprise. When we talked, Dorian was faculty at his second HBCU, and he had entered higher education following a lengthy career in a federal science agency. The career move helped Dorian reconcile a moral obligation related to his identity as a member of the Black community. He recognized differences in fortune between himself and many others who shared his racial identity, and felt a responsibility to attend to those differences by giving back to the community:

Dorian: This is my second career. I did not go from graduate school right into teaching. I spent a long time working with a federal agency so I don't come from academia, and I don't view academia as the be-all, end-all.

INT: So, how'd you end up in academia?

Dorian: I ended up in academia because I wanted to make difference. And so here I am, making a difference.

INT: To whom?

Dorian: For the cause. For the revolution [laughs]. Like it or not, being Black in America, you have a certain responsibility. Some people shirk that responsibility, some of those people are sitting on the Supreme Court [i.e., Clarence Thomas]. Some of them are head of the Housing Department now [i.e., Ben Carson]. Right? But for others of us there's a responsibility to be had. I'm lucky!

INT: How so?

Dorian: I'm not dead. I'm not in prison. Never been arrested. You get busted for pot. What's pot? A felon, right? Try to get public housing now. You already went to jail, you already paid your fine, [but] you keep on paying.

Note, also, in contrast to Dwayne's suggestion of a natural alignment between his identities and his career choices (i.e., he claimed he could have attended to social justice concerns as a lawyer, but chose to do so as a research scientist because he was "just good at science"), Dorian's dim view of academia at the beginning of the above quote painted a less harmonious image of his personal and professional identities. His approach to grant funding was also somewhat fractured. Dorian made clear that he pursued NSF funding primarily for STEM education projects and sought funding for research in his discipline through other means: "It's not that I don't write science grants. I do, I just don't write them to NSF." This was partly because he understood NSF to be uninterested in his particular area of research, and also because he felt his institutional setting placed too many burdens upon him to be competitive for NSF "science grants." At one point in the discussion, he made clear that NSF did not play as significant a role in his work as I had apparently been suggesting:

INT: So, let's go back to intellectual merit, broader impacts.

Dorian: [laughing] Who cares about intellectual merit and broader impacts!?! That's only NSF. No one else does that. Can you name another grant program that does that?

INT: No.

Dorian: Neither can I. [chuckles] So, is it that important?

He did, however, understand NSF to be interested in supporting his efforts to improve teaching within his department, noting, "NSF's mission is also about teaching and how we teach students better. It's all about science education." To that end, he sought support from NSF in order to more effectively attend to his commitment to educating Black students:

Dorian: HBCUs, we have a certain mission, you know? And...at least here,

basically it's open access, so you get a lot of students who have a dream, right? And you want to help them achieve that dream. And to do that, you have to teach them, and you have to teach them well. And I'll tell you - the one thing I can tell you for absolute certainty, the one thing I know for sure, is that, if I teach the same way that I was taught, it isn't going to work. And so, I'm trying to do something different, and it's hard to do something different. It's hard to do something different. And with these grants, if I get them, they'll help me do something different. I'm really interested in this active learning stuff. I've already had a course in it. Have I ever had a course in education? [No.] And that's what I spend most of my time doing. Oh well.

INT: So, you see these sorts of projects as a way of better enabling you to reach the students that you want to reach?

Dorian: Yep. Become a better teacher. At this point, you know, I'm never going to win the Nobel Prize, right? I'm not. The odds are so miniscule I don't want to spend my time on it. But I can become a helluva good teacher. I know I can do that. That is within my grasp.

Dorian's case also helps disrupt the conclusion that *all* Black STEM faculty are willing or able to devote the entirety of their efforts to serving students. Immediately following the above quote, Dorian made it apparent that he perceived conflict between his interests in becoming a better educator and the interests of his institution, whispering to me: "But don't tell anyone else that, yet. You can tell them after next May, if I'm still here." He soon clarified that, unlike Julissa or Denise, he did not see a focus on STEM education research as providing a clear path to tenure at his institution.

Finally, like Dwayne, Dorian drew certain limits on how much consideration he was willing to give to issues of social identity within the scientific enterprise. Dorian dismissed the hypothesis I proposed to him that Black scientists might have different motivations for pursuing science, and that their interests in community service might "somehow translate itself into the proposal they're writing." He posed his own, more practical theory in its place: "I mean, it could be the case. [Or,] it could be the case that we write those [education-oriented] grants because that's what we spend most of our time doing." When I pressed further with my hypothesis, he

responded by rejecting the influence of social constructs on the practice of science:

I don't believe there's anything like Black science. When I was in Malaysia one time I was talking to this guy, and he was talking about Muslim science. I was like: "science is science." You know? It's a process. All right? It's a way of acquiring knowledge, and that process goes through developing a hypothesis, testing a hypothesis, examining the data, coming to some conclusions. That process, which is the essence of science, has nothing to do with whether you're Black, White, whatever. That's my take on it.

**Terrence.** As a researcher, I am particularly grateful for Terrence's presence in this study, as it does much to demonstrate the diversity of thought, understanding, and behavior present among Black HBCU STEM faculty. Like all of the participants, he was interested in attending to the HBCU mission, yet he did not portray the mission in the all-consuming manner many other participants did. Unlike most other participants, Terrence discussed a NSF-funded research project that did not focus on education research, and his personal interests as a young academic research scientist played a strong role in our discussion. Terrence was less than five years into his first faculty position at the time of our discussion, making him the youngest and least experienced of all the participants. His youth shined through in various ways, including his still-enthusiastic reliance on caffeine to make it through days in which he didn't have time to eat lunch. He relied heavily on speech fillers (e.g., "stuff like that") and his responses occasionally came with a degree of hesitancy, as though he was working out the answers to questions as he talked.

Terrence also gave an impression of humility. He described his reliance on collaborators and his efforts to keep his expectations - and the expectations of those around him - reasonable and appropriate to his position as junior faculty. He was concerned with building his reputation and integrating into the social network of his field to gain access to collaborative opportunities on large projects, and he recognized the task of building a research career at a HBCU as a challenging one:

I think it does take a certain respect for the people who have been in this situation before. Because I know there are a lot of good researchers at HBCUs where their career just is at a standstill because of the fact that you don't have the - everything in place to do what you think you can do. So, you say, "Oh, yeah, I'm going to come in and bring in ten million dollars," but if nobody's done that before, that means that they may not be ready for you to do it, either. Like, there may not be the things in place that are at other institutions.

He also identified NSF as playing a major role in his faculty career plans: "my interaction with NSF is my livelihood." Appropriately, he had served on NSF review panels and demonstrated a high degree of familiarity with NSF and its operation. He comfortably discussed the influence of Congressional oversight and mainstream public opinion on program officers' and reviewers' decisions. Whereas Dorian questioned the importance of the merit review criteria, Terrence had clearly spent time developing an understanding of the relationships between the two:

Well, I think that, for me, a lot of my training was NSF, in terms of: this is what they're looking for, this is how you think about broader impacts, [and] intellectual merit.

Terrence also brought a different perspective on the role of social identity to the project. While he acknowledged the role of race in his decision to join his institution's faculty, he generally showed less interest in using race or SES to define his communities of interest. The NSF project he described during our conversation focused on advancing communities defined by scientific disciplines, with no explicit mention of race. Specifically, Terrence's project sought to create infrastructure to facilitate the multidisciplinary work of researchers and students in related fields, while also enabling him to pursue a research agenda involving microelectronics for emerging technologies. He characterized the infrastructure as "somewhat bizarre," in that it comprised a repository of knowledge containing virtual models, toolkits, and tutorials, rather than physical equipment or facilities. He justified the importance of the project by describing how it would allow members of various interrelated disciplines to benefit from each other's knowledge without having to thoroughly understand the other's work:

"...the intellectual merit is that, right now we have these very separate fields of...integrated circuit design and computer design, based on abstraction. So, you have...a computer scientist who does the application, software-level stuff. You have the digital logic designers who know all the Boolean equations...You have the circuit designers who can simulate the transient response of the circuit. You have the device designers who can make a transistor. Then you have the physicist who can talk about the underlying principles of certain materials. So all of these people are working on how to make computers more reliable. [But,] They don't necessarily know anything about any level that they're not a part of."

In justifying the importance of his work, Terrence pointed to his own experience as a graduate student and recalled group meetings in which he felt he could have benefited from the work of peers if he could have more readily understood that work. His NSF project was also intended to prevent such issues among his own graduate students.

When discussing diversity's role in the scientific enterprise, he also intentionally evaded the role of race:

Terrence: ...I think differences in environment create differences in ideas. And so, I think that if you give a problem to the same type of researchers, then you're going to get similar solutions. If you have - I don't even mean this from a cultural or racial point view-

INT: Yeah, I was going to ask, what does that mean: "the same type of researcher?"

Terrence: So like, for instance, if you go to Stanford and say, "solve this problem," it's going to be different than if you go to [a small, nearby PWI], for instance, and you say "solve this problem." And that comes from the fact that every university looks for a certain type of person from a certain background and attracts a certain type of person. In terms of, just personality and the way people think. But then, also, when you have a resource-heavy institution, then that creates a different model than a resource-strapped institution. So all these things are just creating different scenarios. But if you compare - if you give the problem to both Stanford and [a nearby research intensive PWI] for instance, then you might come out with similar types of ideas, compared to if you give it to Stanford and then [the smaller PWI mentioned earlier]. I just anticipate that - assuming both [solutions] are successful that they will be successful in different ways.

Whereas other participants like Walter and Adele spoke of the intertwined nature of their racial, scientific, and professional interests, Terrence discounted the effects of his HBCU's social



environment on his work. He acknowledged the personal appeal of working with Black students, but did not see how it would impact his approach to NSF grant-writing:

Definitely, [his HBCU] gets a leg up from me, compared to, say, [a comparable nearby PWI] just because...of the HBCU aspect of it. But, I don't think that really speaks too much to how someone like me would interact with NSF in comparison to [*trails off*] - I could just as easily be at another institution.

Similarly, Terrence seemed less concerned about fundamental issues of social justice compared to other participants. Here, he demonstrated interest in addressing the issue of Black students not taking part in available opportunities that other students would seek. However, he dismissed the relevance of “whatever reason” may be at the root of the issue:

I don't see that much interaction going on between the [nearby] companies and the students and stuff like that. But there's a lot of smart kids here - or I should say adults, really - but, if I can actually be here and do the things that I do, then I'm creating a pipeline to these different opportunities that, for whatever reason, previously didn't exist.

Certainly, this statement alone does not imply a complete lack of concern on Terrence’s part about issues of structural or institutional racism. However, Terrance’s decision to not delve into the reasons behind the lack of interaction between the students and the surrounding companies stands in sharp contrast to Walter’s declaration that educational inequities are a “national disgrace” or Dwayne’s statement that society operates in a “fundamentally racist” manner.

### **Examining the Role of the Participants’ Institutional Environments**

This section examines how participants included their institutional environments in discussions about NSF and the STEM enterprise. Participants’ discussions about their institutions are divided into three categories. The first deals with the burdens the institutional environments placed on participants’ efforts to pursue NSF research funding. All participants agreed that they faced additional obstacles when writing grant proposals and implementing activities compared to their counterparts at PWIs. Among this group of participants, the nature of the obstacles varied

depending on whether the participant's NSF activities focused on STEM research or STEM education research. Three cases are also examined in which overcoming institutional obstacles served as motivation for the participant's NSF effort. Two of these cases led to rejected proposals; the third case led to a successful grant. The second section deals with discussions about topics of the institutional mission, institutional leadership, and institutional pursuit of research funding. The HBCU mission was central to all of the participants' decisions to teach at HBCUs; however, the discussions raise questions about the participants' satisfaction with how their institutional leadership balanced research aspirations with the educational mission. The final section summarizes participants' discussions about the relationships between HBCUs and NSF. Among the participants, there were varying views regarding what actions either the institutions or NSF should take in order to improve HBCU research funding.

### **Institutional Burdens and Participants' Approaches to NSF**

As anticipated, all of the participants discussed or alluded to obstacles present within their institutional environments that impeded their efforts to procure NSF grant funding, implement NSF-funded projects, or advance their research agendas. The following findings arose from these discussions about institutionally-posed burdens:

- The ways in which participants defined institutionally imposed burdens differed depending on the focus of their efforts. Participants whose NSF projects focused on STEM education activities generally pointed to high teaching loads and minimal administrative support as absorbing time they could devote to grant-funded activities. The two participants whose NSF activities advanced their STEM disciplines focused more on how their institutions' prestige and research infrastructure impacted their efforts.
- HBCU students remain ever-present in conversations regarding research and NSF. They

were sometimes portrayed as part of the obstacles faculty face in procuring funding, and participants pointed to students' lack of academic preparation as adding to their burdens. However, students were clearly the participants' primary concern, and there was nothing to suggest participants perceived them as an unwanted distraction from other interests. Instead, in some cases, desires to meet students' unmet needs served as the motivation underlying participants' NSF projects.

- While the HBCU institutional context lends itself to strong claims of broader impacts (i.e., broadening participation of students underrepresented in STEM), certain aspects served as potential impediments to strong claims of intellectual merit. However, one case provided an example where a potential weakness was leveraged to create intellectual merit for a participant's project.
- Participants frequently utilized their understanding of PWI environments and PWI faculty's relationships with NSF to communicate the situations at their own institutions. In doing so, participants exclusively portrayed PWIs and their faculty as advantaged relative to HBCUs and their faculty. These advantages comprised better institutional support, more available resources, and, in some cases, a better-prepared student body.

Various aspects of participants' discussions about the institutional burdens they faced are examined further in the following sections.

**Defining the institutionally-posed burdens – STEM education.** Participants whose NSF projects involved STEM education activities focused on how their institutional environments impacted the time they had available to devote to research and NSF-related activities. In particular, participants pointed to the difficulties of balancing 12-credit hour teaching loads (and the accompanying advising load) with grant writing and research efforts.

Some also described being expected to take responsibility for additional non-research, non-teaching tasks in the absence of better administrative support.

Participants portrayed these added burdens as placing them at a competitive disadvantage to their faculty counterparts at PWIs in terms of research grant procurement. Dorian, in offering to “solve the problem” I posed of why HBCUs are underfunded by NSF, also related the drains on time to his understanding of his institution’s financial situation:

It's time. It's time and support. My colleagues at [a research intensive PWI], they do not teach twelve credit hours a semester. And they never will. Okay? So it's a time thing. The other thing is just money. Point to me an HBCU that's flush with cash. None of them. Even Howard [University] is struggling right now. Even here our enrollment was down in the Fall. We're what, two million [dollars] short-falling now? The kind of support that my colleagues [at the PWI] get, it's just not going to happen here. [Here,] you do it all...it's up to you to collect all that data, pull it all together, call all those meetings, arrange for those conference calls. And it's time. It's time and effort.

Adele, who had previous experience as research faculty at a masters-level PWI, joined Dorian in recognizing that they were expected to undertake certain grant-related administrative tasks not asked of colleagues at PWIs:

Just getting [a proposal] written, in terms of the time, is hard, and then, after it's written and it's given [i.e., awarded] to me? Managing it. Over there, at the PWI, there was a person in place whose job was to help me get through this whole process. Here, it's also my job.

In addition to arranging meetings and conference calls, participants described collecting biographical sketches and other data from collaborators and collecting multiple signatures for internal approval of grant related activities as non-research related tasks that absorbed their time. One participant also found herself serving as program director for one of her NSF-funded projects, which saddled her with extra duties and responsibilities, including chaperoning undergraduate participants on field trips per institutional policy.

Walter and Vernon also connected institutionally-imposed burdens to the potential of

HBCU faculty to generate NSF proposals with strong intellectual merit claims. Walter focused on the issue of time, which he described as “the most important thing in terms of being able to be successful” at HBCUs. In response to the question of why intellectual merit is more difficult for HBCU faculty, he theorized that institutional factors ensure HBCU PIs lack the time needed to sufficiently engage the scholarly conversations in their respective fields:

"Probably because [of] the time factor. I mean, the broader you can make your literature review, for example, the easier it is to demonstrate the intellectual merit, because you're tying it into what's important in the field...that conversation in the literature. And I think, when you have four classes [per semester] and 50 people to advise, you don't have as much time to peruse the literature. So, I think that's a big issue."

Vernon responded to the same question by contrasting the resources available at certain PWIs to the resources available to STEM faculty in HBCU environments:

“Because [HBCU PIs are] trying to implement something. Okay? They’re trying to get money to buy a computer lab. They haven’t gotten to a sophistication of that level, yet. Oberlin’s already got a damn computer lab! So Oberlin's [on] a whole different level. It's a different level. If you already - you know, the new model now is 'teach more with less.' You heard of that? Well, if I already got the 'more,' I can do with 'less'.

He continued by describing how other institutions can generate intellectual merit by “taking different parts of [an educational] model away [and] seeing what happens,” while many HBCU faculty are still busy building foundational models.

Both Walter and Vernon implied that intellectual merit could more readily be generated when the research questions are posed in institutional environments that provide faculty greater access to resources. In Walter’s description, the resources took the form of time available to focus on scholarship. Vernon focused more on educational resources, both pedagogical and physical. Further, Vernon’s theory suggested a hierarchy of needs within this context, wherein PIs would not be able to focus on proposing research with strong intellectual merit until they had first resolved issues with missing educational resources. Vernon’s theory is considered further in

the following section, which describes the cases of participants who sought grant funding specifically to address education-related deficiencies at their institutions.

Vernon also portrayed faculty at certain PWIs as having advantages in the form of leadership who support faculty STEM education research and grant procurement efforts. Specifically, he pointed to a group of several small, liberal arts PWIs (including Oberlin) he understood as taking action to ensure they are competitive for NSF funding. This action included fostering collaborations and encouraging faculty to visit NSF to directly engage with program officers. Vernon saw the latter practice as particularly crucial for success in the NSF arena. He strongly suggested that faculty dialogue with program officers affords the faculty member competitive advantages in the form of knowledge of “buzzwords,” “key documents,” and other information that program officers might not be willing to share over the phone or by email. In contrast to his portrayal of these PWIs as promoting faculty interaction with NSF, he posed the hypothetical situation in which a HBCU faculty member’s request to visit NSF would be met with an administrator’s misguided concern of, “Hey, your classes? Who's covering your classes?”

**Focusing on meeting unmet needs – Dorian and Denise.** Dorian and Denise served as intriguing cases to discuss in light of Vernon’s assertion that HBCU faculty are more focused on implementation and providing students needed resources than advancing knowledge. In their interviews, both participants discussed projects they had unsuccessfully proposed to NSF related to faculty development. In examining these cases, three aspects can be seen as aligning with Vernon’s theory. First, both of the projects Dorian and Denise discussed were rooted in an institutional deficiency (specifically, unmet student needs), rather than any form of the institutional privilege. Second, both participants chose to focus primarily on aspects of

implementation when discussing their proposed projects - e.g., whom would receive training, what equipment would be purchased to support the activities, what classes would be impacted – rather than presenting their projects as research efforts. Finally, neither participant articulated strong claims of intellectual merit that would benefit audiences outside of their university.

Walter’s explanation of why HBCU faculty struggle is also relevant here, as both cases appear to take place largely outside of the scholarly conversation on STEM education. In the interviews, Dorian and Denise constructed their projects almost entirely within a relatively small sphere of influence around themselves. This sphere of influence was contained within the bounds of the university, and circumscribed all the problems, goals, activities, and benefactors related to their projects. While Dorian’s project incorporated evidence-based practice (i.e., active learning-based pedagogy) and Denise sought the support of the scientific community, there was little evidence of interaction or activity outside of the sphere. As discussed below, this has ramifications for the projects’ intellectual merit, as the objects whose knowledge the PIs sought to advance were also narrowly defined within the small spheres of influence.

*Identifying institutionally-imposed obstacles.* Both projects were intended to address shortcomings the participants identified through critical examination of institutional practice. In both cases, poor student performance was the root of the participant’s concern and, notably, both interpreted their situations as issues of inadequate instruction rather than issues of student deficiency. Dorian recognized his lack of formal training as a teacher, and felt that the informal means through which he had learned to teach (i.e., mimicking the instructors from the PWIs he attended) were insufficient to reach students he saw as underprepared and struggling:

...you have to teach them well. And I'll tell you - the one thing I can tell you for absolute certainty...is that, if I teach the same way that I was taught, it isn't

going to work...<sup>36</sup>

Denise felt students at her university were receiving inadequate instruction in technology-infused classes because many of the instructors lacked formal training in the technology. She believed the absence of faculty training resulted in a lack of rigor and consistency in how technology was deployed and ultimately led to higher DFW rates<sup>37</sup> in affected classes. This recognition stemmed from her earlier faculty experience at a technology-rich masters level PWI, where she had received the training she sought. In Denise's case, the students' unmet instructional needs were further compounded by state budgetary cuts that had limited faculty development.

Denise also sought the grant as part of her strategy to overcome perceived political obstacles within the institution. An academic division external to Denise's oversaw the use of technology in instruction, and rather than directly engaging this division in dialogue about how to use her expertise to help improve the situation, Denise felt the need to "...delicately propose to the [external academic division] that there needs to be some degree of training [for faculty]." Throughout our conversation, she remained hesitant whenever criticizing her fellow faculty members, further suggesting that she recognized the prospect of convincing colleagues they required training as politically tenuous. Part of her strategy to resolve the issue involved utilizing the NSF grant as a valuable endorsement from the scientific community of her ideas. She believed being awarded a NSF grant would increase her legitimacy within the institution and enable her to present the institutional problem as one the *scientific community* had identified, rather than one she, alone, had identified:

I can say in the faculty senate - I've learned grant funding helps to say, okay,

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<sup>36</sup> See page 104 for a more complete context of this quote.

<sup>37</sup> DFW rate is the rate at which students in a course receive a failing D or F grade or withdraw from the course.



there is, you know, our scientific peers and there's a funding agency that believes it is important that faculty teaching [with this technology] have some type of training. And this may speak directly to our DFW rates for our students. Let's give it a try, and if it works: thumbs up.

*Focusing on how to fix the institutionally-posed problems.* When discussing their NSF proposals, both Dorian and Denise primarily focused on describing the proposed activities and how they would address the students' unmet needs. In response to a question about what his proposal "was about," Dorian exclusively listed the project activities, with a reference to summative evaluation serving as the only concession to knowledge generation:

...it was to provide training for faculty and graduate students in active learning techniques. And to bring those techniques into our classrooms. That was the main focus of it. [Reading from the proposal:] "Redesign and renovate classroom space to accommodate student-centered learning, produce a computer cluster, train faculty in student-centered teaching methods, develop inquiry based, problem based modules that can be used in science courses, implement a rigorous assessment and evaluation plan designed to quantitatively measure the project effects and proactively manage challenges as they arise. That was basically the thrust of it."

When pressed on how he could improve the proposal for resubmission, Dorian described how the educational modules laid out in the rejected proposal could be restructured to build upon each other throughout the curriculum. His immediate concern when expressing this idea was how to implement the active learning modules across a course sequence within his discipline in a manner that would accommodate students of various math levels.

Similarly, Denise emphasized the activities she intended to implement when discussing her NSF proposal. She described the major goals of her proposed project as "faculty professional development and addressing the DFW rates that we have in our STEM courses." Further, Denise recalled submitting her proposal to the NSF program she believed represented a "best fit" for her idea by uniquely supporting her proposed activity, stating, "very few...[NSF programs] support faculty professional development...unless it's embedded [within] the proposal."

*Advancing the knowledge of institutional agents.* Neither Dorian nor Denise clearly articulated how their proposed projects would contribute either to scientific disciplines or broader societal goals during our conversations. Instead, in focusing on utilizing NSF grants to address needs and obstacles at their institutions, both appeared to have also directed their efforts toward impacting audiences entirely within the institution. More specifically, it appeared both Dorian and Denise intended the local embodiments of the institutional shortcomings they identified to serve as targets for knowledge advancement. Denise confirmed this:

INT: Here's a more straightforward question: So, intellectual merit is the project's potential to advance knowledge. Whose knowledge were you trying to advance [in the proposed project]?

Denise: Administrators. So, institutional administrators, specifically faculty in STEM and [relevant] education units.

Later in our discussion, I challenged Denise to consider other ways that her proposed project might constitute intellectual merit. While I expected her to explore how the project could generate knowledge on best practices for the use of technology in institutional contexts like hers, instead, she posed the alternative of focusing on students, rather than faculty, as the targets of knowledge advancement. However, she was reluctant to make such a change out of concerns that her students' knowledge could not be *sufficiently* advanced, relative to students at other institutions:

Denise: [pause] I'm thinking about the [academic] divide. So, while we are...enhancing the education of the students that we serve, most of them come in underprepared. And I guess, right now, my mind is thinking there's a baseline level of preparation, and increasing the intellectual climate is expanding them...you know, up. And maybe I need to change my way of thinking. But I know most of our students - and perhaps with our sister institutions - our students come in underprepared and it could be that, in some senses, we are perhaps just raising them to the baseline.

INT: And that would constitute the intellectual merit of the activity?

Denise: Yes, but is that - it goes back to: is that good enough for funding?

Dorian did not provide equally explicit statements about the intellectual merit of his project, but in seeking grant resources to “become a better teacher,”<sup>38</sup> he can be seen as his own target of knowledge advancement. Further, when asked later what he saw as the most important outcomes arising from grant-funded projects, he named resources that directly impact him and reiterated his desires for grants to support his improvement as an educator:

In terms of a science grant, what I'm looking for is supply money. Money for travel. If it's a big grant, enough money to pay a graduate student. For the more STEM education-type grants, I'm just looking for ways to become a better teacher.

*Other Considerations.* It is impossible to conclude that neither Dorian nor Denise intended to advance the knowledge of a discipline or contribute to broader societal goals; however, the manner in which they discussed their projects did not suggest such aims were more important to them than solving the immediate problems they faced. Their projects’ narrow audiences for intellectual merit and broader impacts likely had significant consequences for their interactions with NSF. If Vernon’s understanding that, “NSF is trying to do national models,” is accurate, then the agency would be less likely to support projects focused solely on addressing institutional needs.

While these two cases appear to align with Vernon’s theory about the relationship between institutional burdens and HBCU faculty’s difficulties with intellectual merit, there are caveats to consider. As mentioned earlier, Dorian left me with the impression that he was less interested in a critical discussion of the merit review criteria than he was in discussing broader issues related to the state of his institution. Further, his lack of interest seemed related to a sense of futility, on his part, regarding pursuing NSF funding in his institutional environment:

INT: How'd you know that project had merit when you wrote it? How did you

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<sup>38</sup> See page 104 for a more complete context of this quote.

look at it and evaluate and say, 'you know, this project has merit?'

Dorian: [Pause] Too squishy. Can't tell you.

INT: The question's too squishy? Or the answer's too squishy?

Dorian: The answer's too squishy. You know? For NSF, your odds are so low, for getting the thing [i.e., award]. You have to end up submitting, maybe three or four times before that actually might get something, but each time you might get some feedback from the reviewers to help improve the grant. I wasn't expecting that thing to get funded on the first go-around. That would be amazing if it did.

Therefore, his choice to discuss the project in terms of implementation may be more reflective of his interests - either in general or in the moment of the discussion – than his ability to articulate any contribution he saw his project making to a particular discipline.

In Denise's case, the particular program to which she had applied – the Targeted Infusion Project (TIP) track in the HBCU Undergraduate Program (National Science Foundation, 2016c) – supported HBCU academic units in achieving “short-term, well-defined goals for improving the quality of undergraduate STEM education” (p. 2). The TIP track's emphasis on implementation may explain Denise's focus on describing activities and institutional needs. Nevertheless, TIP proposals – like all NSF proposals – are evaluated using both merit review criteria and are expected to advance knowledge and make societal impacts.

**Focusing on meeting unmet needs – Adele.** As in the cases of Dorian and Denise, Adele's NSF project was also shaped by the burdens and unmet needs posed by her institutional context. However, Adele's case demonstrated how such issues could be converted into a successful NSF project that contributed to the scholarly conversation on STEM education. As discussed above, Adele faced similar burdens to other participants. She also alluded to faculty at research intensive PWIs not having to devote as much time to students as HBCU faculty (while also suggesting that NSF programs outside of HBCU-UP are not as apt to account for the added

workload facing HBCU faculty):

"I'm so thankful for HBCU-UP and the[ir] whole acknowledgment that we have to do more for our students and are asked, at the same time, to be on par, scientifically, with people who are not having to do as much for our students"

The “more” Adele referred to related to the additional effort required of HBCU faculty to ensure the success of students who are not as academically prepared. For Adele, this meant turning to literature on educational research to find ways to improve her teaching in order to uphold a personal standard for rigor based on her previous experience at a masters-level PWI:

I made a personal commitment when I came...to use the same tests that I had used at my previous institution, which was a PWI - the same tests, the finals and midterms that I had used there. So, that was just my own personal commitment, and in order to make good on that commitment [laughs while talking] it required a complete revamping of my teaching. So, I had to go into the literature and find out how to teach to students who come with much less preparedness than in my previous institution.

Adele’s recognition that she would have to change her teaching to better meet student needs echoed Dorian’s realization that “if I teach the same way that I was taught, it isn't going to work.” However, the two participants diverged in how they approached NSF in response to this recognition. Dorian, as discussed earlier, sought NSF funding primarily to improve his abilities as a teacher. Adele, however, sought NSF funding to address the “paucity of work for this population of students” within the academic literature, and spoke of how her project could advance knowledge of how to best educate academically underprepared students in similar circumstances

Indeed, Adele’s case illustrated how the challenges that HBCU students pose to the faculty can be successfully leveraged to provide projects intellectual merit. Her project studied the impact of what she described as a “non-academic academic intervention,” on student success in STEM majors. Her project provided students no traditional academic support like tutoring or mentoring. Instead, it focused on developing metacognitive and basic college skills (e.g.,

notetaking and time management skills) and boosting student identification as scientists. Adele called the work “groundbreaking,” and described recently published findings from the work as well-received by the academic community:

That paper is going into one of the top science education journals. And prominent in it is that this is an HBCU and this is the population of students we're dealing with. And what I learned at the university and [a recent conference on STEM education], where I'm also very upfront [that] this is our population of students, the room was packed. We had a hundred people. Thirty of them asked for citation literature. They saw something in it - even though it's coming from our population - that related to their populations, no matter what they were. So, absolutely I see it as a contribution.

However, Adele’s success in converting a challenging situation into a scholarly contribution still served to highlight the institutional burdens faculty like her face:

I mean, I did publish a paper about it, just because I'm trained to use every opportunity I can to publish a paper. But, at what cost? I - you know, I'm working during my breaks, my husband is saying 'when are you going to take off,' I've had a significant health challenge that was tied to stress, so it's a tremendous cost.

**Defining the institutionally-posed burdens – STEM researchers.** Compared to the other participants, Dwayne and Terrence - whose NSF projects advanced research agendas within their STEM disciplines - focused more on the relationships between their institutional settings and their research productivity. Neither Dwayne nor Terrence were particularly critical of their respective institutions as obstructive. Terrence was complimentary of his institution’s sponsored program office and his department chair for keeping faculty informed of funding opportunities and Dwayne was complimentary of the research equipment infrastructure available to him. Terrence was even able to find a silver lining in not having extensive administrative support for his work, as it forced him to be more familiar with the inner workings of his grants:

So, there are things that I know about proposals right now that I guarantee [others don't]- like, I was on a conference call with somebody from [a prestigious PWI] and they had no idea. A prominent researcher, wrote the textbook - one of the textbooks I used in undergrad - but he said something

about the budget and I just knew that was completely wrong because here I'm forced to do my entire budget.

However, both recognized their institutions as disadvantaged compared to research intensive PWIs when competing for NSF grant funding. While expressing their disadvantages, they also brought a different perspective to the issue of students at their institution. Whereas discussions about students with the other participants generally centered on students' role as learners, Dwayne and Terrence identified graduate students as an important part of institutional research infrastructure. In doing so, the two participants connected their own potential to generate research output and advance research agendas with the presence of productive graduate students. Further, they saw connections between their respective abilities to attract and retain quality graduate students and their institution environments.

*Concerns about NSF's perceptions of their institutions.* Both Dwayne and Terrence recognized their institutions as being less likely to receive NSF grants relative to research intensive PWIs, regardless of the quality of the proposals they submitted. However, their understanding of those disadvantages differed significantly and in ways that speak to a diversity of thought within the HBCU community on the issue of race and fairness.

As a junior faculty member going about the task of establishing the groundwork for a career in academia, Terrence was concerned that his institution lacked a strong reputation in his discipline. However, he did not connect the issue of his institution's reputation with its HBCU status, and even questioned whether reviewers were always aware his institution was a HBCU:

I just feel like [Terrence's institution] is almost a clean slate. I don't think that there's a negative connotation or reputation or anything. Cause when I was on the [NSF review] panel and I was talking to people, they didn't even know it was an HBCU. So, I just think it's, in this area, it's just kind of a no-name school. Like, it could be [City in which Terrence's institution is located] State University, or something like that. I don't think the HBCU-thing has an impact.

Nevertheless, Terrence perceived certain PWIs as having advantages over his institution in this

regard. This was apparent in his remarks that the scientific community would more likely show favor to researchers at certain research intensive PWIs over his own institution on the basis of reputation, alone. This would hold true even when both institutions had ventured into new “areas” of research in which neither had a track-record:

“I think that you can be [a renowned research intensive PWI] and not have been in an area [of research], and then as soon as they see your name, they’re like, “Oh they must be good at that area.” But that’s not true for [Terrence’s institution].”

Dwayne, drew a similar conclusion about his own institution based on his personal experience. However, he connected the advantages certain PWIs held over his institution with the issue of implicit racial bias against HBCUs, in particular<sup>39</sup>:

INT: So, I mean, there's - okay, let's take a step back. The conceptual framework of my study really starts with the historic marginalization of Black education in the United States. One consequence of that could be: the underfunding of HBCUs leads to a lack of infrastructure. Then there's also the possibility of racial bias on the {part of the reviewers}- *note: text in brackets is spoken simultaneously.*

Dwayne: On the {part of the reviewers}, yeah.

INT: -not just against individual PIs, but the institutions, themselves.

Dwayne: Yeah, that definitely happens. I'll give you a really good example of that: so, because, you know, I started out not at a HBCU, but at majority institutions, I have a lot of research collaborations at majority Research-one institutions with people who are top people in their field. So, in, again, [Dwayne's research discipline], I'm considered to be one of the top people in the field. And when I write my research grants, I write them in conjunction with colleagues at Research-ones. I read their grants and they read my grants. Okay? And we work on similar topics, and, in fact, we use similar materials because I've had a long research collaboration with these individuals. So, when I submit a grant to NSF, I often get comments back that are way out of line with, you

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<sup>39</sup> As added context, note that this exchange follows a discussion about eugenics and racial ideology in science that occurred about midway through the interview. I intended to present a general overview of the inquiry’s theoretical framework as a way of steering the conversation back to the topics of HBCUs and NSF. This explains my decision to deviate from the interview protocol and raise the possibility of racism in the NSF merit review process.



know, what might be wrong with the work that I'm doing. I've had comments like, "this is the worst research proposal I've ever seen." Now, this is a grant, by the way, that I had read by top people in the field at Research-ones. And these people would have told me if they thought my research grant was not commensurate with the standards in the field. And, [when] their grant would go in on the same subject, they would get top scores, you wouldn't see any of those kinds of comments about their proposal; but mine: low scores, worst research grant that anybody has ever seen. Even though it's on the same subject, read by the same individuals who collaborate between Research-one and HBCU. And, so, I see this as an example of implicit bias, where people see [Dwayne's HBCU] on the proposal and assume that it's inferior, without reference to what's actually in the proposal.

INT: Can you remember some of the ways they've used to justify those judgements?

Dwayne: Well, they don't have to justify them. That's the whole thing. They do not have to justify them.

Dwayne and Terrence both saw their institutions as disadvantaged, relative to research intensive PWIs in the eyes of reviewers. But, whereas Dwayne saw that disadvantage being related to reviewers' implicit biases against HBCUs, Terrence disagreed. Further, Terrence even conceived of a situation in which a HBCU PI would be considered *favorably* against a comparable proposal from a PWI on the grounds of broadening participation, wherein a hypothetical reviewer would declare:

'wow this is a great proposal *and* this helps with the whole diversity, in terms of Minority Serving Institution. And geographically, we don't fund a lot of proposals from there, so this is an excellent opportunity [for NSF to support].'

The roots of their disagreement appeared related to the factors which they felt should be considered when judging proposals. Terrence held a meritocratic view of the situation that emphasized a PI's potential to achieve proposed goals, without giving consideration to historical issues of racism. He acknowledged the prospect of racism ("Now, if they just say, 'oh, it's a Black school that this-and-that': that's racist"), but felt it appropriate to compare institutions on the basis of quantitative measures of scholarly output (e.g. number of PhDs produced), alone.

Returning to the issue of factoring institutional reputation into funding decisions, Terrence felt that reviewers' biases toward institutions they perceived as having greater productivity was appropriate:

I don't think it's unfair. I think that, it's even more fair than the [reviewer] probably realizes because research is harder here [at an HBCU]. It just is. And so, that means you have to be extra on-point with what you're proposing because, if you have problems in [the proposal stage], it's going to get exacerbated by the resources and infrastructure that you have. Whereas, if you have a great proposal, then actually implementing it might go well. A place like [a prestigious PWI], there's enough set up to where it'll carry you along the way as long as your research is good, but at a place - and not just a HBCU - but at a place where you don't bring in as much external funding or you don't graduate as many PhDs, there are a lot of complications along the way with the student pipeline, in terms of just having viable researchers, with red tape and stuff like that, where it makes your likelihood for success lower, I would say.

Terrence's output-based approach stood in contrast to Dwayne's suggestion that it was unfair for NSF to judge research intensive PWIs and HBCUs by the same standards for intellectual merit, on the grounds that "we're dealing with institutions with very different histories and very different missions." Throughout our discussion, Dwayne spoke of the federal research infrastructure as one that better served institutions with more resources. He eventually proposed that HBCUs would continue to be disadvantaged without fundamental societal changes, concluding: "As long we're playing this game, we can't compete."

***Research infrastructure, students, and competitiveness.*** In addition to their concerns about the scientific community's perception of their institutions, Dwayne and Terrence also both expressed concerns about the impact of their institutional context on their abilities to make significant scientific contributions to their fields. Dwayne articulated these concerns in his response to the question of "Are HBCUs well-prepared to respond to [NSF merit review] criteria?" In his response, he also included graduate students as part of that research infrastructure (hence, connecting students to his ability to generate intellectual merit), and

explained that graduate students at his institution required additional training relative to graduate students at top PWIs:

Well, let's take intellectual merit. In terms of the number of research scientists who have top training at HBCUs, that percentage is smaller. Now, there are a number of us. It's not that there are no top-quality scientists at HBCUs. I mean, on this campus, alone, there are several people who are top quality scientists and who could be working anywhere. And that's true of other HBCUs. So, we just have a smaller number of those people. So, again, when I go to see my colleagues at places like Stanford, I mean, it's just ridiculous. Or when I go down the road to [another renowned research intensive PWI], it's ridiculous how much money they have. How much infrastructure they have. And also, how many of the top people in a given field they have. So, it's not - you know, the age of when you had these sole scientists working alone in their laboratory coming up with great discoveries - that simply doesn't exist anymore. Every scientist is part of a web of connections of colleagues who have specific skill sets that help you get things done, or have specific equipment that help you get things done. Who have, you know,  $x$ -number of graduate students who help you get things done. So, if you're at a place like [the PWI], you've got top colleagues in the field, you've got state-of-the-art instrumentation in the field, you have graduate students who are going to be the next generation of top scientists in the field working on your projects. Here, I have some of the state-of-the-art equipment - and most of that state-of-the-art equipment I've gotten through my research grants, okay? I have students who are good, but I have to put a whole lot more time into my students to develop them into being state-of-the-art students than a colleague at [the PWI] does. So, I do far more hands-on training and work with my students, because most of them come in with various holes in their background that I have to fill in to get them to the point of where they can be independent researchers.

Dwayne also connected the relative lack of resources with difficulties in recruiting top graduate students who could help bolster the institution's research infrastructure, stating that, "top African American students are going to be recruited by top schools, and that's where they're going to be." As an example, he pointed to his son, who he described as a "top student in the state" who was pursuing a PhD in mathematics at a large research intensive PWI after having completed his undergraduate degree at a similar school.

While Dwayne addressed the institution's impact on the recruitment of top STEM graduate students, Terrence discussed his institution's impact on retention. He recalled that

"when I was at [a large, research intensive PWI], the minimum stipend for a graduate student was greater than what the maximum stipend is here...I think I was making triple what one of my students makes now." He then calculated that an out-of-state masters student at his current institution would net less than \$1,000 a semester after tuition and concluded that the meager pay made industry jobs particularly appealing to students:

That almost guarantees that every masters student I get, as soon as Intel says, 'here's a hundred and something-thousand a year,' they're like, 'Oh, actually, Dr. Terrence, I decided I don't want to continue on with the PhD.'"

Terrence also connected pay to student productivity, stating that he would expect graduate students at the PWI at which he did his graduate training to be "more productive" than at his current HBCU, "because their bills are paid." Both the retention and productivity concerns were particularly salient considering Terrence's views on the importance of such outcomes to NSF reviewers' decision-making processes.

### **The HBCU Mission, Research, and the Role of Administration**

In addition to the burdens they faced at their institutions, participants also focused their discussion on interrelated issues of the institutional mission, institutional leadership, and institutional research aspirations. Unsurprisingly, all of the participants pointed to the HBCU mission of educating Black students as central to their decisions to join the faculty of their institutions. However, the discussions also raised questions about the participants' satisfaction with how their institutional leadership worked to incorporate research into the institutional mission. Some participants viewed their institutions' aspirations to become more research intensive as distracting from the missions, and other participants pointed to how the research and teaching aims could be merged to serve one another. Further, participants pointed to administrations' failure to grasp the complexities of attending to both the educational mission as well as their research needs as responsible for the institutional burdens HBCU faculty face. The

general consensus that emerged from the conversations was that the success of HBCU faculty depended on the presence of institutional leaders with a clear vision of the institutional goals and who could instill a unified approach in moving towards those goals.

This section examines the issue in three components. First, the importance of the mission to the participants' decisions to work at HBCUs is discussed. Then, participants' perceptions of their institutions as straying from the HBCU mission are presented. Finally, participant calls for a unified approach to resolving the conflict between teaching and research are reviewed.

**Participants and the mission of HBCUs.** The HBCU mission was a reoccurring topic throughout all of the discussions and many participants portrayed the mission of educating Black students as central to their decisions to join the faculty of their institutions. As discussed earlier in the chapter, some participants felt a moral obligation to serve Black communities as educators and researchers, and HBCUs provided a means of attending to those obligations. Some also described their decisions to join an HBCU as "a calling." In either case, the decision to join a HBCU was not portrayed as one reached after weighing the pros and cons of various institutions in self-interested terms of salary, prestige, etc. Other factors related to social and community identities played roles in their decisions to teach at a HBCU: three of the participants sought positions at their institutions to return home and be near family, and two of the three joined the faculty of the HBCU they attended as undergraduates.

Some participants believed their presence at HBCUs would be beneficial for the students. Both Vernon and Dorian left careers at federal research agencies to join their institutions and make differences in the lives of students. Similarly, Dwayne felt it important to give HBCU students an opportunity to interact with top researchers like himself. An unsettling initial exposure to his institution - he arrived expecting to give an invited lecture, only to discover that

he was actually being considered to lead a new academic division at the school – left him wary of joining the faculty, but ultimately, he felt the mission was sufficiently important:

I talked to some colleagues around the country - in fact, I received several warnings against taking the job - but I said, 'if scholars like me are not at HBCUs, then students are not going to have the opportunity to learn from people with my kind of experience.' So, I did accept the job.

Other participants also discussed how they personally derived benefits from interacting with HBCU students. Adele credited her students and the institutional environment with helping her overcome personal difficulties reconciling the duality of her existence as a scientist and a Black woman. She contrasted the sense of affirmation she received from her current students with the feelings of exclusion she experienced at the PWIs at which she previously worked and trained:

One reason I came [here] is because: what my students give me - in terms of their appreciation of me - is so soul fulfilling. As opposed to when I was a 'good scientist' and published, but my students looked right past me.

Terrence, despite not being "hell-bent on going to [teach at] a HBCU," also saw the HBCU environment as uniquely rewarding. For him, the HBCU mission was a quality he considered alongside other institutional attributes, and a quality that gave his current institution an advantage over the other schools that offered him a position:

If it were not an HBCU, I would not have applied, just based on all the other criteria I had for the schools that I applied to. I think that even though I've never attended an HBCU, I definitely understand the implications on the Black community. ... Just knowing that I had a population of students that were similar to me, at least in terms of race and culture - that was an attractive thing for me...I felt like that would be something that was rewarding. And, as I was looking at, 'well, what do I want to get out of my career?' I wanted it to be special. To me, special means you're either at a very highly-ranked institution (which I didn't get any offers from *very* highly-ranked institutions) or you're doing something that's just different. So, I felt if I was going to be at a middle-of-the-road school, then I'd rather be at a HBCU as opposed to just a face in the crowd at a school that's not even...you know, something that [awes people].

Finally, all of the NSF projects the participants discussed could be seen as adhering to

HBCUs' educational mission. Dorian, Adele, and Denise all directed their efforts toward improving STEM student learning for HBCU students. Walter, Vernon, and Julissa could be seen as embracing a wider view of the educational mission by engaging underserved pre-college students in the surrounding communities to improve their chances of future success in STEM. Even Dwayne and Terrence, both of whom focused on natural and computer science projects, respectively, considered the involvement of Black students in research as an important to their work.

**Administration straying from the mission.** Participants understood their institutions as aspiring to become more research intensive, yet these efforts were not welcomed by all. Some participants saw the decision to become more research intensive as a sign of their leadership having strayed from the mission. It also contributed to a sense of uncertainty or even dissension between faculty and administrators, or between faculty, themselves. Terrence, who described himself as being part of a new wave of faculty brought into his institution to increase the school's research stature, described the issue:

In the case of [Terrence's institution], they're<sup>40</sup> a school that was traditionally a teaching institution, that year after year, they're inching towards more research output. And I definitely see growing pains, in terms of...the...people who were here prior to that goal or transition, and the people that they hired after - like once they decided we want to be [more research intensive], we want to be better than [a research intensive PWI in the same state], and all that kind of stuff. There's going to be a clash, culturally, because then - you brought people here, but then the expectations change, so then, what are you going to expect out of the people that were here? So, yeah, I think that is an issue.

Dorian was one of the participants on the opposite side of the 'culture clash,' relative to

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<sup>40</sup> Note: In the exchange leading up to this quote, Terrence and I were discussing how he believed NSF reviewers view his institution. I believe his use of the pronouns "they," "we," and "you" when referring to his own institution was an unintentional carryover from the previous "outside perspective" he had adopted, and that this quotation is representative of his own perception of his institution.

Terrence. He viewed his institution's move to become more research intensive as a financially-motivated distraction from its mission to education students. He also called into question the ability of faculty to excel at both research and teaching:

Dorian: You've already got a mission. The mission's hard enough. Now you want to add in this other thing [i.e., research], which is going to distract from your mission simply because of the time needed. And also, let's remember, most faculty, like most people, they do one thing really, really well. Most people don't do two things really well. So, at a university like this, you can teach really, really well, or you can go ahead and do research really, really well. Or you can muddle your way in between. [pause] We're going to muddle.

INT: As an institution?

Dorian: [agrees]

“This other thing,” that Dorian said was being added alongside the schools’ teaching mission specifically referred to recent changes his institution had made to publicly signal an increased focus on research and graduate training. In explaining what motivated institutional leadership to undertake such changes, Dorian offered the plausible, if unproven, explanation that the move helped address financial concerns.<sup>41</sup>

Similarly, Vernon felt that “[at] a lot of HBCUs, the leadership, the vision, and the belief of what we're about has gotten off-track,” and described his own institution as having “mission

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<sup>41</sup> Dorian explained: "It's about the money. Apparently, the way they formulate the money, they...get a little bit more per student. So that was the impetus, from my understanding of it." Although he qualified the explanation, admitting, "Now, I haven't gone back to verify that," his rationale was supported by the higher education funding guidelines in his state. The state in question indeed provided institutional funding based on projected enrollment, using a per student funding rate based on the average funding rates of comparable "peer" schools outside of the state that compete for the state's students. Presumably, having a peer group comprising larger, more research-intensive institutions would increase the state's investment in the institution. However, it should also be noted that institutional press releases regarding this change made no mention of state funding. Instead, the official explanation described the change as acknowledgement of the institution's success in achieving long-standing goals to better serve the economic and research efforts of the local region.



creep” in aspiring to emulate research intensive PWIs. Vernon suggested the “mission creep” was enabled by an institutional leadership that had become “too comfortable” in a false belief that HBCUs were adequately attending to the mission of educating Black students. He questioned the quality of education as well as other perceived institutional successes in STEM:

...we’re [relying on] coaching and didactics. But you gotta be a constructivist [educator]. That’s what Oberlin is. So, yeah, we [HBCUs] get a lot of people in STEM, but you’ll be a technician for somebody from Oberlin if you’re not careful. We’re still at the stage where, [when] somebody gets accepted to a PhD program, we have parties. That’s a good thing, but that’s [i.e., sending students to PhD programs] what we’re supposed to be doing!

He also took issue with claims of broadening participation, which he believed too-frequently amounted to HBCUs “stealing” high-achieving Black students from one another. Instead of competing with each other for the same “slice of pie” (i.e., a relatively small subset of potential Black students), he proposed that “real broadening participation” should lead to a situation in which “the pie, itself, is getting bigger.” This would involve devising ways to more effectively identify, recruit, and retain lower-achieving yet high-potential students the schools were overlooking. Further, it would involve a greater commitment to community involvement and service on part of the institutions in order to develop future STEM talent from an early age. In this way, Vernon conceptualized the HBCU mission as extending beyond the education of enrolled students, alone. However, he pointed to the “high poverty, distressed neighborhoods” around many HBCUs as evidence that the institutions were becoming increasingly disconnected from their surrounding communities and not attending to such a mission.

Julissa also saw her institution’s increasing focus on research as negatively impacting its pursuit of the mission. She expressed concerns that the increasing number of research-minded faculty in her department did not share her commitment to providing a quality education and welcoming environment for Black students interested in STEM. In doing so, she suggested that a

unique and vital aspect of HBCUs had been compromised:

I can count on both hands the number of African American tenured faculty members in STEM. But there are about fifty faculty members altogether. So, the attitude that I have is a minority attitude, versus the majority of my colleagues. So, we're already seeing - or experiencing - our students are experiencing what they would experience at a PWI (a predominantly white institution); they are experiencing it here. And so, a lot of students are turned off by STEM, or turned off by the interactions they have with the faculty. It's already affecting - we're getting more research dollars, but we're not really getting and graduating students to go on to higher levels - so, yeah, it's already affecting us.

**Calls for a unified approach to the mission.** Finally, participants advocated for a unified approach to the HBCU mission that valued teaching and research equally. Along with such approaches, they also called for visionary leadership who would see providing faculty with additional time and resources for research activities as investments in their institution's future. However, not all of the participants were optimistic about the prospect of finding such leaders for their institutions.

Walter sought to unify the tasks of research and education by proposing that both activities serve similar ends. Further, those ends would align with institutional interests, satisfying the teaching mission while contributing to infrastructure:

If we can start to- first of all, this distinction between being a teaching institution versus a research institution, in some ways that's a false dichotomy. I think good research informs teaching and if you're a good researcher it will do nothing but improve your ability to pass on information. So as a matter of allocation of resources, instead of trying to squeeze the last drop out of every faculty member in terms of course load, the administration can recognize the value of research to the teaching mission. And also, that this...giving of [release] time is an investment that hopefully will have some return in the form of indirect costs coming from the proposals that are written.

Julissa made a similar appeal for administration to have the foresight to view faculty release time for grant activities as an investment in institutional infrastructure. She also argued that STEM education research should be held in a similar regard to research into her STEM discipline:

Your administrator - going back to your administrators and deans, and such –

[it's difficult] if you don't have a dean that understands, 'okay, wait a minute, I've got to make sure my junior faculty and even my senior faculty who are doing research - they have some type of release time so that they can get the research and bring the dollars in,' okay? I don't have to do bench work. There's millions of - billions of - dollars out there for science education research. So, it's not just the faculty, it's the hierarchical, the administration - depending on which school you're at, which HBCU you're at - if administration understands the importance of bringing in grant money and how it can improve the infrastructure, they're going to work with you.

Many of the calls for a unified approach were articulated as hypotheticals, i.e., “*if this were to happen*,” posed in contrast to the situations the participants perceived to actually be in place at the time of the discussions. Vernon, for instance, remarked optimistically, “If we worked together, Stanford would have nothing on us.” However, this statement came only after he shared his belief that one particular STEM-related academic division in his institution held the favor of institutional leadership and received a disproportionate share of resources and attention. Further, when asked why he felt the group of several small, liberal arts PWIs he repeatedly referred to had greater success with NSF relative to HBCUs, he stated, “Oberlin, [and] these people, they know the students [come] first...[T]he leadership is in lock-step with - genuinely - not trying to puff themselves up. They're about trying to get the college to educate the public.” In making this statement, he reaffirmed his belief that adherence to the mission was essential to institutional success while also implying that leadership at his own institution was, in some ways, at least, operating out of self-interests.

Dorian felt that it would require “exceptional leadership, exceptional vision, and buy-in from the faculty” in order to accomplish the “not impossible, but...extremely difficult proposition” of his institution exceling at both teaching and research. However, he did not believe his institutional leaders fully understood the resources required to do both. He also provided a poor assessment of his previous HBCU’s administration (“Poor leadership destroyed that school”) and held a dim view of HBCU leadership, in general:

"What they do is, at the administration level, it's like musical chairs. They fail at one school and then they'll go to another school and they'll mess up there. And then they'll go on to another school."

Walter, who believed his institution supported his NSF-supported efforts in the surrounding community, lent some credence to the positive impact a supportive leader could make. He attributed his institution's support to having a president with experience in STEM research (rather than one of the 'revolving-door' administrators Dorian referred to):

It's mainly a matter of having people like we have now. We have a president who was a researcher. You know, a faculty member [with a STEM background]. I think that makes a lot of difference than say, having a president whose PhD is in higher education administration or something...who has mainly been going from one institution to another as an administrator.

However, the solution did not appear to be a straightforward one. Denise - who had obtained tenure in her Biology department on the strength of research related to biology education - found having a new research-focused Chair to be disruptive to her continued focus in education research:

...so, now we have a chair who is a basic researcher by training, but there's the mindset that one's publications - you know, "we are a life science department, we have research facilities, we are trained to work in research" [so] our manuscripts should be on basic research to count for promotion and tenure. But with the prior chair, there were amendments made to our [promotion and tenure] guidelines to allow science education research, so it hasn't always been [that way].

### **On the Issue of NSF's Role Regarding HBCUs' Underrepresentation in Funding**

Participants provided a variety of responses regarding what, if any, role NSF should have in addressing the HBCUs' perceived disadvantages in competing for research funding. Some participants portrayed their institutional leadership as solely responsible for resolving the situation. Dorian expressed the belief that "NSF has done what it can do. Maybe it can do a little bit more around the edges, but I think the impetus lays upon the HBCUs." Later, he reiterated that the lack of time and resources at HBCUs is "not NSF's problem" to solve. Terrence's view

on the appropriateness of an ahistorical, meritocratic approach to funding decisions can also be seen as echoing the sentiment that the HBCUs are solely responsible for resolving their funding situations.

Others suggested that HBCUs would benefit from NSF, as an organization, having a greater awareness of both the contributions HBCUs make, as well as the burdens their faculty face. Multiple participants acknowledged and appreciated HBCU-UP's understanding of the HBCU environment, although none clearly articulated exactly how – or even if – they actually derived benefit from HBCU-UP's enhanced awareness. Nevertheless, participants expressed their desires for NSF reviewers to know more about their situations and the value of their work. For instance, Adele said, “So, I guess, what I'd like for NSF to know is: these grants cost me more, here, in terms of life energy and time and thinking, than they did when I was at the PWI, just because every step is harder.” Denise also felt NSF should better understand that schools like her institution frequently nurtured both high achieving students and “diamonds in the rough” that went on to graduate schools at prestigious research intensive PWIs.

Neither Adele nor Denise followed their calls for greater awareness with proposals for how this additional information could be better accounted for within the merit review process. However, Walter felt greater representation of HBCU faculty on review panels would lead to a more robust discussion of the value and impact of the type of projects HBCU PIs pursue. He also saw this as an issue for HBCU researchers to tackle on a broader scale:

Part of the problem is: what HBCUs do is not well-publicized. And part of that is because we don't publicize ourselves. We're not writing enough, we're not presenting enough. We're not forcing ourselves into the larger academic discussion happening around the country.

Vernon also called for HBCU PIs to do a better job of articulating the needs at their institutions to give reviewers vital context in evaluating the appropriateness of proposed interventions and

activities:

That's the problem...why HBCUs are not as successful. They didn't make [the proposal] clear, focused and detailed and the reviewers from Oberlin don't understand the problem you're talking about because they got a lot of implicit biases. Like, 'Jeez, why are they spending extra time on that remedial math? I mean, jeez!' You know? [The reviewer from Oberlin's] students don't have to take Cal I. They already placed out in AP Cal....

Further, Vernon felt that increased interaction between NSF program officers, panelists, and HBCU faculty would help ward off other types of unspoken and unacknowledged biases. Here, Vernon constructs a hypothetical review panel conversation in which a PI known to the reviewers (presumably from a PWI) is given preferential treatment over a PI from an HBCU with whom the reviewers are not familiar:

[The reviewer]'s not going to say it out loud, but you know what? 'Bob, yeah he's competitive, but let's move Bob's proposal up to highly competitive.' 'Well, yeah, yeah Jerry, we should. He didn't have this [i.e., meet a requirement], but that's okay.' 'I don't know Jacqueline from Tougaloo [so] I'm not going to fight for her to move from competitive to highly competitive.'

However, the issue of increased HBCU representation on review panels is not without its obstacles. As Vernon noted, faculty do not always have the necessary support or freedom to volunteer to serve on panels. There may also be a lack of cultural sensitivity on NSF's part that helps impede HBCU faculty participation. One participant who served as a NSF program officer in the EHR directorate recalled being asked to recruit for a review panel scheduled to occur the Monday after Mother's Day. The participant protested to other program officers on the grounds that few Black faculty would agree to travel, given the importance of family within the Black community. They posed the same hypothetical question to me, directly, that they recalled posing to the other program officers:

Who do you think would come on Mother's Day? Would your wife fly on Mother's Day? The mother of your kids? They're seven and nine years old? They worked hard - the Sunday morning before you go to church - to show the cards they made for her? She's going to fly out that day?

Ultimately, the panel took place on the proposed date, and the participant recalled that no HBCU faculty participated. Clearly, it is impossible to infer whether this is an isolated incident or even whether the participant's logic was valid. However, it is telling that the participant was "laughed out the room" by the other, non-Black program officers for considering the sociocultural implications of agency actions.

## **CHAPTER V. CONCLUSIONS AND RECOMMENDATIONS**

The study findings that social identity, community, and institutional environments all played important roles in shaping participants' interactions with NSF have various implications for scholarship, HBCUs, and NSF. This work adds to the relatively small body of literature on HBCUs and their faculty and further develops the theoretical framework posed in Chapter 2. Findings also pose important questions about the future of HBCUs. Finally, study findings serve as the basis for recommendations for how NSF might improve the funding situations for these institutions.

### **Study Contributions to Knowledge about HBCUs, Their STEM Faculty, and Their Relationships with NSF**

This inquiry supports previous findings by Gibbs and Griffin (2013) in discovering that most participants were motivated to attend to the interests of multiple social communities in addition to the scientific community. Findings also support Baez's (2000) conclusion that Black faculty intentionally pursued race-related service. The study generally supports the scholarly image of HBCUs as providing supportive environments for their students and HBCU faculty as devoted to ensuring their students' success (e.g., Fleming, 1984). This inquiry also expands on previous researchers' calls (Blacknall & Johnson, 2011; Brown, 2013; Gasman & Bowman, 2011; Simms & Bock, 2014) to give greater consideration to diversity between institutions when conducting research related to HBCUs. In light of the disconnect this study found between



HBCU faculty and their leadership regarding the issue of the HBCU mission, future researchers are advised to not disregard participants' positions within institutional hierarchies when studying HBCUs.

A theoretical framework for explaining the underrepresentation of HBCUs in NSF research funding streams was proposed in Chapter 2. In developing this framework, I began with the historical marginalization of Black education in the United States as a starting point and built out three potential explanations for HBCUs' relative lack of funding. Here, each of the three explanations is reexamined in light of the study's findings:

**Theory 1: The historical marginalization and underfunding of Black education has stunted the development of HBCUs in ways that have left HBCUs without the resources necessary to compete for NSF funding on equal terms with other institutions of higher education.** All participants agreed that HBCU faculty lacked the institutional infrastructure and support needed to effectively compete for NSF funding, and participants frequently portrayed PWI faculty as advantaged relative to their own situations. However, only one participant, Dwayne, connected these issues with society's historical marginalization of HBCUs. Instead, most participants pointed to their institutional leadership as responsible for the institutionally-posed burdens they faced. While doing so, they also called for a more unified institutional approach to the HBCU mission that valued both teaching and research components and did not attempt to “squeeze the last drop out of every faculty member.”<sup>42</sup> These findings suggested participants were more concerned about their administrators' present-day roles in creating and resolving institutional obstacles than they were about the external social and historical factors that had contributed to their institutions' current situations.

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<sup>42</sup> Walter.

**Theory 2: By opening the door to social and political concerns (i.e., broader impacts), NSF may also allow racial bias against Black institutions and/or Black faculty to enter the merit review process and impact judgments on the merit of proposals.** The findings suggested a need to refine this aspect of the theory to better articulate the nature of the social biases HBCU STEM faculty perceived working against them. While the interview protocol did not explicitly ask participants about issues of racism, multiple participants described incidents of bias or the potential for bias within the merit review process. However, none of the participants articulated a belief that overt racism existed within the NSF merit review process. Instead, participants portrayed issues of racial bias as nuanced or part of larger, more complex social issues. They described acts of “implicit bias” and spoke of the deep entrenchment of racial biases. Even Dwayne, who made the strongest claims of racism within the merit review process and was the only participant who expressed the belief that he had been personally impacted by racial bias against his institution, described it as “implicit bias” on part of the reviewers. Further, he saw the issue of racism as part of much larger social structures of oppression at work in society.

While the conversations did not suggest participants felt racism was a significant part of the NSF merit review process, I am hesitant to conclude that either they - or HBCU STEM faculty, in general - did not perceive racism as existing within the merit review process. Racism is an integral part of United States history (e.g., Ladson-Billings & Tate, 1995), yet remains a sensitive and complicated topic that participants may not have felt comfortable discussing in an interview with a stranger. Further, I see the potential for such conversations to be particularly difficult for Black STEM faculty. Based on my own experiences in STEM, I believe many Black STEM faculty – and likely some of the participants - have devoted substantial energy throughout their training and professional careers to convincing colleagues from dominant social groups that

they are equally (or even more) capable as scientists or engineers. To then conclude that their work might be evaluated differently on the grounds of race might serve as acknowledgement that their efforts to prove themselves have not been entirely successful. Alternatively, the Black STEM faculty who have most strongly internalized Merton's (1973) "ethos of science"<sup>43</sup> and view science as a potentially objective process may have difficulty reconciling their own role in producing work capable of being subjected to racial bias. Dwayne and Dorian's rejections of the concept of "Black science" were also their affirmations that the scientific method stands apart from social or cultural concerns. In their descriptions of science, I heard a belief that the scientific method can serve as a set of instructions that, if followed, can lead to valid solutions regardless of who is investigating a problem (i.e., Merton's "universalism"). Ideal scientific research proposals would then contain no cultural elements for reviewers to consume or consider, since every part of the proposal would be rationalized through the application of a culture-free scientific method. Even the choice of research question could be rationalized in such a manner.<sup>44</sup> It follows that peer reviewers evaluating research proposals based on an "ideal" application of the scientific method would be incapable of racially- or culturally biased judgements against the arguments posed in the proposals, since there would be nothing present in the proposals to evoke such biases. Black scientists and engineers who share such a view might then, logically, be forced to implicate themselves when considering racial bias against their

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<sup>43</sup> See Chapter 2 for a brief description of the ethos of science and a definition of universalism.

<sup>44</sup> Here, I must pause to reflect on the amount of effort I put into early drafts of Chapter 1 to develop what I believed to be an "objective" argument to justify studying Black HBCU faculty to others. I acknowledge the pressure *I placed upon myself* to articulate the significance of this issue in a dispassionate, universal way – e.g., appealing to a broader society by starting with STEM's significance to the nation's wellbeing and using quantitative statistics to argue the importance of HBCUs - so that no one could dismiss the work as a subjective inquiry undertaken by a Black scholar interested only in Black matters.

work, since they “failed” to produce proposals that adhered to an idealized vision of science.

Finally, I conclude this section with additional insight from Adele into the difficulties inherent in discussing race:

INT: What do you think that the broader NSF organization could do to be more inclusive? What do they need to understand- other than what we were talking about earlier, with the lack of infrastructure, for instance? Are there other things that they need to understand better in order to be more welcoming?

Adele: Well, I tell you....in my other life I've done diversity training. So, I'm probably unique in your pool of participants in that, I have actual experience in providing information to an audience that would ask them that sort of question. And what I learned through that, is that this whole conversation around race is still such a difficult question to broach in our society. Still. It's so emotionally laden, fear laden, um, I dunno. It just- it's never been resolved. We had no truth and reconciliation process. And scientists, as much as we want to think we're immune from it: we're not immune from it. Review panels: you are not immune from it.

**Theory 3: Black STEM faculty at HBCUs are inclined to incorporate concerns about service and student well-being into their interactions with NSF; however, their approaches are not well-received by a scientific community that either does not value seemingly “non-scientific” concerns or does not value the contribution of Black scientists, in general.** This inquiry found that participants were motivated to attend to the interests of multiple social communities in addition to the scientific community. In particular, attending to the mission of educating Black students was a significant motivating factor for all of the participants. The mission drew participants to work at their institutions and some participants pursued research agendas that directly or indirectly attended to their desires to redress inequities in education.

It was also apparent that participants’ attendance to concerns about students or social justice did not preclude their successful interaction with NSF. Many of the participants’ NSF efforts clearly appeared to be guided and shaped by their social interests and their institutional environments. Yet, some of these projects were conceived of and proposed in ways that also

addressed both NSF merit review criteria and found acceptance within the NSF community. Participants led projects to develop efficacious models to better teach impoverished students mathematics or improve the quality of instruction at their own institutions. They also sought to develop national models that better addressed inequities in K-12 education within communities surrounding their institutions. And participants like Adele were happy to see the findings from their NSF projects welcomed by the wider scholarly community.

Further, there was no evidence that the racial and socioeconomic considerations that influenced many of the research questions participants posed affected their approaches to addressing those research questions. All of the participants presented themselves as scientists and upheld principles of empiricism and the scientific method. The spiritual nature of the “callings” some participants felt to educate Black students was completely absent when they spoke of proving the effectiveness of their projects. Some participants were more skilled than others at placing their work within a greater scholarly conversation, but there was no evidence that any participant wished to subvert or bypass the scientific establishment. Even Dwayne, who spoke of a racial ideology in science and the abusive use of science during the eugenics movement, rejected any social or ethnic orientation to the scientific method and spoke of it as a potentially objective process.

While multiple participants were successful in their NSF efforts, this study did uncover a potential disconnect between participants’ overarching goals and NSF’s aims. Participants’ motivations focused on advancing communities more than on advancing the knowledge of abstract, disembodied disciplines. To the extent this finding implies HBCU faculty propose research with stronger appeals to broader impacts, the HBCU community might generally find itself at odds with a majority within the NSF community that values intellectual merit over

broader impacts (National Science Board, 2011). The situation is further complicated by debates over the value of such research within each respective community. Multiple participants described having to argue to prove the value of their STEM education research efforts to administrators who were increasingly interested in STEM disciplinary research. Further, the participant who served as a NSF program officer suggested the same arguments over valuing STEM education research existed within the agency, saying that the EHR directorate “always was looked down on” for not conducting “real research.” The participant went on to say that the directorate was “on the track of being more research focused” and explained that the transition likely disadvantaged HBCUs, who weren’t sufficiently engaged with NSF to be aware of the shift.

Even if HBCU PIs’ proposals are not recognizably different from other PIs’ proposals, the nature of the communities they tend to serve may place them at competitive disadvantages. Walter’s interpretation of a reviewer’s feedback as “prejudiced” raised such a possibility. His case suggested PIs who seek to improve the condition of marginalized communities by upending the societal or educational norms that oppress these communities must first overcome those norms in the minds of the reviewers. This is not a trivial exercise in that it may require reviewers to critically interrogate the basis of their own understanding of the world.<sup>45</sup> This includes both scholarly beliefs (e.g., whether a novel intervention could prove efficacious in a particular community) and moral beliefs (e.g., whether such communities are worthy or deserving of the effort). Reviewers who don’t view foundational assumptions about the nature and structure of education as questionable are less likely to see a need to fundamentally change education

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<sup>45</sup> Numerous scholars (e.g., Harding, 1992) and writers such as James Baldwin have discussed the difficulties inherent in understanding oppressive structures from within socially dominant groups.

practice. Instead, they may favor proposals that seek to refine or ensure greater access to existing education practice. Similarly, reviewers from socially dominant backgrounds who benefit from the privilege of full rights to citizenry and lack an understanding of what it is to be socially marginalized may be less likely to appreciate the need for projects that seek to empower people to become more active members of a democratic society. And reviewers who believe strongly in meritocratic principles may be uninterested in directing resources to impoverished and undereducated communities who they believe either *want* or deserve to remain impoverished.

Exploring whether NSF reviewers and program officers perceived HBCU proposals as different from proposals from other institutions was well beyond the scope of this inquiry. However, some participants suspected NSF reviewers, as a group, might be unable to adequately judge HBCU proposals because they lack sufficient knowledge of the context from which HBCU proposals arise. Vernon called for HBCU proposers to better describe their institutional settings and needs to reviewers, particularly related to issues of student achievement. He was concerned NSF reviewers would otherwise judge such projects as making minimal gains because they weren't fully aware of the deficits with which PIs start. Similarly, Walter called for more HBCU faculty to serve on NSF review panels in order to better articulate the value of the contributions HBCUs make to society.

Finally, despite the potential disconnect between participants' and NSF's aims, in some ways, participants can be seen as upholding the ideals to which NSF's founders aspired. NSF was originally intended to play a role in shaping society under a doctrine of "what is good for science is inherently good for society" (Frodeman & Briggie, 2012, p. 6). This attitude is evident in Dwayne's scientific work to uplift humanity. These aspirations are also not unlike the lofty goals Walter and Adele set to better ensure marginalized groups had equal access to the STEM

pipeline and were able to participate fully as citizens in a democratic society. Further, NSF specifically sought to fund research in academic settings free from the pressures of “convention, prejudice, or commercial necessity,” that limited such research elsewhere (Bush, 1945). Denise expressing her dissatisfaction with the incremental pace of her previous research and Julissa’s belief that it was more important to prepare the next generation of Black scientists than contribute to “big pharma,” serve as examples of participants attempting to avoid such pressures.

### **Troubling Questions for the Future of HBCUs**

Findings that participants were at odds with their institutional leadership may be troubling for a HBCU community that continues to face financial and social threats to their existence (e.g., Carter, 2017). In discussing their interactions with NSF and their research pursuits, it became apparent that some participants perceived a disconnect between their own interests and the goals of their institutional leadership. Some participants portrayed their leadership as self-serving or distracted from the HBCU mission of educating Black Americans. Others called for approaches to the mission that better valued their education-oriented contributions. Participants also focused on the advantages they perceived peers at PWIs holding over them (at least within the context of NSF grant writing and research) in a manner suggesting a dissatisfaction with their own institutional environments. And the PWIs they chose when making these comparisons set high expectations for their own institutional environments. Participants exclusively compared their institutional situations to those at *successful* PWIs. None of the participants spoke of their institution’s success or potential relative to other HBCUs or less successful PWIs. There was little to suggest participants were content with the resources available to them to pursue grants.

This study also raised the possibility that faculty are more committed to the mission of



uplifting the Black community than they are to the HBCUs, themselves. I came to see some participants as utilizing HBCUs as one of many resources available to them to attend to their personal goals. Dwayne, for example, said he was a scientist because he wanted to make the world a better place and happened to be “good at science.” Similarly, faculty like him may only be at HBCUs because the schools incidentally provide access to a large number of Black students and allow the faculty to maximize their contributions to the Black community. The historical significance of HBCUs may be of secondary importance, and if faculty committed to the mission find a more effective means of pursuing that mission outside of HBCUs, they may abandon the schools. The continued success of HBCUs in the realm of STEM education relies on the presence of a dedicated faculty seeking to uphold the mission of educating Black Americans. Therefore, it may be essential for HBCU leadership to reaffirm its commitment to the mission of educating Black Americans.

The findings that HBCU faculty and leadership may not be in agreement also highlight a potentially significant limitation with the theoretical framework developed for this study: the framework does not adequately attempt to distinguish between HBCUs, as institutions, and the Black faculty that work at HBCUs. If this study’s findings are representative of the situations at HBCUs seeking to expand their research efforts, future research involving these schools should not assume that the HBCU can be studied as a homogeneous unit. Nor should future researchers assume the attitudes and behaviors of HBCU faculty are similar to those of institutional leadership, or vice versa.

### **Recommendations to NSF to Better Support the Efforts of HBCU STEM Faculty**

NSF’s founders designed a research funding enterprise and merit review system intended to empower scientists with the academic freedom necessary to advance the US science agenda

(Mazuzan, 1992). However, this inquiry raises questions of whether Black HBCU faculty fully enjoy such academic freedom. Therefore, just as some participants sought ways to enable their students to more fully participate in a democratic society, NSF should consider ways to ensure Black and/or HBCU STEM faculty are able to fully participate in the democracy of the scientific enterprise. With due respect to the participants who felt NSF had done all it can do to help HBCUs, I present the following recommendations for how NSF can play a role in addressing issues HBCU faculty face when pursuing research funding.

One constraint on the academic freedom of HBCU STEM faculty is institutional in nature. Participants frequently pointed to high teaching loads and limited infrastructure as impeding their research efforts, and they placed institutional leadership at the root of many of these concerns. Some participants questioned whether their leadership understood what faculty required in order to be competitive for NSF funding. Here, it may be useful to expand on Vanessa's tactic of using NSF and the scientific community to advocate on her behalf within her institutional environment. NSF could actively advocate on behalf of HBCU STEM faculty by helping educate institutional leadership on the needs of faculty. While still respecting the university's sovereignty, NSF could make an effort to help leadership view resources such as release time, grant writing support, and research supplies as investments in the university. NSF is also well positioned to facilitate mutually-beneficial collaborative research partnerships between faculty at HBCUs and other institutions. Highly-funded research-intensive institutions that struggle to show broader impacts could even be required to partner with HBCU researchers and provide them and their students access to their research infrastructure.

NSF could also provide additional resources directly to HBCU PIs to empower faculty to build harbors of academic freedom around themselves, from which they can better pursue their

research agendas. Such a move might involve relaxing funding policies and practices that are prohibitively restrictive for faculty at HBCUs with less resources. Increases in maximum release time might be appropriate to offset high teaching loads. At smaller schools, NSF might even permit supplemental pay to prevent underpaid faculty from resorting to teaching overload courses to make ends meet. Further, PIs at smaller HBCUs might be permitted to request funds for teaching and research supplies (along with maintenance and disposal costs) that would normally be expected to be part of the institutional environment. Alternatively, NSF could consider stipulating a certain percentage of indirect costs be earmarked specifically to support STEM research- and education-related costs. NSF could also provide additional resources and training to empower faculty to take more ownership of their institutional environments and disrupt obstructive practices at their institutions. Opportunities like the ADVANCE program, which seeks to develop and sustain “*systemic approaches* [emphasis added] to increase the representation and advancement of women in academic STEM careers” (National Science Foundation, 2016), could serve as models, provided they were sufficiently modified to be more culturally aware of non-PWI environments.

NSF could also work to ensure HBCU faculty have the academic freedom to pursue *all* of their interests as scientists, and not just the ones they recognize as valued by the mainstream science community. The agency could accomplish such a goal by doing more to acknowledge and respect the multiple social identities of Black scientists and engineers and their close attachments to the Black community. This could include additional funding and initiatives to promote and enable broadening participation research within marginalized communities. Crucially, these efforts must be prepared to face the deeply entrenched social structures that enable the marginalization of the targeted communities. Efforts to refine or provide increased

access to interventions developed in privileged majority settings that ignore the presence of systemic and institutional racism will not suffice.

NSF could also make a more concerted effort to publicize the value of HBCU research to both scientific communities and the general public. Informing the general public of the benefits of HBCU research could garner additional support for the institutions while also attracting more members of underrepresented groups into these schools and the STEM pipeline. Within academic circles, such awareness might better enable reviewers to make more fully-informed judgements of HBCU-led proposals during the merit review process. The publicity may even be useful among HBCU faculty similar to participants in this study, none of whom spoke about the relative success of HBCUs in STEM education, aside from an occasional reference to HBCUs' role in the undergraduate development of Black STEM PhDs.

Regardless of the approach, NSF must ensure that a diverse and representative group of HBCU faculty play leading roles in any efforts to broaden the participation of HBCU faculty. This includes engaging HBCU faculty in discussions about how broader impacts should be weighed against intellectual merit in the review process and ensuring more marginalized voices are present on review panels. However, NSF must also recognize this is not simply an issue of race. All of the participants in this study self-identified as Black, yet Dwayne, Walter, and Adele all expressed views on social justice and fairness that were vastly different from what Terrence expressed in his interview. This suggests the presence of a diversity of thought among Black faculty in how science can or should be utilized to attend to social concerns. However, the Black faculty most likely to volunteer as external reviewers are also likely to have trained at PWI graduate schools, come from institutional environments with more resources than HBCUs, and exhibit behaviors and tendencies better aligned with the mainstream science community. This

may result in a selection bias that effectively undermines the diversity in thought among Black faculty participating in the merit review process. Therefore, NSF must work harder to engage researchers at the margins. In some cases, this may require NSF doing more to educate HBCU leadership on the value of sending faculty to NSF to engage with program officers. And when they are present, other NSF personnel must do a better job of listening to and trusting voices normally marginalized in discussions. For instance, the participant who served as a program officer should have found themselves in a productive dialogue with other program officers when they suggested rescheduling a review panel to avoid Mother's Day, rather than being "laughed out the room." Finally, these actions must be taken across all divisions and directorates, and not be contained in relatively small, isolated programs like HBCU-UP. All parts of NSF should bear responsibility in increasing HBCU participation.

### **Limitations and Directions for Future Research**

When considering the limitations of this study, readers are reminded that the participants in this inquiry represented only a narrow slice of the diverse STEM faculty working at HBCUs. While this study makes no claims to generalizability, it is worth reiterating that the study participants may not be representative of Black HBCU STEM faculty members. Readers should also be aware that selection bias may partly explain the consistency in finding that participants were motivated to attend to the uplift and education of the Black community. These same motivations may have made the participants more inclined to accept the study invitation, particularly if they assumed the study invitation had come from a young Black graduate student whose education they could assist.<sup>46</sup> They may also have seen participation as helping inform the

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<sup>46</sup> Note, however, that the study invitation (Appendix E) gave no obvious clues about my race and made clear that I was affiliated with a PWI.

academic community of the value of HBCUs and their mission.

I also acknowledge the recruitment strategy I employed as biased toward finding faculty who had been successful in procuring NSF grants. Unsurprisingly, the participants, as a group, proved to be relatively successful in their NSF efforts and well-prepared to compete in the research grants arena. It is also notable that all but one of the participants completed their graduate training at large, research intensive PWIs, which undoubtedly rewarded them with valuable capital in the research funding enterprise. They were professionally socialized in competitive research environments, and likely received the benefit of explicit and implicit training in how to pursue a research agenda and obtain research funding within an academic setting. One participant even spoke of benefitting from continued research collaborations with their former graduate advisor.

I do not believe the limitations discussed here significantly impact the conclusions drawn within the study. However, future studies in this area may wish to enroll a more diverse group of HBCU faculty, in terms of experience and success with NSF or similar federal funding agencies. Others may wish to investigate how relevant forms of capital (e.g., skills, knowledge, and behaviors developed or gained while in research intensive graduate environments or through close relationships with supportive graduate advisors) determine HBCU faculty members' approaches to NSF merit review. Future work might also engage faculty at private or liberal-arts focused HBCUs to improve understanding of how various institutional settings influence faculty's understanding of their relationships with NSF.

I also recognize faculty like Terrence as posing potentially interesting cases to study further. Without his perspective, this inquiry would have been more limited in its ability to demonstrate the diversity of thought, understanding, experience, and interests within the HBCU

community. But, I admit I am not sure how Terrence fits into a larger ‘theory of Black STEM faculty at HBCUs.’ Is he evidence of a developmental component to community and social interests? Would I have gotten responses similar to his from a younger Adele, when she was still focused on her research and social issues had not yet found their way into her blindered field of vision? Or was Terrence part of a new generation of Black researchers less interested in – or better equipped to divorce themselves from – issues of race and racism? Or had he found a new solution to the dilemma Adele posed for Black scientists?

Finally, as a Black man, I find this study personally fulfilling. I take pride in concluding that these Black scientists are hard at work not on trivial, self-interested issues, but on finding ways to make marginalized lives better. Yet, I cannot reconcile my satisfaction in these findings with the unsettling anguish I heard in Denise’s voice as she discussed the disillusionment in realizing that she, alone, would not cure cancer and subsequently pondered: “could I better utilize my time doing something else?” Her shift to focus on STEM education research benefited her students, but it was a real loss to the field of cancer research. Similarly, despite her claims that “big pharma” was doing fine without her, I wonder if pharmaceutical companies might benefit greatly from having Julissa’s sense of morality guiding their research.

Within this conflict, I see many questions yet to be posed to Black STEM faculty like these participants, both at HBCUs and PWIs. Do they feel restricted by their moral obligations, and if so, why? Do they worry Black educators (especially at HBCUs) are implicitly steering their students out of particular STEM career paths by teaching them that social connections are a necessary part of science? Are they concerned that we, in passing down our moral obligations to future generations of Black youth, are inadvertently raising obstacles to their entry to the STEM enterprise? Much more research is needed to better understand both the roots and repercussions

of Black scientists' moral obligations to non-scientific communities.



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## Appendix A - Interview Protocol

### **Part I (10-15 minutes)**

You were involved in proposing a project to the National Science Foundation program. Let's start by discussing your experience with that project.

- Tell me about the project. *adjust probes to account for whether project was completed or is on-going*
  - What activities were involved?
  - What were the goals of the project?
  - At whom were project activities targeted?
- What motivated you to pursue this project in the first place?
- Was the project funded?
- *If project was funded:* [What were]/[what did you expect to be] the most important findings or conclusions drawn from the project?
- Why was this project important to you?
- In what ways was this project (or projects like this) important...
  - To the university?
  - To the region/local community?
  - To the nation/global community?
- What stood out most to you about the experience?

### **Part II (15-30 minutes)**

Now I'm interested in learning more about the process you undertook to propose the project to NSF.

- Tell me about where you began with the proposal. Did you have the idea for the project first and find the solicitation later? Or did you see the solicitation first and develop an idea that met NSF's requests?
- *The following question may have been addressed in the prior response; proceed to probes if the main question has already been answered* - Trying to remember the solicitation you were responding to when applying for funding for this project, do you

remember having to make changes to your project to make it "fit" with what NSF wanted?

- Is it a common thing for you or others you've witnessed preparing NSF proposals, to make ideas "fit"?
- How do you go about making your ideas "fit"?
- How did you know the project had merit?
  - *if the definition of "merit" is an obstacle* – What made you believe the project was worth funding?
- What did the reviewers say about the proposal?
- How did the reviewer feedback compare to your expectations?
  - How did this feedback compare to other reviewer feedback from other proposals you've submitted?
- *Proceed to prompt if the previous response addresses the following question:* How did your view of the project's merit compare with the reviewers'? What did they see as the **most important aspects** of the proposal?
  - What do you believe you could have done differently in the proposal to make the project more appealing to NSF?

### **Part III (30-45 mins)**

Now let's talk more about how NSF evaluates proposals, in general. NSF judges proposals based on two criteria: intellectual merit and broader impacts.

- ***Verify definitions with participant before proceeding*** – Off the top of your head, how would you define IMC and BIC? [*present definition of IMC and BIC if requested or if the response doesn't seem close to NSF's definitions*]
- When writing project summaries for your proposals, which criteria do you find to be easier to respond to?
  - And why do you find \_\_\_\_ to be more difficult?
- What's your process for writing the IMC/BIC statements in the project summary?
  - What questions are you asking yourself when writing the statements?

- Do you write the statements at the start or the end of the process? Why do you do it that way?
- Both criteria have ambiguous beneficiaries...
  - IMC seeks to advance knowledge, but “whose” knowledge? Who gets to decide which group should learn something from projects you propose?
  - BIC seeks to advance societal goals, but who gets to decide which goals are important?
- When you think about your role as a faculty member here, and the things you do in that position, do you feel that one of the criterion (IMC, BIC) is more important than the other? Why [not]?
- Do you believe the NSF community feels similarly about [XXC being more important than XXC]? What makes you feel that way?
- HBCUs make a disproportionately positive contribution to diversity in STEM fields, but HBCUs are also underfunded by NSF. Does that surprise you?
  - Why/why not?
  - *If response puts responsibility on...*
    - *NSF:* What do you think NSF needs to know about HBCUs or HBCU faculty to convince them to give HBCUs more funding?
    - *HBCUs/faculty:* What do you think HBCUs or HBCU faculty need to do differently to have better success with NSF?
    - *Ambiguous:* What do you believe would be the most impactful changes that could be made to the relationship between HBCUs and NSF to increase the amount of funding HBCUs receive from NSF?
- How do you think NSF views HBCUs?

Appendix B - Informed Consent Form

## **RESEARCH PARTICIPANT INFORMATION AND CONSENT FORM**

**TITLE:** An Investigation of How Black STEM Faculty at Historically Black Colleges and Universities Approach the National Science Foundation Merit Review Process

**VCU IRB NO.:**

**INVESTIGATOR:** Falcon Rankins, School of Education, Virginia Commonwealth University

This consent form outlines important information about a research study in which you are asked to participate. Before you sign this consent form, it will be discussed with you in detail by the investigator, at which time you will be free to ask any questions regarding the language of the form or your participation in the study. You may take home an unsigned copy of this consent form to think about or discuss with family or friends before making your decision.

### **IMPORTANT ACRONYMS**

The following acronyms are used throughout this form:

- HBCU – Historically Black College or University
- NSF – National Science Foundation
- STEM – Science, Technology, Engineering, and Mathematics
- VCU – Virginia Commonwealth University; a non-HBCU, public research university located in Richmond, VA;

### **PURPOSE OF THE STUDY**

The purpose of this study is to explore how faculty members in science, technology, engineering, and mathematics (STEM) fields at Historically Black Colleges or Universities (HBCUs) approach funding opportunities offered by the National Science Foundation (NSF). This research study is conducted as part of the investigator's doctoral dissertation in VCU's School of Education. You are being asked to participate in this study because you are a faculty member of a STEM department at a HBCU who has self-identified as Black or African American and have experience proposing and/or implementing NSF-funded projects.

### **DESCRIPTION OF THE STUDY AND YOUR INVOLVEMENT**

If you decide to participate in this research study, you will be asked to sign this consent form after you have had all your questions answered and understand what will happen to you. Significant new findings developed during the course of the research that may relate to your willingness to continue participation will be provided to you.

In this study, you will be one of several STEM faculty members asked to participate in an open-ended interview concerning your experiences applying for, formulating, and managing NSF-funded grants. You will also be asked to discuss your understanding of NSF merit criteria and share your personal views on how you judge the merit of your NSF proposals. Interviews will last 60 – 90 minutes and will be tape recorded and transcribed. All interviews and meetings will be conducted at a time and place most convenient to you. After the interview, you will be asked to review transcripts of your interview and complete a post-interview consent form. The investigator may also have additional questions for you related to the research after the



interviews have taken place.

Additionally, you will be asked to voluntarily share a copy of a NSF grant proposal you've submitted within the past five years, along with reviewer comments and feedback you received as part of the merit review process. **You do not have to share a grant proposal or reviewer comments in order to participate in the study.** Please see the CONFIDENTIALITY section for information about how your documents may be used.

### **RISKS AND DISCOMFORTS**

Participating in this study involves the risk of social or professional harm if others are able to associate your identity with data collected from you as part of this study. As a study participant, you may discuss topics in ways you would not normally share with co-workers or peers. You may also make remarks about your institution, department, or administration you would not normally share publicly. Further, NSF program officers or peer reviewers who recognize you might be biased by negative perceptions of your discussion about your experiences with or beliefs about NSF. This may potentially have ramifications for future proposal decisions.

Please understand that the nature of this study raises the risk that peers, co-workers, NSF officials, or other participants may be able to identify you through unanticipated means of deduction. While the researcher will take steps to ensure the anonymity of your data (see Confidentiality, below), it is important to recognize that HBCU STEM departments are close-knit and there may be relatively few faculty members like you in your position. Therefore, certain combinations of information about you - such as your gender, age, rank, institutional affiliation, department affiliation, or experiences at your institution or with NSF - may provide enough clues for readers to identify you. The investigator will work together with you throughout the study to minimize the possibility of this happening.

Finally, it is unlikely participation in this study will cause you any physical risk or discomfort. However, sometimes talking about life experiences causes people to become upset. You do not have to talk about any subjects you do not want to talk about, and you may leave the study at any time.

### **BENEFITS TO YOU AND OTHERS**

*You will likely not receive any direct benefit from this study.* However, the study's findings may benefit the academic community by providing a better understanding of the relationship between Black HBCU STEM researchers and agencies that fund STEM and STEM education research.

### **COSTS**

There are no costs for participating in this study other than the time you will spend being interviewed, reviewing transcripts, and discussing topics relevant to the research with the investigator.

### **CONFIDENTIALITY**

Potentially identifiable information collected from you will consist of this consent form, audio

recordings, grant proposals and reviewer comments you provide, and written communications between you and the investigator. Additionally, the investigator will also generate field notes during the interviews that may contain identifying information. Only the investigator will have access to data that can directly identify you.

Audio recordings of the interviews will be transcribed. Both the audio file and transcription will be stored electronically. All paper versions of grant proposals, reviewer comments, and handwritten field notes will be scanned and stored electronically shortly after the interview. Originals will be destroyed immediately thereafter. All electronic data will be kept in password protected computer files. Hard copies of data may be made as backup and will be kept in locked filing cabinets. All computer files and hard copies of your data will be destroyed five years after the investigator's successful dissertation defense in compliance with VCU policy on data retention.

Your data, including transcripts of the interviews and any grant proposals or reviewer feedback you provide, *will only be used for research purposes*. Your data will be analyzed alongside data collected from several other participants to inform the investigator's doctoral dissertation. The dissertation will be published and made publicly available. Findings from the dissertation may also lead to conference or journal publications intended for various STEM and STEM education audiences. In some cases, direct quotations from interview transcripts, grant proposals, or reviewer feedback may be presented. Finally, the interviews and your data may inform conversations the investigator has with other HBCU STEM faculty, NSF personnel, and others interested in increasing federal STEM funding for HBCUs.

Once your interview is transcribed, you will have an opportunity to review the transcript for errors. At that time, you will also be asked to complete a post-interview consent form. This form will ask for your on-going consent and allow you to specify the degree to which you are comfortable with certain aspects of your identity being presented alongside your data. For now, **the investigator will assume you want to remain completely anonymous, and will protect your identity accordingly**. This includes associating your data with a gender-neutral pseudonym and withholding certain aspects of your identity that might be used to identify you.

The investigator also recognizes the competitive nature of NSF funding and will never share any grant proposals or reviewer comments you provide, in full. However, direct quotations or summaries of ideas you have proposed may be presented as findings, particular those that may serve as evidence of how student concern or other "non-scientific" factors have been incorporated into your proposal.

Note, information from the study and the consent form signed by you may be looked at or copied for research or legal purposes by Virginia Commonwealth University.

### **INVESTIGATOR CONFLICT OF INTEREST STATEMENT**

The investigator maintains a vested interest in a small consultancy firm that actively pursues federally-funded research development, grant writing, and evaluation work at HBCUs. This study is undertaken as a graduate student at Virginia Commonwealth University, and no data or documents collected for this study will ever be used for business purposes.

## **VOLUNTARY PARTICIPATION AND WITHDRAWAL**

Your participation in this study is voluntary. You may decide to not participate in this study. Your decision not to take part will involve no penalty or loss of benefits to which you are otherwise entitled. If you do participate, you may freely withdraw from the study at any time. Your decision to withdraw will involve no penalty or loss of benefits to which you are otherwise entitled.

## **QUESTIONS**

If you have any questions, complaints, or concerns about your participation in this research, contact:

Falcon Rankins (Investigator)  
School of Education, Virginia Commonwealth University  
[rankinsf@mymail.vcu.edu](mailto:rankinsf@mymail.vcu.edu)  
804-554-8274

And/or

Dr. Rosalyn H. Hobson (Dissertation Committee Chair, Principal Investigator)  
School of Education, Virginia Commonwealth University  
[rhobson@vcu.edu](mailto:rhobson@vcu.edu)  
804.828.8308

*The researchers named above are the best persons to call for questions about your participation in this study.*

If you have any general questions about your rights as a participant in this or any other research, you may contact:

Office of Research  
Virginia Commonwealth University  
800 East Leigh Street, Suite 3000  
P.O. Box 980568  
Richmond, VA 23298  
Telephone: (804) 827-2157

Contact this number to ask general questions, to obtain information or offer input, and to express concerns or complaints about research. You may also call this number if you cannot reach the research team or if you wish to talk with someone else. General information about participation in research studies can also be found at:

[http://www.research.vcu.edu/human\\_research/volunteers.htm](http://www.research.vcu.edu/human_research/volunteers.htm).

## CONSENT

*I have been given the chance to read this consent form. I understand the information about this study. Questions that I wanted to ask about the study have been answered. My signature says that I am willing to participate in this study. I will receive a copy of the consent form once I have agreed to participate.*

---

*Participant name printed*

*Participant signature*

*Date*

---

Name of Person Conducting Informed Consent Discussion

(Printed)

---

Signature of Person Conducting Informed Consent Discussion

Date

---

Principal Investigator Signature (if different from above)

Date

Appendix C - Post-Interview Consent Form

## RESEARCH PARTICIPANT POST INTERVIEW CONSENT FORM

**TITLE:** An Investigation of How Black STEM Faculty at Historically Black Colleges and Universities Approach the National Science Foundation Merit Review Process

**VCU IRB NO.:**

**INVESTIGATOR:** Falcon Rankins, School of Education, Virginia Commonwealth University

**Please read this entire form carefully and refer to contact information below if you have any questions.**

You were recently interviewed as part of a dissertation study exploring the perspectives of Historically Black College and University (HBCU) faculty on the National Science Foundation (NSF) grant proposal process. You provided your informed consent to have data collected from you (audio transcript of interviews, grant proposals, reviewer comments, etc.) at the time of your interview.

Now that the initial interview is complete and you've had a chance to reflect on the questions you were asked and the responses you provided, the investigator is requesting you revisit your decision to participate and elaborate further on how you wish your data to be presented.

As discussed in the original consent form, by participating in this study, you risk harm from negative social or professional consequences should peers, co-workers, administrators at your institution, NSF personnel, or others be able to associate your identity with data presented as findings from this study. Further, because there may be relatively few faculty members like you in your position, certain combinations of information about you - such as your gender, age, rank, institutional affiliation, department affiliation, or experiences at your institution or with NSF - may provide enough clues for readers to identify you through unanticipated means of deduction.

While you consider the risks of participating, please remember that the quality of qualitative research is greatly enhanced by a detailed presentation of context and setting. While **you will not receive any direct benefit** from this study, the study's findings may benefit the academic community by providing a better understanding of the relationship between Black HBCU STEM researchers and agencies that fund STEM research and STEM education research. The benefit to the scientific community may increase if the investigator is able to present more (potentially identifying) details about you and your institutional setting.

Therefore, your participation in this study **requires you to balance:**

**risk to yourself** - i.e., potential consequences of loss of anonymity

VERSUS

**benefit to the scientific community** - i.e., providing richer, more detailed findings useful to community

## NEXT STEPS

### ***Step 1: Check your transcripts***

The transcripts of your interview are attached to this document. Please review them carefully. You may redact (delete) any parts of the transcript you do not wish to be included in this analysis or potentially presented as findings. You may also add notes or comments to clarify any parts of the transcript you feel are unclear or not representative of your thinking. You have complete authority to change the transcripts as you wish; **however, the investigator asks you please try to preserve the transcripts as much as possible.** The thoughts you expressed during the interview, *and the way in which you expressed those thoughts*, are very valuable to this research. Please minimize the number of edits you make to the transcripts. Feel free to discuss any concerns you have with the investigator.

### ***Step 2: Decide what aspects of your identity you want associated and presented with your data***

Your data, including transcripts of the interviews and any grant proposals or reviewer feedback you provide, *will only be used for research purposes.* Your data will be analyzed alongside data collected from several other participants to inform the investigator's doctoral dissertation. The dissertation will be published and made publicly available. Findings from the dissertation may also lead to conference or journal publications intended for various STEM and STEM education audiences. In some cases, direct quotations from interview transcripts, grant proposals, or reviewer feedback may be presented. Finally, the interviews and your data may inform conversations the investigator has with other HBCU STEM faculty, NSF personnel, and others interested in increasing federal STEM funding for HBCUs.

All study participants will be minimally identified as US-born, Black and affiliated with a STEM department at a four-year HBCU in the state of VA, MD, NC, DE or DC.

Please select one of the following options:

- I do not want any additional aspects of my identity associated with my data. I expect the investigator to take all precautions to mask or omit any potentially identifying information about me (including information about my gender and institution and departmental affiliations) in reporting.
- I allow the investigator to associate some aspects of my identity with my data, *as specified in the next section.* I accept the increased potential of disclosure of my identity as a participant in this study, and I understand the risks associated with the association of my identity with my data.
- I have decided to withdraw my data from the study. I expect the investigator to return or destroy all data collected from me within 10 business days and provide a signed statement confirming the destruction of my data.

If you checked the second box, please complete this section:

***The investigator MAY associate the following information about me and/or my institution with my data when presenting findings*** (note, this list is comprehensive and is not meant to imply the investigator is aware of all of the following details about you):

- My name
- My gender
- My approximate age
- My faculty rank (i.e., assistant, associate, full professor)
- The approximate number of years I've been teaching, either at my current or previous institution
- Identifying information about my undergraduate or graduate training
- Details about other relevant professional or training experiences outside of my current faculty position
- The disciplinary focus of my department (specific department names will not be used)
- The name of my institution
- The state in which my institution is located
- Whether my institution is public or private
- The approximate enrollment of my institution
- The approximate enrollment of my department

## **VOLUNTARY PARTICIPATION AND WITHDRAWAL**

Your participation in this study is voluntary. You may decide to not participate in this study. Your decision not to take part will involve no penalty or loss of benefits to which you are otherwise entitled. If you do participate, you may freely withdraw from the study at any time. Your decision to withdraw will involve no penalty or loss of benefits to which you are otherwise entitled.

## **REVISITING THIS FORM**

You may be asked to update this form if the investigator, during analysis, concludes disclosure of certain identifying information might appreciably change the risk-benefit balance for you. You may also request to update this form at any time before your data is published.



## QUESTIONS

If you have any questions, complaints, or concerns about your participation in this research, contact:

Falcon Rankins (Investigator)  
School of Education, Virginia Commonwealth University  
[rankinsf@mymail.vcu.edu](mailto:rankinsf@mymail.vcu.edu)  
804-554-8274

And/or

Dr. Rosalyn H. Hobson (Dissertation Committee Chair, Principal Investigator)  
School of Education, Virginia Commonwealth University  
[rhobson@vcu.edu](mailto:rhobson@vcu.edu)  
804.828.8308

*The researchers named above are the best persons to call for questions about your participation in this study.*

If you have any general questions about your rights as a participant in this or any other research, you may contact:

Office of Research  
Virginia Commonwealth University  
800 East Leigh Street, Suite 3000  
P.O. Box 980568  
Richmond, VA 23298  
Telephone: (804) 827-2157

Contact this number to ask general questions, to obtain information or offer input, and to express concerns or complaints about research. You may also call this number if you cannot reach the research team or if you wish to talk with someone else. General information about participation in research studies can also be found at:

[http://www.research.vcu.edu/human\\_research/volunteers.htm](http://www.research.vcu.edu/human_research/volunteers.htm).

## PREFERRED PSUDONYM

If you have a preferred pseudonym, please indicate it here: [Click or tap here to enter text.](#)

## CONSENT

*I have been given the chance to read this consent form. I understand the information about this study. Questions that I wanted to ask about the study have been answered. My signature says that I am willing to participate in this study. I will receive a copy of the consent form once I have agreed to participate.*

---

*Participant name printed*

*Participant signature*

*Date*

---

Principal Investigator Signature

Date

## Appendix D – Research Participant Invitation Email

Subject: Invitation to Research Study on Black HBCU Faculty and NSF

My name is Falcon Rankins and I am a PhD candidate in the Virginia Commonwealth University School of Education. I am conducting interviews as part of my dissertation research study investigating how Black STEM faculty at HBCUs approach the National Science Foundation (NSF) merit review process. I hope that by providing NSF program officers additional insight into how HBCU faculty approach NSF merit review, this study can contribute to redressing HBCUs' underrepresentation in NSF funding streams. I am contacting you because [you are listed in the NSF Award Database as a Principal Investigator for a project funded by NSF]/[your name was provided by another participant outside your institution] and I believe you can make a valuable contribution to this study.

For this study, I am specifically seeking HBCU faculty members in science, technology, engineering, or mathematics disciplines who self-identify as Black or African American and who were born and/or raised in the United States.

Interviews will last 45-60 minutes and take place at a location of your choosing. The interviews will be informal and involve discussing your previous experiences proposing and implementing NSF grant activities. During the interview, we will also discuss your views on how these projects are - and should be - judged, along with your views on HBCU participation in the NSF grants enterprise. Finally, you may be asked to provide a previous NSF grant proposal you have submitted along with NSF reviewer feedback to that proposal. However, you do not have to provide any documents to participate in the study.

If you choose to participate, all data collected from you will be held confidentially and you may choose to remain anonymous. You will receive no compensation or direct benefit from participating. However, the study's findings may benefit the academic community by providing a better understanding of the relationship between Black HBCU STEM researchers and agencies that fund STEM and STEM education research.

If you are willing to participate, please follow the link below to complete a short recruitment survey. Once you respond, I will contact you by email to arrange your interview.

If you have any questions about the study or would like a copy of the informed consent form, which contains additional details about risks, benefits, and confidentiality, please do not hesitate to ask. This study has been approved by the VA Commonwealth University IRB, No: HM20009438.

While I continue to recruit for the study, you may receive 2-3 additional email invitations. If you are not interested in participating, please delete these emails or let me know to remove you from the email list.

Thank you for your consideration.

Falcon Rankins  
School of Education  
Virginia Commonwealth University, Richmond, VA

## Appendix E– Research Participant Intake Survey

## Participant Background (Intake) Survey

Instructions: This survey asks demographics and questions related to your prior experience with NSF. Data collected in this survey will only be used to 1) establish your eligibility as a participant and 2) help the investigator prepare for your interview. Data collected here will not be used for any research purposes before you have been given the opportunity to review and voluntarily sign the informed consent form. If you decide to participate in the study, you will retain the option to withhold any information provided here from being reported with study findings. If you decide not to participate in the study or are deemed ineligible, your responses will be deleted from the study database. Finally, you may skip any question you are uncomfortable answering; however, you will be deemed ineligible if you do not respond to the first three questions.

1. Name: [text box]
2. Preferred email address: [text box]
3. Do you agree with the following statements?
  - I was born or raised in the United States. [Yes/No]
  - I consider myself Black or African American. [Yes/No]

*{if no to either of the above, stop data collection and route to thank you page}*

4. What is the discipline of the department with which you are affiliated? [text box]
5. Which best describes your current faculty rank? [Non-tenure track, lecturer, instructor, etc./Assistant professor/Associate professor/Professor]
6. Have you ever served as an external reviewer for NSF? [Yes/No]
7. Have you ever served as a program officer at NSF? [Yes/No]
8. How many proposals have you submitted to NSF in the past five years? [0/1/2-5/6-10/More than 10]
9. With what gender do you associate? [Female/Male/Would prefer to specify] [route to text input if necessary]

*{upon completion, show thank you message}*

### Thank you

Thank you for your responses. If you are selected as a participant, Falcon Rankins, the graduate student investigator, will contact you soon to make arrangements for your interview. If you have any questions, please contact Falcon at [rankinsf@mymail.vcu.edu](mailto:rankinsf@mymail.vcu.edu) or the study primary investigator, Dr. Rosalyn Hargraves at [rhobson@vcu.edu](mailto:rhobson@vcu.edu).