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Los Angeles

The Life Cycle of STEMM Intervention Programs:

From Adoption to Institutionalization

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy
in Education

by

Edwin Jose Perez

2023

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ABSTRACT OF THE DISSERTATION

The Life Cycle of STEMM Intervention Programs:
From Adoption to Institutionalization

by

Edwin Jose Perez

Doctor of Philosophy in Education

University of California, Los Angeles, 2023

Professor Sylvia Hurtado, Chair

Severe inequities for underrepresented student groups (URGs) in Science, Technology, Engineering, Mathematics, and Medicine (STEMM) fields has remained a topic of national concern for several decades. Research has demonstrated the efficacy of STEMM intervention programs (SIPs) in addressing disparate STEMM outcomes. However, there is a dearth of research that has examined the process of developing, implementing, and sustaining programs. Using a multiple case study approach and organizational theory, this study tracks the life cycle of the Chancellor's Science Scholars program at UNC-Chapel Hill and the Millennium Scholars Program at Penn State (University Park), two SIPs modeled after the nationally successful Meyerhoff Scholars Program at the University of Maryland, Baltimore County. This study provides campuses with important practical and theoretical implications regarding distinct phases of SIPs.

Results demonstrate that unique challenges emerge at each phase of the life cycle, requiring programs to employ multiple strategies to find success. At the implementation phase, campuses navigated logistical challenges determining program placement, setting up a funding model, and integrating into the existing ecosystem of programs and diversity initiatives. Additionally, the cultural contours of UNC-Chapel Hill and Penn State, two predominantly white research-intensive universities, were at odds with the Meyerhoff program features derived from an HBCU model. Addressing these cultural challenges required several adaptations to the model leading to unintended consequences but also some that enhanced diversity, equity, and inclusion (DEI). Sustainability was achieved through garnering buy-in and commitment from organizational members across, and at multiple levels, of the institution. Additionally, programs were sustained through: shifts in their organizational placement and funding models, helping to advance their institutions' espoused DEI goals, and demonstrating their value through programmatic assessment. Using organizational theory, the study moves away from conceptualizing institutionalization as simply moving from grant-funding to institutional funding, to understanding institutionalization as a multidimensional process on a spectrum that is linked to organizational change. Results from this study provide a nuanced and meaningful contribution to the study of SIPs, allowing campuses to use this work as a guide to advance culturally responsive and strengths-based programs through distinct stages of the program life cycle.

The dissertation of Edwin Jose Perez is approved.

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2023

DEDICATION

To my parents, Petrona García and Jose Pérez, who showed me that anything is possible.

Aprendí de ustedes más de lo que cualquier escuela podría enseñarme.

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VITA

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CHAPTER ONE: INTRODUCTION

Background of the Problem

Severe inequities in Science, Technology, Engineering, Mathematics, and Medicine (STEMM) fields among students from underrepresented groups (URGs) is an issue of national concern that has prompted several federal agencies and private foundations to invest heavily in helping institutions innovate and develop programs that ensure greater student success (Granovskiy, 2018; Institute of Medicine, 2011; National Academies of Sciences, Engineering, and Medicine, 2016; Sto. Domingo et al., 2019). In response, higher education institutions have increasingly developed and adopted STEMM intervention programs (SIPs) as a mechanism to improve inequitable STEMM outcomes (Chubin & DePass, 2017; George et al., 2019; National Academies of Sciences, Engineering, and Medicine, 2016; Tsui, 2007). While disparate outcomes among URG students have been slow to change, SIPs are being recognized as an institutionally-focused mechanism by which higher education organizations can turn the tide on this problem and work toward achieving greater equity in STEMM fields (Institute of Medicine, 2011; National Academies of Sciences, Engineering, and Medicine, 2016).

SIPs vary in program design, resulting in a myriad of services and activities provided. However, they all have the common goal of addressing factors associated with unequal STEMM outcomes. As a result, they target critical areas like academic preparation, retention and persistence, and career outcomes (Chubin & DePass, 2017; George et al., 2019; Tsui, 2007). Research on SIPs indicates that the majority of universities employ SIPs as singular services such as offering academic support services (tutoring, workshops, etc.), summer bridge programs, research experiences, mentoring experiences (from faculty and peers), and/or financial support (Kezar & Kitchen, 2020; Pearson et al., 2022; Tsui, 2007). However, universities also combine

services to create programs that address multiple factors simultaneously. The literature on SIPs has used various terms to describe programs that offer a combination of services, such as comprehensive programs, wraparound programs, and integrated programs (Kezar & Kitchen, 2020). While these terms have generally been used interchangeably, researchers have provided some distinctions by explaining that “Comprehensive programs offer a broad range of supports coordinated within a single program. Integrated programs link students to several existing supports on campus so that they essentially become a comprehensive support program” (Kezar & Kitchen, 2020, p. 225). This study will use the term comprehensive program to describe SIPs that offer a combination of services and interventions.

Research suggests that comprehensive programs can facilitate greater success in STEMM for URGs as they allow an institution to create an environment in which student needs are met from multiple angles and disconnected sectors of the university are brought together, thereby creating a “unified community of support for students, faculty, and staff” (Holcombe & Kezar, 2020, p. 350) Many SIPs have documented positive outcomes for URG’s in STEMM such as increasing their persistence and retention, graduation rates, and leading to STEMM careers and graduate degrees (Maton et al., 2012; National Academies of Sciences, Engineering, and Medicine, 2016; Pearson et al., 2022). As such, SIPs have gained significant financial investment both at the K-12 and postsecondary level from federal agencies like the National Science Foundation (NSF) and the National Institutes of Health (NIH), with estimates being around three billion dollars (Granovskiy, 2018). These investments manifest in national programs like the Louis Stokes Alliance for Minority Participation (LSAMP), funded by the NSF, which aims to provide support for URGs in STEMM through multi-institution alliances (James & Singer, 2016). Universities also establish their own SIPs with well-documented programs found at

numerous institutions such as the Biology Scholars Program (BSP) at the University of California, Berkeley (Estrada et al., 2019) and the Meyerhoff Scholars Program (MSP) at the University of Maryland, Baltimore County (UMBC) (Maton et al., 2012).

While SIPs have been documented to improve URG STEM outcomes, researchers have critiqued these programs because many interventions, particularly interventions that use one component, rely on a “fixing” the student approach, whereby URGs are framed as deficit and in need of repairing to be successful in STEM instead of focusing on how institutions can change to better cultivate URG STEM talent through structural transformation (Asai, 2020; Castro, 2014; Chubin & DePass, 2017; Linley & George-Jackson, 2013). As Estrada et al. (2016) note, programs can focus on the individual (person-level) and/or the contextual (institutional/environmental) level. While both approaches have merit and can lead to URG STEM success, sustained equitable outcomes result from transforming universities and changing the structures that create barriers to URG STEM success (Castro, 2014; Estrada et al., 2016; Linley & George-Jackson, 2013; National Academies of Sciences, Engineering, and Medicine, 2016). If these institutional-level factors are not addressed and changed, individual-level programs will always be needed to facilitate URG STEM success because structural barriers remain intact.

Problem Statement

Institutions seeking to improve STEM outcomes among URGs increasingly turn to SIPs as a potential solution with many looking to proven models when designing their programs. While there is extensive literature on the outcomes that SIPs produce and the programmatic elements that they use to achieve these elements, there is a dearth of literature on the process of implementing these models. Moreover, implementation is only the first step to establishing a

SIP. Research is needed to understand how replicating proven models need to be adapted to fit into new institutional environments and what it takes to sustain and institutionalize these programs, ensuring long-term success. Without addressing sustainability and institutionalization, SIPs are bound to become “islands of innovation” (Milem et al., 2005, p. vii) resulting in little impact across the institution. Therefore, research is needed to understand the entire life cycle of SIPs, ensuring that universities are avoiding pitfalls along different stages of development and can successfully implement and institutionalize programs that will meaningfully contribute to the success of URGs in STEMM.

Valuable lessons on the life cycle of SIPs can be learned from the Meyerhoff Adaptation Partnership (MAP), a collaborative that aimed to replicate the highly successful Meyerhoff Scholars Program at the UMBC at two distinct institutions, the University of North Carolina at Chapel Hill (UNC-Chapel Hill) and the Pennsylvania State University, University Park (Penn State) (Hrabowski III et al., 2019; Sto. Domingo et al., 2019). Examining this partnership will have implications that enable campuses seeking to establish their own program interventions to understand how to establish SIPs that best serve URG students in STEMM. This study will also address gaps in the research literature regarding the life cycle of SIPs.

The Meyerhoff Scholars Program

The Meyerhoff Scholars Program at UMBC is one of the most well-documented STEMM intervention programs as it has had incredible success in improving STEMM outcomes for URGs, making it an exemplary national model (Estrada et al., 2016; Hrabowski III et al., 2019; D. M. Lee & Harmon, 2013; Maton et al., 2012). The MSP was established in 1988 through funding from Robert and Jane Meyerhoff and was initially designed to provide support for Black male undergraduate students committed to obtaining Ph.D. degrees in math, science, and

engineering through providing financial assistance, mentoring, advising, and research experiences. In 1990 the program began accepting Black female students and in 1996 it shifted to accepting students of all backgrounds (Hrabowski III, 2015). The MSP has a long-standing record of successfully recruiting, retaining, and graduating URGs in STEMM (Maton et al., 2012; Maton & Hrabowski III, 2004; Stolle-McAllister et al., 2011). Since the inception of the program, more than 1,400 students have participated in the program and graduated with bachelor's degrees in science and engineering, the majority of whom were students from URGs. Alumni from the MSP have gone on to earn 359 PhDs (which includes 66 MD-PhDs), 180 MD or DO degrees, and more than 300 master's degrees (primarily in engineering and computer science). Moreover, 340 MSP alumni are currently enrolled in graduate or professional degree programs (Hrabowski III & Henderson, 2021). The program's efforts have resulted in UMBC becoming the top-producing institution for Black undergraduates earning PhDs in the natural sciences, life sciences, engineering, mathematics, and computer science (Hrabowski III & Henderson, 2021). This is significant because UMBC was once a predominantly white institution, is now more racially diverse, and has surpassed predominantly Black institutions in baccalaureate origin studies of completed PhDs.

To achieve this success, the MSP utilizes a strengths-based and culturally responsive model consisting of 13 synergistic programmatic elements that promote URG STEMM success, with the cumulative goal of having URGs earn PhDs in STEMM (Maton et al., 2012). The combination of these elements is known as the "Meyerhoff Way" and aims to enhance URGs' academic and social integration, knowledge and skill development, support and motivation, and provide holistic advising (Stolle-McAllister et al., 2011). The model elements include: targeted recruitment, financial aid, summer bridge, program values, study groups, program community,

personal advising and counseling, tutoring, summer research internships, mentoring, faculty involvement, family involvement, and administrative involvement and public support.

Program features that are strengths-based and culturally responsive are informed by four pillars of success, which are: high expectations, building community, research involvement, and continuous improvement through program assessment (Hrabowski III et al., 2019). The first pillar focuses on having high expectations for students by recruiting high-achieving students and emphasizing the importance of hard work in achieving one's goals. The second pillar aims to build community among scholars through a cohort model, requiring them to work together and support each other's success. Students learn to value collective success over competition with each other, which creates a support system for students as they navigate through their undergraduate careers. The third pillar focuses on collaboration among scholars and faculty, as "it takes researchers to produce researchers" (Hrabowski III et al., 2019, p. 117). Scholars are able to apply their skills and knowledge through research and strengthen their STEMM identities. Additionally, scholars build relationships with faculty members and begin to change mindsets on the potential of URG students. Lastly, the fourth pillar focuses on continuously improving the program through rigorous evaluation. The evaluation component allows the program to assess its impact and outcomes, and garner buy-in from others through evidence-based data. A visual of the Meyerhoff model is presented in chapter four.

The culturally responsive component of the model is also informed by the supportive practices used in historically Black colleges and universities (HBCUs), which were utilized to develop the model (Hrabowski III et al., 2019). In particular, the program creates a family-like environment for scholars through programmatic experiences like summer bridge and living

together for four years on campus and through program values that focus on collectivism and group success.

The MSP further builds this family-like environment through parental and family involvement. Parents are encouraged to participate in social events throughout scholars' undergraduate years, beginning with selection weekend in which scholars interview at UMBC in hopes of joining the program and culminating in a yearly celebration dinner for the graduating cohort (Hrabowski III, 2015). By incorporating parents, the program builds an extended Meyerhoff family, wherein parents are active participants in their children's education and are invested in the program. This is evident in their formation of the Meyerhoff Parents Association (MPA). The MPA raises funds for the program through endeavors like the sale of the MPA family cookbook, with the proceeds going to fund scholars' conference travel and stress buster events. Lastly, Meyerhoff scholars are cultivated to be future leaders in STEMM, embodying values like "to whom much is given much is required" (Hrabowski III, 2015, p. 114). Meyerhoff scholars are committed to diversifying the STEMM field and being leaders in their post-graduate endeavors. While in the program, scholars engage in service mainly through volunteering in the community. The culturally responsive aspect of the Meyerhoff model is a critical component to the success of the program. The notion of community uplift is also another strong value among HBCUs, but unique to be found embedded in SIPs.

The success of the Meyerhoff Scholars Program has drawn national interest with many campuses interested in replicating the model or aspects of the model, however, the only sustained replication of the program documented in the literature was accomplished through support from the Howard Hughes Medical Institute (HHMI) (Hrabowski III et al., 2019) Through funding from HHMI and annual convening of principal parties, the Meyerhoff Adaptation Partnership

(MAP) was formed, which is a collaborative aimed at replicating the Meyerhoff Scholars Program at UMBC at two predominantly-white, research-intensive institutions: the University of North Carolina at Chapel Hill (UNC-Chapel Hill) and the Pennsylvania State University, University Park (Penn State). HHMI awarded UMBC and UNC-Chapel Hill with phase-1 grants to begin a Meyerhoff replication. Penn State expressed interest in developing its own Meyerhoff replication; however, they did not initially receive a phase-1 award and were supported by institutional resources to become adapters (Crimmins et al., 2017). Through a phase II grant, HHMI funded all three institutions, and their total investment in the partnership was \$8 million over five years (Hrabowski III et al., 2019). Through these collaborative efforts, the Chancellor's Science Scholars program (CSS) at UNC-Chapel Hill and the Millennium Scholars Program (MLN) at Penn State were created in 2013.

Both the CSS and MLN programs recruited their first cohorts in 2013 and welcomed their 10th cohort of students in 2023. Although HHMI funding has ended, the programs have been sustained through institutional funding and some philanthropic support. Recent research has found that initial CSS and MLN student outcomes (cohort 1) exceed those of initial Meyerhoff outcomes (cohort 1) and average STEM retention rates and average GPA of MLN and CSS scholars in the first four cohorts are similar to outcomes of Meyerhoff scholars in cohorts 23 to 26 (Sto. Domingo et al., 2019). It was expected that these science-intensive universities, with more intentional SIP efforts, could do more to advance URG achievement and success and the research provides evidence that it is possible (Sto. Domingo et al., 2019), however little is known about the process of implementing these programs, specific adaptations to the programs that align with institutional contexts, and how they were ultimately sustained and institutionalized since program grant funding ended.

Purpose of Study and Research Questions

The purpose of this study is to examine the lifecycle of the CSS and MLN programs by investigating: (1) the process of implementing the programs at UNC-Chapel Hill and Penn State, (2) the process of adapting the Meyerhoff model into the UNC-Chapel Hill and Penn State context, and (3) the process of sustaining and institutionalizing these programs. In particular, the study aims to understand how a student-centered and culturally responsive model is received at multiple stages at two universities that are predominantly white and research-intensive. Moreover, the study examines how different racial histories, geographies, and campus cultures affect the lifecycle of these STEMM intervention programs. This study will inform campuses interested in adopting similar comprehensive programs by addressing the following research questions:

1. What was the process of implementing the Meyerhoff program at UNC-Chapel Hill and Penn State?
 - a. What elements of the student-centered, culturally responsive MSP program were more widely adopted and what was more challenging to existing practices and norms at predominantly white, research-intensive institutions?
 - b. How did these culturally responsive scholar programs fit within the ecology of other student programs or diversity practices on campus?
2. What key adaptations did the CSS and MLN programs make to the Meyerhoff model in order to fit into their unique institutional contexts and to what extent did this affect model fidelity?
3. What key mechanisms did the CSS and MLN programs employ to achieve sustainability and institutionalization at UNC-Chapel Hill and Penn State?

This study explores the multitude of factors to consider when implementing, adapting, and sustaining/institutionalizing a student-centered and culturally responsive model. In particular, the study highlights challenges that impede success throughout the lifecycle of the programs and how programs and campuses were able to address these challenges leading to programmatic success. Findings from this study provide valuable lessons to institutional leaders, faculty, and program staff of other campuses seeking to advance URG students in STEM.

Scope of Study

This study utilizes data collected from a larger project funded by the Howard Hughes Medical Institute (HHMI), which seeks to examine the Meyerhoff Adaptation Partnership and the programs at Penn State and UNC-Chapel Hill in terms of organizational change and impact. The larger project has three main topics it seeks to explore. The first topic is explored in this study which focuses on the process of implementing and adapting the Meyerhoff model into two distinct contexts, UNC-Chapel Hill and Penn State. The second topic will examine the role that program staff, faculty, evaluators, and institutional leaders from the Meyerhoff program had on the organizational learning and professional development of their counterparts at UNC-Chapel Hill and Penn State through a model of cross-institutional mentorship. The last topic will explore the impact that the CSS and MLN programs have had on their respective institutions and the extent to which they are creating broader institutional change. These three topics will lead to distinct insights that will be useful for other universities trying to successfully utilize comprehensive SIPs like the Meyerhoff model and its counterparts at UNC-Chapel Hill and Penn State. I am lead author on the program adaptation study and co-author on the other two papers resulting from the larger study. I was involved in the conceptualization of the larger study, writing of the grant proposal, collecting data on sites, coding and analyzing, and in weekly

conversations with the principal investigator (Professor Sylvia Hurtado) and the research team that was hired to implement the study.

This study will utilize a case-study methodology to examine the lifecycle of the CSS and MLN programs (see chapter three). Case study methodology requires the use of multiple forms of evidence to understand phenomena within its given context (Yin, 2017). As such, this study will be informed by a variety of data sources. To understand the institutional contexts that the programs exist in, data was collected through documents and webscraping public information about the institutions, their programs (MSP, MLN & CSS), and other related diversity or academic program initiatives on campus. Additionally, site visits were conducted at all three campuses. The study will primarily be informed by interview data, which includes 91 interviews with 72 participants who were current and previously employed institutional leaders, program staff, faculty, and evaluator.

The study will be informed by several organizational theories and frameworks to capture the life cycle of the CSS and MLN programs (see chapter two). Overarching in the study is an understanding of higher education institutions as racialized organizations that have the ability to enhance or diminish the agency of people of color (Ray, 2019a). To understand implementation the study will be guided by theories of isomorphism, namely institutional isomorphism (DiMaggio & Powell, 1983) and white institutional isomorphism (Garbes, 2022), and an organizational theory of implementation effectiveness (Weiner et al., 2009). The process of examining adaptation will be guided by the Framework for Reporting Adaptations and Modifications-Enhanced (FRAME) (Wiltsey Stirman et al., 2019), and an understanding of fidelity as mutual adaptation (Kezar, 2011). Lastly, this study will adapt Cobian and Ramos' (2021) strategies of sustainability to build an understanding of what it takes for interventions to

be sustained and ultimately institutionalized and is informed by Curry's (1992) levels of institutionalization.

Significance of the Study

Disparities in the persistence and retention of URGs in STEMM continue to be a topic of national concern (Asai, 2020). The MAP Programs serve as a catalyst for change providing an opportunity for institutions to improve their URG STEMM outcomes and work towards broader institutional culture change. The success of the Meyerhoff model and the adaptations at PSU and UNC have inspired funding agencies such as the Chan Zuckerberg Initiative (CZI) to invest \$6.9 million in further replications of the MSP model (Pennamon, 2019). This investment has resulted in the creation of the STEM Excellence through Equity & Diversity (SEED) Scholars Honors Program at the University of California, Berkeley, and the PATHways to STEM through Enhanced Access and Mentorship (PATHS) program at UC San Diego. Additionally, the HHMI funded Driving Change Initiative seeks to award up to six universities with \$2.5 million (each), over the course of five years, to initiate their own Meyerhoff-like programs with the goal of creating lasting culture change, enabling URGs to excel in STEMM (Howard Hughes Medical Institute, 2023)

This study is especially relevant at this time as many universities are being incentivized to create their own STEMM intervention programs by funding agencies like CZI and HHMI. Moreover, national agencies have advocated for the creation of SIPs by claiming "What is needed is for *every* four-year institution to develop and implement its own version of programs with demonstrated and sustained success such as the UMBC Meyerhoff, Georgia Tech Focus, or Rice University Computational and Applied Mathematics (CAAM) programs" (Institute of Medicine, 2011, p. 151). Findings and insights from this study are crucial in understanding the

challenges and opportunities that arise throughout the lifecycle of student-centered and culturally responsive programs, providing key lessons to a broad set of audiences who seek to adopt similar programs. Moreover, this study is unique in that it will reveal findings from what is considered one of the premier SIPs in the nation. The study's emphasis on the student-centered and culturally responsive aspect of the MSP provides insights into the challenges and considerations that need to be made when trying to create institutional culture change at predominantly white, research-intensive campuses with legacies of racial exclusion.

Lastly, this study fills a gap in the literature by examining multiple stages of SIPs as there is limited knowledge concerning the challenges and process of implementing, adapting, sustaining, and institutionalizing STEMM intervention programs at universities with different histories, cultures, and missions (Kezar & Holcombe, 2020). Furthermore, while studies have examined SIPs they have mainly focused on outcomes and programmatic elements with some examining the origins of SIPs. Research is needed to better understand how programs evolve to fit into their institutional context and how they are institutionalized in university daily operations (George et al., 2019). This study will also contribute to the organizational learning literature by building upon organizational frameworks and placing them in conversation with issues relevant to the STEMM field to advance our understanding of how institutions can learn and change. In order to enact lasting change, we must move towards an understanding of how to help institutions cultivate an environment that is conducive to URG STEMM success rather than focusing on ameliorating perceived deficiencies in students.

CHAPTER TWO: THEORETICAL FRAMEWORKS & LITERATURE REVIEW

I begin this chapter by providing an in-depth overview of the organizational theories and frameworks that inform this study. I explain how these theories and frameworks enhance my understanding of the different stages in the life cycle of STEMM interventions and how they will guide the study. Next, I examine the literature relevant to this study through three main topics, STEMM cultures, STEMM intervention common practices, and the lifecycle of interventions. I highlight how the literature provides insights for this study but also reveal gaps in the literature and identify key ways that the study will make contributions to existing literature.

Theoretical Frameworks

This section examines the organizational theories and frameworks guiding my understanding of the life cycle of STEMM intervention programs (represented in figure 2.1).

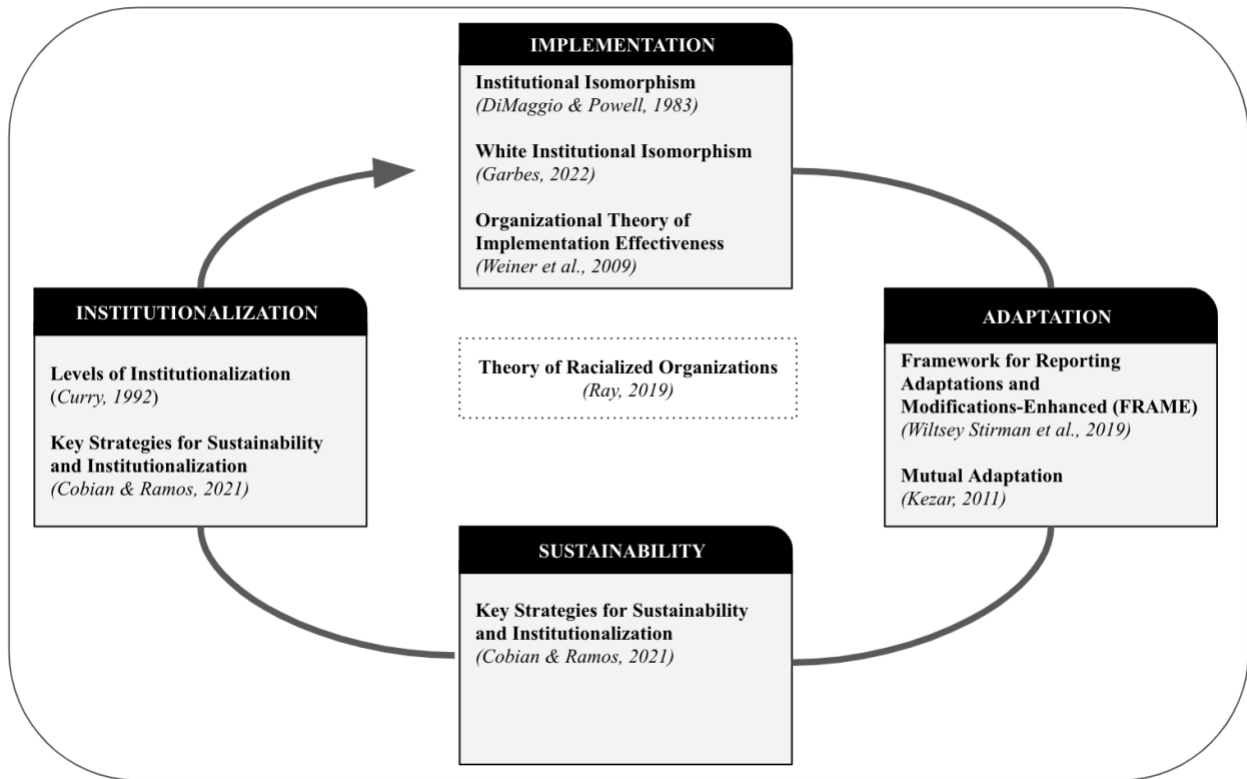


Figure 2.1: Theoretical Framework for the Life Cycle of STEMM Intervention Programs (SIPs)

While research has examined some of the stages in the life cycle of SIPs, there is a lack of studies that have investigated the entire life cycle. Using multiple theories and frameworks allows for a comprehensive understanding of the different stages that SIPs navigate. I begin by examining isomorphism and its role in the implementation stage.

Institutional Isomorphism

DiMaggio and Powell (1983) observe that, as organizations become established in a field, powerful forces are leading them to become similar to each other. This shift toward homogeneity can be understood as isomorphism and is defined as a “constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions” (p. 149). There are three mechanisms through which institutions experience isomorphic change: coercive isomorphism, mimetic isomorphism, and normative isomorphism. These different mechanisms are useful in understanding the different forces that shape organizational actions and how organizations become standardized within a field. Relevant to this study is how these forms of isomorphism lead universities to adopt STEMM intervention programs as a method to diversify the STEMM field.

In coercive isomorphism, organizations experience formal and informal pressures from other organizations upon which they are dependent on as well as from cultural expectations in the society within which they function. A major catalyst of coercive isomorphism is often the government, as government mandates have the power to shape how organizations operate (e.g. regulation or funding stipulations). Mimetic isomorphism is often a response to uncertain environments and is typically manifested through organizations modeling themselves after other organizations. Organizations tend to model themselves after organizations in their field that they perceive as successful or legitimate. This is especially important in higher education settings

where campuses wish to model best practices (George et al., 2019) The Meyerhoff Scholars Program has much national acclaim and research articles on its success (Maton et al., 2012; Maton & Hrabowski III, 2004; Stolle-McAllister et al., 2011). Mimetic behavior can be appealing to organizations as it provides a lower cost or lower effort way of finding a solution to challenging problems. The last source of isomorphic pressure is normative and results primarily from professionalization, the process in which members of an occupation collectively define the conditions and norms of their work (DiMaggio & Powell, 1983). The two aspects of professionalization relevant to normative isomorphism are formal education and networks. As individuals seek to obtain roles in specific fields they must gain the right credentials through attending universities and/or professional training, which in turn diffuse certain norms and rules regarding organizational and professional behavior. These education/training centers produce a pool of individuals that possess almost identical ways of behaving and thinking, which results in organizations being populated by individuals with the same disposition. Similarly, as organizations seek to hire individuals they use mechanisms to filter out personnel, mainly by looking to networks. As organizations hire personnel they typically select from the same specific networks, resulting in individuals from the entry-level through top executives being virtually identical. These norms have the potential for the replication of inequality and/or a level of homogeneity found among program personnel.

The institutional isomorphism framework provides a useful theoretical lens by which to examine the pressures that organizations must respond and adapt to, however, it does not speak to the role of race in organizations. Garbes (2022) develops a theory of white institutional isomorphism through an examination of the birth of National Public Radio (NPR), which demonstrates how organizational actors translate racialized norms from the broader field into

new organizations even when they seek to achieve greater racial inclusivity. White institutional isomorphism strengthens the analytic power of the isomorphism framework as it examines the ways that racial exclusion is recreated in the process of organizational formation by organizational actors who do not see the unequal implication of their actions due to a shared white value system. Garbes builds on DiMaggio and Powell's framework by introducing racially focused forms of isomorphic pressures, which are: white coercive isomorphism, white normative isomorphism, and white mimetic isomorphism.

White coercive isomorphism demonstrates how legal and technical standards imposed by the broader organizational field can serve as a means of racial exclusion. In the case of NPR, elevated technical standards were set for stations seeking membership into the network, however, this created a greater barrier to entry, particularly for minority-owned radio stations. While raising technical standards may seem like a race-neutral decision, it actively worked against NPR's espoused goals of serving a diverse public as those eligible for membership were largely white. This contradiction in goals versus action is made invisible because of the founders' shared white habitus (norms and expectations), which prevents them from seeing how racial exclusion is perpetuated.

DiMaggio and Powell's concept of normative isomorphism highlights how professionalization, through formal education and networks, leads to organizations having personnel that are virtually identical. Garbes' concept of white normative isomorphism demonstrates that, in the case of NPR, the use of networks hindered the creation of a racially diverse workforce and instead led to a predominantly white organization. As the field of educational radio at the time (the 1960s - 1970s) was largely a white space, those who got job offers at NPR were also mainly white. Furthermore, a shared white habitus by executives at NPR

blinded them to the racially exclusionary force that networks played in determining who was suitable for employment and instead was perceived as a race-neutral way of screening personnel.

Garbes notes that starting a new organization is often thought of as a blank slate when in reality this is not the case because of mimetic pressures from the broader field in which an organization operates. As organizations face uncertainty they are prone to mimetic behavior in which they model themselves after other organizations in the field. White mimetic isomorphism highlights how modeling leads to a reproduction of white norms into new organizations. As organizations model themselves after others they are absorbing the same white-field standards that other organizations operate under. Much like in the other forms of white isomorphism, organizational actors are not aware of how this mimetic behavior reproduces whiteness because of a shared white habitus. Organizational actors believe modeling is a race-neutral process when in reality it reinforces racial exclusion as it brings established white norms into a new space.

The concept of white institutional isomorphism is useful to this study because it highlights how racialized norms can be translated and established into new contexts even by organizational actors who hope to increase racial inclusivity. SIPs are typically developed to address the lack of diversity in STEMM fields, however, this does not absolve them from (re)creating racialized norms that hinder the success of underrepresented groups. Adding white institutional isomorphism to an analysis of SIPs will allow for a more critical perspective into how the (re)creation of SIPs can be a site for the development and reinforcement of racialized norms. White institutional isomorphism introduces race into an analysis of organizations, however, it mainly focuses on race in the context of organizational formation. To understand the structuring force that race plays in organizations this study will utilize a theory of racialized organizations (Ray, 2019a).

Racialized Organizations

Ray (2019a) argues that organizational theory scholars have typically seen organizations as race-neutral bureaucratic structures, while race and ethnicity scholars have largely overlooked the role that organizations play in the social construction of race. As a result, Ray develops a theoretical framework of racialized organizations to bridge these subfields and work toward an understanding of organizations as racial structures. Ray advances the notion of organizations as racial structures by introducing the concepts of racial schemas and resources. Racial schemas are “fundamental tools of thought” (Sewell, 1992, p. 7), used to justify the accumulation and distribution of organizational resources. Resources include objects like physical capital and raw materials but also human capital like knowledge. Central to the theory of racialized organizations is the notion that “racial structures arise any time resources are (intentionally or passively) distributed according to racial schemas” (Ray, 2019a, p. 32). Organizations function as racial structures because of their access to resources and their ability to distribute those resources as they see fit. To further demonstrate how racialized organizations operate as racial structures that reproduce racial inequality, Ray (2019a) presents four central tenets to the racialized organizations framework, which are: (1) racialized organizations enhance or diminish the agency of racial groups; (2) racialized organizations legitimate the unequal distribution of resources; (3) Whiteness is a credential; and (4) decoupling is racialized.

Ray’s first tenet is at the core of the framework as he posits that racialized organizations are “meso-level social structures that limit the personal agency and collective efficacy of subordinate racial groups while magnifying the agency of the dominant racial group” (p. 36). This first tenet demonstrates that power and power differentials are produced organizationally, namely through formal structures such as access to resources and one’s position in the

organization. Thus, those at the top (largely white individuals) benefit from the organization's racially segregated power structure by having the most power and being able to control agency, while those at the bottom (typically people of color) have the least power and agency. Ray notes that agency can be shaped through: (1) controlling time use, those at the bottom have little to no power in determining where and how to spend their time, diminishing their ability to influence organizational procedures and the larger institutional environment, (2) theft of time of people of color, organizations differentially distribute time along racial lines or redistribute time from people of color to whites, (3) work hierarchies shape identity agency, racialized organizations shape the habitual action of people of color by having them adhere to employers, customers, and the public and by constraining their range of emotional expressions. While the first tenet is meant to provide the foundation for what a racialized organization is, the following three tenets demonstrate how racialized organizations diminish or enhance the agency of racial groups.

Ray's second tenet posits that racialized organizations legitimate the unequal distribution of resources. Ray argues that racial segregation is a defining characteristic of most organizations and segregation by design is meant to limit access to organizational resources. The unequal distribution of resources is legitimized in several ways. Organizations with large proportions of people of color are typically under-resourced relative to white organizations, creating stark disadvantages when competing. Furthermore, this leaves non-white organizations dependent on white organizations for their survival. Organizations that are racially integrated recreate racial hierarchies through occupational segregation as positions at the top and bottom of the organization are racialized. That is, positions that are associated with leadership are racialized as white, while positions that focus on physical labor become associated with minoritized racial groups. These positions are devalued or overvalued according to their place in the racial

hierarchy and are seen as a normal feature of the organization and the world rather than historically constructed structures. These racial hierarchies, fueled by occupational segregation, help to explain why diversity programs or policies are seen as threats to the organizational hierarchy. As these racial hierarchies are seen as normal aspects of organizations, any threats (diversity programs or policies) to shift the hierarchy are seen as “illegitimate intrusions” (p. 40) into the natural functioning of the organization.

Ray’s third tenet states that “whiteness is a credential providing access to organizational resources, legitimizing work hierarchies, and expanding white agency” (p. 41). Ray argues that credentials are allegedly objective and organizationally-generated measures of status, which in turn demonstrates one’s suitability for employment. Through this notion, credentials serve as a legitimate bureaucratic means of allocating resources, which are predicated on merit. However, in racialized organizations whiteness becomes a credential in itself. As whiteness serves as a credential it becomes the norm and allows organizations to appear race-neutral in principle, while in practice they are institutionalizing whiteness. As people of color deviate from the norm (whiteness) they are not afforded the same agency as white individuals. For example, many organizations operate under supposed race-neutral policies such as looking for individuals who are the “right fit”, however, the right fit is often an individual who fits the norm (whiteness) because they have had access to the right credentials through things like the right schools, networks, or cultural knowledge (Ray, 2019b). As people of color have often not had access to these types of resources, due to systemic racial inequality, they are seen as unfit for the job, but this is under the guise of a supposed race-neutral policy. Whiteness as a credential allows racialized organizations to maintain the status quo and reinforce racial hierarchies without having to explicitly exclude people of color.

Ray's final tenet states that "racialized organizations often decouple formal commitments to equity, access, and inclusion from policies and practices that reinforce, or at least do not challenge, existing racial hierarchies" (p. 42). From an organizational theory perspective, decoupling can be understood as separating formal structures from actual practice (Meyer & Rowan, 1977). Decoupling allows organizations to maintain the illusion that they are working towards a specific goal without having to take practical steps to attain that goal. Ray (2019) argues that decoupling allows organizations to give the impression that they are neutral or even actively working towards racial progress when in reality they are doing little to address racial inequality. For example, diversity policies often serve as an organizational commitment towards racial parity but have little to no power or enforcement mechanisms, which results in a lack of progress and/or meaningful change to racial hierarchies.

The theory of racialized organizations provides an in-depth analysis of the relationship between race and organizations, which is useful to this study as SIPs operate within racialized organizations, higher education institutions. This study seeks to examine the adaptation of the Meyerhoff program into two predominantly white research universities with histories of racial exclusion. A theory of racialized organizations will allow for a critical perspective into how these universities and programs are shaped by race and racism. Although the theory of racialized organizations allows for overarching examinations into how organizations operate they do not examine the functional process of implementing, adapting, and institutionalizing programs. To better understand the process of implementing a STEMM intervention program this study will utilize an organizational level theory of implementation effectiveness (Weiner et al., 2009)

Program Implementation, Adaptation, and Sustainability and Institutionalization

An essential goal of this study is to understand the process of implementing, adapting, and institutionalizing the Meyerhoff model in the UNC-Chapel Hill and Penn State environments, as such, theories and frameworks that provide insights into these areas are central to developing a comprehensive understanding of this topic. Much of the literature on implementation, adaptations, and sustainability and institutionalization comes from the health fields studying the life cycle of clinical and behavioral interventions (Damschroder, 2020). Many of the theories and frameworks focus on the lifecycle of evidence-based programs (EBPs) or evidence-based interventions (EBIs) in a clinical setting or with the goal of attaining certain clinical outcomes (Wang et al., 2018). Although these theories and frameworks have typically not been applied in the study of STEMM intervention programs in a higher education setting they still provide valuable insights. This study will be guided by an organizational theory of implementation effectiveness (Weiner et al., 2009) to understand implementation. An understanding of the adaptation process will be guided by the Framework for Reporting Adaptations and Modifications-Enhanced (FRAME) (Wiltsey Stirman et al., 2019) and an understanding of fidelity as mutual adaptation (Kezar, 2011). Lastly, Cobian and Ramos' (2021) strategies of sustainability and institutionalization will be used to examine the process of sustaining and institutionalizing the CSS and MLN programs.

An Organizational Level Theory of Implementation Effectiveness

Weiner et al. (2009) develop an organizational theory of implementation effectiveness, which highlights the determinants of effective implementation when implementing complex innovations in organizational settings. The organizational theory of implementation effectiveness is valuable to this study because it takes an organizational level perspective into the

implementation process, which is different from most implementation theories. The theory posits that when implementing comprehensive and complex innovations two key tasks must be accomplished: (1) the program and the organization must adapt to each other to achieve a strong fit or a reasonable level of compatibility, (2) targeted employees' acceptance and involvement in the program must be built. Targeted employees include those who are going to use the program (users) and those expected to support the program (implementers). Complex innovations can be understood as a "new idea, practice, program or technology whose implementation requires collective action and whose use entails collective behavior change" (Weiner et al., 2009, p. 295). Through this definition, the Meyerhoff program and its adaptations can be understood as complex innovations as they require collective action and behavior change involving several levels of the university.

The organizational theory of implementation effectiveness proposes that effective implementation is a function of an organization's readiness for change, the quality of its implementation policies and practices, the climate for implementation, and the extent to which targeted employees perceive the innovation as congruent with their values. If the implementation is effective and the innovation works this will result in innovation effectiveness, which provides the intended benefits to the organization.

For implementation to be effective, organizations must first be ready for change. Readiness for change refers to the extent that targeted employees (especially the implementers) are psychologically and behaviorally prepared to make the necessary changes in organizational policies and practices to put the innovation into practice and support the use of the innovation. Making these changes requires targeted employees and management to be jointly committed because the implementation of complex innovations is a collective process. Furthermore, there

must be a shared belief that targeted employees and management have the collective capabilities to execute a successful implementation. Effective implementation requires quality implementation policies and practices, which focus on the strategies, structures, and plans that the organization employs to implement the innovation and support its continuous use. The implementation policies and practices that an organization uses are how the organization attempts to assimilate the innovation to achieve a cultural and strategic fit. In this assimilation process both the organization and innovation must mutually adapt to one another because organizations have varying cultures and contexts, the practices and policies needed for implementation may vary.

Effective implementation is also dependent on the implementation climate, which refers to targeted employees' shared perception about how use of the innovation is expected, supported, and rewarded. Implementation climate is different from the institutional climate as it focuses on targeted employees' collective sense of the innovation and the extent to which they perceive the organization as committed to the innovation rather than an institution-wide climate. Lastly, effective implementation requires that targeted employees perceive the innovation as being able to fulfill their values. When an organization seeks to adopt an innovation, targeted employees will form judgments about the extent to which their values align with the innovation. If the innovation and targeted employees' values match then it is likely to result in committed and consistent use of the innovation. If the values do not match there is likely to be resistance to the innovation and at best compliant use.

If the aforementioned components are met there will be effective implementation resulting in innovation effectiveness, delivering the intended benefits of the innovation to the organization. If the components are not met then implementation will not be effective and the

innovation will not generate the anticipated benefits, meaning that implementation effectiveness is a prerequisite to innovation effectiveness. Innovation effectiveness can further result in three outcomes. The first outcome, “success creates momentum”, occurs when the organization effectively implements the innovation and achieves the anticipated benefits, which results in the implementation climate improving, creating confidence in the ability to implement new innovations and an increase in resources for innovation implementation. If there was a contradiction in innovation-values fit across groups then the group which supported the innovation is vindicated and gains credibility and support while the group that did not agree with the innovation loses credibility and support. In the second outcome, “failure creates doubt”, the innovation is implemented but the anticipated benefits are not achieved resulting in a diminishing implementation climate and resources for implementation. In the final outcome, “failure creates pessimism”, the organization does not implement the innovation effectively nor does it achieve the anticipated benefit resulting in a weak implementation climate that is likely to result in no further innovations. Those who were against the innovation feel vindicated and gain credibility and support whereas those who did support it lose credibility and support.

The organizational theory of implementation effectiveness provides a framework to understand the implementation process of the Meyerhoff program at UNC Chapel Hill and Penn State. Key lessons and insights can be gained by examining components like UNC’s and Penn State’s readiness for change and their implementation policies and practices. Understanding the different components that went into an effective implementation of the CSS and MLN programs will allow for a deeper understanding of what is needed when implementing SIPs in new contexts.

Framework for Reporting Adaptations and Modifications-Enhanced (FRAME) and Mutual Adaptation

The FRAME provides researchers and practitioners with a comprehensive guide on the adaptation process, allowing for a multifaceted understanding of the modification process. The FRAME looks at eight central components of the adaptation process: (1) when modifications were made, (2) whether the modification was planned/proactive or unplanned/reactive, (3) who decided that the modification should be made, (4) aspects that were modified, (5) the level the modification was made (individual, group, organization, etc.), (6) the nature of the content modification (adding/removing elements, using different materials, etc.), (7) the extent the modifications were fidelity-consistent, and (8) the reasons for the modifications (laws, resources, needing to improve cultural fit, etc.).

The FRAME is useful in trying to understand the extent to which the Meyerhoff model was modified in the UNC-Chapel Hill and Penn State context. The FRAME's focus on fidelity is particularly important as it examines the extent to which modifications are fidelity-consistent or fidelity-inconsistent. Fidelity-consistent modifications are those that preserve the core elements of an intervention, which make it work. Fidelity-inconsistent modifications alter the intervention in a way that diminishes its core elements. In the case of the Meyerhoff model, the core elements are the 13 key components of the model as well as its strengths-based and culturally responsive values, which are informed by the four pillars of success (Hrabowski III et al., 2019; Maton et al., 2012). However, a more nuanced understanding of fidelity and adaptation is necessary to address the research questions of this study.

The literature has extensively documented a 'tug-of-war' between fidelity and adaptation, whereby one group advocates for strict fidelity to ensure intervention effectiveness across

contexts and another supporting the notion that adaptations are necessary to increase the likelihood of intervention adoption and sustainability when implementing in a new environment (Bopp et al., 2013; Carvalho et al., 2013; Morrison et al., 2009; Rhoades Cooper et al., 2019). Researchers have moved toward an understanding that both sides have merit and there must be a balance between fidelity and adaptation as it allows interventions to overcome contextual challenges by adapting while remaining faithful to the original model maintaining the core elements that lead to success (Rhoades Cooper et al., 2019). Kezar's (2011) concept of mutual adaptation provides insights on how to attain a balance between adaptation and fidelity. Mutual adaptation is described as a "change process that is flexible and negotiated between the developers and teachers, and its design reflects local needs but still holds true to the nature of the innovation" (Kezar, 2011, p. 241). Mutual adaptation is achieved through three mechanisms: deliberation and discussion, networks, and external support and incentives.

Through deliberation and discussion organizational members are able to learn and understand why change is necessary and how an intervention will lead to change. Moreover, this process creates ownership and internal motivation among members because they come to this understanding on their own instead of being mandated to adopt an intervention. Networks provide implementers with access to others with similar ideas and goals, which can lead to greater support as networks can provide strategies or resources to navigate contextual challenges. External support and incentives provide the material resources needed to help implementers sustain change such as funding, awards, and recognition.

This study deviates from examining fidelity as a static construct to an understanding that the success of an intervention is dependent on a dynamic process that balances fidelity and adaptation. Understanding fidelity through the lens of mutual adaptation allows for an

examination of how adaptations and fidelity of the Meyerhoff model were negotiated at UNC-Chapel Hill and Penn State through deliberation and discussion, networks, and external support and incentives. This is particularly relevant as the implementation of the model was guided through a partnership between UMBC, UNC-Chapel Hill, Penn State, and HHMI. This partnership provided the CSS and MLN programs with the necessary networks, external support and incentives, and a space to deliberate and discuss implementation--including a check on assumptions and recognition when a poor decision was made.

Strategies of Sustainability and Institutionalization

Research by Cobian and Ramos (2021) has examined the key strategies that grant-funded programs utilize to promote sustainability and how this can lead to institutionalization by investigating 10 undergraduate institutions that received the Building Infrastructure Leading to Diversity (BUILD) award from the NIH. Key to understanding this process is a common definition of sustainability and institutionalization. Through a systematic review of sustainability literature Moore et al. (2017) define sustainability as “after a defined period of time, the program, clinical intervention, and/or implementation strategies continue to be delivered and/or individual behavior change is maintained; the program and individual behavior change may evolve or adapt while continuing to produce benefits for individuals/systems” (p. 5). At its core, sustainability is about the maintenance of an intervention. However, institutionalization is observed when an intervention becomes embedded into an organization by integrating into the structure, culture, and fabric of the institution, thereby becoming a permanent fixture (Curry, 1992; Kezar, 2007). The key strategies that emerge from Cobian and Ramos’ study are: 1) scaling and adapting to expand programmatic impact, 2) identifying additional funding and cost-cutting measures, 3) developing and maintaining infrastructure and structural operations, 4)

leveraging relationships and with intra- and inter-institutional partners, and 5) and addressing hiring, policies, and reward systems at the institution. Examining these strategies provides a guide of key areas to consider when investigating the process of sustaining and institutionalizing the CSS and MLN programs.

The strategy of scaling and adapting to expand program impact was observed when institutions would look for ways to scale up a successful program element and expand it to reach a broader group thereby creating impact across the campus. Scaling up can lead to greater sustainability and institutionalization as program elements become integrated into the broader university. Key to sustaining a program is being able to financially support it after grant funding is over. Thus, institutions focused on seeking new funding opportunities or finding ways to cut costs in order to support the program. This strategy speaks to the importance of resources and understanding the role it plays in sustainability. Institutions utilized funds to create permanent structures that could serve biomedical training and research such as building research centers, labs, and active learning classrooms. Institutions also consolidated existing structures to enhance student support such as integrating a career advancement center and a center for undergraduate research. Consolidation allowed institutions to minimize overlap among services and lower costs as no additional personnel were needed, thereby leading to greater financial sustainability. This strategy speaks to the importance of physical structures and how they can lead to programs becoming a more permanent fixture of the institution.

To increase sustainability, institutions also leveraged relationships with intra- and inter-institutional partners. Inter-institutional partnerships with research universities provided opportunities for students to conduct undergraduate research and potentially go on to graduate school, thereby allowing institutions to meet their goals and maximize program impact. Intra-

institutional efforts facilitated program sustainability by connecting ongoing STEMM initiatives on campus and creating networks among groups with similar goals. This network allowed for the efficient use of physical resources and facilitated knowledge sharing. These processes signal early institutionalization as they are making structural changes to the university through knowledge and resource sharing, thus becoming embedded into the institution.

Lastly, institutions address hiring, policies, and reward systems to enhance program sustainability and work toward institutionalization. Key to institutionalization is making sure changes are permanent, therefore, campuses noted that hiring diverse faculty was central to ensuring program goals were met and sustained. Additionally, campuses focused on updating policies, evaluations for tenure and promotion, and creating rewards to facilitate valuing improving pedagogy in biomedical disciplines and mentoring, particularly for URGs. These efforts signal early institutionalization as these values can become embedded in the institution and shift into standard expectations of faculty. Although not labeled as a key strategy Cobian and Ramos (2021) also speak to the importance of senior administrative support (presidents, provosts, deans) in achieving sustainability. Senior leadership is important because they have the power to sustain the program by garnering internal and external resources and beginning the process of embedding program goals into institutional priorities.

These strategies provide key areas to examine the sustainability and institutionalization of the CSS and MLN programs. Areas to be explored are how the CSS and MLN programs have been scaled up, how programs have been financed and whether financial commitments are embedded with the institution, what physical and structural changes were made to sustain and institutionalize the program, how programs have leveraged intra- and inter-institutional partnerships to enhance sustainability and work toward institutionalization, and how policy and

reward structures have changed to sustain and lead to the institutionalization of the program. Examining senior leadership commitments will allow for an understanding of their role in the sustainability and institutionalization process. Lastly, I align with Curry (1992) who posits that institutionalization happens at three levels: the structural, procedural, and incorporation levels. At the structural level institutionalization is observed when there is widespread knowledge of a program. At the procedural level there must be adoption of a program's policies and practices by the broader organization. At the incorporation level, program's values and norms become part of the organization's broader culture.

Summary

This study will utilize several organizational theories and frameworks to understand the lifecycle of the CSS and MLN programs. The theory of institutional isomorphism provides an overarching lens into how isomorphic pressures lead organizations to continue to adapt SIPs as a method to increase URG student success and work toward achieving greater racial inclusivity in STEMM (DiMaggio & Powell, 1983). The theory of white institutional isomorphism adds a critical dimension to this lens by proposing that as programs are replicated it is possible to hinder racial inclusivity even when the intended goal is to increase it (Garbes, 2022). While the theories of isomorphism focus on macro-level explanations as to why SIPs are adapted they do not focus on the functional process of implementation. To address this, the study will utilize an organizational theory of implementation effectiveness, which examines the components needed to achieve a successful implementation, particularly in new contexts (Weiner et al., 2009). In order to understand how the CSS and MLN programs were adapted the study will utilize the FRAME, which provides a comprehensive guide to understanding the modification process (Wiltsey Stirman et al., 2019). Additionally, the study will examine fidelity to the Meyerhoff

model through a lens of mutual adaptation (Kezar, 2011). Examining the sustainability and institutionalization of the CSS and MLN will be guided by key strategies proposed by Cobian and Ramos (2021) and a multi-level understanding of institutionalization as proposed by Curry (1992).

Lastly, this study is grounded in the understanding that higher education institutions are racialized organizations, meaning that they function as racial structures with the ability to enhance and diminish the agency of racial groups (Ray, 2019a). As I examine the life cycle of the CSS and MLN the theory of racialized organizations serves as a backdrop to understanding that race, racism, and power serve as a structuring force. Together, these theories and frameworks will provide a comprehensive guide for this study.

Studies of STEMM and the SIP Lifecycle

This section examines the relevant literature on the topic of STEMM and STEMM intervention programs (SIPs). To understand why STEMM interventions are needed I will first examine the culture of STEMM and the barriers that it creates for URG student success. Next, I briefly look at the literature on STEMM interventions examining their origins and common practices. Lastly, to understand the life cycle of STEMM interventions I examine the literature on implementing, adapting, sustaining, and institutionalizing interventions. There is a dearth of literature that examines the entire life cycle of SIPs, because most studies focus on one stage of the life cycle or student outcomes, and they emerge from varying fields of study such as management, health, and higher education.

STEMM Culture for Students from Underrepresented Groups

To understand the challenges that go into increasing successful STEMM degree attainment it is necessary to first examine the culture of STEMM. This section will examine the

norms and values that create the current STEMM culture and examine how this culture affects the success of underrepresented groups who are pursuing STEMM degrees.

STEMM culture can be understood as the shared patterns, behaviors, norms, and values that make up the STEMM disciplines and shape the way individuals learn, participate, and experience the field (Calabrese Barton et al., 2018; National Academies of Sciences, Engineering, and Medicine, 2016). Examining STEMM culture is important because “the cultures that students experience shape their awareness and understanding of standards, expectations, and their belonging” (National Academies of Sciences, Engineering, and Medicine, 2016, p. 60). STEMM culture is experienced differently by individuals depending on their identities and their historical access to the STEMM disciplines. STEMM culture has been developed and is sustained by the dominant groups who have traditionally accessed the field, those who are white, male, and middle class and above (Brandt, 2008; Calabrese Barton et al., 2018; McGee, 2016). Therefore, the relationship between STEMM culture and students who come from underrepresented groups is not the same as that of a student who comes from a white, middle-class, and male background. The following literature examines how STEMM culture has been found to affect URG students and the barriers that it creates.

Racism in STEMM

The historical exclusion of people of color from STEMM has led researchers to theorize STEMM as a racialized space, structured by whiteness (Battey & Leyva, 2016; McGee, 2020). Whiteness as a theoretical concept moves beyond conceptualizing whiteness as a skin color to an ideology that upholds the system of white supremacy and thus racism. Whiteness establishes and reinforces racial hierarchies by placing whites at the top and devaluing all other racial groups, producing racism (Battey & Leyva, 2016; McGee, 2020). Through an understanding of STEMM

as a racialized space that values whiteness one can understand how racist ideologies become embedded into STEMM culture and help to shape it. In particular, whiteness has been and continues to be the standard in STEMM, producing exclusionary cultures for URG students.

Racist ideologies manifest in STEMM in a myriad of ways such as students of color experiencing racial stereotypes and microaggressions (Beasley & Fischer, 2012; Dortch & Patel, 2017; M. J. Lee et al., 2020) being devalued and facing low-expectation from faculty and peers (Fries-Britt & Griffin, 2007; Hurtado et al., 2011; McCoy et al., 2017; McGee, 2016), and having to continuously prove their intellectual abilities (Lane, 2016; Leyva, 2021; McGee & Martin, 2011). From this view, one can see that racism is embedded and part of the ethos of STEMM culture. Students of color that attempt to enter and aim to persist in STEMM must endure a culture that is hostile to them because they do not fit the norm of those who have historically dominated STEMM.

Sexism in STEMM

STEMM and STEMM culture has also been found to be a hostile and toxic environment for women with sexism and gender discrimination being prevalent in these environments (Kenney et al., 2012; Kuchynka et al., 2018; National Academies of Sciences, Engineering, and Medicine, 2018). Research has found that women in STEMM have to endure unwelcoming environments (S. L. Clark et al., 2021; C. Hill et al., 2010; Ramsey et al., 2013) face gender bias and stereotypes about their abilities (Beasley & Fischer, 2012; Bloodhart et al., 2020; Robnett, 2016), and experience sexual harassment from faculty and peers (Leaper & Starr, 2019; National Academies of Sciences, Engineering, and Medicine, 2018). In addition to facing hostile sexism and discrimination in STEMM, research has observed that women experience benevolent sexism. Research by Kuchynka et al. (2018) explains that while hostile sexism can be understood

as “overtly negative, angry attitudes and behavior toward women” (p. 72), benevolent sexism manifests as “affectively positive but condescending attitudes and reactions to women who embrace traditional gender roles” (p. 72). Examples of benevolent sexism in STEMM include treating women as if they require more assistance than men to handle STEMM-related tasks and assumptions that women’s personalities are sweet or virtuous and thus not suited for competitive STEMM fields. Benevolent sexism is insidious and produces damaging effects for women in STEMM such as leading to lower STEMM major intentions, STEMM self-efficacy, and STEMM GPA (Kuchynka et al., 2018). In examining the damaging effects that STEMM culture has on women it is also important to consider what this environment means for students from URGs who hold multiple marginalized identities such as being a woman of color.

The Double Bind: Women of Color in STEMM

Research on students from URGs in STEMM has historically been divided by a binary with underrepresented minorities representing one excluded group and women representing another. Seminal research by Malcom, Hall, and Brown (1976) drew attention to the exclusion of women of color in STEMM due to both their race/ethnicity and gender, creating a double bind. Malcom et al. (1976) observed that programs designed to increase the number of women in science were largely devoted to assisting white women and programs developed to assist racial/ethnic minorities were mostly serving men of color. Furthermore, science organizations for women were majority white, and minority science organizations were overwhelmingly male. Research on the double bind highlights the unique challenges that women of color experience relative to those of men of color and white women. Recent research has continued these efforts but has begun to apply an intersectional approach to understand how women of color identities compound and intersect to shape their STEMM experiences (Armstrong & Jovanovic, 2017;

Ireland et al., 2018; Rodriguez & Blaney, 2021). Research by Leyva (2021) has theorized STEM as a white, patriarchal space in which women of color face interlocking systems of oppression due to their race and gender. A white patriarchal space explains that women of color experience both racism and sexism as these systems of oppression interlock to produce ideological, institutional, and relational barriers as they navigate through STEM. Understanding the presence of these larger systems of oppression is important as they directly affect the success of URG students.

Psycho-social Effects of Negative STEM Cultures on URG Students

Research has found that racist and sexist STEM cultures pose barriers to the success of URG students by affecting them in a myriad of psycho-social ways. As previously noted, URG students face overt racial and gender-based stereotypes, however, scholars have also examined the concept of stereotype threat and the harmful effects it has on individuals from underrepresented groups. Stereotype threat is a social-physiological phenomenon in which a member of an underrepresented group fears confirming negative stereotypes of their group due to their own actions because it might result in reinforcing these stereotypes to dominant groups (Steele & Aronson, 1995). Research on stereotype threat has found that it can cause adverse health effects like increased blood pressure and reduction in memory capacity (Blascovich et al., 2001; Schmader & Johns, 2003). Additionally, stereotype threat can have negative effects on the academic performance of URG students due to elevated stress and anxiety (Steele & Aronson, 1995). Research by McGee (2016) suggests that students of color in STEM can at times use negative stereotypes as motivation through stereotype management, a “process and learned competency that enables students to recognize and negotiate social and psychological threats to their identities” (p. 1627). Students in McGee’s (2016) study had to constantly prove that they

were capable of succeeding in STEMM and used their desire to prove others wrong as motivation to achieve. However, this took a toll on students as they faced heightened anxiety, increased bouts of anger, imposter syndrome, and feeling the need to compulsively work.

Research has also examined how hostile environments and negative experiences can stifle students from developing positive STEMM identities and self-efficacy, which are key to STEMM success (Carlone & Johnson, 2007; S. L. Clark et al., 2021; Hurtado et al., 2009; Robnett, 2016). Foundational work by Carlone and Johnson (2007) has advanced our understanding of the importance of STEMM identity through their science identity model, which posits that science identity is developed through: *competence* - having understanding and knowledge of science content, *performance* - possessing the necessary skills to perform scientific practices (e.g., communicating and using tools in accordance with scientific norms), and *recognition* - being able to see one's self as a "science person" and being recognized by others as a "science person". Moreover, an individual's gender, racial, and ethnic identities affect their science identity. Similarly, STEMM self-efficacy or STEMM self-concept speaks to the extent to which students believe they are capable of excelling in STEMM fields, with research finding high self-efficacy being important for STEMM success (S. L. Clark et al., 2021; Robnett, 2016)

Understanding the importance of STEMM identity and STEMM self-efficacy is important because it illuminates that STEMM success is not just a product of an individual's STEMM knowledge, it is also a social process (Hurtado et al., 2009). Students from URGs navigating STEMM will have difficulties seeing themselves as a "science person" or believing they are capable of excelling in STEMM if they are continuously exposed to environments that question and undermine their abilities. Furthermore, unwelcoming STEMM environments can negatively affect URG students' sense of belonging and increase feelings of social isolation

resulting in students disengaging from STEMM and ultimately leaving (Charleston et al., 2014; Dortch & Patel, 2017). Social isolation results in students from URGs lacking a support structure, which is critical for their success (Smith et al., 2013).

Ideologies and Norms of STEMM Culture

While racism and sexism are embedded in STEMM culture there are also other values commonplace to STEMM that work against URG student success. Research has extensively documented certain norms and ideologies that enable toxic environments for URG students in STEMM such as competition, debate and argumentation, individualism, meritocracy, and color blindness (Battey & Leyva, 2016; Calabrese Barton et al., 2018; McGee, 2020; National Academies of Sciences, Engineering, and Medicine, 2016). While these norms and ideologies are distinct they work together to create a harmful STEMM culture. For example, STEMM cultures have been found to value competition, which is conducive to a culture of ‘survival of the fittest’ this reinforces notions of individualism whereby students believe that to be successful they must look out for themselves only even to the detriment of others (McGee, 2020; National Academies of Sciences, Engineering, and Medicine, 2016). These notions are often antithetical to the values of URG students who come from cultures that value collectivism, thus there is a misalignment between the values of URG students and those of a ‘successful’ STEMM student (Calabrese Barton et al., 2018; National Academies of Sciences, Engineering, and Medicine, 2016).

These competitive and individualistic cultures are reinforced and justified by values of meritocracy and colorblindness, whereby individuals believe that race and gender do not determine success but rather how hard one works (Battey & Leyva, 2016; McGee, 2020). These ideologies reinforce a ‘pulling yourself up by your bootstraps’ mentality where URG students are blamed for not doing enough to be successful in STEMM, ignoring larger structural issues that

URG students must face as they navigate STEMM (Battey & Leyva, 2016; McGee, 2020). The interplay of these values can be observed in introductory STEMM courses, commonly referred to as ‘gatekeeper’ courses, as they are highly competitive environments in which only the ‘best’ can survive while all others are ‘weeded-out’ because they are perceived as not having what it takes to be successful (National Academies of Sciences, Engineering, and Medicine, 2016; Seymour & Hewitt, 1997). These notions are justified by colorblind and meritocratic ideologies as individuals believe that if URG students were ‘smarter’ or ‘worked harder’ they would be successful in these courses (Battey & Leyva, 2016; McGee, 2020; National Academies of Sciences, Engineering, and Medicine, 2016). However, research indicates that even when URG students attempt to adopt the perceived characteristics needed to be successful (being competitive, individualistic, more assertive, less feminine, etc.) in STEMM they are still excluded from STEMM environments (Dortch & Patel, 2017). Thus, even when URG students attempt to assimilate into the harmful norms of STEMM culture it does not guarantee success or acceptance from the broader STEMM community.

Understanding the culture of STEMM and the challenges that students from URGs endure in STEMM fields is important to this study because it highlights the areas that need to be addressed to increase URG STEMM success. Moreover, programmatic efforts such as culturally responsive models that value collectivism and group success are likely to face challenges from cultures that are built on competition and individualism. It is likely that a model like the Meyerhoff program would be met with resistance because it is going against the norms and values of the UNC-Chapel Hill and Penn State context.

Summary

It is evident from the literature that STEMM culture is harmful to the success of URG students and must be addressed in order to make meaningful changes in the retention and graduation of this population. URG students who aim to earn STEMM degrees must deal with racist and sexist STEMM cultures that negatively affect them in a variety of psycho-social ways. Additionally, certain norms and ideologies like competition, individualism, meritocracy, and colorblindness, compound to create hostile environments for URG students that are often antithetical to their values and ideals. These environments place the blame on URG students for not achieving, all while ignoring larger structural issues that URG students must deal with. As Asai (2020) notes “far from being an innocent bystander, science has been an active participant in the exclusion of persons” (p. 754).

Attempts to address the challenges of underrepresentation in STEMM have been employed with STEMM intervention programs seeming to be a promising way of increasing diversity in STEMM fields. The following section will examine STEMM intervention programs by tracing their origins and looking at the common practices they employ.

STEMM Interventions for Underrepresented Groups

SIPs are an increasingly common approach institutions are employing to try and increase URG student success in STEMM fields (Chubin & DePass, 2017; National Academies of Sciences, Engineering, and Medicine, 2016; Tsui, 2007). There is even a national conference on Understanding Interventions in STEMM supported by NIH, in which program directors and evaluators meet to discuss their efforts (Chubin & DePass, 2017) Research has examined the impetus for SIPs and finds that many SIPs are the product of institutional isomorphism (George et al., 2019). Work by George et al. (2019) examines 40 STEMM intervention programs at 10

universities and finds that SIPs are often developed as a result of coercive, mimetic, normative isomorphism, and opportunistic isomorphism, a new concept the authors form. George et al. (2019) determined coercive isomorphism was the most prominent force in the development of SIPs as SIPs were most commonly established to meet mandates calling for more diversity in STEMM fields from federal and funding agencies. Mimetic isomorphism also played a role in the development of SIPs as universities replicated SIPs, mainly from other universities, which were perceived as exemplary. These replications were attractive to institutions because they were perceived as easier than designing a new program from the ground up. The development of SIPs aligns with normative isomorphic pressure as SIPs were viewed as a mechanism to socialize students into the norms of STEMM and provide them with the necessary skills and background to succeed in STEMM careers. Lastly, opportunistic isomorphism captures the influence that external funding agencies have on the development of SIPs. As the need to diversify STEMM fields is a top priority there have been many calls for proposals that develop SIPs, which in turn provides an opportunity for institutions to take advantage of funding to achieve diversity goals. Thus, the development of a SIP can also be a product of seizing the opportunity of current demands and available resources. Findings from George et al. (2019) provide valuable contributions to the literature, however, a discussion of race and power is largely missing from their work, which this study intends to provide through the use of the theory of racialized organizations (Ray, 2019a) and white institutional isomorphism (Garbes, 2022).

The majority of the SIP literature has focused on the outcomes that they produce, such as greater retention, GPAs, and graduation rates, and the programmatic elements that they use to achieve these outcomes (Barlow & Villarejo, 2004; Cervantes Aldana et al., 2021; Chubin & DePass, 2017; Jackson et al., 2021; Pearson et al., 2022). For example, research by Pearson et al.

(2022) conducts a systematic multiple studies review of 31 empirical articles and finds that SIPs commonly employ 13 programmatic elements to increase URG student success in STEMM. These elements were: (1) intentional recruitment and admissions requirements, (2) professional development/networking, (3) research experience, (4) tutoring/study skills and strategies, (5) targeted academic interventions (enrichment classes, reflective assignments, etc.), (6) graduate school preparation, (7) peer mentoring, (8) faculty mentoring (9) social integration experiences (group trips, living-learning communities, etc.), (10) community service, (11) transition and summer bridge programs, (12) financial support, (13) influencing persistence-related character traits (developing URG students' science identity, sense of belonging, instilling a growth mindset, etc.). While these 13 elements were the most common, SIPs varied in the number of elements that they utilized with some using a single component while others used a combination of them. Pearson et al. (2022) note that there is one program that is using virtually all these elements and has overwhelming success, the Meyerhoff Scholars Program.

Pearson et al. (2022) hoped to be able to determine the specific programmatic components that led to underrepresented student success to create a model for SIPs that included only the most beneficial elements leading to the most impact for the smallest cost. However, they conclude that there is no single list of elements that a program can include that will guarantee improved URG student success. Furthermore, they raise the notion that “how program elements are implemented is more important than what elements are included within a support program” (Hallett et al., 2020, p. 253). Indeed, research by Hallet et al. (2020) on a comprehensive college transition program indicates that program elements on their own do not lead to positive outcomes like academically validating experiences for URGs, rather, how program staff and instructors engaged with students within these elements is what fostered academic validation. Similarly,

research by Holcombe and Kezar (2020) proposes that comprehensive SIPs do not facilitate URG student success solely due to combining different interventions, rather the integration of different elements leads to creating bridges across universities, whereby multiple disconnected sectors of the university become unified and invested in URG student success. Comprehensive programs serve as a catalyst for creating an environment in which multiple organizational members such as faculty and staff have a shared responsibility for student success, thus creating a “unified community of support” (Holcombe & Kezar, 2020, p. 350).

Pearson et al. (2022) note that although the “how” is important there is a dearth of research on this process, leading them to be unable to recommend a precise course of action for institutions who seek to establish their own STEMM intervention programs. This study contributes to filling the gap in the literature as it will directly examine the “how” of program implementation from initiation to institutionalization, providing key lessons and recommendations to institutions that seek to implement or adopt their own SIPs. This study will provide a much-needed examination into the life cycle of SIPs and provide valuable lessons as the programs involved in this study have proven success (Sto. Domingo et al., 2019).

While research has examined the SIP components that are useful in facilitating URG student success it is also important to consider the strategies that SIP administrators utilize to maximize SIP effectiveness, as merely having a combination of components is not sufficient to produce successful outcomes. Dryer-Barr (2014) interviewed 56 SIP administrators at 10 large public research universities and found that being student-centered, focusing on community building, and being collaborative results in greater effectiveness for SIPS designed to serve underrepresented minority students. Taking a student-centered approach requires administrators to focus on student success from multiple dimensions. Effective SIPs must focus on building

relationships with students and aiding in their personal and social success as much as their academic success. Similarly, effective SIPs need to focus on building a supportive community for students. Having a supportive community provides URG students with a support system and aids in their integration and sense of belonging, particularly at large institutions where they are a minority. Lastly, SIPs operate within a larger ecosystem of services, which requires them to be collaborative in order to provide students with the right programming, tangible forms of support (e.g. financial aid), and information. Collective and strategic collaboration allows SIPs to offer a range of services to students and have multiple institutional agents become invested in the success of URG students.

Understanding the origins and common practices of SIPs is important as it provides contextual information on how SIPs work and how they have been written about in the literature. However, important to this study is also understanding the literature on the lifecycle of SIPs and what is missing from current research. The following section examines the literature on the life cycle of interventions particularly examining the challenges associated with multiple stages of development and how programs have sought to address and overcome these challenges.

Understanding the Life Cycle of Interventions

There is limited literature on the entire lifecycle of STEMM interventions, and therefore, insights must also be drawn from programs outside of STEMM as well as fields outside of higher education. Moreover, literature has usually examined interventions through individual stages such as solely looking at their implementation or only looking at how an intervention is institutionalized. Thus, this section will synthesize the literature on different stages to arrive at a common understanding of what is important to the success of the entire life cycle of

interventions. Figure 2.2 shows distinct phases of the program life cycle that were examined, which is followed by the SIP literature in each of these areas.

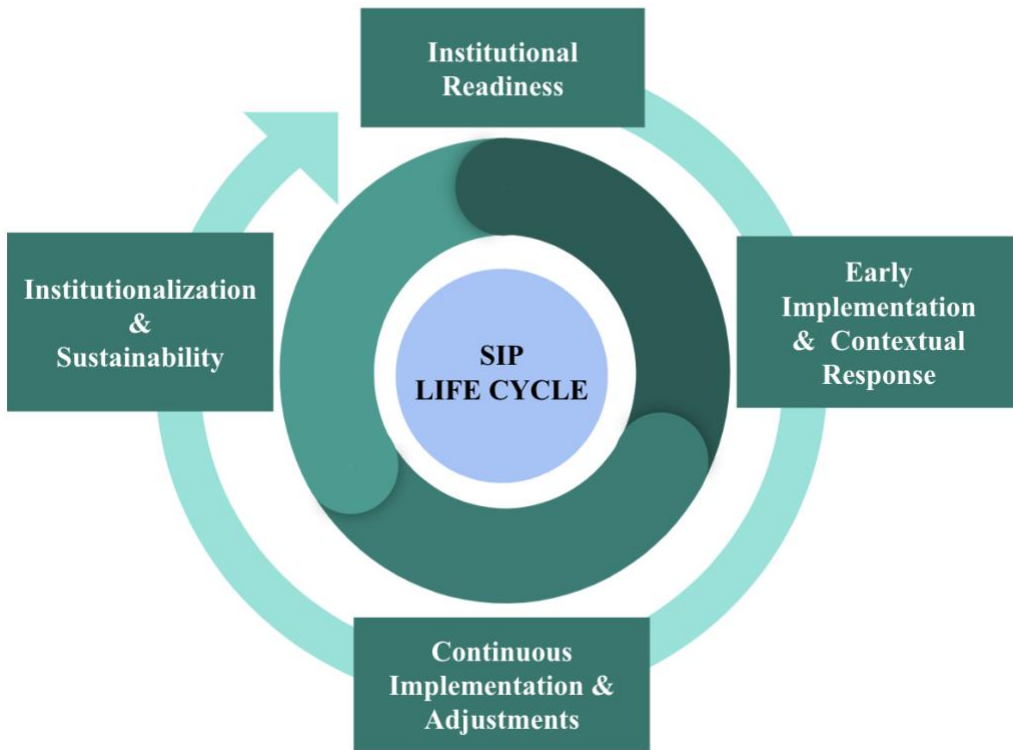


Figure 2.2: Life Cycle of STEMM Intervention Programs Informed by Research

Institutional Readiness

An important topic to consider is an institution’s readiness for an intervention as this can affect the success of implementation and have ripple effects concerning whether an intervention will be sustained and institutionalized. Research by Rosser and Chameau (2006) provides key consideration for institutions seeking to apply for an ADVANCE grant, an award from the NSF which provides funding to institutions in order to develop institutionally focused ways of increasing the participation and advancement of women in STEMM careers. Rosser and Chameau (2006) note that to prepare for an ADVANCE grant, institutions must consider if the

goals and objectives of an ADVANCE grant fit with the institutional strategic plan and other goals and priorities. In particular, institutions need to ensure that institutional goals include advancing women, not just a general diversity agenda, or else the priorities of the grant and institution will be at odds. Institutions must assess the level of change they are hoping to achieve with an ADVANCE grant and whether they have appropriate leadership which can help achieve those goals. If institutions hope to enact change at the institutional level rather than solely the departmental level they need support from upper levels of administration to be involved with the project. Institutions must evaluate what existing programs are currently working toward the advancement of women and develop a plan to leverage existing programs, infrastructure, and the expertise of established leaders on campus, especially those working on women's issues in STEMM.

An institution must be willing to earnestly examine its current policies and practices at various levels and understand that it will have to make changes to facilitate the goals of an ADVANCE grant. Institutions must be willing and able to commit significant resources to the project over a sustained period of time as the grant will eventually come to an end. Institutions must consider where the project will be administratively and physically housed after the grant is over, with the ideal project home being an active and well-respected unit that has the appropriate resources and institutional structure to sustain its current function and the project's functions. Rosser and Chameau (2006) note that project placement should not be something considered during the final years of funding. Rather, preemptively planning for program placement is critical for successful implementation and later for institutionalization. Research by Rosser and Chameau (2006) provides valuable dimensions to consider when institutions are seeking to implement an intervention through their considerations of institutional priorities, leadership

involvement, leveraging of existing programs and resources, institutional policies and practices, financial commitment, and project placement.

Implementation

Literature on the implementation of SIPs is perhaps the most extensive on the different stages within the lifecycle of SIPs, however, it is still limited, particularly as it relates to the implementation of comprehensive SIPs (Kezar & Holcombe, 2020b). Research by May (2013) provides an important framing for implementation in asserting that

“Implementation therefore needs to be understood from the outset as a process – that is, as a continuous and inter- active accomplishment – rather than as a final outcome. Moreover, ‘implementation’ never refers to a single ‘thing’ that is to be implemented. Whenever some new way of thinking, acting, or organizing is introduced into a social system of any kind, it is formed as a complex bundle – or better, an ‘ensemble’ – of material and cognitive practices.” (pp. 1-2)

Indeed, studies on the implementation of SIPs and other interventions hoping to enact institutional change conclude that implementation is an incredibly difficult process with multiple challenges arising that need to be addressed (Cullinane, 2009; Grossman et al., 2015; Kezar & Holcombe, 2020b). Implementation is particularly important to examine as it has been described as the “critical gateway” (Klein & Sorra, 1996, p. 1057) to the routine use of an intervention, thus successful implementation is inextricably linked to the sustainability and ultimately institutionalization of an intervention.

Research on the implementation of innovations, outside of the SIP context, has determined there are common roadblocks when implementation requires the participation of multiple organizational members. In particular research by Klein & Knight (2005) finds six interrelated reasons that implementing innovations is challenging. First, innovations which focus on technology can be unreliable and hard to understand, creating challenges for the adoption of technology-driven innovations. Second, many innovations require users to develop and acquire

new sets of technical knowledge and skills to use the innovation leading to a lower likelihood of use if people are not able to accomplish this task. Third, adopting innovations is often a decision made by senior leadership/upper management and placed upon those usually lower in the organizational hierarchy who are comfortable with the status quo. Fourth, new innovations require coordination, particularly among individuals from varying levels of the organizational hierarchy leading to potential disruptions in the normal functioning of the organization. Fifth, implementation can be time-consuming, expensive, and can drag down performance. Thus, organizations must be able to make significant investments in time, money, labor, training, and evaluation. Lastly, organizations are a “stabilizing force” (Klein & Knight, 2005, p. 244), whereby their norms and routines are meant to maintain the status quo. Introducing a new innovation into an organization is a challenge to the status quo and it is easier to fail to implement an innovation than to make changes to the routine functioning of organizations.

Research on the implementation of SIPs has also highlighted common challenges that arise in the implementation process and how programs navigate these challenges. Work by Cullinane (2009) examined the Model Replication Institutions Program (MRI), a program run by the Institute for Higher Education Policy (IHEP), with NSF funding, which sought to replicate the Model Institutions of Excellence (MIE) model at a cohort of institutions. The MIE model focuses on developing seven critical components that are meant to improve STEM outcomes. These program components include developing: pre-college initiatives, student support services, undergraduate research experiences, faculty development, curriculum development, physical infrastructure, and graduate program and science career initiatives. The MRI project selected nine minority-serving institutions (MSIs) to replicate the MIE model, however, the project mainly provided technical assistance over the course of 24 months and provided no direct

funding to assist the institutions in implementing the models. None of the institutions were able to replicate all seven elements of the model and, instead, campuses chose one or more elements that had the highest probability of being implemented on their campus. This speaks to how challenging it is to implement comprehensive models. Implementing the Meyerhoff model with its 13 synergistic components and values of being culturally responsive was a tremendous proposition. This study contributes to the literature base by examining the process of implementing a comprehensive model with extensive components and values, which can lead to valuable information for campuses seeking to implement comprehensive programs.

Findings from the MRI project indicate that, to facilitate the implementation of MIE model components, campuses engaged in securing faculty and administrative buy-in. In particular, MRI campuses understood that administrative buy-in at the highest levels (provost, vice chancellor, etc.) was critical for their success. Additionally, buy-in from faculty was crucial as they became advocates and supporters of the programs. Implementation was facilitated by working toward broad buy-in as programs have a campus-wide impact. Findings suggest that having open communication and outreach with other groups on campus is critical to cultivating a broad base of support.

Research by Kezar and Holcombe (2020) highlights the importance of collaboration to successfully implement a comprehensive SIP through their study of the California State University (CSU) STEM Collaboratives project. In the CSU STEM Collaboratives project, eight CSU campuses implemented three components to create a comprehensive program, a summer experience, a first-year experience, and redesigned introductory STEM courses. Kezar and Holcombe (2020) find that collaboration was the central aspect of a successful implementation but also what resulted in the most barriers. Barriers to collaboration were the result of poor

communication and relationship building among those responsible for implementing the program, a lack of knowledge of the responsibility of other campus units, poor relationships between academic and student affairs, team composition and interpersonal dynamics, and competition among programs with similar goals.

Kezar and Holcombe (2020) note that the main reason why collaboration is challenging in a higher education setting is due to the decentralized nature of institutions with different units working as individual silos rather than working together toward a common goal. This is particularly evident in the lack of knowledge of other units and the competition among programs that serve similar populations with limited resources. Programs that had similar missions to that of the CSU STEM collaborative perceived the program as a threat because they targeted the same students and even took students away from existing programs. Moreover, the siloed nature of institutions is evident in their policies and practices that complicate aspects of the implementation process. For example, some institutions sought to implement block scheduling for a series of courses in order to create a cohort experience for students, however, scheduling courses was controlled by the registrar's office which refused to implement block scheduling as they perceived it would cause courses to be unfilled. Lastly, implementation was particularly challenging for faculty and staff because it was additional work on top of their other responsibilities. Faculty noted that this additional labor was not counted toward their annual review as the norms and reward systems on campus do not value this type of work. Moreover, staff were not able to get release time to do this work, which hindered their ability to engage. These workload issues disincentivize faculty and staff from participating in implementation and change efforts.

Research by Grossman et al. (2015) examined the implementation of the Completion by Design (CBD) initiative, which sought to substantially increase completion rates for students in nine community colleges through the implementation of reforms like accelerating entry into programs of study and integrating support services with instruction. Findings indicate that there were a set of factors important for implementation, namely, involvement and communication from senior leadership, shared responsibility for planning among multiple campus stakeholders, hiring individuals whose goals align with the initiatives', having adequate resources, and piloting smaller scale reforms to garner buy-in and support for the reform. The authors echo similar sentiments to previous research in noting that the process of implementation and change is difficult, slow, and requires persistence.

Research has indicated that there are several factors to consider in order to successfully implement a comprehensive intervention. In particular, research speaks to the importance of buy-in at multiple levels, the need for resources both in funding and participation from multiple campus stakeholders, the importance of collaborating across departments and units, and the need to address policies and practices that are not conducive to implementation. However, there is a gap in the literature as there is limited research on what it takes to implement an existing model into a new context, particularly a campus whose norms and values are at odds with the model. Examining the implementation of the Meyerhoff model in the UNC-Chapel Hill and Penn State context will produce needed insights into this process.

Sustainability and Adaptation

The literature on the sustainability of SIPs has mainly focused on challenges and threats to sustainability, with the most prominent challenge being the ability to financially sustain the program after grant funding has ended (Cullinane, 2009; Gomez et al., 2021; Rincon & George-

Jackson, 2016; Rosser & Chameau, 2006). Research indicates that funding challenges to sustainability are often a product of where the funding is coming from, with core funds -- money that comes directly from the university, college, and/or department budgets--leading to greater sustainability over the use of temporary funds (e.g. grants, sponsorships, and/or corporate donations) (Gomez et al., 2021; Rincon & George-Jackson, 2016). In particular, SIPs that are initiated through temporary funds such as grants face threats to their sustainability if they are not able to continuously get new funding or shift to being supported through core funds from the institution. Moreover, program directors or leadership who operate programs through temporary funds often have to prioritize securing funding, which diverts attention from student success to writing proposals for new grants and can leave them underfunded and understaffed if they are not able to secure funding (Cullinane, 2009; Gomez et al., 2021; Rincon & George-Jackson, 2016). Research finds that SIPs that operate through institutional funds often received long-term commitment from upper-level administration and were seen as an institutional priority (Rincon & George-Jackson, 2016). These findings highlight the importance of SIPs being seen as necessary and legitimate entities within the university through long-term financial commitments in order to be sustained and ultimately institutionalized.

One of the primary mechanisms of achieving sustainability for SIPs results from conducting assessments of programs and leveraging successful outcomes to garner campus-wide buy-in and support (Cullinane, 2009; George-Jackson & Rincon, 2012; Gomez et al., 2021; Hrabowski III et al., 2019; Institute of Medicine, 2011). Work by George-Jackson and Rincon (2012) posits that evaluating programs serves a legitimizing function in the face of constant pressure to demonstrate their value. By being able to demonstrate that they produce successful outcomes SIPs are able to align themselves with institutions' strategic missions and goals,

thereby becoming an important component of the university. Recognition as a legitimate entity allows SIPs to gain increased support through funding and buy-in from stakeholders across the campus. Evaluation is one of the pillars of success of the Meyerhoff model and has enhanced its recognition as an established, national model (Hrabowski III et al., 2019; Maton et al., 2012).

There is limited literature on the process of adapting existing STEMM intervention programs into new contexts. While replicating models across contexts has been observed, research has mainly examined the outcomes that are produced as a result of adopting an established model, rather than the process of replication and adaptation. In the literature, particularly health and clinical intervention literature, adaptations have been observed to be a mechanism of sustainability whereby the model is more likely to survive and be maintained because it adapts to its new context (Bopp et al., 2013; Dearing, 2008; Kirk et al., 2020; Rhoades Cooper et al., 2019; Wiltsey Stirman et al., 2019). Adaptations to a program can be a way that a program is sustained as it becomes integrated into the norms and values of an institution. This study will contribute to the literature by examining the process of adapting a proven model into a new environment, documenting the challenges of adaptation and highlighting how it can lead to greater sustainability.

Institutionalization

Institutionalization can be understood as the ‘end’ of the life cycle of an intervention as it becomes embedded in the structure, culture, and fabric of the institution, thus losing its status as a special project and becomes an expected and routine part of the organization (Bringle & Hatcher, 2000; Curry, 1992; Kezar, 2007). Therefore, institutionalization is the central goal for an intervention as it has become a permanent fixture of an organization. However, institutionalization is arguably the most difficult stage, as to be truly institutionalized, an

intervention has to fundamentally change an organization (Bringle & Hatcher, 2000; Curry, 1992; Grossman et al., 2015; Kezar, 2007). Work by Reinholz and Apkarian (2018) offers four frames by which to examine systemic change in STEMM departments. The frames are structures, symbols, people, and power. Although institutionalization should be evident across the university, not just departments, the four frames still provide key areas to consider when examining institutionalization. The structure frame examines the roles, routines, and practices of a department. Change on a structural level could be reflected in areas like the tenure and promotion process, the core curriculum, and research expectations of faculty. The symbols frame constitutes knowledge, values, and vision that department members use to guide their reasoning. Change on the symbol level focuses on transformation in the underlying ways of thinking of individuals. Change in the people frame is evident when individuals have a shared vision for change. Lastly, the power frame acknowledges that power is always at play and power structures shape the interactions between people in a department. Change in the power frame is evident when there is a greater distribution of power leading to greater equity. Furthermore, change efforts require support from power holders.

The four frames can be utilized to examine the institutionalization of an intervention. For example examining the institutionalization of a SIP can be achieved by investigating the extent to which they have changed practices and policies to make them more conducive to URG STEMM success, the extent to which a SIP has changed individuals underlying ways of thinking concerning URG students in STEMM, whether a shared vision for the success of URGs in STEMM has been developed, and the extent to which power structures have been changed leading to greater equity in STEMM for URGs. Research notes that on the institutional level

evidence of institutionalization can also be found in a campus's mission statement, leadership priorities, budget allocations, infrastructure, and reward systems (Bringle & Hatcher, 2000).

Research has also suggested that there are levels to institutionalization, namely the structural level, the procedural level, and incorporation (Curry, 1991, 1992). The structural level of institutionalization is observed when an innovation is represented in concrete ways across the institution such as through knowledge of the innovation and changing behaviors to align with the innovation. Institutionalization on the procedural level emerges when policies and practices of the innovation become standard procedures for the organization. Lastly, institutionalization on the incorporation level is observed when the organization accepts the values and norms of the innovation and incorporates them into the broader organizational culture. Through this lens, institutionalization is a process along a continuum.

Research by Bringle and Hatcher (2000) has examined the institutionalization of service learning in higher education and highlights factors that lead to institutionalization. The authors find that two main factors were associated with the institutionalization of service learning, having a centralized office to coordinate service learning and the administrative placement and funding of that centralized office. Universities that developed centralized offices to support service learning were more likely to institutionalize it. Moreover, centralized offices that reported to upper-level administrators like chief academic officers and who were supported through internal funds were more likely to institutionalize service learning. Findings demonstrate the importance of developing structures as a mechanism of institutionalization and having support through campus leadership and institutional funds.

Literature on institutionalization overwhelmingly highlights the importance of leadership in achieving institutionalization, however, leadership must come from the top through senior

administrative, the bottom-up from staff, and through faculty leadership (Bringle & Hatcher, 2000; Curry, 1992; Kezar, 2007; Leggon, 2018; Rosser & Chameau, 2006). The involvement of leadership is important to the entire life cycle of interventions as research indicates it is also critical in the implementation phase and the sustainability phase (Cullinane, 2009; Grossman et al., 2015; Rincon & George-Jackson, 2016).

Research on institutionalization provides a roadmap by which to investigate how and the extent to which the CSS and MLN programs have been institutionalized on their campuses. This study is unique in that it has the capacity to examine the multiple stages in the life cycle of a STEMM intervention program. While other studies have examined certain stages of a SIP, particularly implementation, this study examines programs from their implementation to being on campus for almost a decade. The study will offer a unique contribution to the literature and inform a broad audience as SIPs are increasingly adopted and implemented in hopes of changing inequitable outcomes for URGs in STEMM.

CHAPTER THREE: RESEARCH METHODS

This section will begin by (re)introducing the purpose of the study and the research questions guiding it. I then present the research methodology by explaining multiple case study design and the different elements that go along with conducting this type of research. Next, I provide a brief description of the institutional context of UNC-Chapel Hill and Penn State as well as the program structure and placement of the CSS and MLN programs. I then explain the data that was collected and how it was analyzed. I address threats to the rigor of qualitative research and present ways in which I maximize research quality. Lastly, I provide some limitations of the research.

Research Purpose and Questions

The purpose of this study is to examine the lifecycle of the CSS and MLN programs by investigating: (1) the process of implementing the programs at UNC-Chapel Hill and Penn State, (2) the process of adapting the Meyerhoff model into the UNC-Chapel Hill and Penn State context, and (3) the process of sustaining and institutionalizing these programs. The research questions this study answers are:

1. What was the process of implementing the Meyerhoff program at UNC-Chapel Hill and Penn State?
 - a. What elements of the student-centered, culturally responsive MSP program were more widely adopted and what was more challenging to existing practices and norms at predominantly white, research-intensive institutions?
 - b. How did these culturally responsive scholar programs fit within the ecology of other student programs or diversity practices on campus?

2. What key adaptations did the CSS and MLN programs make to the Meyerhoff model in order to fit into their unique institutional contexts and to what extent did this affect model fidelity?
3. What key mechanisms did the CSS and MLN programs employ to achieve sustainability and institutionalization at UNC-Chapel Hill and Penn State?

The study utilizes case study methodology to address these research questions.

Case Study Methodology

This study uses a qualitative multiple case study design to understand the life cycle of the CSS and MLN programs in two distinct contexts, UNC-Chapel Hill and Penn State. Case study research is concerned with investigating a phenomenon (a “case”) in depth and within its real-world context (Yin, 2017). A case study approach is well suited to examine “how”, “what”, and “why”, questions of a particular phenomenon or “quintain” (Stake, 2006; Yin, 2017). In a multiple case study design the quintain represents the collective targeted phenomenon being investigated (Stake, 2006). Stake (2006) explains the importance of the quintain:

“Multicase research starts with the quintain. To understand it better, we study some of its single cases---its sites or manifestations. But it is the quintain we seek to understand. We study what is similar and different about the cases in order to understand the quintain better” (Stake, 2006, p. 6).

Therefore, multicase study research is not necessarily focused on solely understanding individual cases but rather understanding the quintain under examination. The quintain of this study is the life cycle of the STEMM intervention programs. To understand the life cycle, we must understand the contexts in which it operates, paying attention to the similarities and differences across contexts. Thus, examining the CSS and MLN programs and the UNC-Chapel Hill and

Penn state context should illuminate a deeper understanding of the lifecycle of STEMM interventions (the quintain). However, this does not mean that the programs or institutions are not relevant points of study. The life cycle of a STEMM intervention program is directly tied to how the program is designed, run, and the context in which it operates. Stake (2006) explains this as the case-quintain dilemma.

Stake (2006) explains “Both the quintain and the cases become more worthy of study as fast as they are studied. The more a social action becomes understood, the more there is to be understood. What earlier was believed to be dismissable becomes a component when it is better seen” (p. 7). Therefore, a case study is “both a process of inquiry about the case and the product of that inquiry” (p. 8). A multiple case study design is well-suited for this study because it allowed me to observe how the phenomenon of interest performs in different environments (Stake, 2006). In particular, the multiple case study design demonstrates how different campus cultures, missions, histories, geographies, and a myriad of other contextual factors affect the implementation, adaptation, sustainability, and institutionalization of STEMM intervention programs. The CSS and MLN programs are ideal cases for a multiple case study design because they started at the same time, were both supported through a partnership with UMBC and HHMI, and are attempting to replicate and institutionalize the same Meyerhoff model. Yin (2017) speaks to the logic of selecting cases and notes that multiple case study designs must select individual cases that either: predict similar results (a literal replication) or predict contrasting results but for anticipatable reasons (a theoretical replication). The cases in this study represent a literal replication as research finds that both programs have had success in improving STEMM outcomes for URGs relative to the original program (Sto. Domingo et al., 2019).

In order to conduct a robust multiple case study design researchers must “show how the program or phenomenon appears in different contexts” (Stake, 2006, p. 23). The primary way that case study researchers achieve this is through the collection of multiple sources of data and evidence. There are six sources of evidence commonly used in case study research: documents, archival records, interviews, direct observations, participant-observations, and physical artifacts (Yin, 2017). Multiple sources of evidence are important to case study research because they can serve as a mechanism of triangulation whereby findings are corroborated and critically examined (Stake, 2006; Yin, 2017). This study utilizes multiple sources of evidence, namely interviews, documents, and observations made during site visits. Additionally, Yin (2017) notes that regardless of the sources of evidence one uses, there are four overriding principles to follow in data collection for case study research. First, a major strength of case study research results from the opportunity of using multiple sources of evidence leading to in-depth examinations of a phenomenon in a real-life context and the ability to corroborate findings, therefore researchers should be well-versed in a variety of data collection techniques to maximize the potential of case study research. Second, case study researchers should create a case study database “a formal assembly of evidence, distinct from the final case study report, containing all of your case study notes, the documents and tabular materials from the field, and your preliminary narratives or memos about the data” (Yin, 2017, p. 153). A case study database houses all the data relevant to the case study making it readily accessible and retrievable if necessary as well as leading to greater reliability because it creates a trail of data that others can inspect. The third principle focuses on increasing construct validity by maintaining a chain of evidence. Through this chain of evidence, a reader should be able to follow the evidence from initial research questions to

final case study findings. Lastly, when collecting data, researchers should exercise care when using data from social media sources.

By using multiple sources of evidence and following the four overriding principles of data collection, researchers can ensure that case study research is done in a rigorous manner leading to greater validity and quality (Yin, 2017). This study uses multiple sources of evidence and follows Yin's principles of data collection to enhance the research quality.

Description of Cases

Although not an exhaustive examination of the cases, this section is intended to give a brief overview of the CSS and MLN programs in order to situate them within the institutional context and provide some information on program placement within the organization.

The CSS Program at UNC-Chapel Hill

The University of North Carolina at Chapel Hill was founded in 1789 as the first public university in the nation and today is a very selective Research one (R1) university, according to the Carnegie Classification of institutions. While there are now other public campuses, UNC-Chapel Hill (nicknamed Carolina) is the flagship campus and is home to 19,743 undergraduate students and 11,796 graduate and professional students (UNC-Chapel Hill, 2023). UNC-Chapel Hill is a predominantly white university, with the entering class of the 2022 year consisting of 65% white students and 21% students from underrepresented groups in higher education (students who identify as Black, Latinx, and Native American) (UNC-Chapel Hill Admissions, 2022). The gender breakdown of UNC-Chapel Hill is 60% female and 40% male (U.S. News, 2023). UNC-Chapel Hill has 14 'schools,' including the College of Arts and Sciences, School of Education, School of Medicine, and the Graduate School. The College of Arts and Sciences houses all STEM departments participating in the CSS program.

The CSS Program has served 133 scholars from 2013 to 2021, with its ninth cohort (in 2021) being composed of 80% scholars of color and 80% women scholars (Freeman, 2021b). The CSS program is administratively housed under the Honors Carolina program, which resides in the College of Arts and Sciences. The CSS program is organizationally nested (as seen in figure 3.1) in comparison to the MSP and MLN programs that report directly to the Executive Vice President and Provost. There are additional levels of bureaucracy for the CSS program as its Executive Director (an African American male) reports to the Dean of Honors Carolina, who reports to the Senior Associate Dean of Natural Sciences and Math. The CSS program has experienced staff turnover during the past years but during the time of data collection, the program was composed of a staff of four. This staff consisted of an Executive Director who is a Teaching Associate Professor in Chemistry, two staff Program Coordinators that work to support scholars, and a Recruitment and Communications Coordinator. Additionally, the program's evaluation component is led by two women, the Senior Associate Dean for Undergraduate Education/Professor of Psychology and the Associate Dean for Evaluation and Assessment/Professor of Practice in the Department of Psychology and Neuroscience. Figure 3.1 shows this embedded arrangement of units and the majors that CSS scholars can pursue.

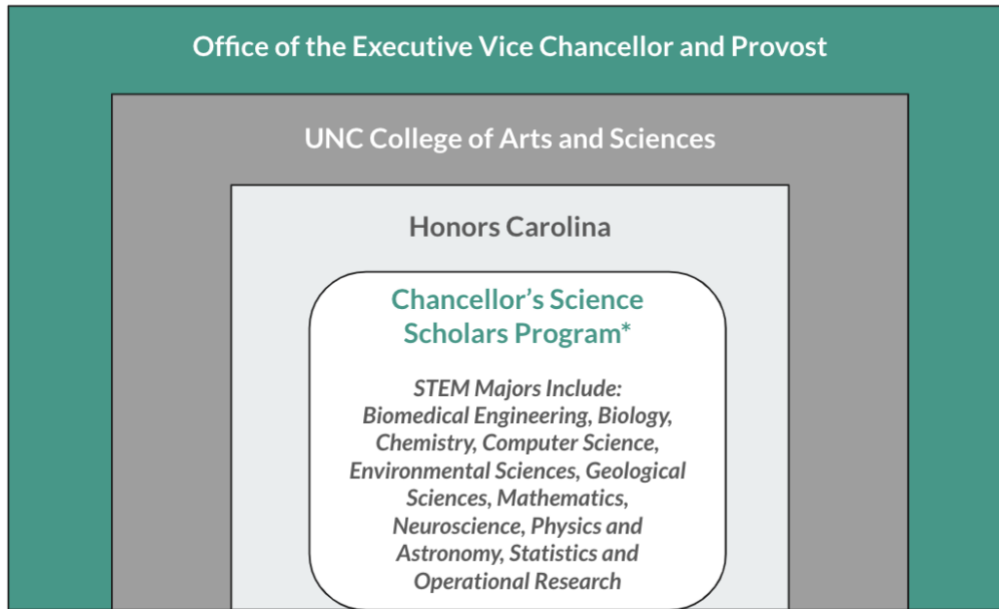


Figure 3.1: Organizational placement of the CSS program

The CSS program is supported by an Advisory Board composed of faculty and leadership across the STEMM departments on campus. Additionally, the Chancellor and the Executive Vice Chancellor and Provost serve on the board (*CSS Advisory Board, 2020*). The Advisory Board is an advisor to the Executive Director, serves as a program champion, and assists with fundraising for the program. At the time of the site visit, members of the Advisory Board had sent a letter to the Chancellor about better supporting CSS, to inform him about staff and the need for resources. This indicates that leadership support at the Chancellor level may be decreasing, though a more nuanced explanation is presented in chapter 4.

The MLN Program at Penn State

The MLN program operates in Pennsylvania State Universities' main campus, University Park. The Pennsylvania State University system consists of 24 campuses across the state, with 80% of students being state residents (Penn State, 2023) The University Park location is the flagship institution of the Penn State system and also the largest with 46,000 undergraduates

attending and more than 275 baccalaureate degree programs offered (Penn State University Park, 2023). Penn State is a predominantly white university with 64.95% of its student body identified as white and 13.41% of students enrolled from underrepresented groups in higher education (students who identify as Black, Latinx, and Native American) during the 2018-2019 academic years (Penn State Undergraduate Admissions, 2019). Moreover, 54% of undergraduates identified as male, and 46% identified as female, primarily because of the large College of Engineering.

The University Park campus consists of 12 academic colleges, seven of which focus on STEMM: Eberly College of Science, College of Engineering, College of Agricultural Sciences, College of Earth and Mineral Sciences, College of Information Sciences and Technology, Ross and Carol Nese College of Nursing, College of Health and Human Development. The MLN program is currently partnered with five of the STEMM colleges (figure 3.2) and is housed under the Office of the Executive Vice President and Provost. The MLN program director reports directly to the Executive Vice President and Provost.

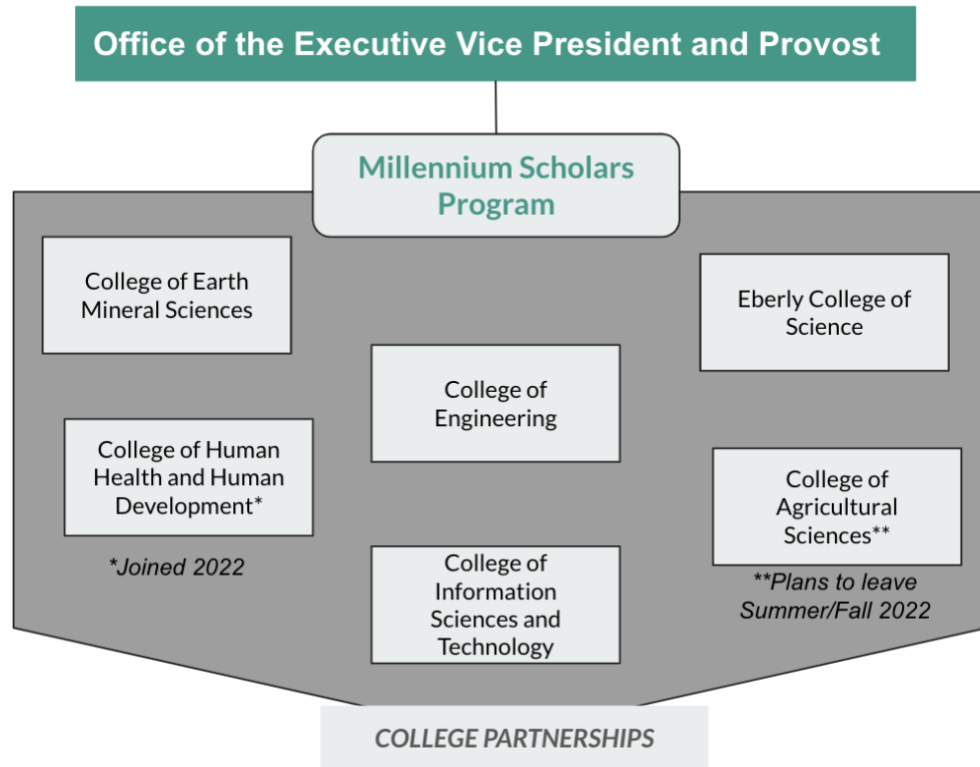


Figure 3.2: Organizational placement of the MLN and program structure

The program has served 297 scholars from 2013 to 2022 with 81% being scholars of color and 59% being women scholars (MLN, 2023). The staffing structure of the MLN program has evolved over time but is currently led by an Executive Program Director (an African American female) who is an associate research professor in Engineering Design, Technology, and Professional Programs. Moreover, the program has four Assistant Program Directors (APDs) who are each in charge of a cohort of students, from 1st years to 4th years. The program is additionally staffed by an Administrative Support Coordinator and Recruitment and Admissions Coordinator. Lastly, the program’s evaluation team consists of two faculty members: a Professor & Scientist of Education who leads the quantitative assessment and a Professor of Education who leads the qualitative side of the evaluation.

The MLN program is also supported and guided by a Steering Committee chaired by the Vice Provost for Educational Equity. Similar to the CSS Advisory Board, the MLN Steering Committee consists of leadership across the university including Associate Deans for Undergraduate Education as well as representatives from the offices of undergraduate admissions, financial aid, and development.

Data Collection

Semi-structured Interviews

The primary source of data for this study comes from semi-structured interviews with participants at UMBC, UNC-Chapel Hill, and Penn State. In total, 91 interviews were conducted with 72 participants who were current and previously employed institutional leaders, program staff, faculty, and evaluators. The majority of interviews were conducted online due to the COVID-19 pandemic, however, some interviews were conducted in person through site visits at all three institutions. Most interviews ranged from 60 to 90 minutes and were guided by an interview protocol designed to understand the three topics of interest of the larger study: program adaptation, cross-institutional mentoring, and program impact. Interview protocols (in Appendix A) were tailored to individuals' roles in order to capture different perspectives and insights into the questions of the larger study. For example, institutional leaders (e.g. Chancellors, Provosts, Deans) had more information on the broad impact of the programs and how programs were sustained but limited knowledge of the process of adapting programmatic elements. In contrast, program staff had more knowledge on adapting the programs and the cross-institutional relationship with UMBC but had less knowledge on broader change and institutional decisions such as deciding where to place programs and how to financially sustain them. Interviewing a broad range of participants allowed for a more nuanced understanding of the CSS and MLN

programs as individuals provided different perspectives depending on their roles and involvement with the program. Moreover, interviewing individuals at UMBC offered unique perspectives because they were able to provide insights based on their interactions with individuals on both campuses, allowing for comparisons across the cases.

Interviews were conducted in two phases. The first phase of interviews focused on examining the three topics focused on research questions of the larger study: program adaptation, cross-institutional mentoring, and program impact. This phase consisted of interviewing evaluators, program staff, program directors, and selected institutional leaders to gain a broad understanding of the topics of interest. The second phase of interviews allowed for follow-up interviews with participants from the first phase, providing greater clarity and details for key areas of interest. Additionally, in the second phase, we focused on developing a deeper understanding of the extent to which the CSS and MLN programs have led to broad institutional change and impact. Therefore, we focused on interviewing more institutional leaders in the second round, particularly focusing on the Deans of the STEMM Colleges, Associate Deans of Diversity, Equity, and Inclusion, and Provosts. We also conducted interviews with members of the CSS advisory board and the MLN steering committee, many of whom are leaders in the STEMM colleges.

Site Visits

We conducted site visits at UMBC, UNC-Chapel Hill, and Penn State in the fall of 2021. Site visits facilitated observing participants and programs in their natural contexts allowing us to build a more comprehensive understanding of the institutional context of the programs (Yin, 2017). During site visits, we were able to observe program offices, interactions among scholars and program staff, and conduct focus groups with scholars at all three campuses. We also

observed one annual event with scholars and the Provost at Penn State. Ravitch and Carl (2016) note that “observations without fieldnotes does not constitute data” (p. 160). Therefore, we recorded observations in team notes and debriefed at the end of each day to reflect on our observations. The site visit assisted us in building institutional narrative reports, which contextualized the programs in distinct campus environments.

Webscraping and Document Collection

Documents are a valuable data source for this study as it allows for the triangulation of other sources of data (Yin, 2017). Documents were collected from student newspapers, board of trustees minutes, news articles, and internal program documents. Documents chronicle the challenges and successes that programs experienced and informed my understanding of the differences within each phase of the life cycle of the programs. For example, the replication of the Meyerhoff model has been highly publicized with multiple articles being written about this partnership (HHMI News, 2014; Schwartz, 2019; Smith-Barrow, 2019). This media attention has resulted in news outlets reporting on program progress and accomplishments. Documents were collected that show large financial donations for the CSS program (Thompson, 2019). This is useful as it shows broader support for the program and can signal the sustainability of the program as it garners more widespread support. In contrast, documents can also highlight challenges, with articles being written that were critical of the MLN program even to the extent that they accused the program of hazing its scholars (E. Hill, 2017; Kuznitz, 2017). This demonstrated challenges between the adoption of the model and the culture of the university, as some of the culturally responsive aspects of the model were perceived as hazing by other members of the university community. Public documents (see appendix B-1 for list) allow for a

greater understanding of how the larger campus community perceived the programs and allow for greater trustworthiness of the study as findings are not solely reliant on interview data.

Publicly available information was also webscraped from CSS and MLN program websites in order to examine program goals, composition, and policies. Understanding these aspects of the MLN and CSS program allow for an understanding of how they are similar and different in comparison with the Meyerhoff model. Webscraping data allows for an examination of program adaptation, particularly in how the Meyerhoff program elements are used by the MLN and CSS programs. Institutional websites also facilitated the development of a deeper understanding of how the programs were placed within the organization by being able to see where the programs are administratively housed and what the reporting lines are relative to the organizational structure of the campuses.

Documents were also collected directly from the programs allowing for sources that otherwise would not be publicly available (see appendix B-2 for a list of internal documents). Key documents include the Meyerhoff manual (Sto. Domingo et al., 2016) and the MAP midterm report (Crimmins et al., 2017). The primary purpose of the Meyerhoff manual is to “describe the intentions, implementation strategy, and assessment methods for the key elements that comprise the Meyerhoff Scholars Program. A second goal is to provide historical context so that institutions interested in bringing a Meyerhoff-like program to their campuses can better understand how the elements, as well as the administrative structure and staffing, evolved over time” (Sto. Domingo et al., 2016). The Meyerhoff manual is useful as it provides insights into the “Meyerhoff way” allowing for comparisons to be drawn with the CSS and MLN programs to examine model fidelity and adaptations made. The MAP midterm report “summarizes partnership activities and outcomes (student and institutional) at UMBC, UNC-CH, and PSU and

provides early recommendations for institutions that may be considering this type of inter-institutional partnership” (Crimmins et al., 2017, p. 3). The MAP midterm report is particularly useful because it provides insights into the early challenges and success of the program. Both the CSS and MLN programs have experienced considerable turnover in program staff, program directors, and institutional leaders and champions. Therefore, insights about the early years, in particular the implementation, have to be drawn from a select few who are still involved with UNC-Chapel Hill and Penn State (as well as some who left but not all responded to requests for interviews). The MAP midterm report allows for corroboration of the implementation process as interviews for this study were conducted several years later.

Data Analysis

Document Analysis

Documents, webscraped data, and site visits observations assisted in the creation of institutional narratives reports. Narrative reports are a part of the initial analysis stage to capture context before cross-site comparisons are conducted to answer the research questions (Yin, 2017). Institutional narrative reports aided in understanding the cases on an individual basis and facilitated cross-site comparisons during later stages of analysis. Documents were also used as a triangulation mechanism to provide clarity and nuance to interviews where participants had opposing views.

Coding

Interviews serve as the primary source of data for this study, which were recorded and transcribed. All interviews were coded by team members of the larger project to examine the topics of interest to the larger study. The coding of the 91 interviews was divided among four team members and was done through the qualitative software MAXQDA. Each member took the

lead on coding interviews grouped by individuals' roles (e.g., evaluators, program staff, faculty, institutional leaders). I coded all interviews associated with the evaluators and assisted in coding interviews from program staff, faculty, and institutional leaders. The creation of codes and the codebook was done through an inductive and deductive process and went through multiple phases of refinement to develop codes that best addressed the three topics of interest. Initial codes were created deductively, informed by theories and frameworks. For example, codes were created that aligned with Cobian and Ramos's (2021) key strategies of sustainability and institutionalization to examine areas of program impact.

Guided by a codebook of mainly deductive codes, we coded a set of transcripts as a team to become familiar with the data and develop a standardized approach to coding. Through this process, we observed areas that were not captured through deductive codes and developed codes inductively through an open coding approach (Miles et al., 2013). Many inductive codes were created as a result, for example in vivo codes like "the Meyerhoff way", "the right people", and "explaining the model" were created to capture the process of program adaptation, noting both challenges to it and how it is facilitated. We discussed codes weekly as a team to obtain consensus. Through this iterative process of coding, we developed a codebook that captured key areas of interest to the larger study.

Although all the interviews were coded by members of the larger team, I conducted a focused re-coding of all the interviews with a refined codebook in order to align with my focus on the life cycle of SIPs. This was important because I wanted to ensure that I was not missing any insights that might be critical to understanding the life cycle of SIPs. While I utilized codes from the larger study, I also developed new codes that aligned with the theories and frameworks described in Chapter 2. A list of codes from the larger study that were relevant to this study is

provided in Appendix C as well as a list of new codes that were developed. Taking this approach was important because it allowed me to retain critical information regarding the types of codes necessary but also develop a codebook that is better suited to the needs of this study. Theories and frameworks like white institutional isomorphism (Garbes, 2022), the organizational theory of implementation effectiveness (Weiner et al., 2009), the FRAME (Wiltsey Stirman et al., 2019), and fidelity as mutual adaptation (Kezar, 2011) were not used in the development of codes for the larger study. The life cycle of SIPs was not intended to be a focus of the larger study, and so these theories and frameworks were not at the forefront of the research team's thinking. Creating new deductive codes that align with the dimensions of these new theories and frameworks allowed me to fine-tune the codebook to address critical stages of the SIP life cycle. For instance, guided by the organizational theory of implementation effectiveness (Weiner et al., 2009), I developed a code on institutional readiness, which is something that the larger study did not incorporate.

Re-coding also allowed me to have a comprehensive understanding of all participants' experiences as I re-coded the 91 interviews myself. My familiarity with the data was beneficial as I re-coded because I had time to reflect and "make sense of the data" (Ravitch & Carl, 2016, p. 219) through my experience with the larger project. After a first level of coding with the refined codebook I employed a second level of coding through axial coding (Miles et al., 2013) in order to develop connections among the codes. Axial coding, also known as pattern coding, allowed me to create categories and themes that addressed the studies' research questions.

Cross-case Analysis

In alignment with the multiple case design, this study employed cross-case analysis to analyze the data (Miles et al., 2013). The purpose of cross-case analysis is to "see processes and

outcomes across many cases, to understand how they are qualified by local conditions, and thus to develop more sophisticated descriptions and more powerful explanations” (Miles et al., 2013, p. 95). Cross-case analysis begins by first understanding each case on its own before moving on to comparative analysis. Therefore, the analysis for this study happened through two stages, first understanding the cases individually through within-case analysis and then moving on to comparative case analysis to understand differences and commonalities across the cases (Miles et al., 2013). Through this logic, it is important to first understand the individual institutions (UNC-Chapel Hill and Penn State) and programs (CSS and MLN) before attempting to compare them. Comparative analysis was conducted through the use of matrices, whereby a matrix serves as a visual display of the data to easily observe differences and similarities between themes of interest (Yin, 2017). I created analytic memos alongside the matrix to note key patterns about the cases both within and across the programs and institutions (Yin, 2017). Analytic memos facilitated a “cased-based” approach, which aims to “retain the integrity of the entire case and then compare or synthesize any within-case patterns across the cases” (Yin, 2017, p. 246). This cross-case approach allowed for a nuanced understanding of the life cycle of SIPs.

Approach to Anonymity

When presenting results, I make the intentional decision to not provide pseudonyms for individuals but rather refer to them as “participants”. I make this choice because there are a limited number of individuals who are and have been involved in these programs. Providing pseudonyms could potentially lead to identifying individuals as there is certain knowledge that only some would have. When it is relevant, I provide the participants’ institutional affiliation and at times the role that they hold. There are a few instances where participants are named, however, this only happens if the information provided is already public knowledge. Providing

complete anonymity is challenging for this study due to campus teams being small, particularly in the early years of program implementation, however, I strive to maximize anonymity as much as possible.

Trustworthiness and Credibility

Yin (2017) notes that rigorous and quality case study research is dependent on maximizing: internal validity, external validity, construct validity, and reliability. In qualitative research, validity refers to “the ways that researchers can affirm that their findings are faithful to participants’ experiences” (Ravitch & Carl, 2016, p. 186). Researchers have tended to use validity and trustworthiness interchangeably and note that in qualitative research, validity can never fully be ensured, because “it is both a process and a goal” (Ravitch & Carl, 2016, p. 187). However, there are ways to enhance and maximize validity. This study maximizes validity by engaging in member checking with participants to ensure that findings and perceptions match with participants' experiences. The ongoing larger project provides a unique opportunity as it provides me with access to individuals at the case study sites, and continues with weekly conversations about findings across the research team. Validity is also enhanced through triangulation, as the study uses multiple sources of evidence that can corroborate and critically examine findings, particularly those from interview data.

External validity or transferability is concerned with how studies can be “applicable, or transferable, to broader contexts, while still maintaining their context-specific richness” (Ravitch & Carl, 2016, p. 189). Unlike quantitative research, the goal of qualitative research is not to be broadly generalizable, however, the research should be transferable to other contexts (Ravitch & Carl, 2016). To enhance transferability, researchers can develop detailed descriptions of the data, themselves, and the context thereby producing thick descriptions (Ravitch & Carl, 2016). Thick

descriptions allow readers to be able to make comparisons between their context and that of the research site. Through an understanding of the differences and commonalities between a reader's context and the research context, a reader is able to transfer aspects of the study design and findings to their own contexts. This study aims to produce thick descriptions (in subsequent chapters) to increase transferability. The use of multiple sources of evidence, primarily documents and site visits, facilitated the production of thick descriptions that allow readers to reflect on how findings can be applied to their contexts.

The goal of reliability centers on the ability of other researchers to follow the same procedures described in a study and conduct the same study over again leading to the same findings and conclusions (Yin, 2017). Enhancing reliability relies on documenting the procedures a researcher followed in order to ensure that the work could be repeated. This study maximizes reliability by following Yin's (2017) pillars of data collection such as building a case database that houses all forms of data collected and maintaining a chain of evidence to ensure that findings can be traced along sources of evidence. As a team in the larger project we have built a robust case database that houses all forms of data collected in order to have them accessible and facilitate being able to create a chain of evidence.

Positionality

Ravitch and Carl (2016) highlight that in qualitative research, the researcher is the primary instrument, as such, the researcher and the research are intrinsically linked. The role of the researcher is a central consideration in qualitative studies because it directly affects the credibility and trustworthiness of the research. The credibility of research can be enhanced through researcher reflexivity, an assessment of one's identity, positionality, and subjectivities (Ravitch & Carl, 2016). Through reflexivity, one can assess their own biases, theoretical

preferences, and analytical interpretations. I understand reflexivity as an ongoing process rather than something that can be accomplished. Therefore, as I conducted the research through its different stages I continuously engaged in the practice of reflexivity to mitigate any potential biases or assumptions that I may hold.

I come to the research as a first-generation, Latino, who comes from a low-income background. These identities are salient to me because they have structured the way I see the world and the way that I am able to navigate within spaces. Due to my status as a first-generation college student, I have had many challenges navigating higher education, however, my success has been a result of a community of support through my peers, family, and university members who believed in me such as faculty and staff. In my undergraduate years, I served as a peer mentor and coordinator of a mentoring program that aimed to increase retention among URGs. I believe that these types of programs and services are critical to the success of students from URGs. However, my experience as a member of multiple marginalized communities has made me keenly aware of systems of oppression and power. I see higher education institutions as having transformative power in advancing the success of URG students, however, I also understand they are racialized organizations whose norms, values, and histories are not always conducive to the success of URGs. My identities and experiences draw me to more critical perspectives and paradigms as I conducted the research. Throughout the research process I continued to reflect on how my experiences and perceptions can lead to potential assumptions and biases that may affect the study.

Limitations

The main limitation of the study is a result of the number of cases I am observing in depth. Although the goal of qualitative research is not necessarily to be generalizable, my sample

size is relatively small with the examination of two program life cycles. Steps were taken to ensure that the current study is transferable and trustworthy to address this limitation, leading readers to be able to reflect on how findings can apply to their contexts. A limitation arises in that the CSS and MLN programs may not be the typical type of STEMM intervention that most campuses are implementing. As seen in the literature many campuses gravitate toward implementing one service such as undergraduate research because of university limitations like resources. The CSS and MLN programs are comprehensive SIPs that take significant financial commitment and buy-in from groups across the campus. Findings on the life cycle of the CSS and MLN programs may not be relevant to campuses that seek to implement one component rather than a comprehensive model as studied here. However, as comprehensive models are becoming more widely recognized as an institutional solution, there may be greater investments and commitments to implementing these programs at more institutions leading to greater relevance of the research. Further, the study of comprehensive SIP lifecycles can be extended to other contexts and institutional conditions in the future.

CHAPTER FOUR: EXAMINING THE LIFE CYCLE OF THE CSS AND MLN PROGRAMS

The goal of this chapter is to examine the life cycle of the CSS and MLN programs by examining their implementation phase, the adaptations made to the programs, and their sustainability and institutionalization phase. The chapter is divided into three sections with each section aiming to address the study's research questions. The first section of this chapter is titled: "Nothing was easy": Implementing Culturally Responsive STEMM Programs in Predominantly White Research-Intensive Campuses. This section examines the implementation phase to understand how the MAP emerged, the role of an organization's readiness for change, the process of setting up the CSS and MLN programs, and the challenges of adopting key Meyerhoff elements at predominantly white research-intensive campuses. The second section is titled: Not a Cookbook Approach: Adapting the Meyerhoff Model to New Institutional Contexts. This section aims to provide an overview of the various adaptations that the CSS and MLN programs made to the Meyerhoff model and how these adaptations facilitated greater adoption of the model. Furthermore, I examine the mechanisms that lead to program fidelity. The last section is titled: Completing the Life Cycle: Sustainability and Institutionalization. In this final section, I examine the different strategies that the programs have employed to become sustained and the extent to which the programs have been institutionalized at multiple levels, namely the structural, procedural, and incorporation levels.

“Nothing was Easy”: Implementing Culturally Responsive STEMM Programs in Predominantly White Research-Intensive Campuses

The following section focuses on the first research question that primarily deals with the implementation phase of the life cycle of SIP, including readily adopted and challenging aspects of the process as well as integration into the ecology of other diversity practices on campus. This section examines the implementation of the culturally responsive Meyerhoff model into the UNC-Chapel Hill and Penn State context, two predominately white and research-intensive campuses. Findings aim to provide insights into the myriad of roadblocks that programs faced as they sought to implement the Meyerhoff model into their unique institutional contexts. I first use an institutional isomorphism lens to examine how the Meyerhoff Adaptation Partnership emerged. I then explore the concept of organizational readiness to demonstrate the key considerations campuses must make before they implement programs. Next, I investigate the logistical process of implementing the CSS and MLN programs. Namely, the process of determining program placement, setting up a funding model, and integrating the programs into the existing ecology of student programs and diversity initiatives on campus. Lastly, I examine the process of adopting the Meyerhoff model with a particular focus on model elements and values. Findings indicate that functional program elements were more widely adopted as they were commonplace to UNC-Chapel Hill and Penn State. Program elements that were particularly challenging were the program values as there was a clear cultural mismatch between the Meyerhoff values and those of UNC-Chapel Hill and Penn State.

An Isomorphic Opportunity: Replicating the Meyerhoff Scholars Program

Leaders at UMBC, UNC-Chapel Hill, and Penn State began discussing the possibility of forming a partnership to replicate the Meyerhoff program in 2011 (Hrabowski III et al., 2019).

Through funding from HHMI, UNC-Chapel Hill and Penn State recruited their first cohort of scholars in the summer of 2013 and the Meyerhoff Adaptation Partnership (MAP) was born. The 2017 mid-term report describes the following MAP goals:

“The overarching goals of the resulting “Meyerhoff Adaptation Partnership” (MAP) is to determine if Meyerhoff-like outcomes can be achieved at larger research institutions with different histories, geographies, and institutional cultures. Specific aims include (i) developing Meyerhoff-like STEM inclusion activities at UNC-CH and PSU that lead to significant, quantifiable increases in URM academic performance, retention in STEM, and matriculation to STEM doctoral programs; (ii) enhancing inclusive institutional cultures at UNC-CH and PSU; and (iii) determining if this type of inter-institutional partnership could serve as a general mechanism for disseminating effective STEM practices. Prompted by HHMI, a fourth aim was to (iv) develop a more granular understanding of the goals and benefits of individual elements of the Meyerhoff program. Finally, because institutional culture, history, local environment, and resources differ among the three academic institutions, we prioritized (v) documenting and assessing the implementation and outcomes of the different programmatic elements at each institution, and to determine which [Meyerhoff Scholars Program] elements could not be easily replicated and required institution-specific adaptation” (Crimmins et al., 2017, p. 3)

At the time of implementation, individuals did not know if the replications at UNC-Chapel Hill and Penn State would succeed or fail. However, leaders at all three campuses saw it as an opportunity to address inequitable STEMM outcomes for URGs. A UNC-Chapel Hill participant explained “We saw the Meyerhoff model as being crucial to this strategy of the university becoming a more just and inclusive place.” The replication of Meyerhoff with HHMI funding

was the necessary catalyst to begin addressing inequitable outcomes in STEMM through an institutional approach.

The replication of the Meyerhoff program into the CSS and MLN programs aligns with DiMaggio and Powell's (1983) concept of mimetic isomorphism, which explains that in order to address uncertainty organizations will model themselves after more successful organizations. The MAP provided UNC-Chapel Hill and Penn State with an opportunity to replicate a proven model in hopes of addressing disparate STEMM outcomes at these predominantly white, research-intensive universities. Existing research by (George et al., 2019) finds that the creation of SIPs is most commonly due to coercive and mimetic isomorphism. As institutions try addressing unequal STEMM outcomes, copying an existing successful model is an appealing solution. A participant at Penn State explains that replicating Meyerhoff allowed them to bypass "reinventing wheels":

Millennium Scholars from the beginning, was started with a conversation with [a faculty member] from UMBC. I was fairly early in my role as [an Associate Dean] in the college and really interested in exploring different kinds of programs available to support students' access and learning, especially programs that improve the inclusion and diversity of our students and really improved success. I was not interested in reinventing wheels, and [Meyerhoff] a known program for excellence, caught our interest very early on. And our friends at UMBC were eager and excited to partner with us...they really opened up their doors and their hearts to be true partners with us.

While UNC-Chapel Hill and Penn State benefited from being able to replicate an established model, UMBC was also poised to gain as the MAP provided an opportunity to prove that the Meyerhoff program could work in places outside of UMBC. As Hrabowski III et al. (2019)

explain, “Over the years I have heard presidents dismiss the program as “expensive” or suggest that it is only successful because UMBC is a “unique place with an African American president” who is the program’s champion in a way that cannot be duplicated” (p. 136). The MAP was therefore viewed as an “experiment” to determine whether Meyerhoff-like outcomes could be achieved in distinct institutional contexts. A participant from UMBC explains that getting buy-in for the Meyerhoff program started in a similar way:

We should see these initiatives as experiments...this is how [we] finally got [our] science colleagues to agree to even try Meyerhoff when they were really against it at the beginning. [We] said, "Let's try it. Let's see if we do these things if we are successful and if we're not, let's learn from the failure, ways in which we can be better."

Choosing universities like UNC-Chapel Hill and Penn State was important because it would lead to key lessons regardless if the replication succeeded or failed. A UNC-Chapel Hill leader provides some background to the decision process:

I think they had decided that Carolina was the best possible place for them. It's in the South, Carolina is really the best public university in the South. [With a] long history, complicated history with race, even more complicated now than it was then. You know, built by slaves in the Civil War. That seemed like an important place to prove that [the replication] could work, [in a] superb, world-class, nobel laureates, billion dollar [science] research university. Because one of the things they were trying to prove was that you could do this at a place that was superb in research by pecuniary objective measures. Not just at what some people, incorrectly in my view, think of UMBC as sort of a regional public university.

While institutional context played a role in selecting UNC-Chapel Hill and Penn State, relationships between leaders at the three campuses most prominently affected decision making. In particular, a faculty member at UMBC who is a champion of the Meyerhoff program played a key role in getting the MAP started. They explain:

[It] started with me giving talks about the Meyerhoff Program at other universities. For many years now, when asked to give a science talk, I'm also asked to give a second talk about the Meyerhoff Program. People routinely would ask me how we could get more of our students into their graduate programs. And I would routinely say, "Why don't you develop your own talent pool?" And the answer that I always got was, "We can't do what you're doing because we don't have a Freeman Hrabowski." So, that really begged the question: is Freeman essential for this? I think Freeman was essential for showing what was possible. The next question is can it be replicated at other majority institutions that have like-minded majority leadership? So I gave a talk at UNC-Chapel Hill and the Chancellor at the time was a friend of mine. We had this conversation [and] he got tears in his eyes and said, "I want to be the one to actually do that. And would you help?" I said yes ... Then the same thing kind of happened at Penn State. I'd been getting several talks there... and they also asked if we would help. So, I went to the Head of HHMI and told him what I would like to do and would it be possible to get resources to try to help UNC-Chapel Hill and Penn State replicate? And he was just thrilled about it.

While the CSS program was established through a Chancellor directive the MLN program was championed by an Associate Dean of the College of Science. Though there was great enthusiasm and administrative support to implement the Chancellor's Science Scholars program and the

Millennium Scholars program, the reality is that implementing any new initiative is a challenging endeavor.

Klein and Knight (2005) have described organizations as a “stabilizing force” (p. 244) because their norms and routines are incredibly effective at maintaining the status quo. Any new innovation is a challenge to the status quo and thus a threat to the routine functioning of organizations. Organizational members may also be resistant to new innovations because they “adhere rigidly to the past” (Klein & Knight, 2005, p. 244). Moreover, Ray’s (2019a) theory of racialized organizations explains “Threats to the organizational hierarchy—for example, the hiring or promotion of non-Whites, affirmative action policies, or diversity programs— are often seen as illegitimate intrusions into the normal, meritocratic, neutral functioning of organizations” (p. 40). The Meyerhoff program utilizes a culturally responsive, strengths based model that aims to advance URGs in STEMM fields. In order to achieve this, there are certain values that they abide by that are contrary to traditional STEMM cultures. For example, the model focuses on collective achievement over individualism. These new ideals and approaches proved to be a challenge as the cultural norms of the Meyerhoff model were at odds with the campus cultures of these predominantly white, research-intensive universities. The process of implementing the CSS and MLN program is perhaps best described by a UMBC participant who shared, “Nothing was easy. There were complications in every way, nothing was easy.”

While the programs are entering their 10th year as of 2023, it was not an easy road to get there. The implementation phase and pre-implementation phase were some of the most challenging times in the life cycle of the CSS and MLN programs. The following section examines findings on organizational readiness in order to provide insights into how to prepare to implement a comprehensive STEMM intervention program.

Organizational Readiness for Change

Assessing an organization's readiness for a new intervention is important because it has a direct impact on the success of the implementation phase (Rosser & Chameau, 2006; Weiner et al., 2009). Organizational readiness for change is defined as "the extent to which targeted employees (especially the implementers) are psychologically and behaviorally prepared to make the changes in organizational policies and practices that are necessary to put the innovation into practice and to support innovation use" (Weiner et al., 2009, p. 296). Thus, organizational readiness for change is a function of the implementers' ability to put into place policies and practices that will facilitate the widespread use and support of an innovation. Moreover, implementation requires high levels of collaboration to be successful, which means that implementers and organizational managers must be jointly committed to implementing a new innovation (Kezar & Holcombe, 2020b; Weiner et al., 2009).

In terms of UNC-Chapel Hill and Penn State's organizational readiness for change, participants collectively agreed that a lack of lead time to start these programs stifled their ability to develop a methodical implementation plan, yet they felt urgency to take action:

And the biggest issue that came up in the early years is they rushed these programs. They said, the timing is hot, the timing is right, we're going to implement it right away. And these programs need like a year or two lead time and they didn't do the lead time. They got the program and instead they really had to push it on people, they really couldn't get the support that they needed. And they said, if we tried to get support we would have never had the programs. So, which is right? You push it, you strike when the iron is hot, even though you have to push your way into something that's good and valuable and that we believe in? That was the toughest issue. The first few years, that was a huge issue.

Some people just felt this is pushed on them, that's not a good way to get a program started, so there's consequences of that. On the other hand, maybe they're right. That they never would have had any program if they didn't strike when they could.

Participants indicated that a lack of lead time was challenging because it hindered the amount of support they could garner and buy-in from the broader organization but also because there was limited clarity on how and who would run these programs. As a participant explained, "During the first year of implementation you learn that you really have to clarify roles, define structures, and lines of responsibility or decision making." Additionally, participants advised that prior to implementation campuses should develop a financial plan for the program. Understanding the level of financial commitment an institution is willing to commit over a sustained period of time is important, especially for programs that are started through a grant (Rosser & Chameau, 2006).

The lack of lead time also led to interpersonal tensions among the implementation teams and other organizational members as explained by a participant:

Now that it's been so many years I can look back and I'm like "oh, it was a positive relationship" but had you spoken to me in year two or something, it felt really strained. It was really stressful. There were a lot of players, a lot of moving parts, I could sense the tension on campus as this new program was being developed. So there was definitely some stress at the beginning about, "Is this program going to work? Who is it serving?" There was just the bureaucracy around a new program. What I mean by that is funding, personnel, personalities, trying to figure things out, right? The people that may not have ever worked together now had to really work together. Since this program does tout itself - and I think it's successful because it truly is a wraparound program, people really have to know one another and get along with one another and be responsive to one another. I

think in the earlier days, that was not the case. People were probably starting to develop trust and perhaps maybe trust amongst some people never ever materialized, but in the beginning there was a lot more angst about, what is this about?

Since implementation requires a collaborative approach, an important factor of an organization's readiness for change is the extent to which they have the structures necessary to facilitate collaboration as well as the right composition of people who can successfully work together. These findings align with research that examined the implementation challenges of integrated STEMM programs as researchers found that a lack of attention paid to team dynamics, relationships and team building was detrimental to effective implementation. Moreover, researchers found that since these types of programs require individuals coming together from distinct parts of campus it was important to focus on relationship building and enhancing team dynamics (Kezar & Holcombe, 2020b). Facilitating effective collaboration in the implementation phase is contingent on teams developing trust among one another. In particular, participants were concerned about some individual's motives for being involved with the replication of Meyerhoff:

We kept using this phrase strike while the iron is hot. And the iron was hot but I wonder did it leave a scar? I mean, I think people were up for it but it was a lot and until you do something, sometimes you just don't get it, right? These things are difficult and so you have to sit and do it. There is a process and rigor and challenge to a lot of things and until you are just in it you just don't appreciate it. And I think that is the case with many of these kinds of initiatives. There are always politics involved and why people get involved, and why people are there, and why they support, becomes really important. At some point you [think] are people making a name for themselves or are they really trying

to do a greater good? And that's a truth ... And are those things mutually exclusive?
Maybe not. But at times you wonder.

A distinct advantage of the MAP was that the CSS and MLN programs could rely on Meyerhoff leadership and staff to garner buy-in and support for the programs. This was particularly important in the early implementation phase when programs needed to garner support from their broader campus community. One of the primary ways that MAP partners were able to gain support and involvement for the emerging CSS and MLN programs was by highlighting the Meyerhoff's record of success:

We could show data from UMBC that showed that if we did these things these were the outcomes. The outcomes being, attracting high achieving minority students, graduating within four or five years with a degree in STEMM. You know, all of the metrics: What is the GPA at graduation? What is the percent that go to graduate school? We had all those numbers. We also had numbers from the NSF, so [we] could get up and say, "Look Penn State, you're a top five school of origin of undergraduates who go on to earn a PhD in STEMM. About 350 undergraduates a year earn a PhD in STEMM, that did their undergraduate at Penn State" So they're top five. Of those 350, over a 10-year period on average, four are Black. So they could look at those data and say, "Crap," because before they had that data, every one of my friends would say, "We don't have that problem." You know, "I can point to two or three Blacks that have been in my class that have done well" So they have this anecdotal, experiential understanding that just doesn't jive with data, with facts ... [We said] at Penn State ... if your goal was to actually develop minority leadership in STEMM, they weren't, they were doing zero. A top five program

doing zero, basically. So they could look at those data and I could make those arguments and the faculty would get excited about wanting to do something.

In order to facilitate implementation it is important to start gaining buy-in and support for the programs during the pre-implementation phase. This would allow campuses to have an existing group of individuals who are committed to working with the programs once they are implemented. Having a dedicated group of people from the entire university is critical to the entire life cycle of STEMM intervention programs. The section on the sustainability and institutionalization phase will provide in depth insights into the importance of dedicated people.

A final consideration in determining an organization's readiness for a STEMM intervention program is understanding their institutional context and culture. Institutions must consider the context in which a Meyerhoff-like program will be entering and what that means for the broader campus community. This is especially important at predominantly white universities with histories of hostile climates for URGs. As Meyerhoff-like programs aim to bring a cohort of URGs into the student body, campuses must assess and understand how these scholars will be received. A participant provided insight into this aspect of organizational readiness:

I don't think Penn State did a good job of thinking about how this program was going to impact the culture here. It didn't think through, well, what are you going to do? What kind of program are you going to do [for] the other students who are not Millennium Scholars? Right? What kind of diversity programming, what type of equity programming, are you doing to those students? So that the Millennium Scholars don't come into an environment where again, there's an expectation that they're here because of some kind of affirmative action or something else that doesn't even exist here. So from an institutional perspective it didn't seem like they had really set themselves up to create a program for

success. So it was really motivated by piecemeal, by people just kind of pulling things together as best they could.

While a lack of lead time was a major contributor to the MLN program being carried out initially in a “piecemeal” approach, campuses can learn from this challenge and examine their own contexts and cultures to ensure that they are setting up policies and practices that are conducive to the success of incoming URG students. It is important for campuses to be reflective and understand how their campus climate, context, and culture will be aligned or misaligned with the mission and values of a Meyerhoff-like program. For this reason, participants asserted that campuses who seek to replicate these types of programs should have a history of being committed to advancing URGs. A UNC-Chapel Hill participant advised:

I think it would be important for an institution to pick schools (participating academic units) on the basis of longstanding commitments rather than their momentary commitment to a grant. You can say a lot of things about UNC, and of course it's been in the press for a lot of bad reasons for the last year. But, the one thing that I think is true about UNC is that in its bones, for 50 years, it has fought the fight. And it hasn't done it well, always, and it hasn't gone far enough sometimes. But [UNC] is not gonna back away. It's just not. And that's beyond the headlines of being on the press. It's too much ingrained in the faculty's values, and the student's values, and the values of the middle administration. It would take everybody at the university to leave in order for that university to change its stripes. It's just not gonna happen. I think part of it is just trust in the long history, and the long trajectory of an institution rather than the momentary trajectory of an institution.

Participants were in agreement that campuses should not replicate these programs simply because they have the financial means to do so. In particular, when replicating a Meyerhoff-like program, campuses must understand that a core mission of the programs is to change institutional cultures to make them conducive to URG success. The programs are not meant to simply be a retention and graduation tool. While that is a byproduct of these programs, the true intention is to work toward institutional transformation. For this reason, a participant shared a more critical perspective on the replication of programs:

The key question is replication of what? Right? So, is it just getting numbers of students who are getting PhDs in the sciences? 'Cause we can get numbers, but does that really speak to the career success or professional development or the influence that people have? ... What are we replicating? Is it that you just wanna replicate an amount of money that comes into these types of programs? Or is that you wanna replicate the numbers of students who finish? It's ironic that you have [Meyerhoff] that has produced so many PhDs in the sciences [and they] come out of a school that has so few black faculty in the sciences. There's no loop that's being created and so it's like I don't know that I'm down for replicating that. 'Cause I don't think that that needs to continue ... I think that it's very important to clarify what it is that folks are replicating. 'Cause if it's just numbers then I think it's an easy answer, yeah you can replicate that. But if it's the quality of the experience, if it's about the experiential product that you're putting out - scientists particularly from underrepresented groups who are competent, confident and conscious about what they're doing and how they can use science to resolve some of these issues that are out here facing us all or come up with these innovative creations, then I don't know that that's easily replicable.

Organizational readiness requires a reflective process whereby campuses assess themselves in a critical manner to determine their intentions behind replicating a program, understand their campuses cultures and climates, develop a methodical plan for implementation, and garner broad campus support. Through these practices campuses can begin to develop a strategy for implementation that can lead to success.

The following section will examine key challenges that the CSS and MLN programs faced when they began to implement the programs. I focus on the process of determining where programs should be placed, setting up funding models, and how the programs were integrated into the existing ecology of student programs and diversity initiatives.

Determining Program Placement and Developing a Funding Model at Penn State.

One of the major initial tasks for the CSS and MLN programs was determining where the programs would be administratively placed and how resources would be allocated to financially support the programs. At Penn State the MLN program was initially started through a partnership between the College of Engineering and the Eberly College of Science. At Penn State there are seven colleges that focus on STEMM, including: Eberly College of Science, College of Engineering, College of Agricultural Sciences, College of Earth and Mineral Sciences, College of Information Sciences and Technology, Ross and Carol Nese College of Nursing, College of Health and Human Development. As a result, the STEMM colleges are independent of one another, and each have their own leadership team including their own Dean and Associate Deans. Each of the STEMM colleges has an Associate Dean tasked with advancing diversity equity, and inclusion within their respective colleges. Therefore, STEMM DEI initiatives are typically siloed as they are enacted by the individual STEMM colleges, resulting in variations regarding DEI activities. A Penn State participant explained:

That's also specific in terms of who the Deans of those colleges are and who their Associate Deans of multicultural ed are and what they're pushing. For instance, across those five colleges, the College of Science, I think historically has had a lot of smaller grants and different people have had grants that are talking about changing the culture of those units. Probably less so in places like, IST, which is the Information Study of Technology or Earth and Mineral Sciences. The College of Engineering has been launching under the Leonard Center, several efforts to try to get a better sense of the problem with students making entry to the major. So while they might enroll higher numbers of say, women or students of color, those students end up not making their entry into their major and so end up having to leave the College of Engineering, and move into one of the other colleges at Penn State. So I think [DEI] efforts are dean specific and college specific.

MLN was initially a grassroots initiative that originated as a college program led by the College of Science in partnership with the College of Engineering. However, the program has now expanded to include additional STEM colleges. MLN expanded to incorporate the College of Earth and Mineral Sciences, College of Agricultural Sciences, and College of Information Sciences and Technology in 2016. As of 2022, the College of Health and Human Development has also joined the MLN and the College of Agricultural Sciences has decided to no longer participate in the program. The expansion of the MLN program was also accompanied by a shift in program placement as the program was moved to be housed centrally under the Office of the Executive Vice President and Provost. The shift in administrative placement and expansion to five colleges was critical to the success of the MLN program as previous to these changes the

MLN program endured a turbulent period in chartering a sustainable home and being allocated the necessary resources to administer the program.

The decentralized organizational structure of the STEMM Colleges required each unit to devise an individual funding model to financially support the new program and its scholars, which amounted to a minimum of \$15,000 per year for each scholar. Initially, college administrators decided to reallocate funding and resources from existing STEMM diversity initiatives and programs and distribute it to MLN to meet these financial goals. Throughout the interviews, participants described that diverting resources to support a “boutique program” created tensions with existing STEMM DEI initiatives and their leaders:

Another part of the challenge here at Penn State was the program itself was being funded by pulling from other diversity programs and that created a real big issue. From the beginning there wasn't a lot of support because directors of multicultural programs saw [the MLN] program as rigged. And it wasn't just a perception. It was a reality that their funding was being removed from them and placed into this new kind of boutique program.

In particular, the institutional context and culture of Penn State compounded these challenges. A Penn State participant further explains:

Penn State's very territorial, they're territorial with space, they're territorial with money, it's a territorial culture. So you gotta get your own space and your own territory. When the program began it didn't have its own territory...when you're looking to create space and territory, people are not willing to lease their space to you, because it's hard won. For example, the Bunton-Waller scholarship [provides full-tuition] for out-of-state, for in-state it's full tuition, room and board. It pushes towards the Bachelor's degree... When

[MLN] evolved, I think there was a naivete about what they thought they could do...they needed their money, they needed money, and they were trying to take fellowships. In some cases we were forced to hand money over to the Millennium Scholars Program in the name of the President. If it's something the President wants, then it's eminent domain kind of. And so they take stuff from [your existing programs]. So that was extremely, extremely, extremely, extremely upsetting.

As a result, MLN was not well received by campus administrators focused on diversity and inclusion in STEMM because the reallocation of resources to support the program diminished the funding of diversity initiatives that already existed. One participant explained the consequences to MLN:

When we decided to bring the Millennium Scholars Program in, it was done at an upper administration [level with the] College of Science, and we didn't pay enough attention to the extent diversity programs going on in the other Colleges. And money is a kind of a zero-sum game early on, until you have your own money. And so a good bit of the early funding for Millennium Scholars was “robbed” from other programs. It certainly cut the funding to some of these other programs, so we inadvertently alienated people that should have been our allies. 'Cause some of the directors of those programs felt like their programs were getting cut for this untested program that was driven by outsiders to them.

The decision to reallocate funds was based on advice college administrators received from partner institutions. Reallocating resources to MLN created tensions with longstanding diversity programs and initiatives, leading to a loss of potential allies. One participant shared the importance of having allies and leveraging on-campus efforts:

Running this program at the beginning, another challenge area was trying to get individuals that managed the program to understand that if you are not collaborative with other diversity-oriented kinds of programs, especially STEM-oriented programs at the institution, you will just have a very hard political time. So while the president loves you and all that, that's all well and good, but for folks who've been here a long time, if you want staying power, you need allies and you need to understand who your allies are gonna be, whether you like it or not. And so that was a challenging area to understand, who some of your equal or similar programs, you know, understand who they are and understand why it's important to collaborate.

The decision to reallocate resources proved to be a mistake as it created tensions among the existing STEM DEI initiatives and resulted in losing potential collaborators who could have helped the emerging MLN program. To address these challenges, the MLN program was moved out of the Eberly College of Science and housed centrally in the Office of the Executive Vice President and Provost. After a meeting between Penn State President Barron, UMBC's president, and UNC-Chapel Hill's chancellor, President Barron appointed a committee to evaluate the MLN program and make recommendations. The committee included the Vice Provost for Educational Equity and the deans of five STEM colleges (Agricultural Science, Earth & Mineral Sciences, Information Science and Technology, Engineering, and Science). As a solution, President Barron delegated the Office of the Executive Vice President and Provost to administer the program and formed a Steering Committee for MLN chaired by the Vice Provost for Educational Equity. Participants at Penn State explained how this shift in placement addressed ongoing challenges:

They moved the program from the College of Science, because then if one college owns it, it just feels like other colleges are bowing down to a single college, it's very territorial here. So they placed the program in the [Office of the Executive Vice President and Provost]. They took it out of a college and made it neutrally placed, and that helped culturally, that it was neutrally placed. And then the [Office of the Executive Vice President and Provost] began to dump money into the program in terms of the scholarships and things like that. A large portion of that came from the [Office of the Executive Vice President and Provost], and they cut the college's [contribution] to \$10,000 per [student]. So you're not paying 19, 20, 30, 40 thousand, you know, you don't have to raise... and so the colleges were more conciliatory like, okay, we can contribute to a program that belongs centrally to the university. It's been run like that for quite some time, for the last I'll say three or four years anyway. That has helped tremendously.

Findings from Penn State suggest that moving the program to be housed centrally could be a solution for campuses whose STEM organizational structures are decentralized and/or institutional cultures are territorial. Perhaps more importantly, the move to central administration came with an increase in funding commitments which allowed the STEM colleges to have a more level playing field. As the previous participant describes, moving the program completely shifted the funding model of the MLN. Where previously each of the STEM colleges were tasked with individually raising money for students, the new model was a partnership between central administration and the STEM colleges. Due to the size and nature of the STEM colleges some have significantly more resources than others leading there to be discrepancies in their ability to raise the necessary funds. Additionally, participants frequently noted the high cost

of attending Penn State and that the financial aid offered to students is usually limited. Penn State ranks in the top 10 public colleges with the highest in-state tuition (Wood, 2021).

The new funding model increased the level of financial support that MLN scholars were able to receive. Now, all in-state scholars receive full tuition, room and board, and all out of state scholars receive at least full tuition (out of state scholars are able to use other fellowships, scholarships, or need-based awards to cover their room and board) (Crimmins et al., 2017). With this new funding model each of the STEMM colleges contribute \$10K per year for each scholar in their college and central administration provides a Provost MSP fellowship which serves as a “last dollar award” to cover the aforementioned levels of funding for scholars (Crimmins et al., 2017, p. 34). Moving the MLN program to a central placement mirrors the approach of the Meyerhoff program at UMBC, which is housed administratively in the Office of the Provost.

Determining Program Placement and Developing a Funding Model at UNC-Chapel Hill

Whereas the MLN program endured a challenging time in developing a funding model and determining program placement, the CSS program did not experience this magnitude of difficulties. In contrast to MLN, the CSS program was established with support from central administration from the onset as the creation of CSS happened through a directive from the UNC-Chapel Hill Chancellor. However, even with the backing of the central administration, determining where to house the program was unclear. A campus administrator explained:

It wasn't clear at the beginning where the program was gonna sit. There was interest from the Medical School, the College of Arts and Sciences, the School of Public Health, Enrollment in the Provost Office, [and] from the Chancellor's Office. There were all these different people with all these sometimes aligned, but also sometimes competing interests. Figuring out how to find a good home, where it should sit, who will pay for it,

who'll be its champion, those were all challenges. I think in a way, they've continued to be challenges. CSS, for a while, was really closely affiliated with the Chancellor's Office, as the name, CSS, suggests. It [also] became more closely affiliated with the College of Arts and Sciences. But there's a risk at universities, generally, that whatever gets housed within a school kind of loses the support, or the backing, or the advocacy of people who aren't in that school. And I think that was a challenge, it may still be a challenge.

The CSS program has been administratively placed under different units. At the time of data collection, the program was being moved for a third time. Subsequent sections will discuss this move and its implications. The first significant shift in placement was moving CSS to be housed under an academic unit as a participant explains:

The program started out not housed in a particular academic unit, rather, it was part of this other entity that no longer exists. It was called Carolina Counts. But early on, it got moved into being a part of an academic unit. We became a part of the Natural Sciences and Math, and that was really where it became part of the College of Arts and Sciences. We had a pretty significant financial commitment from the Chancellor's Office. I think the Chancellor's Office provided about almost \$2 million a year, which is most of our budget.

Being placed in an academic college did not result in the same level of challenges as observed at Penn State. Rather, becoming part of the Natural Sciences and Math division under the College of Arts and Science allowed the CSS program to find a home. The lack of challenges might result from the organizational structure of UNC-Chapel Hill, where the College of Arts and Sciences houses all STEMM departments participating in the CSS program, unlike at Penn State, where the STEMM colleges are independent entities. At UNC-Chapel Hill, CSS scholars must

pursue a degree in the following STEMM disciplines: Biomedical Engineering, Biology, Chemistry, Computer Science, Environmental Sciences, Geological Sciences, Mathematics, Neuroscience, Physics and Astronomy, Statistics and Operational Research. All of which fall under the College of Arts and Sciences.

Additionally, resource based challenges were mitigated for the CSS program because of the strong financial commitment from the Chancellor's Office and existing institutional initiatives aimed at providing an affordable education for students. At the time of implementation, 2013, UNC-Chapel Hill experienced Chancellor turnover, with the Chancellor who was a strong advocate and started the CSS leaving. However, the new Chancellor remained supportive of CSS and had the foresight to bypass major resource related challenges by understanding that resources can be a zero-sum game when starting a new initiative. The initiating Chancellor explained a commitment to prevent zero-sum outcomes:

I took my discretionary resources, almost all of them I had my first year and put them directly into the [CSS] program because it was my belief that I didn't want it to look like we were making it hard on everybody else. That [it's] not a zero-sum game. This was additional, this was excellence, you know? And so people weren't battling over it... no matter how good the program is, they need to feel like they're not fighting for their survival from the day they get going.

The Chancellor's financial commitment to the program allowed for a smoother implementation phase for the CSS program, which is in direct contrast to the case of the MLN program. This demonstrates that top level support is critical for programs as senior leadership is able to harness the power of their office to avoid playing the zero-sum game that arises due to finances.

The institutional context as it relates to college affordability is also in contrast to that of Penn State. Whereas Penn State is ranked as one of the most expensive public colleges, UNC-Chapel Hill has been ranked as a top ten best value public college by The Princeton Review as well as ranking second on the list of public universities for financial aid (UNC-Chapel Hill University Communication, 2023). There is a strong institutional commitment to providing an affordable education at UNC-Chapel Hill, as a participant explains:

We feel that [CSS] is especially important, and in fact, we've been known throughout the country for providing scholarships and resources for first-generation students, and also making sure that students from the various socioeconomic groups or from ethnic underrepresented minorities are in our pool clearly. It is a big part of our mission as one of the most public of the public universities, we like to say. We, public institutions, feel it even more as a mission to make sure that our citizenry and our young people are finding those places to thrive and learn... We started in 1789, it's the oldest public university in the country. So we definitely see our mission in its public way of educating the young people, not only of North Carolina but of the country.

This commitment to affordability benefited the CSS program as they were able to leverage existing initiatives to meet the demands of providing funding for scholars. A campus administrator explained how efforts to fundraise facilitated garnering the necessary capital to fund students:

UNC raises a lot of money for financial aid. So we just figured it would fold into our normal financial aid fundraising, and my understanding is that's what happened... I wasn't worried about that because of Carolina's huge financial aid budget and we raised a lot of

money for financial aid and that was all gonna work together. It wasn't like we had to go out and get a specific gift specifically for [CSS].

In addition to having a robust fundraising operation for financial aid, UNC-Chapel Hill had existing financial aid programs that they could utilize to fund scholars. For example, the Carolina Covenant is a financial aid program, started in 2004, that provides an opportunity to attend and graduate from UNC-Chapel Hill debt-free for students who come from families with incomes that do not exceed 200% of the federal poverty guidelines, based on family size (Carolina Covenant, 2023). Findings from UNC-Chapel Hill demonstrate that central administrative support can play a critical role in ensuring that programs do not experience resource-based challenges. Additionally, leveraging existing initiatives can facilitate the implementation process as it allows the program to utilize the institution's existing resources rather than having to divert resources from other programs on campus or find new funding streams.

Integrating the CSS and MLN Programs into the Existing Ecology of Scholars Programs

In addition to considerations on where the programs would be placed and how to fund them, program leaders had to integrate the CSS and MLN into an existing ecology of scholars programs. The MLN and CSS programs are unique in that they do not neatly fit under a binary of being either a scholars program or a diversity initiative. The MLN and CSS programs are about excellence *and* diversity, demonstrating that these two values are indispensable to one another rather than being antithetical. However, multiple challenges arose for the MLN program because existing scholars and honors programs had concerns that MLN would be duplicating their efforts. For MLN the primary challenge came from the long-established Schreyer Honors College and to a lesser extent the Button Waller program. Participants spoke about these initial tensions between MLN and the Schreyer Honors College:

Everything was hard 'cause it was new...something that should not have been hard, but a minor example of just cohorting the students and housing together. Even that was something that we didn't do unless they were honor students. Even the name, calling it Millennium Scholars. The Honors College is scholars. You can't call it "Honors"...and so there were stupid arguments about really things that don't matter...It's challenging building anything from the ground up, and it was little things like that that were hard.

Not only were there tensions amongst programs regarding using titles like "honors" or "scholars," but there was pushback in providing resources such as housing to MLN because that was reserved for Honors students. While duplicating efforts was a concern, participants perceived there to be clear distinctions between the programs, particularly in that Schreyer Honors has "a long history and massive amounts of funding and [is] not culturally responsive, we'll put it that way, not diverse at all, but that tension, it felt like competition when it shouldn't have been."

To address the perceived competition with the other programs, MLN had to showcase how they were unique. This required distinguishing itself as a program focused on preparing students for STEMM doctoral programs and through the implementation of the cohort model. A participant explains how the cohort model created distinctions between MLN and Button Waller:

There was a need to distinguish between the addition of the MSP versus the other scholars program on campus. So when they brought the idea back to the university, they didn't want these programs to be competing, right, what was the difference between the two programs? And it was clearly evident that the Millennium Scholars program would focus on a cohort model and ways to continue to recruit a diverse student body but to keep them as a cohort with the focus on them pursuing a PhD and then, hopefully, turning

around and coming back and diversifying the professoriate field within higher education, so there was a clear difference there.

Similarly, a participant explained the distinctions made between MLN and the Schreyer Honors College:

There was an ethos for our Honors program about being the best, I don't know if it was defensiveness or territorialism. I'm not quite sure what it was. [Our perspective was] we can literally defend that [MLN] is different by saying our focus is on preparing PhDs in STEM. And if we said that enough, the focus is on preparing PhDs in STEM, then eventually they'd say, "Oh, okay." And that is the wiggle room through it. If we said we're focusing on excellence or focusing on student, anything, cohorting, that was not sufficient, it was PhDs in STEM and then they're like, "Oh, okay."

The MLN program was arguably challenged by Schreyer Honors College because MLN was poised to become a premier scholars program. The objective of being a scholars' program infringed upon the territory claimed by "merit-based" programs that lacked diversity. This specific implementation challenge was rooted in the territorial culture of Penn State.

Diverging from the case of the MLN at Penn State, the CSS program did not encounter the same magnitude of challenges from existing scholars programs or DEI initiatives. Some participants expressed there were initial concerns about competing programs, specifically about infringing upon the established programs' brand. As explained by one participant:

The concept of the [CSS] program was a bit of a challenge because they had Morehead-Cain Scholars and they have this brand, and an organization, and initiative that's sort of seen as their top scholars group. So I think bringing another one on board was challenging.

While there may have been some initial concern about duplicating programs, this was seldom discussed by other participants. The main challenge communicated was related to competing programs focusing on similar goals and the risk of diverting resources, particularly within recruitment efforts. As a participant explained:

We got programs like the Chancellor's Science Scholars trying to target the same students, trying to build the same expertise, trying to provide support to students in terms of tuition or other benefits, and you're the new kid on the block [as a program], they want to be supportive but they don't want you taking their donors away. They know more about how to build the program than you do. Turf battles may be a little strong, but in actuality, those kinds of dynamics are all, in my opinion, almost the most important barriers to overcome at any university.

Participants at UNC, similar to Penn State, expressed that a major implementation barrier is learning how to navigate the existing ecosystems of programs and initiatives in an institution. The MLN program overcame this problem by carving out a niche through their specific focus on STEMM PhDs and being moved centrally to the Office of the Executive Vice President and Provost. Participants at UNC-Chapel Hill had concerns about the dynamics of integrating a program with similar goals into the existing ecosystem, however, they noted that this process was facilitated due to key differences in the CSS program. As one participant explains:

There was some concern with duplicating efforts and programs or the potential to steal resources from other programs that existed already. I didn't see it actually coming to fruition. The closest programs to what we have...there's a summer bridge program, but they're only a summer bridge. They're a summer transition program for students from North Carolina who tend to be from financial need sort of backgrounds and racial

minorities so they tend to be that group in that summer program. But rather than being a competitor with us, we actually collaborated with them to learn how they navigated the system to set up their summer program. We've interacted closely with them since...Another program that's similar where we were worr[ied] how we would co-exist, is the McNair Scholars Program, which lots of schools have. They targeted underrepresented minorities preparing them for graduate studies which is exactly what we wanna do. They just do it later on [in a student's career], and so, that wasn't an issue either...and actually we've had a few students overlap and be McNair scholars, so that wasn't a problem either. So there were some worried that those would be issues, but they never actually were.

The case of the CSS program highlights that it is possible to find opportunities during the early stages of implementation by leveraging support from existing programs. The CSS program was able to learn from an existing summer bridge program allowing them to set up their own. Similarly, they were able to find opportunities to collaborate with the McNair Scholars Program rather than having to compete.

The lack of competition with other scholar programs can be partially attributed to campus administrators' recognition that CSS was uniquely contributing to UNC-Chapel Hill. As one participant described:

We have programs that are sort of the top scholars programs in the university. We have something called the Morehead-Cain and we have an honors program and we have the Robertson Scholars. But we never had one that was focused on elevating science and elevating students from underrepresented groups at the same time. So we never had something like that. And [CSS] got elevated because each of the Chancellors that touched

this program did elevate it. They raised money for it. They did what they could, put their voice forward with this program. So I think that was an important difference. We never had something like this. We never [before] had students sitting in the front row [saying], “I’m a Chancellor's Science Scholar”. And [it’s] changing how faculty and students perceive students, [particularly] science-interested students of color.

As this participant reflects, prior to CSS, there were no programs focusing on both STEM and students from “underrepresented groups.” It is likely that the CSS program experienced fewer implementation challenges related to competition because there were no programs and initiatives focusing on the goal of advancing URGs in STEM. In the case of the MLN program, although there was no central program focusing on DEI in STEM, the STEM Colleges had their own DEI offices and initiatives. As such, the Penn State context and culture was more prone to competition for resources as there were many DEI initiatives, albeit in a decentralized manner. Moreover, participants at UNC-Chapel Hill reflected on their intentional decisions not to partner with other diversity initiatives on campus. As a participant explained:

The one thing that we did and probably it was done on purpose, though I'm not sure it was a great idea, is that [CSS] was totally separated from all the other diversity activities on campus. And that certainly caused some friction with a couple of the people who were running the other diversity programs on campus. In fact, I don't even know that they even knew what was getting set up. We worked through that some but my guess is that it's still potentially an issue. We got a bunch of resources, they had a bunch of activities going on that were actually very relevant to us that we didn't know anything about. They have an Upward Bound program where they bring in sophomores, juniors and seniors to campus, which is an ideal place for us to find people to recruit into this program from. And, it was

three years before we all got back together and a couple of our students were then participating in that program. It's something that didn't need to happen. I would've said [if] we realized and somebody had done a little more proactive [collaboration by] setting this all down together, when we started it, I'm sure we wouldn't have any problems.

While the CSS program experienced far fewer challenges compared to the MLN program in integrating into the existing ecology of programs and initiatives, findings suggest that this was the result of institutional context. CSS benefited from its novelty in being the first program to focus on URGs in STEMM. Additionally, intentional decisions were made to not partner with existing diversity initiatives from the start. While this decision led to fewer challenges relating to integration there were unintentional consequences such limiting access to a potential recruitment source like the Upward Bound program, even as the scholars program begins with recruitment of high school students.

This section examined the process of navigating program placement, setting up a funding model, and integrating into an existing ecosystem of programs for the MLN and CSS programs. Findings indicate that the institutional context and culture played a meaningful role in the extent to which programs encountered challenges or found opportunities to facilitate program implementation. The following section examines how the institutional contexts and cultures of predominantly white research-intensive campuses play a role in the extent to which a culturally responsive program is adopted. In particular, I examined which Meyerhoff model elements were more widely adopted and which ones faced the most resistance. Findings demonstrate that the more functional components were readily accepted such as those relating to funding or academics while program values faced the most scrutiny and resistance.

“The Meyerhoff Way” vs. The Cultures of Predominantly White Research-Intensive Campuses

The Meyerhoff model is a comprehensive STEMM intervention program as it offers a wide array of support and services to its scholars. The model applies a cohort approach where students come in at the same time and go through their collegiate experience together. The various aspects of the model are meant to complement each other, thereby creating a cohesive experience for students. For example, the summer bridge component is the gateway to the MAP programs as it is the first time they are introduced to what it means to be a scholar in their respective program and learn to embody the values of the program. The summer bridge component is when students begin to learn values such as the importance of collective achievement, discipline, and leadership. While the leaders of CSS and MLN were eager to replicate the Meyerhoff model there were various challenges they encountered as they sought to implement these wide array of elements and values. Not only did leaders have to navigate program placement, devising a funding model, and integrating into an existing ecosystem of programs they also had to implement program elements and values that were not the norms at UNC-Chapel Hill and Penn State. Therefore, adopting the Meyerhoff model with its 13 key elements, extensive program values, and four pillars of success proved to be a formidable undertaking. Figure 4.1 provides an overview of the Meyerhoff model.

THE MEYERHOFF MODEL

Four Pillars of Success

- High Expectations
- Building Community
- Faculty and Student Engagement
- Improvement through Program Assessment

Program Values

- | | |
|------------------|---------------------------|
| ■ Excellence | ■ Group success |
| ■ Inclusion | ■ Community |
| ■ Discipline | ■ Professionalism |
| ■ Collaboration | ■ Character and integrity |
| ■ Service | ■ Commitment to diversity |
| ■ Leadership | |
| ■ Accountability | |

13 Key Elements (Cohort Model)

1. Recruitment
2. Financial Aid
3. Summer Bridge
4. Program Values
5. Study Groups
6. Program Community
7. Personal Advising and Counseling
8. Tutoring
9. Summer Research Internships
10. Mentors
11. Faculty Involvement
12. Administrative Involvement and Public Support
13. Family Involvement

Figure 4.1: The Meyerhoff Model

Challenges of a Culturally Responsive HBCU Model

Findings suggest that program elements which faced the least resistance and thus were more readily adopted were ones that focused on more functional components such as the academic aspects of the program. Participants rarely spoke about components like study groups, tutoring, or research internships. Arguably, this is because they were not major challenges for the programs. However, elements that dealt with the cultural elements of the Meyerhoff model, particularly ones rooted in HBCU culture, were challenging. A Penn State participant explains:

When people read [the program elements] on paper, from the outside perspective, people are like, “Yep, check. We can do this. Study groups, absolutely. Tutoring, check.” All the elements seem very standard common practice. But when one really thinks about Meyerhoff and one really thinks about what needed to happen to really incorporate these elements, I would say that's where the growing pains were. What I mean by that is, Meyerhoff is rooted in Black culture, it's unapologetically embracing of the strength of

black churches, community uplift, [and] support. And that didn't come through [to adopters]. There were people who really kept trying to remind folks that this is what it was about, and that for it to be done well, there had to be people who really understood Black fraternity/Black sorority life, what this meant and these different cultural practices. So I would say here at Penn State, we were not prepared at all, or the folks were not prepared at all to really create an adaptation that really looked like Meyerhoff. I think it was really light when it came to anything around celebration, affirming, embracing of any identities that were non-white. Right? But it seemed like at the beginning the [program] director herself got it, and I think that's what really allowed a lot of this to flourish at the beginning.

One of the primary reasons why the cultural elements of the Meyerhoff model, particularly the ones rooted in HBCU culture, were challenging can arguably be attributed to the leadership team who brought the programs to UNC-Chapel Hill and Penn State. As the previous participant notes at Penn State the founding director hired was a Black woman who had knowledge of HBCU's, leading to better understanding of the Meyerhoff model and greater attention paid to ensuring these values were enacted. At UNC-Chapel Hill the original leadership team was composed of all white individuals. A UNC-Chapel Hill participant reflects on the challenges that emerged:

And then another big challenge was three white people started this program. We didn't really understand what we were doing, right? At least I'll speak for myself. I mean, I can't speak [for my colleagues]. I think our hearts were in the right place, but we just didn't really understand the challenges that our own students were facing.

In the implementation phase, the background and knowledge of program leaders played a major role in the extent to which they were able and willing to adhere to the values of the Meyerhoff model with fidelity. A participant at UMBC shared their insight on these challenges:

I think one of the great challenges that you have is more on the qualitative side. How do you make sure that the will is there? How do you change old attitudes and some that may be under the surface that people don't even recognize that they might have...I think that's the part of replication that oftentimes is not addressed, is oftentimes a little bit of a challenge, especially for people who think they're progressive. The quantitative, the observable measurable aspects of the program, I think, are more easy to replicate. The attitudinal, the implicit, the qualitative, that requires something like hermeneutics or ethnography to really get at are sometimes more difficult to replicate. You can oftentimes find a handful of people who are willing, able, and eager to make these kinds of changes, but you can find that others are not quite as ready or prepared.

While the background knowledge of program leaders played a role in the extent to which they were able to implement program values, perhaps equally as important were the institutional cultures of UNC-Chapel Hill and Penn State, which were at times antithetical to the values of the Meyerhoff model. When asked about the challenges to implementing a culturally responsive model that focuses on collective achievement, one participant answered, "Penn State is not based on that. Penn State is based on competition and my way or the highway, and I will step on your head to get where I need to go. It's very Western business professionally-based." Similarly, a UNC-Chapel Hill participant noted how the institutions' individualistic values were contrary to the collective approach of the Meyerhoff model:

One of the things that was challenging to implement in the beginning was this idea of group grading. Meyerhoff does that, particularly in their [summer] math class. There was very strong opposition to that from the leadership and they didn't want to do it because that's typically not the sort of thing that happens in classes at UNC-Chapel Hill. A lot of it is about individual effort and people becoming independent.

The norms of these predominantly white, research-intensive universities centered around individualism and competition rather than valuing collective achievement and fostering a supportive family-like environment, creating challenges for initial implementation. As these values were not the norms of these campuses in science they faced resistance. Furthermore, embracing these new ideals required a shift in mindset for the leaders and faculty working with these programs. A UNC-Chapel Hill participant explained:

At UNC we're trying to create something that really nobody had ever [had] any experience with, and in a different way of thinking about things, right? "Hey, somebody's not getting good grades, and all that means is that they're not studying hard enough." Well, that's not true, right? There could be a wide variety of reasons why they're not getting good grades and you have to really approach it from an entire student perspective, holistically, because that student brings their entire self to their academics, their entire self to that research and so you have to approach it from a broader direction. That is something that a lot of historical scientific training just doesn't take into account ... and so when you are just building things sometimes there's a bit of apprehension, 'cause keep in mind a lot of people that were involved with the program [in the beginning] were distinguished professor, and this distinguished professor, and this distinguished professor in that. All White men. All have [found] success in the normal way of doing things. And

now, we're saying, "Hey, in order to be successful, we're gonna have to do things differently." I think there's an understandable reluctance to that because they have found success doing things the historic, the old way, and now, we're trying to say, "No, no, no. That's not good enough. We gotta do things different." And so I think there's a lot of understandable pushback to that. And so, [there] was a little bit of difficulties [in] understanding ideas and concepts.

Implementing some of the Meyerhoff values and ideas required a complete shift in ideas and ways of thinking for individuals. Challenges arose because those implementing these programs had found success in the traditional norms of STEMM and academia. It was difficult to get faculty and others to understand the challenges that URGs in STEMM face and why values like collective achievement and building community are important for science success.

Challenges related to culture were particularly evident as the CSS and MLN programs implemented the summer bridge component of their programs. Summer bridge plays a crucial role in introducing scholars to the HBCU-derived values of the programs and practices essential for collective student success. Practices such as no cell phone usage, eating together, waking up early, and walking as a unit are meant to instill discipline in students and foster community. However, individuals at UNC-Chapel Hill and Penn State saw these practices as “military-like” and pushbacked against them. One Penn State participant recalls:

The Millennium Scholars Program is culturally very different [from] anything that we had at Penn State. And I can remember when I came back from our first visit to Meyerhoff, saying to our dean that, “We need a drill sergeant to run this.” There aren't a lot of drill sergeants among university faculty administrators (laughs). It's all a different kind of mindset. And so that kind of strict enforcement and regiment[ation] on Summer

Bridge was something that a lot of people at Penn State weren't ready for. In fact, one of the early reasons and problems that was brewing right when I came in is, we had two hazing charges brought against us as the program from a faculty member and a parent, separately. And that's part of this cultural [difference in approach]. So that was tough.

The mismatch between the “Meyerhoff way” and the culture of Penn State resulted in public accusations of hazing, exemplifying a clash in values. The institutional context of Penn State was primed to be wary of anything that resembled hazing as there had been negative incidents related to Greek life on campus, even as the origins and purposes were distinct. An article in an online student newspaper, “Penn State’s Double Standard on Hazing” (E. Hill, 2017), draws unfair parallels between fraternity hazing rituals and the discipline-based practices that the MLN program employed as they sought to replicate the Meyerhoff model. The article states:

Picture this: It’s nearing the end of fall semester. A dozen or so freshmen are pledging Oozma Kappa and nearing their initiation. It’s what the fraternity calls “hell week,” and it comes with its own set of rules. First of all, the pledge class must walk closely together, with no gaps in the line — and they know better than to get caught walking on the grass. They can’t use their cell phones during the day. Pledges are expected to open doors for women at every opportunity. Obligations are scheduled from 6:45 a.m to 10 p.m., so the pledges normally get just four or six hours of sleep each night by the time it’s all said and done. They must report to breakfast at the fraternity house each morning. And if the pledges don’t follow the rules set for them? Consequences vary from writing long essays about following the rules to pulling weeds. If the pledges were late to breakfast, the next day’s wake-up time was even earlier...

Penn State pledged to crack down on hazing after student Tim Piazza died in February from injuries he sustained during a night of alcohol-fueled hazing. The university has a zero tolerance hazing policy, and six Penn State fraternities are currently suspended for hazing. So why hasn't this fraternity been suspended yet, if its hazing activities are so well-documented? This is textbook definition hazing by the fraternity in question. Except it's not a frat at all. It's a university-sponsored honors program.

The author of the article interviewed MLN staff who explained that the practices in summer bridge are meant to build community among scholars in order to ensure they support each other in their academics as well as social and emotional well-being. Moreover, alumni of the MLN and then-scholars wrote letters to the editor to dispute the claims made (G. Richards, 2017; The first cohort of the Millennium Scholars Program, 2017). Program leadership navigated these accusations by trusting in the Meyerhoff model's record of success. A Penn State participant explained:

And we get questions like hazing, just hard questions that we've had to modify the program to just be very careful, you know? And some of that is reasonable, [but] some of it they just don't understand the leadership model. In terms of cultivating underrepresented PhDs in STEMM, show me another model that produces more. I'm open. But if you can't show me another model that produces more of them [than Meyerhoff], then this is the model, you know? This is the best practice, until you get a better practice. Therefore, I support the model and the process. And it's hard to explain to students, some get it, some don't. I explain at the end of the day, look at the other end, here's the product we're gonna produce [increased underrepresented STEMM PhDs]. To get from here to this product, trust us on this. It's all research proven, we've done the

homework on it and it does work. So, I try to explain to students that this is a different leadership paradigm, a different leadership model than you're used to, but it works.

In order to bypass tensions between cultures, program leadership and scholars had to take on an educator role whereby they explain the Meyerhoff model and demonstrate that it has a documented history of success. Beyond the cultural values of Meyerhoff, challenges also arose due to the strengths-based component of the model. In particular, programs had to work to shift existing assumptions that diversity and excellence are in opposition.

Challenges of a Strengths-Based Model

A central goal of the Meyerhoff program is to change perceptions, particularly of white faculty, regarding the potential of URG students. The Meyerhoff program has shown that diversity and excellence go hand in hand rather than having to compromise on one or the other. However, at UNC-Chapel Hill and Penn State some had the perception that the programs were about remediation or addressing student deficits because they focused on diverse students. A Penn State participant shared:

We talk about [MLN] as a strength-based [program]. One of the biggest challenges here was the perception anytime there were Black and Brown bodies that it was a program that was for subpar students and that it was about remediation. I recall I was at an event and it was some senior faculty and they were like, “And [an applicant] couldn't even get in, not even to the Millennium Scholars Program.” And so it was this perception that it must be some subpar program and again about remediation... [The program leadership], I don't think wanted to call it a diversity program [but wanted to]... frame it in a way that it really was about excellence. ... “Do not call it an X program, it is not about diverse” - sort of trying to hide that ... this is antithetical to what Meyerhoff is, right? Meyerhoff

unapologetically puts it in your face. Like, these are the best, these are going to be the best. They are leaders and here [Penn State] it was sort of like, "Oh yeah, they happen to be Brown. They happen to be Black. They happen to be women." It was sort of about the program first. When we talk about strength-based, they only wanted to highlight the academic strengths and they wanted to kind of hide that the groups were non-white people.

As this participant shared, there is a racialized notion that anytime a program primarily serves URG scholars it must be about remediation. This perception is directly at odds with the mission of the Meyerhoff model where scholars are both diverse and academically excellent. In order to successfully implement the strengths-based component and recruit excellent scholars, program leadership had to (re)educate individuals about the purpose and goals of the program. A UNC-Chapel Hill participant explained:

Oftentimes we know our faculty come in with these biases, with these strange concepts of excellence and race and gender and all of these things. [CSS is] trying to bring in the best students. [Faculty] try to sometimes [go with] the student who hasn't had a fair shake of it. But they might not be [a] good fit for our program, right? They might [not] even like science. So there'll be a student who's like, "I wanna be a lawyer." And then [faculty] will be like, "Well, but he just had such a tough life." I mean, we always wanna help people, but at the end of the day, we want scientists not lawyers, right? ... We are a program based on excellence, we gotta bring everybody in who's great, who love[s] science, who's got a passion for diversity and service and so on and so forth and bring them in. Like there's this concept that we are simply just a diversity program, and we are. But that's because excellence doesn't have a look, but it's hard for a lot of people. Because

think about it, they've been socialized through propaganda, through movies, through television, through literature, through a Euro-centric view of history that excellence and knowledge only looks one way. And we have to kind of train that out of them. But it's really hard...

The notion that "excellence and knowledge only looks one way" was a challenge that the programs had to work through and to a certain extent continue to work through. The MAP programs begin to change perceptions and address myths about excellence and diversity not being able to coexist. However, there is a lot of work that needs to be done in order to change perceptions of the broader campus community, and society in general. Programs face similar challenges when trying to recruit staff. A Penn State participant shared:

The assumption that [some have] is, we're only helping the students that are really poor, but not smart enough. I'm like, "No, you need to actually be really smart and your financial background doesn't matter." It's like, "Are you smart? Are you dedicated? And do you wanna be here?" We've been going through an interview process the past two and a half years to fill some of these [staff positions] that we've created. A lot of different people's perspective of our job, either internal candidates or external, are just "Oh, we're just gonna help all the people that we think are just really poor and they can't be here. And we're just gonna give them a leg up." And that's also a whole other problem. But you see that and you hear that, and sometimes within candidates, and also sometimes within faculty, and it's really explaining like, "That's not who we are. There's nothing wrong with being that either, but you need to understand the true values." ... There's just DE&I competencies that are lacking within professionals, as well as faculty at Penn State.

A central piece of demonstrating that diversity and excellence are not at odds is by recruiting, retaining, and graduating URG students who have been historically excluded from STEMM. Meyerhoff started as a program for Black males but has expanded to include individuals of all backgrounds. Yet, Meyerhoff has remained committed to advancing scholars who are the most underrepresented in STEMM fields, namely, Black and Brown scholars. In the initial years of the CSS and MLN both campuses had concerns regarding their ability to recruit a racially diverse cohort of students. The next section demonstrates that institutions' campus contexts played a role in advancing racial equity, however, program leadership's social identities and priorities also stifled commitments to racial equity.

Challenges to Commit to Racial Equity

All the campuses involved in the Meyerhoff Adaptation Project have had challenges with race and racism. This includes segregated higher education systems, severe underrepresentation of Black, Latinx, and Indigenous students and faculty, and racially charged "education violence" (Mustaffa, 2017). For example, *Adams v. Richardson* (1973) ruled that Maryland, North Carolina, Pennsylvania, and seven other states, continued to operate segregated higher education systems (Allen et al., 2018). The Meyerhoff Program's success is that despite the university's racial history, UMBC now produces the highest number of Black undergraduates who advance to complete PhDs in the natural sciences and engineering (Hrabowski III & Henderson, 2021). As a result of Meyerhoff's success, a key goal of the MAP was to understand if a Meyerhoff-like program could be successfully implemented at predominately white institutions with histories of racial exclusion and more institutional resources. Campuses explained how issues of race and racism persist today forcing programs to confront this. As a UNC-Chapel Hill participant explained:

It's not just within the past two years, it's not just within the past five years, it's the past 200 years, right? This is a historically white institution, and not just primarily white, historically white. So we're combating that history and that messaging, and trying to tell our students, "We know that this exists. We know that when you step outside, if you're not carrying your student ID, if you're not carrying your backpack, people may doubt that you belong here. They may question why you're walking on this campus. Even if you are doing all of that, they still may look at you and wonder why you're walking into a science lab, wonder why you're walking into our library. It's a public university. It's for all and yet, your place and space at this institution will be questioned and denied." And that's what I mean by combating. We are trying to tell [students] that that message exists, and tell them to ignore it because that message is not important, and it shouldn't be there.

Historical legacies of racism were and continue to pose a challenge in trying to recruit URG students, particularly at UNC-Chapel Hill. Beyond a campuses' history, their geographic location also created barriers in recruiting students of color. A Penn State participant shared:

...we're [a] PWI, kind of in the middle of nowhere in "Cornville", and depending on your background some of the students might not feel physically or mentally safe in this community and environment. Being a PWI, and the surrounding community as well, is a pretty conservative and rural area. So recruitment does become a challenge in a different way than I know some of my counterparts at UMBC [face].

Participants at UNC-Chapel Hill expressed similar challenges in recruiting racially underrepresented groups:

Thinking about underrepresented minoritized students who are, let's say Black or Native American students, I think there is often a lot of skepticism about attending an institution

like ours. For one, because there's not a large community of those students on our campus. We have at Carolina, a few very large native populations and they tend to go to institutions where there are more native students. So like UNC-Pembroke is an example. So I think there are some challenges for our campus to diversify because there are more critical masses of students [of color] at other campuses.

The institutional context and history of UNC-Chapel Hill proved to be challenges in their efforts to meet the Meyerhoff value of advancing racial diversity in STEMM. Moreover, both campuses feared that they would face legal challenges if they explicitly included race in their recruitment efforts. A campus administrator described how legal concerns resulted in their decision to focus on “diversity” rather than racial underrepresentation:

[When recruiting there are] three things [the] Millennium Scholars [Program] is looking for. They're looking for students who are interested in [getting] a PhD, interested in any of the STEMM fields, and interested in diversity. We don't want to get sued (laughs). So, we don't want to say we're interested in underrepresented students, because that will get us in trouble. You know, we'll get a court case from someone who's not underrepresented. So we just say someone who's interested in diversity.

Similarly at UNC-Chapel Hill campus administrators sought to mitigate any legal challenges:

[The Office of Admissions] work[ed] with people to help them understand why no matter what the model was at UMBC for selection at UMBC, [UNC-Chapel Hill] because of its own legal environment, couldn't have a program that was limited to students who identified as Black or Latinx. And just really helping people see why it was in the program's interest for it to be grounded as solidly as it could in what the university's lawyers understood the law to be, so that we could keep it going over time instead of

having to spend all the money that we would spend running the program, defending the program from a lawsuit.

The explicit recruitment of racially underrepresented students was hindered by campus contexts, histories, and the concern of potential legal challenges. However, in the case of the CSS, program leaders also played a critical role in determining the types of students to target to meet the mission of diversifying STEMM. Early challenges at UNC-Chapel Hill centered around figuring out the “clunkiness” of recruiting diverse students given the multitude of “ways to be underrepresented in STEMM,” such as being a woman, first-generation, and/or low-income. Leadership at UNC-Chapel Hill initially decided to focus on white students from low socio-economic backgrounds, which diverged from the intended mission of Meyerhoff. A participant recalls:

One thing that was a bit challenging for our campus was the notion of who should be in the program. [In] the Meyerhoff Program, when you look at the pictures there's a very clear demographic that you can see. Right? It's visible. For us, there was a weaker inclination to go after students from clearly [historically] underrepresented groups. So specifically targeting African-American, Hispanic students, or Native American students. There was some reluctance to do that. [Early program leadership] were trying to focus a bit more on students from low-income. [In] the first few cohorts [there were around 50% underrepresented racial minority students]. After [a shift in leadership] we bumped those numbers up to around 70-something percent. We started to increase the numbers of underserved students from ethnic and racial minorities.

A UNC-Chapel Hill participant further spoke about the reasoning behind having a large emphasis on white low-income students:

There was a group of leaders who ran the program, all of them were old white men. And so, they had these ideas about the sort of students that they could understand, that they could resonate with, that they could connect to. One was particularly vocal about this. And we want the poor white kids too in the program, which is totally fine. I'm good with that, but there was a very strong emphasis for that particular demographic. So, that's sort of where it came from. It's just basically who was running the program.

The case of CSS demonstrates that leadership priorities can actively shape the degree of adherence to model values. While low-income students are an underrepresented group and thus contribute to diversifying STEMM, this clearly deviated from the values of Meyerhoff which are to meaningfully advance racial and ethnic minorities in STEMM. While campus contexts and legal challenges pose real barriers to the recruitment of racial and ethnic minorities it is also the case that leadership can find ways to address these challenges. This is evident in that the number of racial and ethnic minorities increased for the CSS when there was a shift in leadership.

This section has examined the Meyerhoff elements and values that were most challenging for partner campuses. Findings demonstrate that campuses were most challenged by the HBCU derived values of the Meyerhoff model, conceptions of diversity and excellence, and how to approach commitments to racial equity. More broadly, this section has examined the multitude of challenges that the CSS and MLN programs encountered during the implementation phase. But, also highlighted some of the ways that the programs worked through these challenges.

The following section examines the different adaptations made by the programs (addressing the second research question), the reasoning behind these modifications, and the mechanisms that ensure they remain committed to maintaining fidelity to the Meyerhoff model.

Not a Cookbook Approach: Adapting the Meyerhoff Model to New Institutional Contexts

Adaptations are important to examine because they permeate the entire life cycle of SIPs. Guided by the concept of mutual adaptation (Kezar, 2011), in addressing the second research question, this section will show that adaptations are a mechanism that can help facilitate implementation by adjustment and integration into the institutional context and culture, ensuring that programs are more widely accepted.

Mutual adaptation is a “change process that is flexible and negotiated between the developers and teachers, and its design reflects local needs but still holds true to the nature of the innovation” (Kezar, 2011, p. 241). Mutual adaptation is achieved through three mechanisms: deliberation and discussion, networks, and external support and incentives. Through deliberation and discussion organizational members learn about an intervention and begin to understand why change is needed. Deliberation and discussion lead to creating ownership over an intervention and ignites internal motivation helping to mitigate resistance, particularly when an intervention is mandated from an external source. Networks create access to organizational members with similar goals serving as a support system that can provide strategies or resources to navigate contextual challenges. Lastly, external support and incentives provide the material resources needed to help implementers sustain change such as funding, awards, and recognition.

The concept of mutual adaptation is important to this study because it helps to examine adaptations and program fidelity as a dynamic process rather than a static construct. Findings will demonstrate that the adaptation process of the CSS and MLN programs reflected a mutual adaptation approach as the MAP provided the partner programs with an opportunity to deliberate and discuss, provided external support and incentives, and supplied the necessary networks to improve practice.

Key to the “experiment” aspect of the MAP was ensuring that partner campuses adopted the entire Meyerhoff model. Many campuses had tried to replicate Meyerhoff by taking pieces of the model but no campus had adopted the entire model until the emergence of the MAP (Hrabowski III et al., 2019). For this reason maintaining high fidelity to the Meyerhoff model was a key goal of the replication process. Though the CSS and MLN started as replication of the Meyerhoff model, many realized that a strict replication was not possible, but rather an adaptation of the Meyerhoff was needed. When asked if the CSS and MLN programs were meant to be a replication or an adaptation a UMBC participant shared:

If you look at our original first year application, it was replication. The question we posed is can you replicate Meyerhoff outcomes? Now that doesn't mean that every aspect of the program will be exactly like Meyerhoff. There are many, many, differences, especially in the way the program[s] started up...So when we talk about replication, we said, "These are the key things that Meyerhoff does." And we said, "Fill in what you're going to do to try to achieve those goals" And what those two schools both did is, in almost every case, they said, "We're going to do the same thing." In some cases, they said they couldn't because of just the environment. And so they said, "We'll do something a little different" So if you want to call that adaptation, you can. But our goal from the beginning, the big picture goal, [was] can you replicate Meyerhoff outcomes at a school that's much different from UMBC?

The institutional context and culture of campuses posed barriers to enacting a strict replication of the Meyerhoff model. Moreover, some participants noted that there were varying opinions on whether a strict replication was the right goal to have. Many participants saw adaptations as

necessary because implementing STEMM intervention programs is not done through a “cookbook” approach:

I think listening, learning, being open and realizing that it's not a cookbook, it's not a recipe. I firmly believe that these programs have to be tailored for your students, your staff, your faculty, your university campus. You can take these components and they will transfer, but somehow you have to tailor them I think to be your very own. We learned we had to tailor our own Meyerhoff program. It began for African American males, right? A year later, we opened it up to females. We listened, we learned. I think that's an important part of any replication, the ability both to be flexible, to understand the complexity of these programs, to take the best, and to look and say, "What will work at our campus and how can we make it our own." I think going into it as [if] it's simply a cookbook and a recipe, and you take a little bit of this and a little bit of that, measure it out carefully, and you'll have success is probably a tad naive and may actually limit the level of success you could have.

While adaptations were seen as a positive by some, others had differing opinions. More specifically, some saw these adaptations as a means to carve out a unique program identity leading the CSS and MLN to not be Meyerhoff programs. A UMBC participant explains:

Then at some point it turned into a Meyerhoff adaptation, and that also changed the scope of what it was. I would say now, from my perspective, you have two really strong programs that are entering their 10th year, but they're not Meyerhoff programs. They have some similarities to Meyerhoff, but they've [created] their own niche at their institutions. And for some, that is success.

Interestingly, participants at all three campuses shared the sentiment that the CSS and MLN programs are not Meyerhoff programs but rather their own programs. While the CSS and MLN programs were started using the Meyerhoff model many agree that they are now their own entities with their own identities and brand. A UNC-Chapel Hill participant explained:

While we are a Meyerhoff adaptation program, at this point we are our own unique program now... while a lot of people call us Meyerhoff adaptation programs, I don't necessarily know that is the best description of us now because we are the Chancellor's Science Scholars program... I think innovation is important, right? Adaptation is great but I think innovation is more important because the Meyerhoff, they innovated. And yeah, it is good to adapt, it is good to replicate but if you are to do what Meyerhoff does then you can't leave out their innovation piece. They innovated; you too must innovate. Don't just emulate, because the Meyerhoff program, they're not imitating anybody, they're not emulating anybody.

As explained by participants, the CSS and MLN programs employed modifications to the programs in order to adjust to their campus context but also to create an individual program identity. Though there are differing opinions on whether the CSS and MLN programs can truly be considered Meyerhoff programs, participants agreed that adaptations were necessary to ensure that the Meyerhoff model could live in a new context. Moreover, in line with the mutual adaptation approach, participants noted that adapting the programs allowed for a sense of ownership leading to increased buy-in from scholars and staff:

Prior to having our established identity, I would definitely say we were trying to be like Meyerhoff. Now, we definitely have our own Chancellor's Science Scholars [identity]. When we were establishing identity, we didn't have things like program values quite

established yet. We didn't have things like a motto, we didn't have things like vision statements, like what we were working towards. A lot of that was just pulling bits and pieces from Meyerhoff. And so we always framed it in the light of Meyerhoff, right? That made it hard to get staff to buy in, in my opinion, but also get students to take program ownership. One of the things that [the new Program Director] had done when he took the helm was to sit down and really establish what's our vision, what's our mission statement, what are these values that we talk about, when we talk about who we are as a program? What do we want our students to take away from this experience, from their scholarship program? That's a sense of leadership, of accountability, of striving for excellence. That's what I mean by identity, is that we are based on the Meyerhoff model, and we have those elements of Meyerhoff, matching them, but in our own language, in our own interpretation, and taking ownership of them so that we can understand them and take pride in that.

Making adaptations to the Meyerhoff model allowed for fidelity to the model while at the same providing the programs with the opportunity to do it in their own language or as others put it, “add their own flare”.

Though UMBC and HHMI valued a close replication of the Meyerhoff, in the beginning, they also recognized that the Meyerhoff has gone through its own adaptation and evolution process throughout its life cycle. A UMBC participant reflected:

They weren't recreating Meyerhoff 1.0 they were recreating Meyerhoff 20 point something (laughs) right?... They weren't trying to start with the small number of interventions and components that we had in 1988, they were doing the things that we were doing with a staff of eight people. That was tough to see.

The following sections will examine some of the primary modifications made to the Meyerhoff model. Following the FRAME (Wiltsey Stirman et al., 2019) I find that modifications to the Meyerhoff model were primarily a result of the organization/setting (institutional context and culture), providers (program leadership), and recipient (student requests). Though I follow the FRAME to more systematically track adaptations, I find that the reasoning behind modifications did not necessarily fit into neat boxes. Rather, modifications were often the result of a combination of conditions involving the campus culture, student requests, and leadership's willingness to change. Furthermore, the adaptation process was informed by deliberation and discussion, networks, and external support and incentives.

I find that there were three primary ways that fidelity-consistency and accountability was maintained, namely through the partnership with UMBC, accountability to HHMI, and the values and actions of program leaders. Findings suggest that adaptations can lead to positive outcomes which contribute to programs being integrated into the campus context and resulting in a greater likelihood of being sustained. However, the adaptation process also proved to be iterative, requiring continuously fine tuning the program in order to navigate mistakes made that led to negative outcomes for scholars.

Adapting Academic Requirements

While the Meyerhoff program requires scholars to maintain a 3.0 GPA to remain in good standing, the MLN program found themselves needing to raise the GPA requirement in order to fit within the institutional culture being driven by the existing honors program. In particular, leadership was worried that a program of primarily URGs would be perceived as deficient if they did not uphold the same level of academic standards as the Schreyer's Honors program. A Penn

State participant recalls how the MLN program had to adjust their GPA and academic requirements to gain credibility:

I think another challenge when you try to do Meyerhoff, [is that], [Meyerhoff] presents the image that [they] are an academically elite program, [and they're] pushing [their] students to the PhD. At Penn State, in order to get that same effect, we had to measure ourselves against the current model that fits that description, and you've got to stand against that model to say you're equal, or you're better and [at Penn State] the Schreyer Honors College has that model or has that that brand. Schreyer Honors College requires an undergraduate thesis and Schreyer Honors College requires a 3.4 GPA. In order to compete in this environment we had to take on some of the culture of the Schreyer Honors College, to garner the same brand or the same credibility as the Meyerhoff Program had. So the Millennium students have to write an undergraduate thesis, unlike Meyerhoff Scholars. Millennium, when it started, I think they were on a 3.4 GPA, which my argument was, even if Schreyer does it, it's apples [to] oranges. We're all those things, but we have a different model than Schreyer, but that was hard to make people understand. Since that time [the GPA requirement is] now a 3.0.

The need to adapt academic requirements to meet or exceed the standard of the Schreyer Honors College speaks to a broader institutional and societal culture that views URGs, particularly Black and Brown students, as deficient. The decision to increase the GPA requirement and add an honors thesis component was made by early leadership as they were trying to adjust to the institutional culture of Penn State. After a shift in leadership the GPA requirement was lowered to 3.0, mirroring Meyerhoff. A participant provides some background:

And the individuals who began the program, I am of the opinion that they were familiar with STEMM, but they were not as familiar with diversity in STEMM and what the politics of that is about. Some things I think surprised them, which did not surprise us. How come our students aren't viewed as bright as the Schreyer Honors students? Even though [MLN] GPAs are higher, even though they're publishing scholarly work. I remember at the very beginning it was [a] 3.5 GPA [and] they were gonna take your [scholarship] money [if you dropped below the GPA requirement]. I was like, "Schreyer's only 3.4, why would you do 3.5?" And the response I got is "we wanna be better". But why are brown people always asked to do more work?

The modifications to the GPA requirements for MLN scholars exemplify that adaptations are an iterative process shaped by a confluence of pressures. The decision to adapt the GPA requirement was first made to compete and assimilate to the standards of the institutional context and culture. While the following adaptation to reset the GPA requirement was primarily driven by a new Program Director who had more experience in STEMM education and diversity and understood that the requirement was harming the URG students that the program aimed to help. This example demonstrates internal deliberation and discussion as organizational members were able to speak to each other about previous decisions and make changes to benefit scholars.

At UNC-Chapel Hill there was resistance to implement some of the academic components of the summer bridge program. Despite the documented success of the Meyerhoff Scholars program in advancing underrepresented students in STEMM, UNC-Chapel Hill's institutional ranking led to perceptions that their students were unique or more "sophisticated" than UMBC's. As such, programs made decisions that resulted in unintended academic consequences. A UMBC participant shared:

I had the opinion sometimes that Chapel Hill was sort of like we don't need to do all of that, particularly some of the academic things. Even later on we would talk about some of our practices in Summer Bridge about math and the chemistry workshop and why we did these things; and not that they were remedial, but the students needed support and they needed to check their skills and they needed to strengthen their skills. And we would hear things about how folks [at UNC-Chapel Hill] weren't doing well in math or chemistry. I'm like, did you do the chemistry workshop? Like no, okay (laughs). Okay. There's a reason why we do these things. I mean everything was there for a reason and you just kinda got the opinion sometimes like "Oh well maybe they do it at UMBC but we don't do it at Carolina." Overtime they did come back and institute some of those [academic] components and practices. But, I got that people really [did] want the students to do well and they did care.

UNC-Chapel Hill's reputation as a top university led to perceptions that the scholars they recruited were not in need of academic support like chemistry workshops. Ultimately, program leadership implemented the chemistry workshops to the summer bridge component, demonstrating that continuous adjustments are necessary to the success of the programs and scholars. Though the CSS and MLN programs faced some consequences in their adaptations there were also instances where adaptations lead to positive outcomes. For example, programs made adaptations and established additional practices to advance diversity, equity, and inclusion at both campuses.

Adaptations that Enhance Diversity, Equity and Inclusion

Findings reveal that adaptations can also be a mechanism by which diversity, equity and inclusion is promoted and enhanced. Perhaps the most controversial aspect of the Meyerhoff

model is the practice of men holding doors open for women. This gendered practice faced much scrutiny at both UNC-Chapel Hill and Penn State. While some were against the practice from the start others who came from a more traditional background were willing to attempt to implement this practice. Ultimately, both UNC-Chapel Hill and Penn State did not retain the practice of men holding doors for women and Meyerhoff has also ended this practice. A UNC-Chapel Hill participant shared how they adapted this practice to make it more inclusive:

The Meyerhoff Way, one of the big things was... all the women go first. For everything. So through all the doors, to get food, all that stuff, women first, which is how I was raised and so I'm like I get it. I'm fine with it, but it started to become really tricky as we started to get students from the LGBTQ+ community, some of who are non-binary, and/or some students who were trans...and then they're put in a situation where ... they have to figure out how to fit into this binary that we set up ... What we ended up doing instead was whoever's first to the door holds the door for everybody ... It was really about just general cordiality and being courteous to the people around you and aware of them and just respectful in general. We didn't genderize it in any way. So that was like an early distinction that we made from the Meyerhoff program, which Penn State also did that, and Meyerhoff ended up adapting and they replicated that from us, right. (laughs)

Similarly, Penn State participants explained concerns and challenges that they faced in trying to enforce these gendered practices:

And so I think the way that Meyerhoff has done it has actually been very challenging. We've had to no longer continue to have men open the door. It's really being more inclusive in that way. We also have [the legal department] that looks at us in a different way that I know UMBC does. The year that cohort five was going through [summer]

bridge there were a lot of issues, that sometimes people felt segregated, and people felt isolated, and people felt targeted in multiple ways, based on some of the philosophical principles that UMBC had. And so that'll be like the men opening the doors or consequences not being fair and just and logical in the way that they were.

Both UNC-Chapel Hill and Penn State adapted this aspect of the Meyerhoff model in order to be more inclusive. In particular, these changes were a result of an influx of students who did not conform to traditional gender roles and identities. While many saw these practices as outdated, they were remnants of the history of Meyerhoff. A UMBC participant shared some historical context on this practice and how they have evolved overtime:

We've seen much more openness about sexual and gender identity among our students... Our first transgender student really helped us walk through some things, because we had a lot of gendered practices. We ended up doing a session in [summer] bridge one year, because we realized we needed to contextualize some of the history and legacy of Meyerhoff. It wasn't out of discrimination. It literally was out of 19 black men showing up in a space that was designed for white men, and them having to have, quote unquote, you may think of them as identity politics, values and cultural appropriations and practices. But they had to show up and have the norm of behavior and pull chairs out for women and open doors, and not be the first person to bum-rush a buffet. Dress appropriately at all times. We showed [current scholars] pictures of the [first cohorts]. I said, "You never see pictures of them in shorts and T-shirts and caps." And said, "That was for a reason." I said, "That's not coincidental." ... The values are still in place, but [how we] institute them now have to become different because of understanding and being mindful of the full diversity of our student population.

Many of the HBCU derived practices of the Meyerhoff were a result of trying to navigate a larger racial structure that diminishes the agency of people of color. As Ray (2019a) explains “Racialized organizations shape habitual actions, as employees are expected to defer to customers, employers, or the public. Racialized organizations also constrain agency by limiting people of color’s range of emotional expressions” (p. 37). As the previous participant describes, the earliest cohorts of Meyerhoff had to engage in the politics of respectability (Sengupta-Irving & Vossoughi, 2019) in order to change the perceptions of white individuals and be accepted into predominantly white spaces. As Sengupta-Irving & Vossoughi (2019) explain, the politics of respectability function as “... a demonstration to white people that African Americans can be respected (and respectable)” (p. 481). The first cohort of Meyerhoff scholars had to “dress appropriately” and “pull chairs out for women and open doors” because they would be judged or (re)affirm stereotypes that white individuals had if they did not engage in these practices. Thus, scholars’ agency was diminished as they had to shape their actions to gain acceptance. As a participant explained Meyerhoff ended up adapting their own practices to mirror those of the CSS and MLN, demonstrating that access to a network such as the MAP allows for an exchange of ideas that can aid in being more inclusive.

Beyond adapting practices of the Meyerhoff, the CSS and MLN programs also incorporated more explicit work on issues of diversity, equity, and inclusion. A UMBC participant explains that explicit programming on DEI issues was a deviation from the model:

I think some of these campuses really had more [of a] sense [that] we need to do a lot of consciousness raising. We should do a lot of training. We need to do a lot of radicalizing. We need to do a lot of work. And at UMBC ... there's not as much explicit programming on culturally responsive. I think it's all done in the style that they do things. I mean, they

are incredibly culturally responsive, but I don't think it's programmed at UMBC. I think it is implicit in the talents and the commitment to the people. I think some of the other campuses wanted a lot more explicit work on race and gender. And I think there was a tension there because that's not the UMBC way to do a lot of explicit programming on race. It's all through the style and the way you do things... And the other campuses wanted to just focus a whole ton on that and make that be a central piece of it.

Both UNC-Chapel Hill and Penn State decided to do more explicit programming relating to DEI.

A UNC-Chapel Hill participant shared some of the DEI work that the program is engaging in:

The programmatic aspects, some of the things that we've changed [are] the workshops on gender identity, the workshops on sexuality, the LGBTQ+, the training on sexual violence and sexual assault. Those are all new to our programs. Those aren't things that the University of Maryland at Baltimore County was doing. But we thought it's important.

Findings indicate that the explicit work on DEI was a response to hostile campus culture and contexts. This is not meant to imply that UMBC does not have their own challenges with race and other equity issues. Rather, findings suggest that racial issues and other DEI issues are magnified at partner institutions due to their predominantly white contexts and historical legacy of exclusion. In order to combat these issues the programs had to work toward providing additional support for URGs, as a participant shared:

Penn State's climate and culture, it's racist, it's sexist. We've had problems. There's report after report around how hard it is for faculty. For how faculty experience this climate. And so one can imagine then that's sort of magnified at the student level because the student population is also very homogenous. I think we're what, like 80 something

percent white and then spackled in there are other groups and some of our higher populations are international students... And so several of the Millennium Scholars and just many other scholars of color have experienced really kind of hostile situations here and hostile environments in the classroom. They've had to over the years incorporate more opportunities for students to talk about these different experiences.

These DEI challenges were even more prominent on the UNC-Chapel Hill campus due to their historical legacies of racism and white supremacy. A UNC-Chapel Hill participant explained:

We have a lot of things to deal with such as Confederate monuments that other universities don't have to deal with. And because of that our students in our program have been put on a platform and leadership positions in which we're able to voice and advocate to our Board of Governors, Board of Trustees, the president of the UNC System, exactly how we feel and exactly how this affects us. And ultimately it results in Confederate monuments being torn down. Their pedestals being completely removed from campus despite the pushback from politically and the pushback from white supremacists and neo-nazis. These are all things that we actually have to deal with...Right? I'm talking about marches on our campus by white supremacists with Confederate flags.

The CSS program in particular has taken a more active role in fighting back against issues of racial injustice. CSS scholars and leaders engage in activism work such as protesting and putting out statements on issues such as police brutality, the confederate statue Silent Sam protests, and the tenure case of Nikole Hannah-Jones. While the program's campus context certainly contributes to the need to be more activist oriented, this value is also embodied by program leadership. A member of the program leadership shared:

I really like to push the envelope and like let's get some revolution going here. And other people are not that way. They're much more moderate and want like, "Oh yeah. Let's just ask people nicely to do these things." And I get that to a point. But you know that's why change is slow around here.

While adaptations and additions to the Meyerhoff model are largely driven in response to the campus context and climate, program leadership can also play an active role in shaping the values of the program. For UNC-Chapel Hill in particular, the program leader's values have helped to facilitate a greater focus on issues of diversity, equity, and inclusion.

Adapting Program Values, STEMM PhDs

Both campuses have relaxed the Meyerhoff value of having scholars pursue STEMM PhDs, which is a foundational component of the model. The Meyerhoff program seeks to advance students of color to STEMM PhDs because it would lead to diversifying STEMM faculty and cultivate more diverse science leaders (Hrabowski III, 2015). Early research demonstrates the stringent commitment Meyerhoff had to this value as they explained "Beginning at the recruitment phase, the shortage of African American science Ph.D.s is discussed, and the importance of achieving a research-based Ph.D. is emphasized. An M.D. degree is considered a disappointment given the program's focus on producing Ph.D. level researchers, and students know this" (Maton et al., 2000, p. 633). A UMBC participant shared some contextual information:

And what the Meyerhoff program does, is there's lots of programs and lots of schools where people stay in science, but most of them go to med school. I say that as if it's a bad thing (laughs). It's the best thing in the world that we're diversifying our doctors. But what makes the Meyerhoff program special is that it's getting people who come from

backgrounds where it would be the best thing in the world to become a medical doctor... And so it's really challenging to get these kids to stay in the PhD and to stay with physics, and to stay with math, and to stay with biochemistry. I mean, it's a big deal to do that at the PhD level, and these programs do it... of course now because the program has a reputation and they want to live up to it, but at the beginning they somehow have to get those students to buy into the PhD.

One of the novelties of the Meyerhoff was its dedication to helping URGs obtain STEMM PhDs. As previous findings showed, the MLN program was able to carve out a niche at Penn State by grounding itself in the mission of helping scholars pursue STEMM PhDs. This value separated the MAP programs from other scholars programs and other STEMM intervention programs on campus. For UNC-Chapel hill adaptations to this core program value was primarily a function of the institutional context and the type of student they attract. As many participants shared, UNC-Chapel Hill's medical school presence affected the extent to which they could fulfill the mission of sending underrepresented students to PhDs:

I think one thing that is a challenge and continues to be a challenge is that we also have a very excellent medical school on our campus. Many of our STEMM undergraduates come to Carolina wanting to be doctors, to be medical doctors. There's a bit of tension about that in terms of, is that an acceptable outcome for scholars to go into a medical degree, where the program was really intended to diversify the doctoral program, right? Like to [eventually] have professors who are underrepresented faculty members. Of course the ideal situation would be that they get MD/PhDs and do that work. But, I think that it is tough when you live in a state with such a reputable medical school and especially when so many STEMM students really see the profession of being a doctor as

a very prestigious one and not necessarily understanding really what a PhD is and does. I think that can be very challenging to change direction or course.

As the CSS and MLN programs have evolved, they have begun to expand their thinking on the mission of these programs, which has led to some tensions. On one hand, these programs were started to diversify STEMM faculty, which means that deviating from this would diminish these stated goals. On the other hand, as a participant stated, “it's the best thing in the world that we're diversifying our doctors.” Moreover, the severe underrepresentation of students of color in STEMM needs to be addressed on multiple fronts.

Leadership priorities and accountability to funders also shaped the extent to which this value was adhered to. A Penn State participant shared:

Now that we've moved away from HHMI, it seems to have morphed again... I think there's still an emphasis on getting students into PhD programs, but since we're not being funded by HHMI, I think the idea is we just want to get students so that they're prepared for graduate school. And if that means masters programs, if that means they move into MD programs, that's a really positive thing as well.

The CSS and MLN programs are evolving and shaping their own identities as they have moved away from grant funding. Leadership priorities have also shaped fidelity to the original program mission. A participant at UNC-Chapel Hill shared that though they aim to support scholars toward the PhD, what matters most is helping scholars achieve their goals:

A lot of our students end up in research labs where they're very well-supported, people are trying to help them get publications. So, they get published research articles... They do a good job with helping the students explore who they want to be as a scientist. Then we help them get into whatever programs they want to try to get into. They are inclined to

go more to medical school, we'll help them with that too. It doesn't matter that much, all right. I mean, we say we want them to go to grad school with PhD's but, they are our kids. We love them and we want to help them do what they want to do.^[P]_[SEP]

Programs that seek to adapt a Meyerhoff-like program need to consider the mission that they are trying to achieve as this determines the level of fidelity they must have to the model. If a program aims to diversify STEMM in general, then deviations from the mission would facilitate this goal. However, if programs wish to work toward creating more diverse faculty members they must remain committed to having students pursue PhDs in STEMM.

Adapting Program Values, Commitment to Diversity

Prior findings demonstrated that the CSS and MLN programs have had some challenges as it relates to advancing racial equity. A core value of the Meyerhoff program is a commitment to diversity with a particular focus on racial and ethnic diversity. Both the CSS and MLN programs have adopted a broader understanding of diversity when it comes to the recruitment of scholars. In part due to legal battles over the explicit recruitment of racial and ethnic minorities and their campus geographies, programs broadened their commitment to diversity. A UNC-Chapel Hill participant shared:

The mission of the program is still to diversify STEMM research and other STEMM careers. I think given the school that we are with that vision of who brings diversity is a little bit broader. Just because [of] our population. We're not Meyerhoff, we're not attracting the population of African American students that they are to UNC-Chapel Hill. We have a relatively large Native American population in North Carolina with the Lumbee tribe. We have a lot of Hispanic students that come into our program. If you were to just look at a picture and see the faces it wouldn't necessarily look like a

Meyerhoff. But I believe that we are still fulfilling that mission within the state where we are, just kind of in some different ways [such as] gender diversity, sexual orientation diversity, things that you wouldn't necessarily see when you look at a person. So I think that we are still following the mission, given the parameters of where we are.

Participants explained that though the programs did not necessarily “look” like a Meyerhoff they were still striving to advance diversity, often in ways that were not visibly apparent. Namely, the programs lack the number of Black scholars that Meyerhoff is able to attract and enroll in the program. Many participants noted there are a multitude of ways to be underrepresented in STEMM, which means committing to diversity does not necessarily look one way. Participants at Penn State also shared that their understanding of diversity has evolved:

Some of the philosophical approaches to selecting students has been really a push to be like, "We need to make sure students look this certain way and come from this certain background." My perspective is very much DE&I. So I've always pushed alternative ways of looking at people or understanding people. Not everybody had the same philosophy, which is fine. But I would say it's got a mix of some people seeing it as larger and holistic and some people having a more specific definition of what diversity is, and all of us coming together, and trying to select that one student. Over the years it's morphed and changed. I also can't deny what has happened in the past year and a half in our culture, that has actually changed some people that we work with directly or indirectly, their own mindset of diversity and inclusion. And so I have seen people grow and change in different ways. And I am not just talking about people I work with directly. I'm also talking about some of the colleges we work with that also influence the students we have. Not everybody had the same mindset, so we found there was a political

conversation sometimes to figure out who we want, who we don't want, and what is diversity and inclusion and equity.

As this participant notes, conversations regarding diversity can be multifaceted as there are differing perspectives regarding what constitutes diversity. When selecting students at Penn State, it is a collaborative process that involves program staff, faculty, and college leaders, with everyone bridging in their own values and ideals regarding diversity. Through deliberation and discussion programs are expanding their understanding of diversity and making some adaptations to this program value. There is no clear answer whether having a more expansive view of diversity is the right or wrong goal to have. As in the case of prior adaptations, these modifications are contingent on program goals and the values of program leadership.

Adapting to Student Requests

One of the ways that the Meyerhoff model fosters a cohort and builds community among scholars is through its residential component, requiring students to live on campus together for four years. Participants shared there were challenges to implementing this living-learning component at both UNC-Chapel Hill and Penn State. A UMBC participant recalled the misalignment between residential living and UNC-Chapel Hill culture:

I think having a model where students live together was challenging. That seemed not to be a Carolina value. That's what we kept hearing again and again. "That's not the Carolina way", "that's not a Carolina value." There was some push back about [cohort living].

Many participants spoke about the "Carolina way" as a barrier to implementing Meyerhoff elements and values with fidelity. In particular, participants noted that UNC-Chapel Hill, with its history of being the first public university, is very traditional and conservative to change.

Likewise, Penn State values were contrary to the residential component, ultimately leading to modifications:

I think the residential requirement was difficult to adopt. In fact, we have modified that because the student culture at Penn State is not a culture where students stay on campus the entire four years. The university requires first year students to stay on campus but after that most students seek off-campus housing. So that was definitely a point of contention for the scholars, and we have modified that requirement. Now we only require our scholars to live on campus the first two years.

At both UNC-Chapel Hill and Penn State the residential component, aimed at building a program community, was adapted due to campus cultures and student requests. Scholars at both programs are now able to live-off campus after their second year.

Throughout the adaptation process universities continued to adapt elements to better fit within their institutional context and respond to student requests. During the early years of the MLN program, the leadership placed a hard ban on joining Greek organizations as opposed to the Meyerhoff program's stance of strongly discouraging their students to do so. However, this policy was later changed to be more culturally responsive to students' interest in joining Black Greek Letter Organizations. As one participant explained:

The fraternity culture here at Penn State is troubled (laughs). There have been some recent very public incidents with students being hurt, or losing their life. Now those do tend to be majority organizations. But even organizations like The Divine Nine, pledging at the wrong time still has a very negative academic effect. So, our approach was just to say no, flat out. But there were students that were interested, and for very good reasons. It does provide some types of support. We had a student who very eloquently made the case

of what the value of being involved in such an organization was. She wrote a really nice letter and I believe we actually had her speak with the steering committee and we made the adjustment to the policy.

Though these student-level adaptations are more minor in comparison to other modifications made, they are still important as it demonstrates that adaptations can function as compromises between leaders and students resulting in greater acceptance of the model. Moreover, the adaptation process can also include deliberation and discussion with scholars and is not limited to program leadership. In the case of Penn State adaptations were also facilitated through networks as participants explained that they leveraged the MLN steering committee to help make decisions on whether to allow scholars to join Greek life. The MLN steering committee provided access to a broader set of organizational members allowing them to receive input and support.

Overall, adaptations made to the Meyerhoff model were a mechanism by which to acclimate, and at times assimilate, into the campus context and culture. As one participant put it, adaptations were a means to "... reframe it for a historically white institution, not just to make sure that it fits, but also that it could "sell" and work here and be established here." Though programs made several adaptations to the Meyerhoff model they still retained a high level of fidelity to most of the elements. Retaining high fidelity is the result of the unique opportunity that the MAP provided. The following section demonstrates that the main drivers of fidelity were the partnership with the Meyerhoff program and HHMI. Additionally, program leaders who "got it" helped to facilitate fidelity to the model.

Mechanisms of Fidelity

Findings reveal that fidelity to the Meyerhoff model was primarily a function of the close and collaborative relationship among the MAP programs. The MAP provided a unique

opportunity to share practices and collaborate across campuses, which is unusual due to the nature of replications where the norm is for implementers to act independently of those who developed the intervention (Carvalho et al., 2013). Indeed, research has argued:

“Therefore, it is essential that effective technology exchange systems be developed and implemented to help agencies modify their programs appropriately so that the intervention is implemented with greater fidelity to the original program’s methods, and to problem–solve with agencies about how to implement the program with less than optimal resources” (Rebchook et al., 2006, p. 132).

While replicating interventions is a common endeavor, research has rarely documented sustained cross-institutional collaborations that lead to organizational learning and ensure continued success (Hurtado et al., 2015; Kezar & Holcombe, 2020a). The MAP is unique in that it has served as a mechanism of facilitating success throughout the life cycle of the CSS and MLN, not just the implementation phase.

The concept of fidelity is critical to replication and implementation research because studies have found that close adherence to fidelity leads to a greater likelihood of replicating positive outcomes and being able to diffuse the intended benefits to recipients (Durlak & DuPre, 2008; Rhoades Cooper et al., 2019). Moreover, existing research argues that the effectiveness of interventions and other evidence-based programs is often the function of core elements working in synergy and removing or drastically modifying these core elements can lead to unfavorable outcomes (Bopp et al., 2013; Durlak & DuPre, 2008; Rebchook et al., 2006; Wiltsey Stirman et al., 2019). Having UMBC and HHMI involved in the MAP provided the necessary accountability and support to achieve greater fidelity for the CSS and MLN programs. This speaks directly to the concept of mutual adaptation as findings will show that the MAP provided

the space to deliberate and discuss when fidelity was threatened, facilitated access to a broader network that could help navigate challenges to fidelity, and served as an accountability mechanism by having control over funding.

Meyerhoff Adaptation Partnership (MAP) and HHMI as a Fidelity Mechanism

One of the many ways that UMBC helped CSS and MLN implement the programs with fidelity was through problem solving. A UMBC participant shared:

It felt like at some points we were at a phone clinic ... We did begin to have some structured conversations monthly, biweekly meetings together but initially it was more like a hotline. Because they were jumping in and they had to understand how to make things happen at their place pretty quickly. So we weren't able to structure it and sort of walk it out and roll it out in a methodical way, it was sort of like we jumped in the deep end and we all [had to] make it happen.

The CSS and MLN programs were implemented quickly and with very lead time. Several participants shared that the lack of lead time was one of the central challenges to implementing the model with fidelity as often certain expectations were not communicated or lost in translation. Early CSS and MLN leaders were trying to implement program elements that they had little experience with and that were not norms at their campuses. While the campuses were able to work through these challenges, the early years were a tumultuous time. The relationship with UMBC was essential in this early success as one participant shared “They taught us how to do everything. Everything ... We wouldn't have had this program if they hadn't been there.” Participants at UNC-Chapel Hill and Penn State were very grateful to the support provided to them by UMBC and shared the myriad of ways that they helped to promote implementation and fidelity to the model.

One of the primary ways that UMBC assisted the campuses was by sharing their knowledge through documents, having frequent meetings, and hosting UNC-Chapel Hill and Penn State staff at UMBC. A UNC-Chapel Hill participant shared how impactful the collaboration was for them:

When I first came in I felt like I was at the [UMBC] once a month because there was a lot of training and I wanted to learn from the people who kind of innovated it. And so [the Meyerhoff staff and faculty] really took me under their wing and provided me with a lot of resources and encouragement because we were trying to implement a huge cultural shift at UNC-Chapel Hill. And I needed a lot of support and a lot of understanding to do that and I received a lot of that at the [UMBC meetings].

Participants at Penn State also shared that being able to go to UMBC and observe how the program worked was critical to their success. Moreover, participants shared that being able to have access to individuals at multiple levels helped to facilitate success:

The other thing is Freeman [Hrabowski's] willingness to talk to other presidents and other university heads is a good thing ... sometimes you need a university President to talk to another university President, and you need faculty to talk to faculty, and staff [to] interact with staff. I think they've done really well at matching all the levels to provide insight at all the different levels that are needed, so you don't have staff trying to convince a university President to [do] something. Or a university President telling staff what he thinks they ought to do when he's not living up in the dorms with those kids.

UMBC and the Meyerhoff served as a shining example of what was possible. This helped the CSS and MLN programs work toward implementing the models with fidelity in hopes of achieving similar outcomes. In particular, participants shared that the partnership served as an

accountability mechanism as they were able to point to Meyerhoff as an example of what could be achieved:

My biggest role was cheerleader in the beginning, and then when I had connections with leadership being able to steer them when they were making decisions that might not be the best decisions. Other people at UMBC had other major roles to play. Freeman [Hrabowski] being the sort of moral guidepost for this whole thing. What it meant is that the President or Chancellor at those schools could redirect a lot of money into their programs and point to Freeman and say, "If Freeman can do it, we should be able to do it." And my feeling was that they should be able to do it better because they have more resources. They're bigger schools. They have lots of alumni contributions. And so if the white leadership and enough white faculty really do care they ought to be able to be even better than us. And that was the goal so that they could be outperforming Meyerhoff, and that's a great goal to have.

Having UMBC involved in the implementation and adaptation process allowed CSS and MLN to have access to a network that could help them resolve problems and provided an example of what could be achieved.

While the partnership with UMBC and the Meyerhoff program helped to promote fidelity, previous findings have shown that the CSS and MLN programs made several adaptations to the model. The UNC-Chapel Hill and Penn State context were at times at odds with the cultural values of Meyerhoff making it challenging to implement elements and values with fidelity. Furthermore, findings showed that program leaders also created deviations from the program values such as focusing on low-income white scholars as a means to diversify STEMM

rather than focusing on racial and ethnic minority scholars. The partnership with UMBC was a mechanism to course correct. A UNC-Chapel Hill participant shared:

Going into [the] third year [we were looking at] the group of students who were coming and suddenly it was like we were going backwards, right? It's great to have women coming here who are physics majors, that's an important piece of our [aims]- 'Cause our goal was a little bit broader, right? And I had [Meyerhoff leadership] grill me. Boy, that was one of the more interesting experiences of my life. The first meeting we had down there, the whole two teams and [Meyerhoff leadership] is there telling me that our student selection process is wrong. And no, we shouldn't be thinking about kids who are poor white kids and we shouldn't be thinking about women who are coming into physics.

Meetings across all three programs provided the space to deliberate and discuss when questionable decisions were made. Having UMBC involved in these meetings served as a fidelity mechanism as programs had to be accountable to the adaptations they made. While the previous instance was a more drastic example of accountability, participants also shared that the sustained collaboration was helpful in addressing challenges that arose from communication issues and turnover. A UNC-Chapel Hill participant shared how being able to easily check in with the Meyerhoff program facilitated addressing ongoing challenges and fidelity:

We had fewer students actually going to grad school than our partners. We had a lot going to med school which is great and everything, but very few going into PhD or Masters programs. I'm a little competitive so I was like, "Let's see if we can improve this." And so, I asked [the Meyerhoff team] "What are you all doing to get so many in?" And they're like, "We make them all apply" and I'm like, "What?" (laughs), "Why aren't we doing that?" [That's] one area where I do think that might have either been lost in the

conversation or overlooked or whatever ... because there were like four other [CSS] directors before me...

While the collaboration with Meyerhoff was certainly one of the main drivers of fidelity to the model, participants also shared that the presence and involvement of HHMI played a central role in replicating the programs with fidelity:

One of the top reasons why this was sustained is because HHMI gave funding. HHMI has incredible prestige in these fields. And the requirement to maintain your funding was to adapt, as best you could, [the] Meyerhoff components. I don't doubt for a second, when times got tough, and even some people who didn't really believe in the model, it would've gone a different way if they could keep the funding no matter what they did. I think there's no question about it... I think that was very important in the early years, that they had to, if they wanted to keep the HHMI [funding]...I think the message was clear to them, that either you stay in tow or the funding won't be there. And having HHMI behind the scenes, and having the funding tied to HHMI was very important.

Participants agreed that requiring a close adaptation to receive funding promoted program fidelity. Having a central funding organization was an integral part of the partnership because “it raises a sense of urgency in a way that you're not just given the money and now you can just go and do what you want to do.” These findings suggest that funders can play an important role in ensuring that programs replicate models with fidelity. In particular, playing the role of active funding partner can be conducive to success. This is evident in HHMI organizing meetings for all campuses to attend. Participants shared that having to report to HHMI and meet with other campuses was a strong accountability mechanism. A participant at Penn State explains how the relationship with HHMI has evolved:

At the beginning years, I felt really invested in this program. I was really excited about this program. We were doing these kinds of HHMI meetups and there was also accountability because we had to come with a report about what we were doing. It was in the context [of] the HHMI funding, but now we're on closeout funding. Now [it's] here are the questions they want answered or here are the final reports that they want from us around this project.

Similarly, a campus administrator at UNC-Chapel Hill shared that attending meetings at HHMI ensured that campuses didn't received a "free pass":

We'd go [to HHMI] and we were expected and I think the Presidents or the Chancellors, we all felt, we thought, we were gonna be judged. I'm gonna say it. [It] wasn't like we went in thinking we could just go say anything. We put a lot of effort into it because we appreciated that support, [we] knew we were just a handful of people [that] got [funded]. That we were gonna be watched ... [HHMI] had program leaders who were pretty shrewd and they weren't gonna ask give away questions ... I just felt like it was a matter of respect that when we went there we didn't go in ever expecting a free pass. And we thought we were gonna have to earn it every year. I think there's something good about that. We don't fear the NSF or the NIH either, but we take it seriously.

HHMI played a central role in ensuring that programs collaborated and that the MAP goals were adhered to. The funding served as an incentive, but it also provided the necessary resources to carry out the collaboration and implementation of the programs. From a mutual adaptation perspective, HHMI exemplified the external support and incentives needed as they provided the material resources needed to implement the programs with fidelity. This is especially important as research has shown that organizations will implement and replicate

intervention without sufficient resources, leading to creating modifications that can be detrimental to success (Rebchook et al., 2006). Not having the necessary resources to carry out interventions with fidelity can lead to cost-cutting measures that require partial implementation such as completely removing core elements (Rebchook et al., 2006). Having the necessary resources and capital was especially important for the CSS and MLN as the programs provide extensive services that require a significant amount of resources. One of the main reasons why the Meyerhoff had not been replicated in its entirety is because campus leaders believed that it would be too costly (Hrabowski III et al., 2019).

Program Leaders as a Fidelity Mechanism

While the partnership with UMBC and HHMI were the main drivers of fidelity, program leaders also played a role. Program leadership's background, values, and willingness to learn affected the degree of fidelity observed. Participants explained that program leaders who "got it" promoted fidelity:

I think the [founding] director herself got it. That's what really allowed a lot of this to flourish at the beginning. The director herself had a lot of experience with fraternity/sorority, kind of understood what that [Meyerhoff] model really represented. I would say most other people involved with trying to move this program forward didn't have that understanding. So she understood, and I think she really helped push this program here because she had this understanding and she really took the time to talk with [Meyerhoff leaders] over at UMBC and really be mindful about what that project was about, and did a lot of learning and understanding to really make this program. So unfortunately a lot of the other folks [around campus] just sort of looked at it as just another kind of academic program.

Similarly, participants shared that changes in leadership enhanced program fidelity allowing the programs to evolve and start to look more like a Meyerhoff program:

The other thing that we obviously don't have is the HBCU culture. That was true for both replications. We're just a different place. [The new program director] has brought us a dimension of this program that we were just really really missing, which is that lived experience, right, at the top... I still think that's the biggest challenge at this place. We're a predominantly white institution with a predominantly white faculty who don't understand the cultural differences that many of our students face.... and that's a giant problem.

Program leaders play a central role in ensuring that programs are implemented and sustained with fidelity to the model as they have decision making power over the day to day operation of programs as well as the long term vision.

Tensions in Attaining Fidelity

Findings have demonstrated that the main mechanisms of fidelity were the partnership with UMBC and HHMI as well as the individuals leading these programs. Though the collaboration has led to success for the CSS and MLN programs this does not mean that everything was easy or free of tensions. Some participants were more critical about the MAP and cautioned against looking to the Meyerhoff model as the recipe to success:

The other challenge is because the Meyerhoff model is framed as a model as almost like here's the recipe to success. Sometimes I challenge that just because every institution is different... I would also say to be careful that it doesn't just become this is a recipe because my concern always is around we don't want to make it seem like we're making the students assimilate. Right? Like if you follow this thing where you now become this

model student you will be successful. But instead it's how do we teach our students how to advocate for themselves? How do we teach our students to find their voices? How do we provide the resources for our students to be successful instead of forcing students into boxes? Because I check all the boxes for the Meyerhoff model.

As this participant explains, every campus has their own institutional contexts, cultures, and histories meaning that any model will need to undergo modifications to be integrated within the institution. Moreover, they provide a more critical view of Meyerhoff in that they see Meyerhoff's approach as one that tries to create model scholars that can be assimilated into the dominant culture of STEMM and universities rather than empowering students and changing the institutional conditions that shape student success.

Differing institutional contexts also led to tensions among the MAP campuses. A participant shared there have been some tensions over the course of the partnership:

It's an underlying tension. They may not even feel it, because there's been a lot of turnover, right? There's no one from the beginning or very few people from the beginning that are there ... But the tension that I [felt] is kind of "Oh, yeah, we recognize that Meyerhoff has had some success." I don't think anybody would deny that. But it's always like, "But we're UNC, we do it different." Or, "We're Penn State and it's a very different landscape for us, so we need to do it differently." And I understand that, right? You have one that's the oldest public institution, I believe. And one that has so many people that you couldn't even compare [to] our 12,000 [student population] So I do recognize that they're coming from different spectrums, but I get the sense that there's only so much that they're willing to learn from a school. I don't wanna say beneath them, but a school as small and unknown as UMBC.

Findings have shown that the institutional ranking and research-intensive context of the partner campuses led to adaptations deviating from the Meyerhoff model. For example, UNC-Chapel Hill originally did not adopt the chemistry workshops used in summer bridge because they perceived that the scholars they recruited would not need them. Ultimately, CSS leaders ended up implementing the workshops after scholars were not as academically prepared. These findings suggest that in cross-institutional collaborations the prestige of campuses could be a factor in how likely they are to adhere to the model. Perceptions of prestige can lead to creating power dynamics that inhibit fidelity.

While the partnership with UMBC ensured fidelity some participants were hesitant to classify UMBC as an accountability enforcer:

Well, to remain accountable it's a delicate line to walk, because as [a UMBC faculty member] said, we're sometimes unwanted consultants. So you can share [when] people are sharing a problem or a challenge, like this is the way we would do that or this is why we did this a different way. But I'm very careful with it because I think sometimes people have just decided that they want to do something a [certain] way. So in some ways, I see that they have adapted the model, but in many other ways, I see some of the details of it and I see that they align and they match and they reflect. But I think there may be some things not so much, but we may not be aware of the details of all of that. I don't know that we are holding people accountable to that, I don't know that we are, and I don't know that it's our role to. I don't know. That's a tricky one.

Though some participants are uncertain whether it is the role of the developer of an intervention to be an accountability enforcer, it is clear that they are in a prime position to fill this role. Moreover, funders can also play an active role in ensuring that programs are implemented with

fidelity leading to a greater likelihood that the intervention is successful and diffuses the intended impact (Durlak & DuPre, 2008; Rebchook et al., 2006).

Summary of Findings

Findings have shown that the CSS and MLN programs have made several adaptations to the Meyerhoff model, mainly through an iterative process where they attempt to respond to the institutional context and culture while also remaining true to the core elements of the Meyerhoff. This approach to adaptation aligns with a mutual adaptation approach (Kezar, 2011), as the adaptation process was informed by deliberation and discussion, networks, and external support and incentives. The CSS and MLN programs have made adaptations to academic requirements, program values like the mission of pursuing a STEMM PhD and having a more expansive view of diversity, program components like the residential requirement and ability to join Greek life, but also adaptations that enhance diversity, equity, and inclusion such as removing the gendered practices of Meyerhoff and adding more explicit DEI programming. Program fidelity has largely been driven by the collaboration with UMBC and HHMI as they provided a space to discuss and deliberate when there were deviations to fidelity, they served as network that assisted in problem solving and teaching how to implement models with fidelity, and HHMI provided the material resources needed to carry out this partnership.

It is outside of the scope of this study to measure exactly how these adaptations affected program success, however, existing research demonstrates that the CSS and MLN scholars are having similar rates of academic success to Meyerhoff scholars and early CSS and MLN cohorts are outperforming early Meyerhoff cohorts (Sto. Domingo et al., 2019). This may imply that the adaptations made to the programs were not to the detriment of the programs. However, a more nuanced analysis might suggest that the CSS and MLN programs are achieving different goals

than the Meyerhoff. For example, participants shared that the programs are not retaining strict fidelity to the goal of advancing URGs to obtain STEMM PhDs and their approach to diversifying STEMM has deviated from a more narrow focus on race and ethnicity to one that includes gender, sexuality, and other forms of diversity that are not necessarily visible. Though the CSS and MLN programs are advancing the broader vision of Meyerhoff, which is to advance diversity in STEMM, the process by which this is happening is different as it faces pressures from campus contexts and cultures. Overall, the adaptations made to the programs ensured that there was more widespread acceptance of the program by accounting for the local context and culture but also retained high levels of fidelity to the original model, exemplifying a mutual adaptation process (Kezar, 2011)

The following section aims to address the final research question of this study and examines the “end” of the life cycle of STEMM intervention programs by focusing on the sustainability and institutionalization process of the CSS and MLN programs.

Completing the Life Cycle: Sustainability and Institutionalization

This final section seeks to examine the sustainability and institutionalization phase of the CSS and MLN programs and answer the third research question, to address long term implementation of a new SIP. In the sustainability phase programs receive the resources necessary to maintain the programs after grant funding has ended (Cobian & Ramos, 2021). Many would argue that the CSS and MLN programs have reached sustainability and even institutionalization as they entered their 10th year in 2023 and have been financially supported by the institutions, rather than grant funding, for five of those years. This section will provide findings that demonstrate the myriad of ways that the CSS and MLN programs have worked to be sustained. Moreover, I examine the extent to which the programs have been institutionalized and demonstrate challenges to achieving this goal.

Sustaining the CSS and MLN Programs was achieved through various strategies that included: obtaining buy-in and sustained support from key organizational members (staff, faculty, and senior administrators); scaling the programs through organizational and financial development; helping to advance the values and missions of the institution; demonstrating the value of the programs through evidence-based success. Additionally, sustainability can be promoted through documenting the program's policies and procedures.

Securing Buy-in and Support From Key Organizational Members

Key to being sustained was securing buy-in and support from a broad set of institutional stakeholders. As the CSS and MLN programs offer various services they require cross campus collaboration and support between several offices. A main finding is that sustainability is contingent on support from members across the entire institution rather than relying solely on program leaders and staff to ensure that programs succeed. Therefore, buy-in and support is not

only required across the campus but also at multiple levels. Participants at all three campuses stressed that having program champions who were committed to the programs was essential. Program champions can be located at multiple levels and across the institution, however, their position within the organization plays a large role in the type of support they can provide. For example, senior administrators are able to use their power and resources to create initial legitimacy for the programs. A UNC-Chapel Hill administrator shared:

I think you really want to know this is truly all the way up to the top. I think that was something HHMI demanded. We all have a lot of big grants but if you don't have your leadership deeply willing to go to the mat for [these programs] to say, "This is one of my priorities, I'm gonna raise the money for it." I don't know if it'll work. So that's where I felt like that was our commitment there. And I think they were trying to do that at Penn State too. [That] at least made a difference in launching it and keeping people believing that we meant it, that it wasn't just another cool program to put on your list.

Having upper-level administration involved in the program creates legitimacy for the programs because it sends a message to the broader campus community that the programs are a priority and they have the backing of central administration. Moreover, there are material resources to having upper-level support:

It becomes very clear that having a champion on campus who's high up is absolutely essential. Because one, they can make people work together who may not wanna work together, right? (laughs). Two, they have the resources and it gives you somebody to go to when you have a problem and somebody who actually can fix it.

Having upper-level administrative support can help to facilitate addressing challenges as individuals at the top can harness the power of their role and office to find solutions. While

having the backing of central administration is important, participants also resoundingly spoke about the importance of having buy-in and support from leaders and faculty in the STEMM colleges. One of the primary ways that the CSS and MLN programs have been able to garner this support is through the formation of the CSS advisory board and the MLN steering committee.

The advisory board and steering committee comprises leaders from across the campus with most of the members coming from the STEMM colleges that scholars can major in. A Penn State administrator shared how they were able to secure initial buy-in across the STEMM colleges:

Our president arranged another dinner where we invited our deans in. At that dinner our president [had] the deans begin to work on what the goals and objectives will be for our Millennium Scholars program. When you have the leadership of the institution then tapping into the academic leaders, who will eventually sponsor this program, if you have them create what it will look like then you have buy-in, they have skin in the game and they have a commitment to the success of it because they actually created it. So the key thing there, you got to have the commitment from the leadership, from your president, your chief academic officer and the provost, and then your deans on board who will essentially lead the group forward.

One of the early benefits of the MLN steering committee was establishing early buy-in by making sure that college leaders had “skin in the game”. Being involved with the early decisions of MLN led to college leaders feeling a sense of ownership over the program and helped to cultivate program champions across the STEMM colleges. The steering committee has now expanded to consist of leadership across the university including Deans and Associate Deans of Diversity, Equity, and Inclusion from all the participating STEMM Colleges as well as

representatives from the Offices of Undergraduate Admissions, Financial Aid, and Development. Having a wide array of organizational members involved and bought-in to the programs ensures that “the right players are in the room”, particularly when it comes to addressing challenges that programs may face.

The CSS advisory board has also been a sustainability mechanism for the program. The advisory board consists of central administration but also faculty and leadership from across the STEMM departments. The formation of these groups allows the programs to harness the influence and commitment from individuals across the campus. A UNC-Chapel hill participant provided an example of one of the ways that the board shows its support:

And the advisory board that [the Program Director] has convened has been really helpful in terms of really getting key stakeholders in a room regularly to think about the future of this program. It has been frustrating at times because in one of the last meetings we had in person, [the Program Director] expressed his concern about the budget for CSS and where things are heading in terms of the money that needed to be raised and would they need to cut the number of scholars, just things [like] that. He really didn't want to see CSS trimmed in any sort of way and he was worried about the finances and rightfully so discussing it with the advisory board, trying to brainstorm ideas about how we might fundraise, what kinds of ways we could get commitments. At that time, a few of us on the board said, we've been talking about [the importance of] DEI, [this is] one of those examples where we've got an amazing program. We don't want to see funding pulled from a program like this. A [fellow board member], and I, and one other person drafted up a letter just to the Dean [of the College of Arts and Sciences] and the Chancellor to just say we're supporters of CSS, we think this is an outstanding program that meets these

initiatives. And unfortunately, we never heard a response back. So that to me was a little bit hard because as people who are invested in this program, and I would think they would be invested, and we have signatories [saying] this was valuable, to not get a response back was a little bit hard.

In this particular example, the advisory board's letter was a way to show that the CSS program has the support of a broad set of organizational members. As another participant explained, the letter had "signatures from faculty across campus, close to 100 - 200 faculty and postdocs, all kinds of scientists across campus including the med school in support of [CSS]." Though the letter did not receive a response from administrators it still served to send a message that organizational members believe in the program and that it should remain an institutional priority. Members of the advisory board saw their role as being advocates and champions of CSS.

Beyond providing support for programs, having a steering committee or advisory boards promotes collaboration among organizational members who otherwise would not interact. This is important because it allows for the creation of a broader network of organizational members who are interested in advancing URGs in STEMM. Previous research has found that one of the main facilitators of a successful implementation was the degree to which organizational members collaborated (Kezar & Holcombe, 2020b). Findings suggest that collaboration is important throughout the life cycle of programs, not just the implementation phase. The creation of a board or committee is a tangible way for campuses to address issues of collaboration and ensure that there are program champions invested in the success of programs.

Support from leadership plays a major role in the sustainability of programs particularly when it comes to institution wide challenges. However, the success and sustainability of the programs is also contingent on its day-to-day operation. Faculty and program staff have the most

interaction with the scholars and are essential in carrying out many of the 13 elements of the Meyerhoff model. One of the pillars of the Meyerhoff model is “it takes researchers to produce researchers”, therefore, faculty are involved in a multitude of activities such as: participating in selection weekend, teaching the scholars during summer bridge, mentoring scholars, and working with scholars through research. Faculty involvement is critical to fulfilling the mission of advancing URGs to STEMM PhDs as gaining research experience as an undergraduate is conducive to graduate school enrollment. However, undergraduate research is not the norm at all campuses, which can be a challenge as explained by a participant:

Having the faculty buy-in, the faculty support is absolutely critical, having that infrastructure in place where the faculty are actively engaged, working with undergraduate students in research. That's something that might be a little bit different depending on where you go. The faculty are fully invested in working with their graduate students and their PhD students, but they're not used to engaging with undergraduates in research, that alone is a different experience. If they aren't already familiar with it, you probably need to put something in place to help those faculty understand how different it is to work with an undergraduate student in a research context.

In order to sustain the programs, institutions must be able to create structures and support systems that allow faculty to engage with the programs on multiple fronts. Participants also spoke about the need to ensure that a broad set of leaders and faculty are involved with the programs rather than relying solely on faculty of color:

I can't stress enough that it needs to be everybody. I think sometimes there is a sense, incorrect, that this is for minority students, so we'll recruit more minority faculty and then they'll run it. While you absolutely want more minority faculty, because it's important

that these students see what's possible, everybody has to think that this is important. You can't just put it on faculty of color and say "well you guys need to make this work." It's important that the entire campus supports it. That is a critical, critical piece because if it's just a few people that are supposed to support it I think it has a greater chance of not being as successful as Meyerhoff.

Institutions cannot rely solely on faculty of color to run these programs because it creates silos to DEI commitments, sending the message that DEI issues are the problem of those who come from diverse backgrounds rather than the entire institution. Moreover, there are very few faculty of color especially in STEMM fields, making it a challenge to have the necessary amount of faculty needed to support these programs. Participants explained that the success and sustainability of these programs is in fact contingent on the support of white individuals and white allyship:

If we only relied on people of color, there are so few at many universities in the professoriate or in major positions, we couldn't get anywhere, you've gotta have allies. And so that's why [the] replication [is] so important because what we're showing [is] that we [have] [white] men and women who were really committed to [these programs], and their commitment was contagious. When they had it, more and more people learned, "I can be in this work." You don't have to be a minority to help minority students.

The understanding that "you don't have to be a minority to help minority students" is particularly important at institutions like UNC-Chapel Hill and Penn State where it is a predominately white environment. In order to sustain the programs, enough white faculty and administrators needed to recognize the value of these programs and become active participants and champions.

Although faculty have very close interactions with scholars, it is the program staff who have the most interactions with the scholars. It is important to consider and recognize the

incredible amount of work that it takes to run these comprehensive programs. The day-to-day operation and success of these programs are primarily a result of work from the program directors and the program staff. As one participant pointed out “Freeman was always quick to say, "It takes scientists to make scientists," and that's true. It's very true. I would always say, "It takes the Meyerhoff staff to make a Meyerhoff scholar." I think that's true as well.” The involvement of program staff is essential to the sustainability of the programs. A UMBC participant reflected on the synergistic process of running the programs:

Well, you won't be surprised to know that most faculty assume what makes these programs work is the faculty. That if you have a good mentor, and particularly if you have a mentor who's committed and maybe who's culturally responsive, and a mentor who is a champion for their students that's all you need. And it's the faculty who get these students into PhD programs. And of course, that's really important. I would never downplay the importance of faculty, [they] help raise the money to keep these programs going... And the thing I learned early on [is] it's equally true that all that really matters is the staff. I mean, this program does not work without [the program staff]. Summer bridge does not work [because of faculty]. Summer bridge works 'cause of the staff. So what you have is faculty believing that what matters is the students' research experience and giving them scholarships. And you have staff who believe what matters is the values and the sense of community that the staff are responsible for. So who is right? I don't know, but clearly it's a combination.

Fulfilling the mission of these programs requires collaboration among multiple groups and individuals who are not only committed but also have a unique set of skills. As the programs

have multiple components and values, those who operate them have to be well versed in how to achieve those goals. A UNC-Chapel Hill participant explains:

We did have some rocky [program staff] at the start. There were some people that just didn't know how to relate to students. A lot of this early program, in the summer, when it's not just about teaching [students], it's about [helping students] adapt [during] their first time away, living on [campus]. I mean, there's all the same things that go into student services and not all faculty are as good with student life and student services and residential dorm living and what it means when they're first away from their families or don't know how to act. And so you need to have a team that basically mimics student services, academics, and support. That's not normal, I think that's why [the program] is extraordinary, but it's not that easy to find all those right people to do that.

These comprehensive programs require a combination of support services, which is not always easy to achieve. To facilitate the operation of these programs it is important to bring on staff that are able to assist and support students in a multitude of ways. Program success and sustainability is enhanced when program staff and leaders are well versed in handling student issues as well as big picture challenges. Furthermore, participants explained that sustainability and success is enhanced when the program team works well together and there is little to no turnover. Constant turnover is a challenge because it requires teaching a new member the values and goals of the programs. The program values must be understood and embodied by program staff and leaders as they are the ones who diffuse these values to the scholars throughout their undergraduate career.

Participants shared that program directors can also play a large role in helping to sustain the programs, mainly by providing stability and direction to the programs. Though the

background and experience of program directors has varied over the years, participants noted that there were certain qualities and qualifications that were conducive to being an effective program director. One of the main qualities that program directors and staff had to possess was a deep commitment to the success of the scholars. Participants stressed that these programs are often a “labor of love” and require an immense amount of time and commitment. The success of these programs was often a result of a dedicated group of people putting their “hearts and souls” into the programs. However, participants were also critical of this approach and expressed that it was unfair to place the burden of success on a select few individuals.

Participants emphasized that one of the main reasons why the MLN program was able to make it through the implementation phase and be sustained was due to the work of the founding program director. A Penn State participant explained:

From the beginning, I remember having conversations with some of the other partners and even with the director herself. And I was just thinking, this can't be sustained, right? Like you're going way above and beyond your job description. If there wasn't a program director who was willing to take on all these added things [the program wouldn't succeed]. I just thought that was really unfair to put that much burden on one person ... [She] would just do amazing things, no one should have to do that kind of stuff. And for these programs to succeed, we can't expect that people are like super women and super heroes running these programs. They have to have the support ... I think in the early success, that doesn't show up in the data, right? It shows that [the program was] successful, but it doesn't show just the type of things that were happening behind the scenes by [the program director and] by others.

Participants frequently expressed that the MLN founding Director was “phenomenal”, however, they faced challenges related to politics and power dynamics at Penn State. Namely, the program director was hired in a staff role resulting in having diminished power:

...eventually she had a strained relationship with people above her because they initially said “this is yours, run it”. And then when some issues developed, they tried to take control back and they tried to tell her what they wanted her to do. And that created some strain ... Ultimately, she realized that if she really, really wanted to have control, she had to have a PhD. And so she eventually left the program so that she could go and earn a PhD. I think she's spectacular, but there was a learning curve for her, and she lacked a mentor at Penn State, somebody she could turn to.

The reality of racialized organizations like Penn State is that people of color are often drivers of change but lack the institutional power to truly effect change. Program directors often have to navigate campus politics and power dynamics with a wide set of organizational members resulting in challenges. For this reason, participants explained that it was important for program directors to be “power figures”. A participant at UNC-Chapel Hill explained how their position as a faculty director was conducive to success:

I think it mattered to the faculty, that one I was a faculty member. Now that's just the UNC version, right? This is why [adaptation] is interesting, it's not a one-to-one. So, as long as Freeman [Hrabowski] is at UMBC, the number two person is less important for them to be a faculty member because he's the president of the university and a well-respected scholar. So there are conversations that he can have that a staff person cannot have as easily. So when we did the [adaptation] we didn't have the President [like Meyerhoff] and so the person who was leading, really needed to be a faculty member.

My colleague who was trying to lead this at Penn State was a staff person, and she struggled because she did not have the pull that she needed, like the power [and] she couldn't do it. And unfortunately, it won't be a surprise and nobody's feelings will be hurt that faculty really only listen to faculty. I wish that were not the case, it is a truism, right? ... It was also important because when our students needed help within different departments, it was easy for me as a faculty member to talk to another one of my faculty colleagues. And also to recruit those faculty to be liaisons in different departments ... that was important. I didn't need to do everything but there were times when I needed to be a faculty member in order to effectively lead.

Participants explained that being a faculty director aided in dealing with issues of politics and power. Moreover, it was important for that faculty member to ideally be tenured and senior faculty because “as an assistant professor ... [you] can't go scream at the Dean (laughs). Us old guys, we can go scream at the Dean.” Though being tenured and a senior faculty member does not automatically guarantee success, it can be helpful in navigating issues of power within multiple levels of the institution.

Findings have shown that one of the most important contributors for success and sustainability is deep commitment and support from a broader set of organizational members both in different sectors of the institution and at multiple levels. Institutions who seek to sustain these programs must be able to find organizational members who are committed to advancing URGs in STEMM and interested in serving as program champions. There were times during the early implementation phase of the CSS and MLN programs where participants did not know if the program would make it. In fact, participants shared that at key points the programs were at

the brink of collapse. However, one of the primary drivers of sustainability was the people involved in these programs. A participant explained:

These programs could have ended because apart from complications, their champions left. At one of the campuses, the champion was a chancellor and [they] left because of a scandal and all of a sudden you don't have the champion anymore. And so many Deans left, so many associate deans left. The turnover in higher ed is incredible. Within five years, almost every champion seemed to leave. It was unbelievable how many people left. And the staff turned over as well, and the heads of the programs turned over the early years on one of the campuses every year. And what helped sustain during the turnover is they actually got people in who were willing to support the program. So how does that happen? How did they get people to replace these champions who supported the program? ... Well, there's commitment to this program ... These universities have enough people who are committed to diversity and achievement of people of color that they dealt with the turnover in a way where new people came in who were committed to the program. If they wanted to kill the programs, they could have killed them by just not replacing these people with people who were committed, but they didn't do that. So I think that sustainability was partly because they got people in who were believers and supporters of this program.

Findings suggest that one of the main drivers of sustainability is those involved in the programs. However, there were also various other ways that programs were sustained. One of the other ways programs were sustained were through changes in their organizational placement and financial development.

Scaling Programs Through Organizational and Financial Development

The MLN Program

The implementation section of this chapter demonstrated that one of the key challenges was figuring out where to administratively place the programs and developing a funding model. The MLN program started through a partnership between the College of Science and the College of Engineer, however, they were later moved to be centrally housed under the Office of the Executive Vice President and Provost. The move to be housed centrally was also accompanied by a change in their funding model. Now, each of the STEMM colleges contributes \$10k per student and the Office of the Executive Vice President and Provost provides a last dollar award to ensure that in-state scholars receive full tuition and room and board and out-of-state scholars full tuition. Participants consistently spoke about this shift in placement as one the primary reasons why the MLN was sustained and see it as a sign of the program being institutionalized. A Penn State participant shared:

So, ultimately, I think the funding came with institutionalization of the program. When the program moved out of the College of Science to central administration and it was a formal agreement between the President of the university and the five Colleges, now six, all of their Deans and it became a development priority for fundraising, a huge development priority. All of those pieces finally stitched all together and they put lots of money on the table to, for example, pay the salaries of the director and four program coordinators, a dedicated admissions person, all that stuff fell into place once that happened with the President. I do think that the meeting that happened at HHMI, that brought the Presidents and Chancellors together from the three institutions played a

formative role in that. Before that, it was very flying by the seat of our pants, in terms of the money.

Moving the MLN program into the Office of the Executive Vice President and Provost was frequently cited as the turning point for the program as it brought stability to the program and formalized the relationship between the STEMM colleges and central administration.

This shift in placement also came with material resources that allowed the program to scale its staffing structure. Prior to the move, the MLN program was staffed by a staff program director, an administrative assistant, two advisors from the colleges worked with the scholars (in addition to their existing role in the college), and support staff from the College of Science was occasionally used to address more complex administrative tasks (Crimmins et al., 2017). At the time of data collection, the MLN program was led by an Executive Director who is a tenured faculty member, four Assistant Program Directors (one for each cohort year), a dedicated admissions recruiter, and an administrative assistant. Some participants saw MLN's placement in the Office of the Executive Vice President and Provost as a cultural shift because there are no other student-centered programs that report directly to this office. Participants saw this central placement as a message to the institution that the program is important and a priority. Moreover, participants observed that the amount of resources MLN receives for staff is out of the norm:

[MLN] has so much staffing [we're] totally jealous. Because [our] office has nowhere near the amount of staffing as the [MLN] office does. But I do think that says a lot, right. That the university is willing to put the money into actually having a well-staffed office. We know DEI offices are never well-staffed (laughs). And so by actually putting the money into getting [a] well-staffed office they can have the amount of high touch that's

needed to run such a successful program. That speaks to the institution's commitment to the program.

Campus administrators shared that having the program centrally placed was important because they did not want to “bury” the program, particularly as it relates to the reporting structure of the program. Through this central placement the MLN Program Director reports directly to the Executive Vice President and Provost, allowing them to meet regularly.

While this shift to central administration was critical in ensuring the sustainability of the MLN program this did not absolve the program from having to raise funds. The MAP programs are very expensive and require constant sources of funding. When speaking about the threats and challenges to sustainability the majority of participants spoke about the importance of funding. As one participant put it “I keep coming back to money, I'm a strong believer that money just fuels a lot. People will [say] "no, you need heart." Yeah, yeah, yeah, if you ain't got the money you get nothing.” The goal of both the CSS and MLN programs is to eventually be fully endowed, however, that is a long road and the programs are still some time away from achieving this goal. Key to raising the funds necessary to financially sustain the MLN program is being a development priority for the institution and the STEMM colleges. A Penn State participant shared the importance of development:

The other important thing is that we are now a development priority, money isn't everything, but it's something. Being in the mix in terms of who development officers are talking about when they see folks who might give money and this year we're for the first time participating in the Giving Tuesday campaign and all of those things. Having a group of folks who are willing to support the program with their dollars is important.

Participants from the STEMM colleges shared that MLN was a development priority for them as well. Leaders from the STEMM colleges will use the MLN as their cause for philanthropic efforts like Giving Tuesday. MLN has become a development priority centrally and for the STEMM colleges.

Findings have shown that a shift in program placement came with a myriad of upsides for the MLN including: easing tensions with the existing DEI initiatives, securing buy-in and financial commitment from the STEMM colleges, an increase in their budget allowing them to scale up their staffing structure, and becoming a development priority. Campuses who seek to establish a Meyerhoff-like program could consider placing their program centrally as it can lead to generating several positive outcomes.

The CSS Program

While both the Meyerhoff program and the Millennium Scholars program are placed centrally, the Chancellor's Science Scholars program is not. The implementation section of this chapter demonstrated that moving the CSS program into the College of Arts and Science, under the division of Natural Sciences and Math, provided stability in the early years. However, at the time of data collection (2021) the CSS program was being moved out of Natural Sciences and Math and being placed into Honors Carolina, still within the College of Arts and Science.

Though the CSS was able to secure a substantial amount of funding from the previous chancellor, they have not enjoyed the same privilege in recent years. The CSS has been facing financial challenges, which were exacerbated by the COVID-19 pandemic leading the program to be reduced. At its height, the program was bringing up to 40 scholars per cohort, however, recent cohorts have gone down to 20 scholars. In an effort to ameliorate these financial

challenges campus administrators decided that harnessing the resources of Honors Carolina could aid in sustaining the CSS. A UNC-Chapel Hill participant explained:

So [we] were working on trying to shrink our budget and dependency on the state before the pandemic hit. And [we] did things like start looking at maybe recruiting fewer students and just trying to get us to a place that was a bit more manageable and palatable. While doing all that, the pandemic hit and [administrators] were like, "Well, cut some more." (laughs). Right? It was like, "Okay, you're gonna cut us to death if we're not careful." While trying to [get the budget] more manageable or acceptable to the powers that be, [the Chancellor] came up with an idea to bring us into Honors Carolina. The idea behind it was to further increase our visibility on campus by partnering with the Honors program. It would give the students access to additional Honors resources that we don't have [and] allow us to take advantage of their development resources. [Honors Carolina has] dedicated development officers that we don't have...So they were thinking that the folks in Honors would be able to help us out. [We were] like, "Okay, this sounds great. Let's do this."

Moving the CSS program was supposed to be a strategy for sustainability, however, findings indicate that this move led to negative outcomes. Namely, CSS's program staff, infrastructure, and decision-making power is being reduced:

One thing that is a very sore spot right now is that there was this piece of our MOU (memorandum of understanding) for transferring administrative authority over [the] program from [the] Senior Associate Dean of Natural Sciences and Math [over] to Honors, and it was our three permanent positions. That would be the two program coordinators and the recruitment coordinator. Those would stay as is. But then they're

like, "Well, you have these two temp positions," our business manager and we had an administrative assistant...So [they said] we'll reevaluate these positions, that was in May when we finalized the MOU. There were no further conversations about any of this. So [we] check with [the Senior Associate Dean of Natural Sciences and Math], check with [the Senior Associate Dean for Undergraduate Education], and [the Senior Associate Dean of Natural Sciences and Math] is sort of feeding [us] the same line. Like, the college just wants to be more efficient with the way we spend the dollars. and so that's why we're gonna [remove the part-time positions in CSS]...And [we're] again, very confused because per the MOU, there was supposed to be a discussion about reevaluating these positions, and that never happened.

The move to Honors Carolina led to the elimination of CSS's Business Manager and Administrative Assistant because the College wanted to use that money "more efficiently". Participants were not opposed to using the money more efficiently, however, this decision was made without any consultation from leadership, leaving CSS members feeling like this was a "breach in trust". While these challenges may just be part of the growing pains that come with shifting program placement, it is clear that the CSS is not enjoying the same level of institutional commitment and support it once had.

Participants consistently spoke about the previous Chancellor as a champion for the program because they put the CSS front and center, raised funds for the program, had close interactions with the program and scholars, and were a vocal supporter. Seeing the CSS shrinking and not having the same level of support it once had has led to some claiming "the program really hasn't had a champion" Participants shared that while they receive verbal buy-in from leaders this is not always reflected in their financial commitments to the program:

Our Chancellor's like, "Oh, I love this program. I support you 100%. This is the best thing. You are my number one priority", great. You have the provost, who's like, "Yes, I'm going to do everything for you. I'm going to fight for you", fantastic. You have our Dean and our Department Director, who's like "Slow your roll just a little bit. We got to watch out for those finances." And so then is it lip service that we're getting from the top two? Is communication not flowing down to them? I don't know.

While upper administrative leadership has remained verbally and symbolically committed to the programs, this is not necessarily reflected in their financial contributions or reporting structures. In particular, the reporting structure as it relates to the CSS Program Director and the Chancellor has become administratively convoluted. Whereas in the MLN program the Director reports directly to the Executive Vice President and Provost this is not the case for CSS. A participant provided some history and insight into how the reporting structure has developed:

So it went from reporting directly to [the Senior Associate Dean of Natural Sciences and Math] to [now] reporting to [the Associate Dean for Honors Carolina] who now reports to [the Senior Associate Dean of Natural Sciences and Math] So, just more administrative hurdles. Initially [the Program Director reported] to the Dean of Arts and Sciences and the Chancellor. That's where [it] started ... So, there's this growing distance between the program and the Chancellor. So [we] do worry, quite a bit actually, about this removal or distancing from the most powerful people in the university. I think that that has left us in a vulnerable position because before when you had someone like [the previous Chancellor] around, people are like, "Well, we can't touch CSS. We can't do anything to this program." And now, [we] don't think people feel that way. So that's a problem, [we] have to do something to fix it.

The reporting structure after moving to Honors Carolina has raised concerns for those in CSS because it is resulting in more distance between the program and the Chancellor. This is especially troubling for a program that holds the Chancellor's name. Other participants are left wondering about the level of impact the CSS can make if it is being reduced by the number of students it serves. Moreover, participants worried that moving the program into Honors could lead to a loss in identity and visibility:

The pessimist in me sees like down the road [CSS being] just absorbed like, "Oh, it's a merit scholarship within Honors Carolina," when it's not really. That's one other way to kind of lose identity and influence on campus. I hope that's not the case, but I don't know. Universities can be tricky places to work (laughs).

Throughout the interviews, campus administrators at UNC-Chapel Hill expressed their enthusiastic support for the CSS and often stressed their commitment to the success of the program. However, as participants have pointed out this verbal commitment is not necessarily reflected in practice. Ray (2019a) has argued that "Racialized organizations often decouple formal commitments to equity, access, and inclusion from policies and practices that reinforce, or at least do not challenge, existing racial hierarchies" (p. 42). From an organizational theory lens, decoupling allows an organization to maintain the illusion that they are working towards a specific goal without having to take the practical steps to attain that goal. Arguably, this discrepancy between espoused verbal and symbolic commitments to CSS and actual monetary commitments is an example of organizational decoupling. UNC-Chapel Hill is able to maintain legitimacy through their support of a premier diversity initiative like CSS while at the same time reducing the resources needed to enact change and fulfill their missions. Though the move to Honors Carolina could prove to be the step needed to infuse CSS with the necessary capital to

expand and restore its status, it is not clear if the commitment to serving Black and Latinx talent will reach the original MAP goal of producing much higher numbers of doctoral degree earners with the best scientific resources.

While the move to Honors Carolina could be beneficial in the long term there are some obvious challenges that have emerged. It is still too early to determine whether the shift in placement was the right or wrong choice. Some participants were optimistic about the move and believed that it could lead to positive outcomes for CSS:

One, Carolina Honors has a certain distinction that is fairly well known, both within the university and amongst our alumni. And so it carries with it an additional level of prestige.... The other driver is funding and Carolina Honors has historically been a very well-funded program. One of our aspirational goals is to garner enough money so that these students can have full scholarships. And so the best way of achieving that is through development. And we have a very ambitious development plan, but we thought that because of the historical connection of the Honors program and the loyalty that so many of our alumni have towards the Honors program, that this would be another way of garnering additional financial resources to help support [the CSS] program.

Several participants stressed that moving the CSS to Honors Carolina would be beneficial in the long run because of the amount of development Honors has historically received. Participants saw this shift in placement as a long term play:

Moving into the Honors program enables [CSS] to have a stronger core of development officers working for it ... So I think that raising it to an even higher level has been very important and will be as we continue on into the next years for the program. I see it as a long term, long thriving program, but in this moment we've been in a difficult budgetary

moment, UNC Chapel Hill with a structural deficit, lowered state funding, even though our state funding is really fairly strong when you look across the country. But still it's only going to keep going down. So we have to look at philanthropy as a way to sustain some of our most important initiatives, and [CSS] is certainly one.

Moving the program into Honors could prove to be a good decision if the anticipated benefits are realized. As observed in the case of the MLN, additional resources can bring much needed sustainability to the programs. Additionally, participants anticipate that the move to Honors will elevate the prestige of CSS leading to more visibility and legitimacy for the program. One of the main ways that additional resources could immediately help CSS is by being able to scale up their program staff. At the time of data collection the program was run by a Program Director who later became a tenured faculty member, two Program Coordinators, an Admissions Recruiter, a Business Manager, and an Administrative Assistant. However, after the move to Honors Carolina the program consisted of the Program Director and one program coordinator. This was the result of both budget cuts and staff turnover (presumably unrelated to the move). The sustainability and success of these programs are dependent on having a well-staffed office as findings have shown. Participants pointed out “If you want to have a bigger impact on the campus, you need to have a bigger cohort. They don't have enough staff to even manage a bigger cohort right now. It's a pretty high touch program.”

Findings from the CSS program have demonstrated that the sustainability and institutionalization phase can be precarious. Campuses who seek to adopt a Meyerhoff-like program must ensure they have plans to sustain the programs when grant funding has ended, particularly planning how they will use program placement to their advantage and how they will financially support the programs.

Advancing the Values and Missions of Institutions

Researchers have demonstrated that organizations are values driven, with higher education institutions often having a diverse set of contrasting values and belief systems (B. R. Clark, 1983; Kezar, 2013). Moreover, value systems can be found at different levels such as the: institutional level, the college level, the department level, and the individual level. These value systems can be uniform but can also be in opposition to one another (Kezar, 2013). Research by Kezar (2013) asserts that values can be: actual, espoused, or aspirational. Actual values are difficult to define because they are often not clearly expressed but rather found in people's behaviors as well as campus artifacts and symbols. Espoused and aspirational values can be found in campuses' mission and values statements; however, this does not mean that they are actual values. Oftentimes, these values are what the organization strives to be rather than what they actually are.

Research has documented that higher education institutions have increasingly adopted espoused and aspirational values and policies relating to diversity, equity, and inclusion (Casellas Connors & McCoy, 2022; Ching et al., 2018; Iverson, 2007). UNC-Chapel Hill and Penn State are no exception as they too have adopted values of diversity, equity, and inclusion within their strategic plans and mission statements. Findings indicate that one of the factors contributing to the sustainability of the CSS and MLN programs is that they are advancing the goals and values of their campuses. Participants largely spoke about the programs helping to advance campuses' espoused DEI goals, however, the programs were also advancing other institutional goals. To understand how the programs are advancing these goals I first examine the campuses espoused and aspirational goals through their strategic plans.

Penn State is currently operating under the “Our Commitment to Impact” strategic plan which is meant to last from 2016 to 2025 and is underpinned by six foundations: Enabling Access to Education, Engaging Our Students, Advancing Inclusion, Equity, and Diversity, Enhancing Global Engagement, Driving Economic Development, and Ensuring a Sustainable Future (Penn State Strategic Plan, n.d.). Within the foundation of advancing Inclusion, Equity, and Diversity the university has four goals: 1) Foster a culture of respect and inclusion that values the experiences and perspectives of faculty, staff, and students; 2) Develop and implement curricula and scholarship that interrogate social issues and inspire social responsibility; 3) Evaluate and rectify organizational structures, policies, and practices that cause differential impact and limit access and opportunities for faculty, staff, and students at Penn State; 4) Recruit, support, and advance a diverse student body, faculty, and staff. (Penn State Strategic Plan, n.d.). The strategic plan asserts that the university will incorporate DEI into their research, teaching, learning, outreach, assessment, operations, and decision making at all levels.

UNC-Chapel Hill is currently operating under the “Carolina Next: Innovations for Public Good” strategic plan which is framed around eight strategic initiatives allowing the institution to: 1) Build Our Community Together; 2) Strengthen Student Success; 3) Enable Career Development; 4) Discover; 5) Promote Democracy; 6) Serve to Benefit Society; 7) Globalize; 8) Optimize Operations (UNC-Chapel Hill Strategic Plan, n.d.). The campuses’ DEI commitments are most prominent within the “Build our Community Together” initiative as it has the following three strategic objectives: 1) Invest in policies, systems, and infrastructure that promote belonging, community and transparency throughout the University community; 2) Enhance the educational benefits of diversity, equity, and inclusion through effective student recruitment, enrollment, retention and graduation; 3) Prioritize diversity, equity, and inclusion in teaching,

research and service, and in hiring, evaluation, retention and promotion of underrepresented faculty and staff (UNC-Chapel Hill Strategic Plan, n.d.)

Participants at both UNC-Chapel Hill and Penn State were in agreement that the programs were a critical piece of advancing the campuses' espoused and aspirational goals. The primary ways that programs aligned with and facilitated institutional goals were through: serving as a recruitment tool to increase compositional diversity, advancing components of the strategic plan, and advancing the academic success of students.

Programs Function as a Recruitment Tool

One of the primary ways that the programs are helping to advance DEI is by increasing the compositional diversity of campuses through serving as an effective recruitment tool. A Penn State participant explained some of the benefits provided by MLN:

Now we are able to really be a little bit more aggressive with our reach for a diverse student body as it relates to recruitment. When we're looking specifically at students who demonstrate an interest and a commitment to one of the STEMM disciplines, now we can go specifically to those targeted school districts or those targeted high schools and showcase the Millennium Scholars Program. We can put out information about the program, we have data to support the success of the students who come to Penn State, graduate from the program, and successfully matriculate into a PhD program. We're in a different conversation now where we can compete with some of the great tech institutions. I think that is a part of where I see the strength of the program, that gives us a little bit more leverage to compete for those really talented students that are interested in one of the STEMM disciplines.

Similarly, a UNC-Chapel Hill participant explained how the CSS program allows the university to be competitive in recruiting talented students:

These students get recruited to top-notch institutions. So this program, to me, is a way to sweeten the pot (laughs) for somebody who's like... "I could get [admitted] to this more prestigious [college]", what they consider more prestigious institution, "but I wouldn't have the support that UNC is offering me." So for me, I think of it as a way to say, "we want your talent here and we're willing to put some money behind that talent," and... "you can go to X institution, and maybe you'll make it, maybe you won't but we're actually gonna make sure you're on the right path. And you're having your goals met." But for me, I think it's more just thinking about how do we keep those people who are gonna be offered so many options, something really attractive that they can't turn away?

Both programs allow their campuses to be more competitive when trying to recruit high achieving diverse students because the programs have data demonstrating the success of MLN and CSS and they provide tangible benefits to students such as financial aid packages and extensive services and support. The CSS and MLN are seen as a centerpiece of recruiting diverse students because the campuses have a hard time getting a large enough applicant pool of URGs. As both campuses are PWIs they have struggled to increase the number of diverse students in their study body. Participants shared that several students of color in both programs claimed that they would not have gone to their institution if it was not for the CSS and MLN programs. However, participants also pointed out that relative to the size of the campus the amount of diverse students the program is bringing is not statistically significant. Others pushed back and explained that although the numbers may not be very high, the scholars made significant impact on campus in ways that are not necessarily quantitatively measurable. Moreover, participants

shared that the amount of students of color in some STEMM fields is so low that even helping to advance two CSS or MLN scholars of color to the PhD would double the amount of students of color with PhDs in those fields.

Participants also spoke about the close relationship that the programs have with their Office of Admissions. CSS and MLN scholars assist in admissions endeavors through serving on panels and sharing their stories for admissions marketing materials. The program's admissions recruiter also assists the university as a whole because they are able to recruit in areas where the university might traditionally have not gone before. The admissions recruiters do not solely recruit for the programs but the university as a whole, leading to opportunities to recruit a wider set of scholars. Elements of the program have also been shown to be beneficial for the STEMM colleges. For example, a Penn State participant shared how the College of Engineering is using MLN selection weekend to recruit more diverse scholars:

The College of Engineering, in terms of recruitment collaborations, [does] the interview weekend... They'll invite 45 students to the interview weekend, and out of that, they'll choose one-third of those students [to join MLN]. What the College of Engineering has started doing is, they'll choose their 15 [for MLN], but that remaining 30 students, they'll offer them scholarships to the College of Engineering. That's a whole other applicant pool that they didn't have before. The students who don't get in [MLN], they're all excellent students, so the [College of Engineering] will work hard to offer those students scholarships.

As participants described the CSS and MLN programs are helping the institutions achieve their goals of recruiting a more diverse student body.

Convergence with the Strategic Plan

Campus administrators at UNC-Chapel Hill and Penn State enthusiastically shared that the programs were very aligned with their strategic plans. In particular, administrators shared that the programs were a key component to their DEI goals and often served as a tangible example of the institution's commitment to DEI. An administrator at UNC-Chapel hill shared how the CSS program converged with the "Carolina Next: Innovations for Public Good" strategic plan:

Our very first priority in that plan is, build our community together. And that has a [DEI] component to it. The third strategic initiative in that plan, there's eight of them, is around promoting career development and advising our students in both academic advising and career advising. And [CSS] clearly is really focused on that. Serve to benefit society is another one of those strategic initiatives and everything that [CSS] is about is preparing the next generation of leaders in the STEMM disciplines, something that our nation is going to need and will be really important. And that initiative also has sort of an entrepreneurial component to it. Many of our Chancellor's Science Scholar students also receive a minor in entrepreneurship, which is something we're trying to prepare our students for careers that don't even yet exist and that would include those in STEMM disciplines around innovation and new technological advances. So those are three examples.

An administrator at Penn State shared how the MLN serves as a tangible commitment to DEI:

But now show[ing] evidence that we have a larger group of students of color who are now focusing on the STEMM disciplines is also a really compelling piece that the Millennium Scholars program actually showcases for the university. And when we go

into our accreditation with Middle States, one of the things that Middle States would ask [is] "What's working? What are you doing in terms of changing the landscape for diverse students at Penn State?" The Millennium Scholars program is one of those programs that we point to in our Middle States accreditation process to show evidence of success and commitment from the university to not only recruit a more broad and diverse student pool, but we're also retaining them and we're graduating this cohort of students at a higher graduation rate.

Examining the espoused and aspirational goals of a university can be a strategy for sustainability because it allows programs to understand what an institution values are and thus can align themselves with these values and goals. Research has argued that "espoused and aspirational values can be potentially significant levers for change because they represent specific areas where stakeholders across the campus might be willing to invest resources and effort to achieve goals" (Kezar, 2013, p. 100). As seen in the case of the CSS and MLN programs they are becoming intertwined with the institutional goals of their campuses, thereby making it more likely that the institution will continue to invest resources into the program in order to continue reaping the benefits provided.

Advancing Academic Success

UNC-Chapel Hill and Penn State have also espoused goals of advancing DEI through the effective retention and graduation of students. Participants provided numerous examples of how the programs are helping to increase the success of students both within the program and the broader campus community. For example, a UNC-Chapel Hill shared how CSS scholars are helping to address the challenge of limited faculty of color in STEM:

Many of our [CSS] scholars now serve as undergraduate learning assistants or peer mentors in the classroom, and that's exactly what we want. This visibility of scholars who are dedicated to helping their peers in STEMM classrooms and students seeing students who look like themselves as educators in the classroom...thinking about undergraduate learning assistants is that it's not just about the experience that those students receive being teachers in the classroom, but it's about the model that they serve for other students who can see that not only were they successful on the course, but they've returned to actually help their peers, and that this might be something that they might like to do when they finish the course, right? So it's a really good example of how it might take us years to get a Black professor in front of the chemistry class, but it doesn't take years to get Black students in the chemistry class to be undergraduate learning assistants. We have some sort of shorter-term abilities to diversify, at least the instructional team, in a course. And so that's something that I think has been really beneficial.

One of the key values of the Meyerhoff model is service. Scholars are expected to be leaders who give back to their communities and thus embody the motto “those whom much is given much is required” (Hrabowski III, 2015, p. 114). Scholars value collective achievement and aim to strive for group success rather than individual achievement. The cohort model and values of collective achievement help to cultivate a family-like environment that is essential to the success of scholars as a participant explains:

We create community for students who might not have one. So if you're a Black woman in engineering, or a Black woman in astrophysics, who you gonna tell? We have people that get you. They understand you, there's somebody to tell stuff to, you have an ongoing

community. It's the difference in whether you finish the program or run down the street screaming in that moment.

The programs can also aid in facilitating academic success by addressing traditional STEMM teaching and learning practices. Faculty participants spoke about how their involvement with the CSS and MLN programs have helped to change their teaching and learning practices to be more inclusive. This directly advances espoused institutional goals as it works toward addressing achievement gaps of URGs and making the classroom a more diverse and inclusive space. A participant at Penn State shared how their involvement with MLN has led to change:

The [MLN] has completely changed the way I teach. I was trained as a theoretical mathematician in the culture and norms of theoretical mathematics. Which in terms of teaching [is]: sage on the stage, monologues 50 minutes packed tight as could be, merciless, super low empathy. You keep up or you drop, that's fine. I don't actually care because I'm just here to teach my math and it's on you to absorb what I throw at you. That's the mentality that I had for most of my career. But then I started to teach [MLN]. And, I started to learn about psychosocial components of learning and teaching, things like sense of belonging and stereotype threat. And, all of this, slowly, completely changed the way I teach. Now, I never do monologues, sage on the stage. Now [students are mainly] in small groups, three to four students working in groups. I'm very intentional about building community, emphasizing the importance of communication. When I put [the students] in groups they're not just there to work on the problems, they're there to explain their thought process, which, to me, is a reflection of metacognitive awareness and to see where they're at. [It allows for them] to train themselves to be their own thought processes.

Faculty involvement with the program is helping to combat traditional STEMM culture and practices that are not conducive to student success. The previous participant is a more drastic example of how STEMM practices are being addressed as they completely changed their approach. However, other participants also shared that their approach in the classroom has also changed, namely in understanding the importance of recognizing students as a whole person and being more aware of socio-cultural differences, thus working to create more welcoming environments. Though the CSS and MLN programs are working toward creating environments that are conducive to student success they are not the only programs doing this. For example, UNC-Chapel Hill was awarded a grant from the American Association of Universities (AAU) in 2013 to reimagine STEMM education resulting in revised introductory courses in biology, physics, and chemistry. The CSS and MLN programs are part of a large web of initiatives that are striving to make the institution a more equitable place.

Participants also see these programs as a potential long-term solution to the ongoing and persistent STEMM pipeline challenge, whereby at every stage of education more and more students of color are leaving STEMM. A participant explained:

We've got to create an environment where we are growing the critical mass challenge.

We cannot work with the same pie and just simply steal talent from one institution to another. I think that is the beauty of [replicating Meyerhoff] because we're never going to get to the point that we need to as a society and as academic institutions, unless we grow the critical mass challenge.

The MAP programs are working to address this “critical mass challenge”, which can increase STEMM diversity in the future. In the meantime, the programs are helping their campuses cultivate an environment that is more conducive to student success. Organizational members

recognize the value that the programs add in this area which is leading to more buy-in and a greater likelihood of sustainability.

Demonstrating the Value of Programs Through Evidence-Based Success

Research has demonstrated that the use of evaluation can increase the sustainability of STEMM intervention programs (George-Jackson & Rincon, 2012). Evaluation can be understood as “the systematic review of a program or policy, which uses various methodological approaches to determine its merit, quality, worth or value. In addition, evaluations aid in generating knowledge of what interventions and services work best for which students, and in informing decisions related to funding and programming” (George-Jackson & Rincon, 2012, p. 2). The use of evaluation is impactful to the sustainability of SIPs because it allows them to demonstrate their value in an effort to garner additional funding and establish legitimacy within the institution. In addition, evaluations allow SIPs to assess their effectiveness and work toward making changes that facilitate success. One of the pillars of success for the Meyerhoff model is improvement through program assessment (Hrabowski III et al., 2019), as such, the CSS and MLN programs had to implement an evaluation component to their programs as part of the MAP.

Participants at all three campuses spoke about the benefits of having an evaluation component, confirming previous research (George-Jackson & Rincon, 2012). One of the ways that evaluation data has helped the programs is through helping to garner buy-in for the program and to raise funds:

That data that the program generates is important for them getting external funding so they can afford this program. And it's important for when they go to their donors. Both campuses I think have included their programs as part of their national campaigns. When

they go to their big rich well-heeled benefactors, they go with data from their program and try to make the case that this program [matters] ... A lot of STEMM scientists are data-driven. At the faculty level, it's important to have data for at least some of them. And even then it's hard to change attitudes and beliefs, [they] go through a transformative experience of some kind over time. But the data [shows] these students are getting A's in calculus, they're getting A's in physics, they are getting A in intro chemistry course. [Data] is part of how the programs sell themselves in their universities, which is a major thing they have to do. And that was clear from the start ... you can't succeed in this program unless you sell it in your university and you have to do everything you can to get your whole university behind it, which you can't get the whole university behind it. But it's the kind of program that needs support up and down the line. And so data can help you get support [by showing] that the program succeeding.

Assessment has been a critical part of being able to show the success of the Meyerhoff, ultimately leading to replication like the CSS and MLN programs. Evaluation is particularly important for newer programs because it allows them to prove that they are adding value to the university and thus should be sustained. Moreover, success documented through data can lead to material resources and benefits. A participant explains how cross-institutional research by the MAP (Sto. Domingo et al., 2019) was beneficial:

We published a paper in Science, based on the work from the [MAP] collaboration. That's a beautiful bit of currency for us at our university. I hate to think about things in this instrumental approach, but it is very difficult to get certain things done. The Chancellor's Science Scholars was sort of alone into Chemistry and [program success] allowed us to say let's put it in Honor space where there's an advisory board that can raise

money for it and where it will have career guides and we'll have extra advising and the extra benefits of being in a space where it can be supported. We can do that easily because we have the backing of the Meyerhoff, we have the backing of research results, we have the backing of the fact that we now have a track record [after] doing this for many years where we can now move it into a space where it could be optimal - We hope it will be a good space for it going forward.

Research data has allowed the programs to “sell” themselves to the universities as they provide evidence that they are meeting their intended goals. Though not as easily quantifiable, participants spoke about the visibility of student success as a way to demonstrate the value and impact of the programs. Both the CSS and MLN are highly publicized among their campuses, as a Penn State participant explained:

In terms of visibility every year we produce probably easily - five to seven students who are either student marshals, that's like a valedictorian of their department of their college, or Goldwater Fellows, which is very prestigious, or NSF Graduate Fellowship Awardees. So when you look just university wide, like all the marshals, all their pictures are listed, that picture has a little more gender diversity, and color diversity than it used to. I think that sends a message.

Similarly, a participant at UNC-Chapel Hill shared the various ways that scholars success is diffused to the broader campus community:

First of all, we have a pretty strong social media presence, we have a Twitter account, Instagram, and Facebook. Our Recruitment and Communications Coordinator shares all of the cool things that the students are doing. We had a student win a Goldwater Scholarship, so that was huge. That was blasted out everywhere, right? So we do share

what we're doing. But it's not just us putting it out there. The college, and several of the campus publications often feature our students. So if there's a Women in Science Wednesdays thing, one of our research publications on campus, we always have students in that. We have students in the College of Arts and Science magazine. All of our major publications, we usually have a student featured in there somewhere on a pretty consistent basis. So people are seeing their faces. We also parade them out any opportunity we get (laughs). So for example, whenever [we] meet with Board of Trustees or development folks who want to learn more about the program and what it means to the students and what it means to the campus I have them meet with students. [We'll] bring a group of some of our, our shining stars, and it's always a struggle for [us] to figure out which ones do I pick because there's so many awesome students. A lot of them are superstars and people see that and they're just always super impressed.

Having quantifiable research data and demonstrable success in various public outlets has allowed the programs to prove their worth, thereby leading to greater buy-in, legitimacy, and continued support.

Though evaluation provides tangible benefits to programs it is also challenging to sustain. Research finds that evaluations are difficult to conduct due to a lack of resources including staff, funds, and time (George-Jackson & Rincon, 2012). Evaluators at both UNC-Chapel Hill and Penn State experienced and continue to experience challenges in gaining support for the evaluation component of the CSS and MLN programs. One Penn State participant shares:

From the beginning, evaluation and the assessment was sort of like an add-on, like, "Oh yeah, yeah, we have to do that. The funders are asking for that." Without a fundamental understanding of the value in actually tracking and monitoring students and more than

just again, grades and test scores, but also in [science] identity changes, sense of belonging, some of these other valuable constructs that we know matter for success in these programs. From the beginning that was challenging, because the [evaluation] budget was really small and then we were almost cut out of the budget and then the budget was reduced. So there was some bad blood in the beginning and it was tough to establish legitimacy from an evaluation assessment perspective.

Likewise, participants at UNC-Chapel Hill echoed a similar “fight” to ensure program evaluation remained a fundamental component:

I have to [elevate the importance of evaluation] in every single space I'm in, including with the chancellor. [I say] “You can't go to donors, you can't go anywhere without knowing [program success]”. I have to speak in his language, but the basic element has to be there. They're working on the money to make sure that the Chancellor's Science Scholars stays vibrant and solvent. So that's the first area that they concentrate on. The evaluation always comes second and people want to attenuate it, but I'm not going to allow that to happen, but that's because I'm here and [I'm] invested. I know how important it is for the [CSS] program and for the Meyerhoff and for all of us.

Some campuses may be constrained by their resources and may opt-out of implementing an evaluation component. While this could be a cost-cutting measure it is clear that there are various benefits that a program would miss out on if they do not adopt an assessment component. A participant at UMBC provided some advice on approaches a campus might take when trying to implement and sustain a rigorous assessment component:

We have never had a problem with [evaluation] funding, other campuses struggle and it's hard. The model that worked at UMBC is they had a faculty member who was willing to

make this program their career ... I always say first and foremost find someone [who is willing to make this program their career] if you want to have a sustainable, well funded evaluation effort. You're going to be able to do things more rigorously and less driven by program pressure and program needs and you're going to have a theoretical base for it. Find a social science person, anywhere on your faculty, who cares about this, who can see their career paths going forward with this research. That's [the] number one thing. I think that's what made it possible at UMBC. If you don't have a tenured faculty member, you [may] have an internal evaluation unit, that's another way. The larger universities probably can just do it with one of their evaluation units being committed to it, definitely better because they have a larger multidisciplinary base.

The evaluation teams at both CSS and MLN are composed of tenured faculty members from disciplines like Education and Psychology. Campuses who seek to achieve greater sustainability for their SIPs should consider investing in a rigorous and well-funded assessment component as it can provide tangible benefits to the longevity of the program.

Sustainability Through Documentation

Participants at all three campuses spoke about the importance of documenting processes and procedures for the program as a mechanism of sustainability. This was especially important as there was overwhelming turnover in the early years of the programs. A participant at UNC-Chapel Hill shared:

It's crucial that things be written down. This is going to sound strange, but there wasn't a lot written down about CSS when CSS got going. And so, three, four, five, six years down the line people have to reconstruct from memory what we did and why. It would be a lot better if there were clear - [it could] take the form of clear MOUs, take the form of

having a really clear governing structure with accountability. We didn't have any of that when we started CSS at UNC. We had our relationship with UMBC and HHMI, but we didn't have much else written down. And that's tough. I think you need people to be methodical about governance, and about writing things down.

Similarly, a participant at Penn State explained that an early mistake was not creating written documents to be able to facilitate the implementation of programmatic components:

Following the Meyerhoff way, the devil's in the details. Really getting in there and going here's how you do interview weekend, let's do it exactly that way. There's a reason for all these little things that we've never done before, but let's do it exactly that way. And then you figure out why they're doing it that way. I think one of our early mistakes was we didn't have our own written documents. Meyerhoff didn't have their own ones until the [MAP] started either and they put them together. And I think we should have early on really drafted some guidelines and student guidelines, and everybody's guidelines.

Because that would have helped us. They can be living documents, they're not the end of the world.

Participants agreed that being more systematic in how they approach creating and retaining information could serve as a mechanism of sustainability. This is particularly important as programs begin to develop a unique program identity and culture. Being able to refer to a document that has procedures, values, missions statements and other critical information could assist in onboarding new staff and leadership. Both the MLN and CSS programs have now developed handbooks that speak to these areas. Documents could also assist in cross-institutional partnerships like the MAP. In speaking about future replications, a participant advised “If we ever do this again, we have people make journals and record all of this stuff.” Indeed, as

institutions continue to participate in replication partnerships, documents can prove to be a useful tool for preserving values and facilitating program sustainability.

Institutionalization of the CSS and MLN Programs

The institutionalization of any intervention can be thought of as the “end” of the life cycle because at this stage the intervention has become embedded into the structure, culture, and fabric of an institution, thereby becoming an expected and routine part of the organization (Bringle & Hatcher, 2000; Curry, 1992; Kezar, 2007). Institutionalization is the central aim of any intervention that desires to become a permanent fixture of their organization. Findings from this study have demonstrated that reaching institutionalization can be incredibly difficult as an intervention must have endured and persisted through the implementation phase, balanced adaptations in a manner that still retains the intended benefits of the intervention, and employed various sustainability strategies to prove it should become institutionalized.

Organizational theory has posited that there are levels to institutionalization rather than being a singular stage that is achieved (Curry, 1991, 1992). Work by Curry (1991, 1992) posits that institutionalization can be observed at the structural, procedural, and incorporation level. The structural level is the baseline of institutionalization and is achieved when an intervention is present in concrete ways across the institution such as organizational members being aware of the intervention and starting to change their behaviors to align with the intervention. At the procedural level, the policies and practices of an intervention become standard procedures for the organization. Finally, at the incorporation level the organization accepts the values and norms of an intervention as their own, demonstrated through incorporating them into the broader organizational culture. The notion of institutionalization at multiple levels aligns with research that argues that institutionalization is not simply about moving from being grant funded to being

supported by institutional funds, rather it is a process that seeks to embed the intervention into the fabric of the institution (Cobian & Ramos, 2021). This nuanced understanding of institutionalization is important as several participants spoke about institutionalization as simply being able to support the programs with institutional funds and having them placed in a central or elevated unit on campus. Institutionalization at its highest levels is about change as the values and norms of an intervention become part of the fabric of the institution. As Curry (1992) argues, “organizational change and its institutionalization are inexorably linked. Change is difference: institutionalization is making that difference last” (p. 21).

The goal of this section is not to prove that the CSS and MLN programs have widespread institutionalization, but rather to examine what the institutionalization of a STEMM intervention might look like at different levels. It is outside the scope of this study to be able to prove or disprove widespread institutionalization of the programs given that it would require examining multiple departments in distinct areas of the institution to do so. While interviews were conducted through a wide array of organizational members they mainly consisted of program staff, faculty and leaders from the STEMM colleges, and central administrators. The following sections aim to provide some examples of what institutionalization looks like at these different levels for the CSS and MLN programs.

CSS and MLN at the Structural Level

Although institutionalization at the structural level is the baseline it is still difficult to achieve, particularly in large organizations like UNC-Chapel Hill and Penn State. Participants had contradictory views regarding the degree of CSS and MLN visibility as it relates to the broader campus community. Some participants asserted that CSS and MLN are signature

programs with high visibility and prestige while others argued that in comparison to existing programs they are the the “scrappy new thing”:

The Morehead Scholars has enormous advantages in terms of funding, in terms of history because it has been here [for] a long time. Prestigious status, right? Because they have a building on campus. The Morehead foundation has a very nice hotel over there. So I would say that [CSS] is the scrappy new thing in the face of that hefty institutional historical monolith.

Similarly, participants at Penn State acknowledged that compared to longstanding programs the MLN is not institutionalized at the same structural level:

The Schreyer Honors College it's a fixed piece of the Penn State establishment. So to imagine that the Schreyer Honors College doesn't continue ... a whole lot of people would remember and would want it back. My goal is, ideally, if the Millennium Scholars program becomes something that is as recognized as the Schreyer Honors College ... Schreyer Honors College, it's not an academic college, but somehow has the name College and it has a dean, so will Millennium be that? ... So in terms of institutionalized, no it's not institutionalized in the same way Schreyer is. It's institutionalized, but I don't feel like it has the staying power of Schreyer [which] is decades old. We're just nine years old. So I think that just comes with time and being around a long time ... So I would hope, say in 20 years [MLN] might be more readily recognized or the branding might be just a greater part of the Penn State fabric.

Participants explained that one of the primary factors that affects structural institutionalization is the amount of time that programs have existed on campus. Existing programs like the Schreyer Honors College at Penn State and the Morehead-Cain Scholars program have been on their

campuses for a long time in comparison to CSS and MLN. Moreover, factors like having their own physical structures leads to greater awareness and enhanced visibility of programs like Schreyer and Morehead-Cain.

Participants explained that one of the reasons that the CSS and MLN programs need more time to make a significant impact on their campuses is that their mission is a longterm one. As a participant explained, “We’ll produce our first set of PhDs, next year. We’ll start seeing PhDs from cohort one. To me you’re a fully mature program [once] you produced the product, it took 10 years. It’s a 10 year product we’re producing.” One of the main goals of the MAP programs is to advance URGs to STEMM PhDs, which is a lengthy process. Participants were optimistic that the programs would have greater visibility on campus and nationwide as their earliest scholars are beginning to earn their PhDs and entering STEMM fields. The programs are entering their 10th year in 2023, which will allow them to see the results of their efforts if they have a constant flow of scholars earning PhDs.

It is difficult to assess the extent to which the CSS and MLN programs have reached the structural level as awareness of the program is contingent on organizational members’ interactions with the programs. Some of the sustainability strategies that the CSS and MLN programs have employed help with structural institutionalization because they lead to greater visibility and awareness of the program. For example, publicizing scholars’ achievements in various campus outlets helps to achieve structural institutionalization. Moreover, the use of a steering committee and advisory board is also conducive to achieving this level of institutionalization because it ensures that a greater number of STEMM faculty and leaders are knowledgeable about the programs. Since the CSS advisory board includes members from

different units on campus it has led to greater awareness in those spaces. A UNC-Chapel Hill participant shared an example of the visibility of CSS:

My unit, the Center for Student Success, it's morphed and changed over the last few years ... And because Chancellor's Science Scholars is so well known, we were trying to think of our acronym. And someone said, "Well, it'll be CSS." And then immediately someone said, "No, you can't use that. That's Chancellor's Science Scholars." So it definitely has a brand. It definitely has an awareness. I was like, "Oh yeah, we don't want to create any confusion and move into [CSS] space. That's [their] space." Instead of going with CSS, we're going CFSS just so we have a distinction. I think that speaks to just the extent of the footprint on campus, because I know that if I had rolled that out with no real in-depth descriptions about what the Center for Student Success was, nine times out of ten everybody would have assumed it was Chancellor's Science Scholars first. So they do have a good footprint and good awareness on the campus. It's a great program.

The longer that the CSS and MLN programs are on their campuses the greater structural institutionalization they will achieve, as there is a clear temporal dimension to this level.

Participants asserted that in 20 years it is likely that they will become part of the fabric of their institutions. This idea was mainly constructed in comparison to the long standing Meyerhoff program. Participants pointed out that Meyerhoff has been in existence for over 30 years, which has allowed them to achieve a deep level of institutionalization. A participant described the level of structural institutionalization that the Meyerhoff has at UMBC:

Well, there's so much buy-in from every part of the University. We have a full time program staff. The structure is there, but more than the structure, it is like the philosophy, the basic belief that permeates all this, you can see [it] everywhere from all the other

programs around campus. So every time you listen or you attend a program they always mention Meyerhoff. So there's always that influence. It's as if in the air all the molecules have an "M" on it, so you breathe it, you breathe it. It's part of the culture that it [would] be difficult to imagine UMBC without it. There's buy-in from every faculty, administration, even the staff. So it's pervasive.

As long as the CSS and MLN programs are sustained on their campuses they will continue to achieve greater success and visibility leading to enhanced structural institutionalization.

Programs that seek to be institutionalized at this level should consider various approaches to enhancing their visibility and recognition among the broader campus community.

CSS and MLN at the Procedural Level

At the procedural level, interventions should be diffusing their policies and practices to the broader campus community. Findings indicate that there are some policies and practices that the broader campus community is adopting as a result of the CSS and MLN programs, demonstrating a degree of procedural institutionalization. One of the key practices that other organizational members and programs on campus are beginning to adopt is the cohort model. Participants spoke highly of the cohort model and indicated that the CSS and MLN programs were key in showcasing that a cohort model approach could be successful at UNC-Chapel Hill and Penn State. A participant at Penn State explained how the cohort model has influenced their college:

[MLN] has really been an example of - as you're developing programs and thinking about the sort of cohort experience, how do we build other programs that replicate some of the strengths of [MLN]. We have a program that's more recent in the College of Engineering called the Clark Scholars Program ... a lot of the things that the Clarks wanted us to do,

we had models for how to do from Meyerhoff, from [MLN] of how to build a community experience around students. The Clark Scholars is different from [MLN] in that [MLN] is really focused on developing people towards going to graduate school and for the PhD, whereas Clark is really about getting students to think about leadership and business and things like that. But, the fundamental piece of bringing students in as a community and that idea of them supporting each other to succeed is very similar in terms of trying to come up with those structures. And so we've been really thinking more particularly in the College of Engineering about cohort models. How do you bring students in where you're not just saying, here's your scholarship money, good luck, but you're actually saying, here's the scholarship money and here are the things you can do to make sure you keep the scholarship, to make sure that you succeed and all of that. And so, we've been more intentional, I think about our programming and with, with some excellent models of how to do that.

The value of a cohort model is being diffused to individuals and programs on a broader scale, mainly due to the success of CSS and MLN. A UNC-Chapel Hill participant similarly shared how CSS is a primer example of a successful cohort model:

[CSS] students come in at a very high level and then they uniquely develop themselves as a cohort. [CSS] is probably one of the best examples of a cohort program that we have. We have another program on campus, the Morehead-Cain program, which is a [national] very high-end scholarship program for students, highly competitive. We take great pride in that program...but I don't think there is a more intimate cohort of people committed to a common vision of what the opportunities are for a student at this university than [CSS]... What is impactful about what this cohort can do for each other is that they

challenge each other in ways faculty could never challenge them. And [CSS] create[s] a training experience that they all participate in evolving for each other, that then enables them to consistently make meaningful contributions in our education ambitions, our research ambitions, our public engagement ambitions, and they do it in a way that is extremely reinforcing so that as they succeed. This cohort shares in the successes of others as individuals struggle and try to find their way, they do it together and they move each other along for the betterment of the institution and for the betterment of themselves.

The value of the cohort model has not only been diffused to other programs and students. Campus administrators also spoke about how the cohort model and close interactions with the programs have influenced their approaches to faculty hiring. A Penn State administrator shared:

We recently did recruitment for bringing in a large group of faculty members in our African American Studies department and one of the conversations we had was, "Okay, we learned from Millennium Scholars that when you create a cohort of support amongst peers, the likelihood of students succeeding and staying and being retained at the institution is higher." So when we recruited the nine faculty members we purposely wanted them to bring them in all at the same time and kind of hopefully try to create kind of a professional cohort where they would have the support of each other and so far it looks like that model is working with this cluster hire that we had in our African American Studies department.

The CSS and MLN programs are helping to shape the policies and practices of the broader campus community by diffusing best practices. The programs are helping to demonstrate the importance of collective achievement and valuing building community over competition and

individualism. Adopting these practices can be a meaningful step toward institutional change as it disrupts traditional institutional and STEMM cultures that are harmful to the success of URG students.

Participants indicated that working with the CSS and MLN programs has helped to shape their goals and priorities, for example in faculty hiring:

[My involvement with CSS has] certainly influenced [our] goals for hiring more faculty of minority backgrounds to get students the mentors that they want to have in the departments where they are most apt to major. We're hiring a faculty member in biology this year who came up through the Carolina Postdoctoral Program...hopefully we're going to land this guy in Chemistry...[We're] working right now with Exercise and Sports Science, on a faculty member of color. We hired two in the Sciences through the cluster hire on communities of color and wellness--one in Biology and one in Exercise in Sports Science.

A greater emphasis on recruiting faculty of “minority backgrounds” is another practice that could lead to meaningful institutional change if it is achieved. The CSS and MLN programs are serving as the necessary catalyst to reflect on existing policies and practices and address those that are not conducive to the success of URGs.

A final way that the CSS and MLN programs are changing practices is by creating the necessary conditions to facilitate greater interaction among the STEMM entities on their campus. The use of the CSS advisory board and MLN steering committee has created the necessary space to facilitate interactions among STEMM faculty and administrators. Participants explained that prior to the MLN the DEI efforts of the STEMM colleges were very decentralized because each of the STEMM colleges led their own efforts with little to no collaboration between them. While

the STEMM colleges are still leading independent DEI efforts the MLN program has allowed for a more synergistic commitment to addressing issues related to DEI in STEMM. Moreover, it has created accountability among the STEMM colleges, through interactions within the steering committee:

It's hard to come in and hear, say Engineering, talking about they're doing all this new stuff for diversity, and then you didn't...so what are you doing equity wise? [The Steering Committee] meeting helps all of us to get better about doing more to support students. So having Millennium in the mix, I think encourages the other Colleges to do more, and in the time that I've been here, I've seen all of them grow and do more.

Similarly, the CSS program has helped to unify the STEMM departments within the College of Arts and Sciences:

I think the culture in the Sciences has changed. I can't speak for the whole University, but I think from my perspective, it's changed because it gave the STEMM Department something to gather around. They were like, "Oh yeah, this is ours." It's not just the diffuse and distributed Honors Program. It is the STEMM Honors Program for recruiting students. That gave them something more concrete to point to, to recruit from.

The CSS and MLN programs are helping to cultivate a culture of collaboration among the STEMM departments and STEMM colleges at UNC-Chapel Hill and Penn State, respectively. These findings indicate that the CSS and MLN programs have met a certain degree of procedural institutionalization as their policies and practices are being diffused and utilized by organizational members in the broader campus community. Though, it is hard to determine the extent to which these practices are being diffused to all parts of campus.

CSS and MLN at the Incorporation Level

At the incorporation level the values and norms of an intervention should be part of the broader organizational culture. Like in the other levels of institutionalization it is difficult to assess the extent to which the values and norms of the CSS and MLN have been incorporated by the entire organization. However, participants shared some of the ways that the broader campus community is beginning to understand and embody some of the values and norms of the CSS and MLN models. One of the main values being accepted is an understanding that diversity and excellence go hand in hand rather than being mutually exclusive. Though the CSS and MLN programs are not the only programs working toward creating this change they are in a prime position to do so as it aligns with the Meyerhoff way. Namely, CSS and MLN scholars are expected to sit in the front of the class, introduce themselves to faculty, and conduct research alongside faculty, thereby creating an environment that is conducive to the experiential learning of faculty. Through this process the programs aim to transform perceptions regarding who belongs in science and what a scientist looks like. Participants often asserted that the programs were helping to change “hearts and minds” regarding URGs and their ability to excel in STEMM. A participant explained how the programs are working to change mindsets:

Cause they just look at you as a diversity program, right? That's the biggest problem. They can't say that y'all are producing the best scientists ever that the university has ever seen, until you do, until you show them the numbers, and then they're like, "Oh." It challenges their thought or their vision or their personification of excellence. And it creates this kind of cognitive dissonance... I know because I'm on fundraising and so I have to craft a lot of the narratives. [Faculty] are like, "This diversity program." [I'm] like, "No, no, no. We're just the best, period. This is what our students look like. You're

saying what? Because they're diverse, that [it's] synonymous with mediocrity." See that was the problem right there. [The program] creates this complete change within their mindsets, and yeah, it absolutely has changed. We've had faculty tell us as much. And because we have faculty involved with our selection process, and they go to a training in our selection process we change their mindsets. [Faculty] are like, "Hey, this program is for underserved students, right?" I mean, it could be, but that's not necessarily what we are. We are a training program that recruits the best students. I think you can see the gears turning [in faculty's mind], "[But] you've got so many Black and Hispanics students?" They disconnected this concept of excellence with this basically color. Because if you have color [then students] are just underserved...they're just on the wrong end of the tracks, right? It's until they just come in and we indoctrinate them, that [faculty are] like, "Wait, you can be excellent and non-white." (Gestures mind being blown, laughs). It's like "does not compute, does not compute."

Close faculty interactions with the programs and their scholars are critical to changing mindsets regarding URG students in STEMM. As mindsets begin to shift this starts to spillover into the larger campus community, thereby creating higher expectations for all students of color and other underrepresented populations. A participant shared how their mindset shifted as a result of the CSS program:

This happened pretty quickly after we started bringing [CSS] cohorts on campus. When I see an African-American male or female, the first thing that enters my mind, unconsciously, subconscious[ly], is, "I wonder if they're a Chancellor's Science Scholar?" It used to be, "I wonder if they're an athlete?" and I don't know if that's true for other faculty, I hope it is, because what it makes you [think is], "I wonder how academically

successful they're being? I wonder if they're involved in research in an undergraduate laboratory already? I wonder if they have a summer internship set up?"... and those are different questions than I wonder if they're on the football team? I wonder if they play women's soccer? So to the extent that faculty have expanded their subconscious. The Meyerhoff [expectations for scholars] are what matter. Sit in the front, ask questions, introduce yourself, be professional.

The experiential opportunities that the programs provide to faculty, especially white faculty, help to combat racialized notions of students of color. As faculty continue to interact with the scholars they begin to reflect on previously held deficit based beliefs regarding students of color.

Participants noted that this was important because many white faculty were used to the norm of STEM being a field dominated by white and Asian individuals. Interactions with the programs allow faculty to realize that change needs to be made in STEM fields and should be expected:

The explicit and subtle racism that somebody like I was raised with is that science is a world of white people and some Asian people who come from other countries. Up until I got [to UNC-Chapel Hill], the only Black scientist I had ever met was a postdoc...that's it. I have been to hundreds of scientific meetings, especially up through the mid '90s, that were exactly like that. So that's my picture. And I'm sorry that that's the way it is, but it is, right? And now having a handful of Black faculty colleagues, [Black postdocs, Hispanic graduate students, and meeting the Chancellor's Science Scholars], it has to have changed the way that I think. And if you asked any [faculty], they would say, "Well, of course, anybody can be a scientist." 'Cause we're all liberal white people and that's what we're gonna say. But there's still all that stuff that we lived with, right? The stuff that makes me, if I'm walking down the street at night in Chapel Hill, worry about some

people more than I worry about other people. That's all there. It's all there. I can wish it went away, but it doesn't go away... That personal experience is gonna help you reshape the way you think about things... I just wish it would make my colleagues more wanting to make things change in a bigger way. That's why I'm frustrated with people. We should be demanding change.

The presence of the CSS and MLN scholars are a disruption to the status quo, thereby providing a unique opportunity to create change at the values and norms level. This is important as creating change is a key component of institutionalization at the incorporation level.

Findings have shown that the CSS and MLN programs are creating change in some areas particularly ones related to DEI in STEMM. However, creating culture change is exceedingly difficult, particularly if that change is expected to come from a singular program: A UNC-Chapel Hill shared their perspective on the challenge of creating change on campus:

Those two institutions started at very different places culturally. I mean Maryland and North Carolina are very different starting points (laughs). Although there are racial issues on every campus it's a different thing to be an institution in the South. There is history that you are going to have to unpack and deal with ... And so the lift of culture change of an entire institution after more than a 100 years of it being a particular way - We just celebrated 50 years of black students on our campus, 50 years. That's not a long time. So to try to think about institutional change at a place like North Carolina and putting it on the back of a singular program, that's a lot, that's a heavy lift. Can it make a difference, for sure. Has it made a difference, I'm confident. But if you're looking at it to be the remedy of the mess that keeps happening at UNC that is longstanding and deep and complex.

Participants recognized that in order to create change they must go up against the historical legacies of campuses, which can be unachievable at times. Moreover, participants recognized that much of the burden of change has been placed on the scholars. In particular, scholars are expected to perform in manners consistent with the politics of respectability in order to change faculty mindsets and provide them with an experiential education. Some participants were critical of this approach to institutional change:

By folks not being [able] to engage these really tough questions of privilege, identity, power, we fall short. The idea was somehow the students were going to do this and somehow the students were going to change culture and somehow the students were just gonna be wonderful and then everybody, everything was going to be wonderful as a cultural place at Penn State. And so that's just not reality. Right? If the folks who are charged with leading this - [if] there's some resistance to that or ignorance about how to really push against white supremacy, push against patriarchy. If folks aren't willing to do that then...we're falling short.

The institutionalization of the CSS and MLN programs at the incorporation level will be dependent on a deep commitment by those with power as they have the agency and resources to create meaningful change. Unless there is buy-in and sustained commitment from multiple levels of the institution the CSS and MLN programs will not be able to be institutionalized at the incorporation level. To be truly institutionalized at this level the programs need to be incorporated into the fabric of the institution, which cannot happen if the onus of change is placed on the scholars rather than the most powerful people in the institution.

This section has sought to create a more nuanced understanding of the institutionalization of STEMM intervention programs. Rather than conceptualizing institutionalization as simply

moving from being grant funded to being funded by the institution, I propose that institutionalization is a multidimensional process that occurs on a spectrum. For this reason, institutionalization should be seen as a continuous process rather than a singular stage that is achieved. These levels of institutionalization can help STEMM intervention programs assess how they can work toward institutionalization through different approaches. The CSS and MLN programs have worked toward institutionalization at all three levels and have achieved it to some degree. However, the reality is that these are still relatively young programs that are working toward making their mark on their campuses. While institutionalization, and therefore change, is difficult to achieve, programs like CSS and MLN have the potential to be the spark that ignites transformation.

CHAPTER FIVE: THE LIFE CYCLE OF SIPS

Severe and persistent inequities for students from underrepresented groups in STEM fields has remained a topic of national concern for several decades (Asai, 2020; Granovskiy, 2018; Institute of Medicine, 2011; National Academies of Sciences, Engineering, and Medicine, 2016). More recently, STEM intervention programs have been lauded as potential “solutions” to helping address these disparities with high profile programs like the Meyerhoff Scholars Program at UMBC serving as shining examples of what could be (Chubin & DePass, 2017; George et al., 2019; Hrabowski III et al., 2019; Institute of Medicine, 2011; Tsui, 2007). It is not surprising that these programs have been looked to as potential answers to enduring challenges as they have been shown to lead to greater outcomes in retention, graduation, and career outcomes for URG students (Chubin & DePass, 2017; National Academies of Sciences, Engineering, and Medicine, 2016; Tsui, 2007).

National agencies have even made bold claims encouraging the adoption of such programs by asserting, “What is needed is for *every* four-year institution to develop and implement its own version of programs with demonstrated and sustained success such as the UMBC Meyerhoff, Georgia Tech Focus, or Rice University Computational and Applied Mathematics (CAAM) programs.” (Institute of Medicine, 2011, p. 151). Such hefty proclamations as to the value of STEM intervention programs is what drove part of the development of this study. As I began researching SIPs I encountered numerous articles, primarily quantitative, which demonstrated the academic value these programs brought to URG outcomes. However, it was difficult to find studies that explained *how* to develop these programs. Moreover, I observed that the few studies that did examine the processes of developing such programs mainly focused and ended at the implementation stage. This dearth in

research was surprising because if national agencies are asserting that *every* four-year institution should be developing their own version of programs like Meyerhoff, then there should be resources available that help facilitate this goal. I sought to examine the life cycle of the Chancellor's Science Scholars program and Millennium Scholars program in order to help inform campuses of the various challenges that they might encounter as they develop their own programs, but also highlight some mechanisms and strategies that could facilitate success. This life cycle perspective was critical to the development of the study because the success of programs is not solely contingent on a successful implementation. Results show that it is also important to consider how programs are adapted, sustained, and institutionalized.

Lastly, the lack of research regarding the life cycle of STEMM intervention programs pushed me to look at fields outside of higher education and immerse myself in organizational theory. This study has been heavily informed by organizational theories and frameworks that examine topics such as racialized organizations (Ray, 2019a), institutional isomorphism (DiMaggio & Powell, 1983; Garbes, 2022), implementation effectiveness (Weiner et al., 2009), frameworks and concepts of adaptation (Kezar, 2011; Wiltsey Stirman et al., 2019), strategies of sustainability (Cobian & Ramos, 2021) and theories of institutionalization (Curry, 1991, 1992). Being informed by organizational theories allowed for a more nuanced examination into the organizational dynamics of UNC-Chapel Hill and Penn State. Emerging research finds that STEMM intervention programs are rarely informed by organizational theory, resulting in a narrow focus on student-level insights rather than organizational dynamics (López et al., 2022; Reinholz et al., 2021). Key to this study was examining processes that can help higher education institutions implement, adapt, sustain, and institutionalize STEMM intervention programs in hopes of cultivating environments that are more conducive to URG student success. More

importantly, such interventions can touch many more areas of the university than anticipated, resulting in questioning current practice and introducing innovation.

Examining the Life Cycle of the CSS and MLN Programs: Summary of Findings

In the following section I summarize key findings pertaining to each research question.

Figure 5.1 shows elements of the SIP life cycle examined in this study.

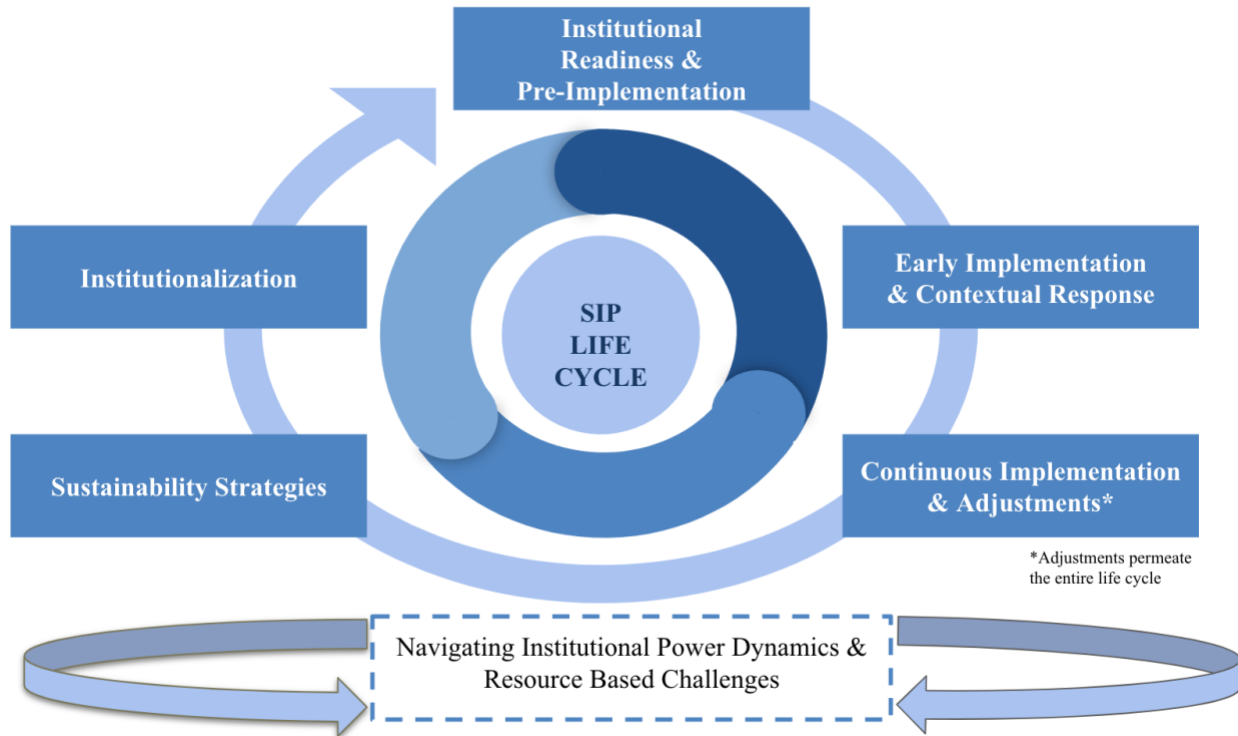


Figure 5.1: Model for the Life Cycle of STEMM Intervention Programs

The goal of this section is to provide context to a conceptual model for the life cycle of STEMM intervention programs which is informed by results of this study. For a more thorough explanation of the existing literature that informs each stage of the life cycle refer to chapter two.

Research Question 1

What was the process of implementing the Meyerhoff program at UNC-Chapel Hill and Penn State? (A) What elements of the student-centered, culturally responsive MSP program were more widely adopted and what was more challenging to existing practices

and norms at predominantly white, research-intensive institutions? (B) How did these culturally responsive scholar programs fit within the ecology of other student programs or diversity practices on campus?

Results indicate that it is important to assess an institution's readiness for change prior to implementation. Evaluating readiness for change requires implementation teams and partners to engage in a reflexive process in which they assess their institutional context and culture to understand the barriers they might face but also the potential resources they could leverage to facilitate their goals. During this pre-implementation phase it is critical to develop a methodical plan for implementation that entails (but is not limited to): how to garner buy-in and commitment from the broader campus community, what the goals and purpose of establishing the program are, who will compose the implementation team and how will interpersonal team dynamics be enhanced, what will program leadership and staff look like, and figure out the logistical details of the programs (how will it be funded, where will it be placed, what does the reporting structure look like, etc.). In the case of the CSS and MLN programs lacked the necessary lead time to develop this methodical plan, therefore the implementation teams were “trying to build a plane, while flying it”.

During the implementation phase programs must put into practice their implementation plans and navigate broader campus dynamics resulting from existing programs and organizational members, the contextual response. However, findings demonstrated that programs have to navigate institutional power dynamics and resource-based challenges throughout their life cycle. Though, it is amplified at the implementation phase because programs pose a challenge to the status quo of routine organizational life, particularly involving race and DEI activity.

Results showed that the main challenges the CSS and MLN program had to face were figuring out where to place the programs, how to set up a funding model, and how to integrate the programs into an existing ecology of student programs and diversity initiatives. The CSS and MLN programs had distinct experiences during the implementation phase in that the CSS faced minimal resistance while MLN had to address multiple challenges. The territorial culture of Penn State and decisions to fund the MLN program by diverting resources from existing DEI programs led to losing support from DEI leaders in the STEMM colleges. Rather than helping, this approach to funding hurt MLN in developing allies and buy-in. Additionally, the long established Schreyer Honors College was reluctant to welcome MLN into the existing ecosystem of programs because they had concerns MLN would be duplicating their efforts. MLN had to carve out a niche for themselves in order to gain acceptance and accomplished this by stressing their emphasis on advancing URG students to STEMM PhDs through a cohort model, something that no other program at Penn State was doing. For CSS, intentional decisions and strong support by multiple Chancellors allowed them to avoid initial pitfalls. Namely, the program was started under the directive of one Chancellor (who left in the early years of the program) and received substantial financial commitments from the incoming Chancellor, allowing them to mitigate funding challenges. Lastly, CSS did not experience the same magnitude of challenges in trying to integrate into the existing ecosystem of programs because there were no other programs focusing on URG students in STEMM at the time of implementation and there were intentional decisions made by program leaders to not engage with existing diversity initiatives.

A key goal of the MAP collaborative was to determine whether the entire Meyerhoff model could be replicated at larger research institutions with different histories, geographies, and institutional cultures. Due to this the CSS and MLN programs sought to implement all the

elements and values of the Meyerhoff model. Results demonstrate that the more functional elements like the academic components were more widely adopted while program values were difficult to adopt as there was a cultural mismatch between the values and cultures of UNC-Chapel Hill and Penn State and those of the Meyerhoff model. Campuses struggled with the HBCU-derived program values of Meyerhoff including a focus on collective achievement over individualism and competition, and program activities and rules meant to instill discipline in scholars. Adopting a strengths-based model was difficult because campuses operated on a binary where they had not seen a program that focused both on diversity *and* excellence, as such, the programs had to combat racialized notions of URG students. Lastly, programs struggled to commit to advancing racial equity. A key value of Meyerhoff is to advance racially underrepresented scholars in order to diversify STEM fields. Campuses were challenged to achieve this goal due to their institutional histories and geographic locations. Moreover, program leaders were hesitant to take steps to explicitly recruit racially underrepresented scholars due to the potential of legal challenges. For the CSS program, decisions made by initial leaders resulted in focusing on low-income white students as a means to diversify STEM, a clear difference from the Meyerhoff approach.

Overall, the implementation phase was a tumultuous time for the CSS and MLN, however the programs were able to work through these challenges, in part due to adaptations made to the Meyerhoff model, as well as the support and accountability from UMBC and HHMI.

Research Question 2

What key adaptations did the CSS and MLN programs make to the Meyerhoff model in order to fit into their unique institutional contexts and to what extent did this affect model fidelity?

Results demonstrated that the CSS and MLN programs made several adaptations (or adjustments) to the Meyerhoff model in order to reframe and “sell” the programs to their predominantly white research-intensive campuses. Adaptations were a mechanism by which programs could adjust, and at times assimilate, into their unique institutional contexts and cultures, ensuring there was more widespread acceptance. Adaptations resulted in positive outcomes like allowing the programs to develop their own program identities leading to a sense of ownership over the programs and enhanced buy-in. Adaptations made to the model included: adaptations to academic requirements, modifying and adding practices to enhance diversity, equity, and inclusion, modifying program values such as the mission of advancing scholars to STEMM PhDs and broadening commitments to diversity, and adjustments as a response to scholar requests such as allowing scholars to live off campus after the first two years and allowing them to join Greek life (in the case of Penn State). Though the CSS and MLN programs made several modifications to the Meyerhoff model they retained high levels of fidelity by keeping all the programmatic elements and values, albeit, in different ways.

Findings also indicated that there were three primary mechanisms that enhanced fidelity to the Meyerhoff model, these included: the relationship with UMBC/Meyerhoff, accountability measures by HHMI, and program leaders who had values consistent with the Meyerhoff model. Being attentive to fidelity is important as research has found that close adherence to the original model leads to a greater likelihood of retaining the intended benefits of an intervention. Results show that cross-institutional collaborations can enhance fidelity to the model and can be important for the entire life cycle of SIPs. Additionally, funding agencies who play active roles can promote fidelity by holding programs accountable and providing them with the resources necessary to maintain fidelity. Finally, program leaders who have values consistent with the

original intervention are more likely to adhere to the values and missions of the model. Further, selecting the right program director or leader who “gets it” can be a fidelity mechanism in that they will grasp the intent of practices and their effectiveness.

Research Question 3

What key mechanisms did the CSS and MLN programs employ to achieve sustainability and institutionalization at UNC-Chapel Hill and Penn State?

Findings demonstrated that the CSS and MLN programs engaged in several strategies to promote sustainability, which included: obtaining buy-in and sustained support from key organizational members (staff, faculty, and senior administrators); scaling the programs through organizational and financial development; helping to advance the values and missions of the institution; and demonstrating the value of the programs through evidence-based success.

One of the main, if not the main, drivers of sustainability was the result of deep commitment from a broad set of organizational members both across different units on campus and at multiple levels. The support of senior administrators provided the programs with legitimacy and the resources needed to carry out their missions. Faculty support and engagement allowed the programs to carry out many of the program elements such as selection weekend, summer bridge, and mentoring scholars in their research labs. Lastly, program staff and directors take on an incredible amount of work to ensure that the programs are successful both in the day-to-day operations and in the long term. Results demonstrate that the success of these programs is contingent on the entire university, not just program staff and leaders. Programs were also sustained due to developments in their organizational placement and funding sources. For MLN being placed centrally in the Office of the Executive Vice President and Provost and forming a partnership with the STEMM colleges was essential to being sustained. CSS has endured a

turbulent time in trying to be sustained, leading to campus administrators moving the program out of the division of Natural Sciences and Math to Honors Carolina, still within the College of Arts and Sciences. The move to Honors Carolina could prove to be a major step toward sustainability, however, it has also come with challenges such as losses in program size, staff, and decision-making power. The CSS and MLN programs have also been sustained because they help to advance their institutions' espoused and aspirational goals mainly around diversity, equity and inclusion. Namely, the programs serve as a recruitment tool leading to greater compositional diversity, the programs serve as tangible committees to DEI aligning with institutional objectives in the strategic plans, and the programs help to advance academic success leading to more effective retention and graduation of URG students. Lastly, the programs are sustained by demonstrating their value through rigorous evaluation and data proving that they are meeting their goals. Though both the CSS and MLN programs have had challenges in maintaining a well-funded evaluation component.

Many participants conceptualized institutionalization as simply moving from being grant funded to being funded through institutional resources. However, the study sought to expand the concept of institutionalization by exploring distinct levels of institutionalization, namely the structural, procedural, and incorporation levels. Findings showed that institutionalization is a multidimensional process that occurs on a spectrum rather than being a single stage or status that is achieved. In particular, institutionalization can be observed in the extent to which the program is known around campus (structural), if the programs' policies and practices are being adopted by the broader organization (procedural), and if the programs' values and norms are being incorporated into the broader organizational culture (incorporation). Findings indicated that there are contradictory perspectives as to the level of visibility the programs have and how well known

they are on campus. The CSS and MLN programs are diffusing their policies and practices to the broader organization, mainly in showcasing the value of the cohort model and creating structures to promote collaboration. At the incorporation level, the programs are helping to change values and norms around diversity and excellence primarily through changing mindsets regarding the ability of URG students and who belongs in science. Results indicated that the CSS and MLN programs have achieved a degree of institutionalization at all these levels, however it is difficult to assess the full extent of institutionalization.

Significant Contributions to Scholarship and Theory

Contributions to Implementation Literature

The results of this study align with findings from existing research on the implementation of SIPs, namely the importance of collaboration (Kezar & Holcombe, 2020b), the value of assessing institutional readiness (Rosser & Chameau, 2006), and the importance of securing buy-in from multiple levels of the organization (Cullinane, 2009; Grossman et al., 2015). This study makes a unique contribution to the implementation literature by examining the replication and implementation of a comprehensive SIP that has values of being student-centered, strengths-based, and culturally responsive. Research has often referred to the Meyerhoff as a special or unique case that is only possible because it was developed by the university President who has remained actively involved in the program (though they retired from the university in 2023) (Kezar & Holcombe, 2020b). This study provides critical information demonstrating that a Meyerhoff-like program is possible at institutions with distinct campus cultures, missions, and geographies. Results from this study were able to highlight various challenges that programs encountered when trying to implement the cultural values of the Meyerhoff model into a predominantly white research-intensive institution. Meyerhoff's roots in HBCU culture were

particularly challenging for these campuses as these values and approaches were at odds with the existing culture of UNC-Chapel Hill and Penn State. Through a racialized organization lens, this illuminates that cultural clashes were a result of whiteness being the norm at these universities (Ray, 2019a). This study is one of the first to examine the process of replicating and implementing a proven national model into a distinct campus context and being able to examine it over a ten-year period.

This study also makes a contribution to the implementation literature by joining others who have made calls for greater incorporation of organizational theory in the study of SIPs (López et al., 2022; Reinholz et al., 2021). Through an organizational theory lens, I have joined other scholars in framing organizations as a stabilizing force that aims to maintain the status quo (Klein & Knight, 2005). The introduction of a new innovation is a challenge to this status quo and thus a threat and disruption to routine organizational life. The values of Meyerhoff were certainly a disruption to the normal way of doing things at UNC-Chapel Hill and Penn State leading to resistance and hesitancy to implement all aspects of the model. Findings demonstrate that research that seeks to examine the replication, implementation, and life cycle of SIPs would gain from using organizational theory. Moreover, examining institutions as racialized organizations can provide more clarity on institutional power dynamics and how institutions are a structuring force which can enhance and diminish the agency of people of color. This study joins emerging research that strives to incorporate organizational theory in order to work toward institutional change.

Contributions to Adaptation Literature

While research has documented that SIPs are often the product of mimetic isomorphism (George et al., 2019), where a program is created by modeling a more successful one, there is

limited work that has examined the actual process and challenges that emerge from a replication and from adaptations made to established models. Moreover, work that has examined the process of adaptation has largely been conducted in fields outside of higher education. The majority of the work that focuses on adaptations and fidelity to models is usually contained to health fields that examine clinical and behavioral interventions in order to understand whether similar clinical outcomes are obtained in different contexts (Damschroder, 2020; Wang et al., 2018).

This study sought to bridge these distinct fields in order to examine the adaptation process of the CSS and MLN programs. Using the the Framework for Reporting Adaptations and Modifications-Enhanced (FRAME) (Wiltsey Stirman et al., 2019) and an understanding of adaptation and fidelity as mutual adaptation (Kezar, 2011) I examined how the CSS and MLN programs approached the adaptation process. Through this approach I presented novel results that show multiple areas in which the Meyerhoff model was modified and explored mechanisms of fidelity. This approach showcases one way that researchers and practitioners can track adaptations in a more systematic way. Moreover, a meaningful contribution is made to the literature by showing that the adaptation is a dynamic process rather than a static construct. Results showed that adaptations don't always lead to negative results as much of the literature warns against making too many modifications to the original model. One of the key findings of the adaptation phase is that modifications can help programs develop unique identities which help garner buy-in and ownership in the new context. Adaptations can also lead to enhancing greater diversity, equity, and inclusions as results showed that modifying the gendered practices of Meyerhoff and adding explicit programming on DEI issues allowed the programs to work toward greater equity. As adaptations are an understudied topic in higher education, future work should seek to measure the extent to which modifications shape programmatic outcomes.

This study also makes a meaningful contribution to the topic of fidelity by highlighting the importance of cross-institutional partnerships with the original developer of an intervention and the funding agency sponsoring the project. Findings demonstrated that programs benefit when the funding agency takes a more active role in the process of adapting a program. The role of the funding agency in a project is also an understudied topic that should receive more attention. As institutions continue to get funded to replicate Meyerhoff-like programs (Howard Hughes Medical Institute, 2023; Simmons & Asai, 2022), examining the role of funders becomes increasingly important.

Contributions to Sustainability and Institutionalizing Literature

Findings from this study regarding sustainability are well aligned with research that has examined the sustainability strategies of grant-funded programs (Cobian & Ramos, 2021) and other existing STEMM intervention programs (George-Jackson & Rincon, 2012; Gomez et al., 2021; Rincon & George-Jackson, 2016). Existing research has indicated that programs have been sustained due to buy-in from top down and bottom-up leadership, scaling the programs, showing their value through assessment, and through finding alternate sources of revenue, which are all things that the CSS and MLN programs have done. One topic that has not been as extensively studied is the relationship between program missions and goals and those laid out in institutional strategic plans. This study finds that one of the reasons why the CSS and MLN programs are sustained is because it creates a synergistic loop where the programs serve as a tangible commitment to DEI leading them to be sustained so that the institutions can retain the produced benefits. Future research might consider doing a more in-depth investigation of the relationship between SIPs and campuses' espoused and aspirational goals presented in their strategic plans and institutional missions.

Results from this study similarly find that financial challenges were one of the focal threats to sustaining a program (Cullinane, 2009; Gomez et al., 2021; Rincon & George-Jackson, 2016; Rosser & Chameau, 2006). Much like existing research has noted, one of the main facilitators of maintaining funding is through financial commitments made directly from the institution rather than relying on grants and donations (Gomez et al., 2021; Rincon & George-Jackson, 2016). Having institutional commitments from UNC-Chapel Hill and Penn State allowed the CSS and MLN programs to be sustained after HHMI grant funding ended. Results from this study show that sustainability is an ongoing process that is shaped by internal and external factors. In the case of CSS the COVID-19 pandemic has constricted institutional budgets leading to a decrease in cohort size. Though there is little research can do to ameliorate these macro level challenges it is still important to document these barriers and showcase how programs are working through these problems. In the case of CSS they are moving the program to Honors Carolina in hopes that it brings financial stability.

Results from this study echo existing research that has stressed the importance of having a rigorous and sustained evaluation component (Cullinane, 2009; George-Jackson & Rincon, 2012; Gomez et al., 2021; Hrabowski III et al., 2019; Institute of Medicine, 2011). One of the strategies that the CSS and MLN programs have been able to use to be sustained is showing their value through assessment. However, both the CSS and MLN programs have not been able to obtain sustainable funding commitments for the evaluation component. Institutions who seek to implement Meyerhoff-like programs should take preemptive steps to budget for an evaluation component as existing research has demonstrated that it is a necessary component that is often overlooked. While not a novel contribution it still adds to the growing body of literature that has advocated for greater assessment efforts within SIPs.

While higher education studies have examined institutionalization of service learning programs, diversity initiatives, and equity based policies (Bringle & Hatcher, 2000; Kezar, 2007; Kezar & Sam, 2013) there is a lack of literature that has examined the institutionalization process of STEMM intervention programs. This study has aimed to provide a more nuanced understanding of institutionalization by using organizational theory. From the lens of Curry (1991, 1992) I posit institutionalization as a multidimensional process on a spectrum that is linked to organizational change not simply moving from grant funding to institutional funding. Moreover, there are different levels of institutionalization that a SIP can attain, which takes different strategies and approaches to achieve. Emerging research like that of Cobian and Ramos (2021) has argued that while some have conceptualized institutionalization and program sustainability as interchangeable concepts, this is not the case as strategies to achieve sustainability are different from those needed to achieve institutionalization. Whereas sustainability is mainly focused on maintenance, institutionalization focuses on embedding practices, policies, cultures, and norms of a SIP into the broader campus context and culture. This expansive view of institutionalization makes a meaningful contribution by creating distinctions between sustainability and institutionalization and providing campuses with a clearer understanding of what it means to institutionalize a program. For the CSS and MLN programs institutionalization can be seen in their diffusion of practices such as showcasing the value of cohort models leading to greater adoption of this practice and through changing mindsets regarding diversity and excellence. Future research should consider using organizational theory to further develop the concept of institutionalization especially as it relates to STEMM intervention programs specifically.

Implications and Recommendations

Implications and Recommendations for Research

The Need for a Life Cycle Approach

Throughout the study I have explained that a life cycle perspective is missing in research focusing on SIPs. Though there is a growing body of research that has begun to examine the phases of the life cycle of SIPs, namely the implementation phase, there is still a lack of scholarly work that examines multiple phases. Future research should examine multiple phases of SIPs in order to better understand how to ensure their continued success at distinct stages. Additionally, future work should consider investigating the life cycle of different types of SIPs, particularly ones in different institutional contexts. The MAP programs are unique in that they are comprehensive SIPs entailing multiple programmatic components, values, and pillars, as well as being very expensive programs with tailored services. These types of SIPs are not the norm, rather institutions have been found to employ a singular component or a few components to create their SIPs such as providing a summer bridge and/or research component (Pearson et al., 2022; Tsui, 2007). Future work that examines the life cycle of these types of smaller SIPs could lead to confirmatory or divergent results. Future work that examines SIPs at different institutional contexts could also lead to more nuanced understandings. The challenges found in this study were largely a product of institutions that are predominantly white and research-intensive. It could be the case that these challenges are not the same at other institutions. For example, minority serving institutions (MSIs) might face unique challenges as it relates to their SIPs but could also leverage different resources.

Lastly, future studies should consider assessing the replication and/or implementation of multiple programs. This study is limited in its generalizability as it only examined two

institutions. However, being able to examine the trajectory of these programs at two distinct campuses, over a 10-year period, led to rich findings. Future work that seeks to develop more generalizable results could consider comparing multiple programs in order to search for variance within and across programs.

Toward a “STEMM Inclusion Program” Perspective

Reflections from participants, insights from literature, and my own desires to shift the onus of transformation to institutions led me to reflect on the power of language and how the term “intervention” can reinforce deficit discourses of underrepresented students. As researchers have explained “More than simply a collection of words, language is representative of beliefs and values. Language is a reflection of how one makes meaning of social reality but, language also works to construct social reality by producing meaning” (Castro, 2014, p. 410). Research has documented that deficit discourses are present within STEMM intervention programs when students of color are labeled as “at risk” or “underprepared” (Castro, 2014). Though individuals and programs who use these terms may not be necessarily using them with malice this is one of the many ways that racialized notions of students of color are maintained, thereby undermining efforts to achieve equity. If we are to move toward meaningful change we need to reflect on how our language is a representation of our goals and ideals. Namely, how the word “intervention” reflects a perspective that sees students as in need of fixing. Meaningful transformation will be achieved when we focus on how to “fix” institutions, not students (Asai, 2020; Castro, 2014; Chubin & DePass, 2017; Estrada et al., 2016; Linley & George-Jackson, 2013; National Academies of Sciences, Engineering, and Medicine, 2016)

With this perspective in mind, I propose a simple but powerful shift in terminology to reflect a focus on transforming institutions. Rather than STEMM intervention programs I suggest

the term STEM *inclusion* programs. This shift in language would allow researchers to retain the established acronym “SIPs” while at the same time emphasizing and reinforcing the notion that these programs are meant to help *include* URGs into spaces where they have been historically left out. Namely, these programs should have the broader goal of cultivating *inclusive* environments that are conducive to the success of URG students, not simply being a retention or graduation tool. Examples of a STEM inclusion program are seen with the MAP programs as they employ specific strategies to create more inclusive environments. The cohort model is an example of an inclusion strategy as it helps to combat individualistic and competitive STEM environments that are harmful to URG success. A STEM inclusion program is focused on developing activities and strategies that can be put into place to change the broader institutional context rather than focusing on interventions that can be done to arm students to supersede barriers. This simple shift in language could aid in institutions and individuals being more introspective as they continue to design and implement new STEM inclusion programs.

I posit that this focus on “interventions” is one of the reasons why the bulk of research on SIPs has focused on student level outcomes. Rather than assessing the organization, researchers have focused on the ability of these programs to shape student outcomes. While documenting successful programmatic outcomes is important, as findings from this study have shown, it is equally important for research to study the organizations that these programs are operating under. As emerging research has shown there is a dearth of work that incorporates organizational theory in the study of SIPs (López et al., 2022; Reinholz et al., 2021). I join these scholars in calling for a more intentional focus on organizations as a unit of analysis. Without an explicit focus on organizational change and transformation there will always be a need for programs to

“intervene” because the context and structures that impede URG success are not examined, and therefore not addressed.

Implications for Practice

Findings from this study have sought to provide several practical implications for campuses who seek to replicate and implement their own SIPs. I developed a model for the Life Cycle of STEMM intervention programs (Figure 5.1) in hopes that it could serve as a tangible guide to reflecting on the multiple stages that a SIP would go through if the goal is to institutionalize it. I outline some additional practical implications that could help facilitate the success of SIP development, based on the results of this study.

The Importance of Being Proactive

One of the major implications for practice is the need for campuses to be proactive rather than reactive throughout the life cycle of SIPs. The pre-implementation phase is an ideal time for institutions to earnestly examine their institutional policies, practices, cultures, and histories in order to understand the context in which they plan on developing a SIP. This assessment can aid in a smoother implementation and therefore a greater likelihood that the program is sustained and ultimately institutionalized. Campuses should reflect on the goal and purpose of implementing a Meyerhoff-like program or distinct SIP. As participants explained, a campus should not replicate a Meyerhoff-like program simply because they have the monetary means to or if their sole goal is improving academic outcomes. A Meyerhoff-like program should have the broader goals of changing institutional cultures to make them more conducive to URG student success. Therefore, programs will need to determine how they will garner broad buy-in and support, who will compose the program teams and who key allies will be, what steps will be taken to work toward institutional change and determine measures and milestones of success in order to build toward

greater change. Existing work like that of Rosser & Chameau (2006) provides a list of questions that institutions should ask themselves if they seek to apply for an ADVANCE grant in order to assess whether their institution is ready to develop an ADVANCE proposal. However, campuses should use these types of questions as a guide and develop and adapt their own questions that are responsive to their local contexts and needs.

Campuses will be well served if they lay out clear objectives and measures of success. This will assist in forming a program identity but also provide guidance on necessary steps to take to achieve these goals. For example, if a goal of the program is to advance racial diversity this might entail doing more focused recruitment in areas that have a higher concentration of students of color or attending recruitment events that are focused on racially minoritized students. Clear goals and objectives facilitate measurable actions.

The importance of being proactive is not limited to the pre-implementation and early implementation phase. Results showed that in order to be successful the MLN and CSS programs had to make various changes and adapt to new and ongoing challenges. While the need to be reactive is inevitable, careful planning and an eye to future goals can help create stability during turbulent times. For example, if the goal is to have a cohort with a specified number of students or to scale up to a bigger cohort, programs should assess what the monetary needs of this cohort would be and plan for ways to diversify their funding streams, well in advance. As seen in the case of the CSS budgetary constraints brought on by the COVID-19 pandemic has led to their cohorts shrinking. The CSS program took a big financial hit because the majority of their funding was coming from central administration. In contrast, the MLN programs' funding model is a partnership between central administration and the STEMM colleges. While this does not absolve them from financial challenges it does help in distributing the weight of funding. Those

who seek to adopt a similar SIP should consider how their funding model is or is not conducive to expanding cohorts and how well it will do during challenging financial times.

Results also showed that sustainability is not merely dependent on finances. CSS and MLN employed various strategies to enhance their sustainability like aligning with institutional strategic plans and showing their value through rigorous evaluation. Campuses who wish to promote sustainability of their SIPs should be planning to use a broad set of sustainability strategies. Lastly, while institutionalization of a program is extremely difficult, the levels of institutionalization presented in this study can help campuses to reflect on the steps that need to be taken to achieve institutionalization at each level. For example, institutionalization at the structural level deals with awareness of the program from the broader campus community. Programs can take steps to promote greater awareness of the program such as developing a steering committee or advisory board, partnering with existing programs that have similar goals, and showcasing student success through public outlets.

Success is a Shared Responsibility

This study joins research that finds collaboration is a key piece to successfully implementing comprehensive SIPs (Kezar & Holcombe, 2020b). Furthermore, results show that collaboration is important throughout the life cycle of SIPs. Findings indicate that program success is contingent on members from the entire institution coming together and remaining committed to the programs. One of the primary ways that the CSS and MLN programs have been sustained is because there is support from organizational members across the institution and at multiple levels of the institution. The success of these programs cannot be the sole responsibility of the Program Director and program staff, rather success is a shared responsibility. Furthermore, the burden of success cannot be left to people of color to bear. Results from this study have

shown that support and allyship from white individuals is critical to the success of these programs. This is particularly important in predominantly white environments where the majority of leadership and faculty are white individuals. Transformation emerges when the most powerful people in the university take meaningful actions to catalyze change. As white individuals have traditionally, and continue to, hold positions of power it is necessary to leverage that power to help create a more inclusive and equitable environment.

In order to facilitate this approach campuses should consider how they can create structures that promote greater collaboration among organizational members. For CSS and MLN, the use of a steering committee and advisory board has helped to bring together central campus administrators, administrators and faculty from the STEMM colleges, and members from campus offices like Admissions. This is one approach to building synergy among a broad set of organizational members, but campuses can employ other strategies to promote cross-campus collaborations. Working toward an understanding of success as a shared responsibility can help advance these SIPs but also broader institutional missions and goals.

Findings showed that cross-institutional collaborations with UMBC and HHMI were also key at multiple stages of the life cycle of the CSS and MLN programs. Though this type of cross-institutional relationship is not common, results indicate that it can be conducive to success and campuses should consider establishing these relationships when possible. Results from this study showed that a cross-institutional collaboration can help by providing initial guidance during the implementation phase, serve as an accountability mechanism when programs make adaptations to the model, and enhance sustainability and legitimacy, as seen in the visibility brought to the programs when research was published (Sto. Domingo et al., 2019). A cross-institutional collaboration allows campuses to harness the knowledge and expertise of institutions who have

gone through the process of setting up and running SIPs. An emerging example of this type of cross-institutional collaboration can be observed in the HHMI sponsored Driving Change Initiative and the “Driving Change Learning Community” (Simmons & Asai, 2022). As campuses continue to replicate and implement these STEMM inclusion programs cross-institutional collaborations can serve as an effective tool in working toward broader institutional transformation and culture change. These cross-institutional collaborations can be conducive to starting national networks that aim to advance equity in STEMM for students across the country.

Shared Responsibility, Unique Contributions

While success is a shared responsibility, individuals have unique roles to play due to their positions within the organization.

Institutional Leaders. Results from this study demonstrate that those at the highest levels of leadership such as Chancellors and Presidents can leverage the power of their offices to make meaningful changes that are conducive to program success. For example, one of the UNC-Chapel Hill Chancellors used their discretionary resources to fund the CSS in order to avoid zero-sum outcomes that can emerge from limited finances. Being able to fund the CSS in the early years without diverting resources from existing programs allowed them to be better integrated into the campus context and facilitated a smoother implementation. While having verbal buy-in and support is beneficial, leadership at the highest levels must also demonstrate their commitment to these programs through tangible resources provided.

Faculty. Faculty play a central role in the success of programs because they are involved in multiple activities such as teaching, mentoring, and conducting research with scholars. Enough faculty must buy-in and be committed to these programs in order for them to be successful. Moreover, faculty involvement must include tenured faculty members rather than

relying solely on pre-tenured faculty. Participants spoke about the importance of protecting pre-tenured faculty of color as too much involvement in service commitments might be detrimental to achieving tenure as it can diminish time devoted to research. Tenured faculty are also better positioned to handle issues related to power dynamics and politics that may emerge.

Program Directors and Staff. Program directors and staff are at the center of ensuring that these programs are successful. Program directors play a unique role as they can shape the direction and aims of the programs to align with their preferences and values. As seen in the case of the CSS, early leadership shifted recruitment priorities to low-income white students as a means of diversifying STEMM fields. Ensuring fidelity to the Meyerhoff model is typically dependent on the program director and staff believing in the “Meyerhoff way” and embodying the values that go along with the model. Program directors have the power to make changes to the model leading to greater equity such as removing the gendered practices that Meyerhoff once had but can also make changes that start to deviate from the original intended outcomes.

Funders. Results demonstrated that involvement from HHMI was central to keeping the CSS and MLN programs true to the Meyerhoff model. HHMI served as an accountability mechanism by being able to “hold their feet to the fire” through their monetary commitments and grant stipulations. HHMI provided the financial means to replicate the entire Meyerhoff model rather than allowing institutions to take a piecemeal approach. Additionally, meetings hosted by HHMI provided a critical space for campuses to report on progress, problem-solve, and build relationships. Results suggest that rather than taking a passive approach, funders should be active partners throughout the life cycle of programs. Funders can promote program success by leveraging the power they hold.

Conclusion

At the core of this study was a desire to work toward finding institutionally focused solutions to help address decades of disparities within STEMM. STEMM inclusion programs can serve as the necessary catalyst for change if they work toward changing institutions, not students. This study has aimed to provide campuses with practical and theoretical implications that can help facilitate the successful implementation, sustainability, and institutionalization of SIPs. Through presenting the nuances within the life cycle of the CSS and MLN programs my hope is that I have provided campuses with insights and strategies that they can apply to their own institutions and programs in order to find success. Findings have demonstrated that efforts to create change through SIPs can be incredibly difficult with multiple challenges emerging along the way. However, dedicated groups of people who are committed to the success of URG students can make a meaningful and lasting difference. Efforts to work toward greater equity are never easy, but they are necessary if we are to cultivate the next generation of diverse scientists.

Appendix A-1: Interview Protocol for Evaluators

at UNC-Chapel Hill/Penn State

Introduction

Thank you for participating today in this interview. Let me introduce who is on the call today.

UCLA IRB has now adopted verbal consent in interview data collection. **[Start Zoom Recording]. Do you consent to participate in this recorded interview, knowing that confidentiality will be provided regarding statements attributed to you and that you can opt to terminate the interview at any time?** (wait for response)

If we do not complete our questions today, are you willing to participate in a second interview to follow up or complete our questions - or extend this interview by 15 minutes?

Role

Thank you for participating today in this interview. For the record, please state your name and your role in the MLN/CSS program and the Meyerhoff Adaptation Project.

Program Adaptation

1. What program elements of the MSP model were central to adopt in order to ensure the success of the MLN/CSS program? What program elements were easily adopted/accepted? Was there any pushback or resistance in adopting certain elements of the MSP model?
 - a. Were there any compromises or negotiations to adopt the program at Penn/UNC?
 - b. Were there any factors that were pressures to adopt the program? Events? Student Demands? Board of Trustees?
2. In adopting a culturally-responsive program like MSP, what were some of the challenges in starting MLN/CSS on this campus? How were they addressed?
3. In what ways have the CSS/MLN programs become distinct from MSP? What role did the institutional context play in developing these differences?

Cross-Institutional Mentoring

4. Can you describe the relationship Penn State/UNC has with UMBC?
 - a. In what ways do you see UMBC serving as a mentor to Penn State/UNC?
5. How was your experience working with UMBC to replicate your MLN/CSS program through the MAP partnership?
 - a. What was challenging/easy to get guidance from UMBC to support program implementation? Did the partnership evolve over time?
6. How was knowledge translated from UMBC to promote MLN/CSS fidelity/adaptation at your campus?
7. Have there been opportunities for you to share successful practices within your program with UMBC and UNC/PSU? Can you provide any examples?

8. In your opinion, in what ways has the collaboration across campuses contributed to addressing concerns regarding equity and inclusion on the campuses?

Program Impact, Institutional Change and Transformation

9. In order to sustain the programs (keep it running after HHMI funding), what were key events or changes that ensured its institutionalization (long term implementation)? Was there funding, personnel, program elements that were modified?
10. As a result of implementing a Meyerhoff-type program, what main changes in institutional practices or initiatives have occurred that show greater commitment to equity and diversity in STEMM on the Penn/UNC campus? What do you expect to see?
 - a. Do you think the programs create a greater awareness/change in mindsets about who can do science?
11. Considering that a central role of adopting the MSP program was to increase diversity in STEMM, in what ways has the adoption of this program helped expand diversity at your campus? How has the program continued to evolve to address issues of diversity?
 - a. Can you give an example?
 - b. How does the program fit into the broader mission of the university? How does it contribute to the goals the university has set out?
12. Can you share some findings from any evaluations the program has conducted? How, if at all, has this shaped the current program?

Concluding Questions

13. Is there any information you would like to share that we did not ask about?

Please forward any documents that may help us understand the programs or collaboration better. We have already collected a number of them. Thank you for participating.

Appendix A-2: Interview Protocol for Program Directors and Staff at UNC-Chapel Hill/Penn State

Introduction

Thank you for participating today in this interview. Let me introduce who is on the call today.

UCLA IRB has now adopted verbal consent in interview data collection. **[Start Zoom Recording]. Do you consent to participate in this recorded interview, knowing that confidentiality will be provided regarding statements attributed to you and that you can opt to terminate the interview at any time?** (wait for response)

If we do not complete our questions today, are you willing to participate in a second interview to follow up or complete our questions - or extend this interview by 15 minutes?

Thank you for participating today in this interview. For the record, please state your name and your role in the MLN/CSS Program and the Meyerhoff Adaptation Project.

Program Adaptation

1. In adopting a culturally-responsive program like MSP, what were some of the challenges in starting MLN/CSS on this campus? How were they addressed?
2. What program elements of the MSP model were central to adopt in order to ensure the success of the MLN/CSS program? Was there any pushback or resistance in adopting certain elements of the MSP model?
 - a. Were there any compromises or negotiations to adopt the program at Penn/UNC?

Cross-Institutional Mentoring

3. Can you describe the relationship Penn State/UNC has with UMBC?
 - a. In what ways do you see UMBC serving as a mentor to Penn State/UNC?
4. How was your experience working with UMBC to replicate your MLN/CSS program through the MAP partnership?
 - a. What was challenging/easy to get guidance from UMBC to support program implementation? Did the partnership evolve over time?
5. Have there been opportunities to work collaboratively with UMBC and Penn State/UNC?
 - a. Have there been opportunities to learn from one another since the launch and implementation in 2013? Can you provide any examples?
 - b. In your opinion, in what ways has the collaboration across campuses contributed to addressing concerns regarding equity and inclusion on the campuses?
6. Have there been opportunities for you to share successful practices within your program with UMBC and UNC/PSU? Can you provide any examples?

Program Impact, Institutional Change and Transformation

7. In order to sustain the programs (keep it running after HHMI funding), what were key events or changes that ensured its institutionalization (long term implementation)? Was there funding, personnel, program elements that were modified?
8. As a result of implementing the Meyerhoff-type programs, what main changes in institutional practices or initiatives have occurred that show greater commitment to equity and diversity in STEMM on campus? What do you expect to see?
 - a. Do you think the programs create a greater awareness/change in mindsets about who can do science?
9. What events or factors were you aware of that reflected the campus becoming more responsive or committed to diversity in STEMM fields? At the student level or faculty level?
10. Considering that a central role of adopting the MSP program was to increase diversity in STEMM, in what ways has the adoption of this program helped expand diversity at your campus? How has the program continued to evolve to address issues of diversity?
 - a. Can you give an example?
 - b. How does the program fit into the broader mission of the university? How does it contribute to the goals the university has set out?

Concluding Question

11. Is there any information you would like to share that we did not ask about? Is there anything you thought we would ask but didn't?

Please forward any documents that may help us understand the programs or collaboration better. We have already collected a number of them. Thank you for participating.

Appendix A-3: Interview Protocol for Faculty at UNC-Chapel Hill/Penn State

Introduction

Thank you for participating today in this interview. Let me introduce who is on the call today.

UCLA IRB has now adopted verbal consent in interview data collection. **[Start Zoom Recording]. Do you consent to participate in this recorded interview, knowing that confidentiality will be provided regarding statements attributed to you and that you can opt to terminate the interview at any time?** (wait for response)

If we do not complete our questions today, are you willing to participate in a second interview to follow up or complete our questions - or extend this interview by 15 minutes?

Thank you for participating today in this interview. For the record, please state your name and your role here on campus and in the MLN/CSS program.

Questions:

1. How and why did you first become involved in the CSS/MLN program?
2. What are some best practices or key lessons you have learned since having joined the CSS/MLN program?
 - a. In what ways have these best practices and/or new knowledge developed in the CSS/MLN program been used to support underrepresented students who are NOT in the scholars program? Can you give an example?
3. In what ways has your involvement in the CSS/MLN program benefited other roles and responsibilities you have? (i.e. other initiatives, councils, committees, senates, etc.)?
 - a. Can you provide any examples on how new knowledge or insights you have acquired have been applied, shared, or informed the work you do?
4. Can you describe the relationship between the CSS/MLN program and STEM departments on campus?
 - a. How have your peer faculty responded to the CSS/MLN program?
 - b. Are there incentives or rewards provided to faculty involved in mentoring underrepresented students?
5. In your opinion, in what ways has the CSS/MLN program helped expand diversity at PSU/UNC? In your opinion, would you say the program addresses issues related to race and racism on campus?
6. What events or factors are you aware of that reflected the campus becoming more responsive or committed to diversity in STEM fields? At the student level or faculty level?

7. In what ways, if any, has the program helped to challenge traditional STEMM teaching and learning practices?
 - a. Does your college participate or collaborate with other entities on campus to support curriculum and pedagogy development?
 - b. How would you say your approach to teaching has evolved since your involvement with the CSS/MLN program?
8. In what ways, if any, has the program prompted new considerations regarding faculty recruitment and promotion and tenure?
9. Are there any indicators of how the program has had a broader influence on STEMM Colleges? Have you observed any changes in practices or initiatives within your college that show a greater commitment to equity and racial diversity in STEMM?
 - a. Do you think the programs create a greater awareness/change in mindsets about who can do science?
 - b. Has the program influenced the implementation of any new programs or initiatives?
 - c. Has the program influenced any changes in procedures, processes, or policies?
10. In your opinion, since the inception of the CSS/MLN Program, has the institutional culture of PSU/UNC changed? What are some examples?
 - a. How has the program impacted culture change as it relates to racial diversity, equity, and inclusion, if at all?
 - b. What are the barriers or challenges that impede institutional culture change at PSU/UNC?
11. Are there other ways the CSS/MLN Program is impacting PSU/UNC that we haven't asked about?
12. Is there any information you would like to share that we did not ask about?

Appendix A-4: Interview Protocol for Institutional Leaders at UNC-Chapel Hill/Penn State

Introduction

Thank you for participating today in this interview. Let me introduce who is on the call today.

UCLA IRB has now adopted verbal consent in interview data collection. [**Start Zoom Recording**]. **Do you consent to participate in this recorded interview, knowing that confidentiality will be provided regarding statements attributed to you and that you can opt to terminate the interview at any time?** (wait for response)

If we do not complete our questions today, are you willing to participate in a second interview to follow up or complete our questions - or extend this interview by 15 minutes?

Thank you for participating today in this interview. For the record, please state your name and your role here on campus and with the MLN/CSS Program and the Meyerhoff Adaptation Project.

Program Adaptation

1. In replicating the UMBC Meyerhoff program, what elements or components were easier to adopt? What elements are more of a challenge to adopt?
2. Were there any factors that were pressures to adopt the program?
 - a. Events? Student Demands? Board of Trustees?
3. What were the challenges in implementing this program at PSU/UNC, considering it was initially designed to be strengths-based and culturally responsive? Why?
4. Now that the MLN/CSS program is established on campus, what advice would you recommend to other institutional leaders interested in adopting the program? Are there challenges that arise that other institutions should be aware of?
 - a. Can you describe how you were able to garner support of the program from the broader campus community?

Cross-Institutional Mentoring

5. Can you describe the relationship PSU/UNC has with UMBC and the Meyerhoff Scholars Program?
 - a. In what ways is UMBC serving as a mentor to your campus?
6. Have there been opportunities for you to meet or discuss with other institutional leaders either at UMBC, UNC, or PSU regarding the program?

Program Impact, Institutional Change and Transformation

7. In order to sustain the programs (keep it running after HHMI funding), what were key events or changes that ensured its institutionalization (long term implementation)? Was there funding, personnel, program elements that were modified?
8. How have resources, be it space or funding, been allocated or reallocated on-campus to support the program?
9. How does the Meyerhoff Program and the partnership between UMBC, UNC, and Penn State align with the institution's current priorities or strategic plan?

- a. How does the program fit into the broader mission of the university? How does it contribute to the goals the university has set out?
10. What events or factors were you aware of that reflected the campus becoming more responsive or committed to diversity in STEMM fields? At the student level or faculty level?

Concluding Questions

11. Is there any information you would like to share that we did not ask about?

Please forward any documents that may help us understand the programs or collaboration better. We have already collected a number of them. Thank you for participating.

Appendix A-5: Interview Protocol for Second Round Interviews
at UNC-Chapel Hill/Penn State

Introduction

Thank you for participating today in this interview. We will begin by re-introducing ourselves.

UCLA IRB has now adopted verbal consent in interview data collection. I will now begin recording and ask you the consent question. **[Start Recording]**.

Do you consent to participate in this recorded interview, knowing that confidentiality will be provided regarding statements attributed to you and that you can opt to terminate the interview at any time? [wait for response]

Thank you for participating in this interview. For the record, please state your name and your role in the CSS/MLN Program, how long have you been at PSU/UNC, and your field of study?

Questions

1. In your opinion, since the inception of the MLN/CSS, has the institutional culture of PSU/UNC changed? What are some examples?
 - a. How has the program impacted culture change as it relates to racial diversity, equity, and inclusion, if at all?
 - b. What are the barriers or challenges that impede institutional culture change at PSU/UNC?
2. In your opinion, would you say the program addresses issues related to race and racism on campus?
3. What role has the MLN/CSS program played in advancing equity, diversity, and inclusion for (racially and ethnically) underrepresented students in STEMM Colleges who are NOT MLN/CSS Scholars?
 - a. Have there been opportunities to provide benefits or share resources to the broader student body, particularly underrepresented students who are not in the scholars program?
4. Are there any indicators of how the program has had a broader influence on the STEMM Colleges and departments?
 - a. Has the program influenced the implementation of any new programs or initiatives?
 - b. Has the program influenced any changes in procedures, processes, or policies?
5. In what ways, if any, has the program advanced new approaches to the recruitment of students?
 - a. What about faculty? Has the program influenced new approaches to faculty hiring?

6. In what ways, if any, has the program prompted new considerations regarding promotion and tenure?
 - a. Are there incentives or rewards provided to faculty involved in mentoring underrepresented students?
7. In what ways, if any, has the program helped to challenge traditional STEMM teaching and learning practices?
 - a. Does the College participate or collaborate with other entities on campus to support curriculum and pedagogy development?
8. Can you describe how evaluation has been used to inform practices within academic departments and Colleges?
 - a. Has this information led to any changes or challenged traditional approaches to STEMM?
9. In what ways has your involvement in the MLN/CSS program benefited other roles and responsibilities you have? (i.e. other initiatives, councils, committees, senates, etc.)?
 - a. Can you provide any examples on how new knowledge or insights you have acquired have been applied, shared, or informed the work you do?
10. Many would argue that one of the critical factors for programs like the MLN/CSS to succeed is getting buy-in. How has the program addressed garnering support from individuals more reluctant to support a culturally relevant and strengths-based program?
11. In thinking about sustaining the program, what mechanisms are in place to ensure the values and mission of the program are preserved despite challenges like turnover, legal challenges, etc.?
 - a. In your opinion, has institutionalizing the program resulted in changes or modifications to the mission of the MLN/CSS program?
 - b. How has the criteria of which students to accept into the program evolved over time? Are there certain factors or considerations that are prioritized?
12. Are there other ways the MLN/CSS Program is impacting PSU/UNC that we haven't asked about?
13. Is there any information you would like to share that we did not ask about?

Appendix B-1: List of Public Documents Collected

| Institution | Document Title | Document Description |
|--------------------|---|--|
| PSU | 'Many mental breakdowns': A closer look at the rigorous Penn State Millennium Scholars Program 'Summer Bridge' (Kuznitz, 2017) | Article in the Daily Collegian (an independently run student news site) that is critical of the MLN program. Focuses on the challenges that MLN scholars experience in the summer bridge such as long hours, following strict rules, and high expectations. Demonstrates how some of the cultural aspects of the Meyerhoff model were not well received at Penn State. |
| PSU | Penn State's Double Standard on Hazing (E. Hill, 2017) | An opinion article in Onward State (a blog website run by Penn State students) accusing the MLN program of hazing its scholars. Compares it to the hazing that goes on in Greek life at Penn State. Demonstrates how some of the cultural aspects of the Meyerhoff model were not well received at Penn State. |
| PSU | LETTER TO THE EDITOR: Millennium Scholars Program alumni respond to Onward State article 'including misleading information' (The first cohort of the Millennium Scholars Program, 2017) | A letter written by the first cohort of the Millennium Scholars Program in response to the Onward State article accusing the program of hazing its students. The letter requests that the Onward State article be retracted, as it includes misleading information and could damage the reputation of the program. |
| PSU | LETTER TO THE EDITOR: 'I was appalled to read the Onward State article...' (G. Richards, 2017) | A letter written in response to the Onward State article accusing the program of hazing its students. The author accuses the Onward State article of misrepresenting the program and using partial quotes to create the narrative that the MLN program hazes its scholars. |
| PSU | Penn State's Millennium Scholars Program receives new alumni donor support (Ferguson, 2021) | \$1 million gift to the MLN program on behalf of Paul Heffner. Additionally, a \$100,000 gift from Duane and Roslyn Norman. Demonstrates some of the ways the MLN program is being financially sustained. |

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| PSU | Coming to Penn State was a culture shock and shows a need for diversity Opinion (Garcia, 2020) | Opinion article by an MLN scholar that speaks about the benefits that the program provides for scholars. Focuses on how the MLN program provides a diverse space for URG students, which is important due to the lack of diversity at Penn State. |
| PSU | College of Health and Human Development to join Millennium Scholars Program (Penn State News, 2021) | Article highlighting the College of Health and Human Development joining the MLN program. Demonstrates how the program is expanding. |
| PSU | Millennium Scholars Program growing into third year (Penn State News, 2015) | Article profiling the MLN program as it enters its third year. |
| PSU | Millennium Scholars pull from program, each other to grow in STEM (Kubarek, 2019) | Article that includes profiles of MLN scholars who are in Penn State College of Earth and Mineral Sciences. Shows how the program and scholars contribute to increasing diversity in STEMM departments. |
| PSU | Penn State Board of Trustees chair commits \$5 million for University-wide impact (Penn State News, 2017) | Article that highlights a \$5 million financial gift to Penn State, including \$2.4 million for the Millennium Scholars program. Demonstrates that MLN is a priority and how funds are used to sustain the program. |
| PSU | EMS sets goal of raising \$10,000 on Giving Tuesday for Millennium Scholars (Penn State News, 2016) | Article highlighting the MLN program as a fundraising priority for the Penn State College of Earth and Mineral Sciences. |
| PSU | Millennium Scholars Program connects diversity and STEM degrees (Eberly College of Science News, 2015) | Profile of the MLN program. Details program history, design, and values. Talks about some of the cultural values of Meyerhoff being used in the MLN program demonstrating model fidelity. |
| PSU | Millennium Scholars Program, philanthropy support student success in STEM (Penn State News, 2019) | Article highlighting a \$1 million commitment to endow the Mahle Millennium Scholars Program Scholarship in the Eberly College of Science. Demonstrates financial commitments that assist in sustaining the MLN program. |

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| PSU | Our Commitment to Impact, Penn State Strategic Plan (Penn State Strategic Plan, n.d.) | Strategic plan which is meant to last from 2016 to 2025 and is underpinned by six foundations: Enabling Access to Education, Engaging Our Students, Advancing Inclusion, Equity, and Diversity, Enhancing Global Engagement, Driving Economic Development, and Ensuring a Sustainable Future. Used to examine DEI goals. |
| UNC | Chapel Hill student body president: It's past time for a genuine reckoning at UNC (L. Richards, 2021) | UNC student body president, and a trustee of UNC-Chapel Hill, Lamar Richards (a Black man) writes an op-ed "Brace for Reckoning", which encourages students, staff, and faculty from URGs not to attend UNC-Chapel Hill and instead look for other options. Argues that UNC-Chapel Hill requires deep reform but it is not prepared to make this transformation. Shows the institutional context of UNC-Chapel Hill. |
| UNC | UNC student body president slams university in open letter, encourages Black students to look elsewhere (WRAL News, 2021) | Article reported by WRAL news (a local tv station and news source). Reports on Lamar Richards' op-ed "Brace for Reckoning", which encourages students, staff, and faculty from URGs not to attend UNC-Chapel Hill and instead look for other options. |
| UNC | Chancellor's Science Scholars Program receives \$15 million in gifts (Thompson, 2019) | Article in The Daily Tar Heel (the independent student newspaper of the University of North Carolina at Chapel Hill). Highlights a \$10 million donation from the Sherman Fairchild Foundation and a \$5 million gift from the William R. Kenan, Jr. Charitable Trust to the CSS program. Demonstrated funding used to sustain the CSS program. |
| UNC | Chancellor's Science Scholars receive national awards for fifth consecutive year (Williams, 2018) | Article in The Daily Tar Heel (the independent student newspaper of the University of North Carolina at Chapel Hill). Highlighting achievements of CSS scholars. Shows that the program and its scholars are becoming recognized on campus for excellence in science. |
| UNC | Summer program aims to fill | Article in The Daily Tar Heel (the |

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| | gaps in science fields (Kim, 2013) | independent student newspaper of the University of North Carolina at Chapel Hill). Highlights the CSS program's first summer bridge (2013). Gives some context to the implementation of the CSS program. |
| UNC | UNC increases aid to science scholars (Green, 2014) | Article in The Daily Tar Heel (the independent student newspaper of the University of North Carolina at Chapel Hill). Highlights the growth of the program after one year. While the program started with 20 students a financial commitment from then Chancellor Carol Folt allowed them to expand to 40 students. Chronicles the expansion of the program and how it was achieved. |
| UNC | The stories that have defined UNC since 2018 (McClellan, 2020) | Article in The Daily Tar Heel (the independent student newspaper of the University of North Carolina at Chapel Hill). Shows a timeline of controversies at UNC-Chapel Hill from 2018-2020. Including the confederate statue Silent Sam, the resignation of Chancellor Carol Folt, Clery Act violations, and the appointment of Chancellor Kevin Guskiewicz. The article helps in understanding the context of UNC-Chapel Hill. |
| UNC | Carolina Next: Innovations for Public Good, UNC-Chapel Hill Strategic Plan (UNC-Chapel Hill Strategic Plan, n.d.) | Strategic plan which is framed around eight strategic initiatives allowing the institution to: 1) Build Our Community Together; 2) Strengthen Student Success; 3) Enable Career Development; 4) Discover; 5) Promote Democracy; 6) Serve to Benefit Society; 7) Globalize; 8) Optimize Operations. Used to examine DEI goals. |

Appendix B-2: List of Internal Documents Collected

| Institution | Document Title | Document Description |
|-------------|--|---|
| MAP | MAP Mid-term Report (Crimmins et al., 2017) | Summarizes the progress the MLN and CSS programs have made in replicating the MSP model. Notes challenges and success of their programs 5 years after initial implementation. |
| UMBC | Meyerhoff Manual (Sto. Domingo et al., 2016) | Describes the design of the MSP program and strategies regarding implementation, assessment, and evolution. |
| PSU | Millennium Scholars Program Brochure (Penn State Millennium Scholars Program, 2021a) | Informational brochure for the MLN program. |
| PSU | Millennium Scholars Program Summer Bridge Handbook 2021-2022 (Penn State Millennium Scholars Program, 2021b) | Comprehensive handbook given to incoming scholars during summer bridge. Assists in orienting students to the core components of the MLN program including program policies, requirements, and values. |
| PSU | Millennium Scholars Program Second-Year Seminar Syllabus (2019) | Course syllabus for the seminar that second-year MLN scholars enroll in. Course titled “Social Justice and STEM”. The course is taught by MLN program staff. |
| PSU | Millennium Scholars Program Third-Year Seminar Syllabus (2020) | Course syllabus for the seminar that third-year MLN scholars enroll in. Course titled “Preparation for Applying to Graduate School”. The course is taught by MLN program staff. |
| PSU | Millennium Scholars Program Development Presentation (Millennium Scholars Program, 2017) | Presentation detailing MLN program design, outcomes, and program costs/expenses. |
| PSU | Millennium Scholars Program Information for Faculty and Advisors | Document intended for faculty and advisors involved with the MLN program. Details program requirements and expectations for scholars. |
| PSU | Proposal for Management of The Millennium Scholars Program | Document prepared in 2015 which details a restructure to the administrative placement and structure of the MLN program. |

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| | (Committee on Inclusive Penn State, 2015) | |
| UNC | Chancellor’s Science Scholars Presentation by Michael Crimmins at the 5th Annual Bridging the Gap Conference (Crimmins, 2016) | Presentation on the CSS program given by former Executive Director, Michael Crimmins. Details program design, outcomes, and lessons learned from program implementation. |
| UNC | How the Sherman Fairchild Foundation Grant is helping the University of North Carolina Chancellor’s Science Scholars Program build a brighter future (Freeman, 2021a) | Report created by the CSS Program Director detailing how a \$10 million grant provided by the Sherman Fairchild Foundation has benefited the program. |
| UNC | Letter to the UNC-Chapel Hill Board of Trustees regarding Nikole Hannah-Jones tenure decision (2021) | The CSS program wrote a letter to the UNC-Chapel Hill Board of Trustees demanding they change their decision regarding denying the tenure of Nikole Hannah-Jones. The letter is signed by CSS program staff and scholars. It demonstrates the ways that the CSS program is involved with social justice matters on campus. |
| UNC | Letter to the Chancellor, Board of Trustees, and UNC System Board of Governors regarding confederate monuments (2018) | A subset of the CSS program wrote a letter to the Chancellor, Board of Trustees, and UNC System Board of Governors regarding the confederate monument Silent Sam. The letter urged leadership to reconsider building a museum to house the monument and remove it from campus. |
| UNC | Diversity in STEM, course syllabus for first-year scholars (2019) | Course for first-year CSS scholars intended to explore STEMM research at UNC and address issues of diversity in STEMM. |
| UNC | Diversity in STEM, course syllabus for second-year scholars (2021) | Course for second-year CSS scholars intended to explore STEMM research at UNC and address issues of diversity in STEMM. |
| UNC | Diversity in STEM, course syllabus for third-year scholars (2021) | Course for third-year CSS scholars intended to explore STEMM research at UNC and address issues of diversity in STEM. |
| UNC | Presentation to the CSS | Presentation to the CSS Advisory Board given by |

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| | Advisory Board (Freeman, 2021b) | the Executive Director. The presentation details program composition, outcomes, and financial challenges. |
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Appendix C-1: Relevant Codes from the Larger Study

| Parent Code | Subcodes | Subcodes | Code Description |
|-------------------------|-----------------------------------|----------|--|
| Models of Achievement | | | Theoretical models of achievement, success, and/or support |
| | Culturally Relevant or Responsive | | Culturally Relevant: a “pedagogical practice,” specifically, a ‘theoretical model that not only addresses student achievement but also that “helps students to accept and affirm their cultural identity while developing critical perspectives that challenge inequities that schools (and other institutions) perpetuate (Ladson-Billings, 1995, p. 469). Culturally Responsive: “using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them” (Gay, 2010, p. 36). |
| | Student Learning | | formerly academically achieve in earlier editions, “the intellectual growth that students experience as a result of classroom instruction and learning experiences” (Ladson-Billings, 2014, p. 75). |
| | Cultural Competence | | “The ability to help students appreciate and celebrate their cultures of origin while gaining knowledge of and fluency in at least one other culture” which is usually the dominant culture for minoritized groups (Ladson-Billings, 2014, p. 75). |
| | Sociopolitical Consciousness | | “The ability to take learning beyond the confines of the classroom using school knowledge and skills to identify, analyze, and solve real-world problems” (Ladson-Billings, 2014, p. 75). |
| Four Pillars of Success | | | Informed by (Hrabowski III et al., 2019) |

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| | High Expectations | | "Helping students understand they do have what it takes to succeed ... [and] emphasizing the fact that they can reach this goal through hard work" (Hrabowski III et al., 2019, pp.116-117). |
| | | Strengths-Based | "Rather than a deficits-based approach, one that would have focused on remediating deficiencies in student preparation, we would recruit talented, well-prepared students and then build on their knowledge and skills through a combination of high expectations and a transformative academic and social environment" (Hrabowski III et al., 2019, p. 116). See also Maton & Hrabowski III (2004) p. 548 |
| | | Deficit and Remediation | The approach that assumes students have deficiencies and are in need of remediation to get up to speed or be on par with (dominant) students. |
| | Building Community | | "Community of learners" in which community members work together and support each other in reaching their goals (Hrabowski III et al., 2019, p. 117). |
| | | Cohort Model | A model in which a group of students who begin the program together. |
| | | Collective Achievement | Different from individual achievement, the success of all is important. |
| | Faculty and Student Engagement | | "It takes researchers to produce researchers" faculty not only teach students but engage them in their research (Hrabowski III et al., 2019, p. 117). |
| | Improvement through Program Assessment | | The program is continuously engaged in evaluation and improvement through data (Hrabowski III et al., 2019, p. 117) |
| Racialized | | | Race is constitutive/a part of organizations and helps us better |

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| Organizations | | | understand the formation and everyday functioning of organizations. Four tenets: (1) racialized organizations enhance or diminish the agency of racial groups; (2) racialized organizations legitimate the unequal distribution of resources; (3) Whiteness is a credential; and (4) the decoupling of formal rules from organizational practice is often racialized. (Ray, 2019a) |
| | Resources | | Resources (material, social, or power) are (intentionally or passively) unequally distributed according to racial schemas. For instance, occupational segregation connects racialized schemas regarding competence to workplace hierarchies, time-management rules, and even informal rituals of interaction between racial groups. (Ray, 2019a, p. 32). |
| Power Dynamics | | | Interactions that are shaped by power and/or perceptions of power, authority, and/or status. |
| Institutional Context and Culture | | | Institutional context: The characteristics of the institution that inform and shape the campus (i.e., demographics, history, legacy, location, policies, procedures, etc.) Institutional culture: The shared system of values that are distinct to the institutional context. |
| Buy-in | | | The process in getting folks to believe in MAP Scholars Programs and remain invested in MAP. |
| Institutional Isomorphism | | | Organizations become the same overtime due to three types of isomorphic pressures: coercive, mimetic, and normative (DiMaggio & Powell, 1983). |
| Meyerhoff Way | | | The program model in its totality that encompasses the pillars, program elements, values, and beliefs that distinguishes itself from other programs. (See Stolle-McAllister et al., 2011) |
| | Explaining the | | Explanations of Meyerhoff and/or adaptations of the model to key |

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| | Model | | institutional stakeholders and constituents who don't get it. |
| | Right People | | Having the "right people". The right people - those who understand and apply the values of Meyerhoff and are fit to run the program, also used to capture characteristics that are perceived not to be "right". |
| Meyerhoff Program Elements | | | A "proven formula for success" which consist of 13 key components: recruitment, financial aid, summer bridge, program values, study groups, program community, personal advising and counseling, tutoring, summer research internships, mentors, faculty involvement, administrative involvement and public support, family involvement. |
| | Recruitment | | Target high-achieving URM students who are interested in advanced careers in STEMM. |
| | Financial Aid | | Scholars receive varying degrees of financial aid depending on the institution and contingent on maintaining a strong GPA in a STEMM major and fulfilling all program requirements. |
| | Summer Bridge | | Mandatory six-week intensive summer program for incoming scholars. |
| | Program Values | | Central program value of getting students to a STEMM PhD and advanced STEMM careers - some variations based on program but centered around excellence, community, commitment to diversity, leadership, etc. |
| | Study Groups | | Students consistently engage in study groups. Makes use of the cohort model and helps students succeed in STEMM courses. |
| | Program | | Emphasis placed on a family-like, campus-based, social and |

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| | Community | | academic support system for students. Scholars live together on campus. |
| | Personal Advising and Counseling | | Scholars receive academic and personal advising. |
| | Tutoring | | Scholars are encouraged to engage in tutoring services in order to excel and also serve as tutors. |
| | Research Internships | | Scholars engage in research internships in order to gain hands-on experience and to develop a clearer understanding of what studying science entails. |
| | Mentors | | Scholars are mentored by varying individuals like faculty, program staff, professional contacts. |
| | Faculty Involvement | | A significant number of faculty, including department chairs, are involved in all aspects of the program, including recruitment, summer bridge, advising, research mentoring, teaching, and special events. |
| | Administrative Involvement and Public Support | | The program requires campus leaders to be strong supporters of the program. The program also benefits from public support such as financial support from outside organizations. |
| | Family Involvement | | Families are invited to be involved in the program (selection weekend, special events, etc.) and serve as a resource. |
| Challenging Program Elements | | | Program element was identified as challenging to adopt or implement on campus. |
| Easier Program Elements | | | Program element was identified as easier to adopt or implement on campus. |
| Origin Story | | | Descriptions on the history of the program and/or MAP particularly |

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| | | | as it relates to how the program and/or collaborations were started. |
| | Motivation to Adopt | | Expressed or perceived reasons for why institutions wanted to adopt the Meyerhoff program. |
| | Rebuttals to Adopt | | Expressed or perceived reasons and concerns on why not to adopt the Meyerhoff program. |
| Program Fidelity | | | “Delivery of an intervention adheres to the protocol or program model originally developed” (Mowbray et al., 2003, p. 315). |
| | Adhering to Program Fidelity | | Instances of individual or institutional conscious decision to adhere to implementing specific components of model |
| | Resistance to Program Fidelity | | Instances of individual or institutional conscious resistance to implementing specific components of model |
| Program Replication or Adaptation | | | Program Replication: Original program model is transferred into a new context exactly as is and no modifications are made. Program Adaptation: is adopted into a new setting while trying to closely adhere to the original model but some aspects are modified to integrate with the new environment and context. |
| | Program Mission | | How participants describe the mission, vision, and/or objectives/goals of their programs and MAP. |
| | Program Evolution | | Ways in which program changes as it becomes adjusted to institutional context (more logistical evolution) and expands and makes changes as new ideas, focuses, problems, and or challenges arise. |
| Program Implementation | | | Early stages of developing program. |
| | Commitment | | Indicated by campus leaders leveraging power and influence to |

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| | and/or Secured Resources from Senior Leadership | | support the implementation of the program. Further, campus leaders investing and securing resources to support the development of infrastructure and structural operations (i.e., budget, personnel, organizational structure). |
| | Secured Organizational and Physical Structures | | Access to space to house programs as well as programming activities. |
| | Financial Development of Program | | Procure funds to launch program. |
| | Program Sustainability Plans | | Consideration and plans on how to sustain the program prior or during the early stages of program implementation. |
| | Faculty Involvement | | Leveraging faculty committed to diversity to implement program elements. |
| | Policy Structures | | Efforts, changes, and/or reform in institutional policies and procedures that align with the program and/or program goals that would support the implementation of the program. |
| | Curriculum Structures | | Efforts, changes, and/or reforms to teaching and learning to enhance curriculum that align with the program and/or program goals that would support the implementation of the program. |
| | Leverage Intra/Inter Efforts | | Leveraging intra or inter institutional efforts that can provide or advance additional support, resources, skills, and/or information that can support program implementation. |
| Program Sustainability/ | | | Sustainability - The continuation of a program that involves "maintaining desired outcomes of grant-funded innovations" and |

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| Institutionalization | | | <p>maintaining or expanding momentum (Cobian & Ramos, 2021, p. 2) particularly after initial funding for launch has ended.</p> <p>Institutionalization - "a process and outcome of iterative shifts between practices that embed innovations into permanent parts of the institution" (Cobian & Ramos, 2021, p. 2)</p> |
| | Indicators of the Lack of Program Sustainability and/or Institutionalization | | Indicators that signal programs are having challenges in sustainability and institutionalization. (e.g., not able to receive necessary institutional funds, a lack of support from senior leadership, etc.). |
| | Commitment and or Secured Resources from Senior Leadership | | Leveraging power and influence to ensure the sustainability and/or institutionalization of the program. Further, continued investment and secured resources to ensure the program is maintained and may be embedded in institutional operations. |
| | Financial Development of Program | | Sustain grant level-funding through alternative revenue streams (both internal or external) and the program may be included in the institution's financial commitments and obligations |
| | Organizational and Physical Structures | | <p>Program is placed in a vital part of organizational structure. Program has maintained access to physical structures necessary to advance program goals.</p> <p>Program is beginning to be viewed as a vital component of the campus mission & ecology.</p> |
| | Achieving program goals | | The notion that the program is sustained because it works. There are program outcomes that indicate the program is reaching its goal. |
| | Faculty | | Expanding faculty involvement via changing mindsets on the value |

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| | Involvement | | of diversity & inclusion with the goal or evidence of implementing faculty rewards, promotion, and/or policy systems in place to advance program goals. |
| | Policy Structures | | Efforts, changes, and/or reform in institutional policies and procedures that would support sustaining the program and institutionalizing it. |
| | Curriculum Structures | | Efforts, changes, and/or reforms to teaching and learning to enhance curriculum that would support sustaining the program and institutionalizing it. |
| | Scaling | | How innovative programs are scaled in relation to the broader campus. May involve adaptation and/or evolution of the program and/or integration or expansion into other programs, initiatives, or innovations due to available resources and budget. |
| | Leverage Intra/Inter Efforts | | Leveraging intra or inter institutional efforts that can provide or advance additional support, resources, skills, and/or information that can support program sustainability and lead to institutionalizing. |
| Organizational Structure | | | Description of the structure of a college, division, department, and/or initiatives. |
| | Description of MAP Programs | | Description of MAP scholars programs, program logistics (staffing, reporting lines, budgeting, etc.). |
| | Ecology of Scholar Programs | | Description of the ecology and placement of scholars and honors programs (either merit or DEI based, the emphasis is being scholars program that are NOT MAP). |
| | Ecology of DEI Programs and Initiatives | | Description of the ecology and placement of DEI programs and/or initiatives (general). |

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| Program Champions | | | Supporters of the program who advocate, cheerlead, and/or invest in the program. In addition, the program needs a "community" to learn and depend on to be successful. |
| Program and Institutional Opportunities | | | Stated aspects that provided opportunities regarding program implementation, sustainability, and/or institutionalization. Including institutional contexts that allowed adopting, implementing, and/or sustaining the program and/or elements with more ease. |
| Program and Institutional Challenges | | | Stated challenges or concerns regarding program implementation, sustainability, and/or institutionalization. Including institutional contexts that made adopting, implementing, and/or sustaining the program and/or elements challenging |
| HHMI | | | Role that HHMI had on aspects of the MAP |
| Campus Based Committees | | | Committees that arise on campuses. Can include MLN steering committee and CSS advisory board but also other committees. |

Appendix C-2: New Codes Developed

| Parent Code | Subcodes | Subcodes | Code Description |
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| White Institutional Isomorphism | | | <p>“White institutional isomorphism explains a process wherein racialized norms shape how founders adopt particular racialized standards and practices over other alternatives within an organizational field” (Garbes, 2022, p. 82).</p> <p>Includes white institutional isomorphic pressures: white coercive pressure, white normative pressure, white mimetic pressure</p> |
| | White Habitus | | <p>White habitus – “a shared value system of racialized attitudes with practical implications. This racialized white habitus is reified through narratives that facilitate white ignorance regarding how their behaviors perpetuate racial inequality... The white habitus simultaneously is conditioned by and upholds white-dominant norms of larger institutions in American society” (Garbes, 2022, pp. 81-82).</p> <p>“In the context of institutional isomorphism, social actors’ translation of white-dominant norms, due to their shared white habitus, is rendered a race-neutral process to them” (Garbes, 2022, p. 82).</p> |
| Organizational Level Theory of Implementation Effectiveness | | | <p>Weiner et al. (2009) develop an organizational theory of implementation effectiveness, which highlights the determinants of effective implementation when implementing complex innovations in organizational settings.</p> <p>The organizational theory of implementation effectiveness proposes that effective implementation is a function of an organization’s readiness for change, the quality of its implementation policies and practices, the climate for implementation, and the extent to which targeted employees perceive the innovation as congruent with their values. If the</p> |

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| | | | implementation is effective and the innovation works this will result in innovation effectiveness, which provides the intended benefits to the organization. |
| | Organizational Readiness for Change | | Readiness for change refers to “the extent that targeted employees (especially the implementers) are psychologically and behaviorally prepared to make the necessary changes in organizational policies and practices to put the innovation into practice and support the use of the innovation” (Weiner et al., 2009, p. 296). Making these changes requires targeted employees and management to be jointly committed because the implementation of complex innovations is a collective process. Furthermore, there must be a shared belief that targeted employees and management have the collective capabilities to execute a successful implementation. |
| | Implementation Policies and Practices | | “Implementation policies and practices refer to the plans, practices, structures and strategies that an organization employs to put the innovation into place to support innovation use. Implementation policies and practices are the means by which an organization assimilates an innovation in order to achieve an acceptable level of operational, cultural and strategic fit. The assimilation process, as others have noted, entails a mutual adaptation of the innovation and the organization” (Weiner et al., 2009, p.297). |
| | Innovation-Values Fit | | Effective implementation requires that targeted employees perceive the innovation as being able to fulfill their values. When an organization seeks to adopt an innovation, targeted employees will form judgments about the extent to which their values align with the innovation. If the innovation and targeted employees’ values match, then it is likely to result in committed and consistent use of the innovation. If the values do not match, there is likely to be resistance to the innovation and at best compliant use (Weiner et al., 2009). |
| Fidelity Accountability | | | Mechanisms, processes, or people that lead to greater fidelity of the model at the UNC-Chapel Hill and Penn State campuses |

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| FRAME | | <p>The FRAME provides researchers and practitioners with a comprehensive guide on the adaptation process, allowing for a multifaceted understanding of the modification process. The FRAME looks at 8 central components of the adaptation process: (1) when modifications were made, (2) whether the modification was planned/proactive or unplanned/reactive, (3) who decided that the modification should be made, (4) what aspects were modified, (5) at what level was the modification made (individual, group, organization, etc.), (6) what was the nature of the content modification (adding/removing elements, using different materials, etc.), (7) to what extent were the modifications fidelity-consistent, (8) what were the reasons for the modifications (laws, resources, needing to improve cultural fit, etc.) (Wiltsey Stirman et al., 2019).</p> |
| | When Modification Occurred | <p>(1) when and how in the implementation process the modifications were made</p> <p>Ex: pre-implementation/planning/pilot, implementation phase, scale-up and/or maintenance/sustainment</p> |
| | Adaptation Planning | <p>(2) whether the modification was planned/proactive or unplanned/reactive</p> <p>Reactive modifications “occur during the course of program implementation, often due to unanticipated obstacles. These modifications often occur in an impromptu manner, in reaction to constraints or challenges that are encountered, and may or may not be aligned with the elements of the intervention that make it effective” (Wiltsey Stirman et al., 2019, p. 4)</p> <p>“Adaptations are typically made proactively through a planning process that identifies ways to maximize fit and implementation success while minimizing disruption of the intervention” (Wiltsey Stirman et al., 2019, p. 5)</p> |

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| | Who Made Modifications | | (3) who decided that the modification should be made Ex: Program leader, funder, administrator, researcher, individual practitioners |
| | What is Modified | | (4) what aspects were modified Ex: Content - Modifications made to content itself, or that impact how aspects of the treatment are delivered Contextual - Modifications made to the way that staff are trained in or how the intervention is evaluated Training and Evaluation - Modifications made to the way that staff are trained in or how the intervention is evaluated Implementation and Scale up activities - Modifications to the strategies used to implement or spread the intervention |
| | Level of Modification | | (5) at what level of delivery was the modification made? (For whom/what is the modification made?) Ex: individual, target intervention group, cohort/individuals that share a particular characteristic, individual practitioner, organization, network, system/community |
| | Nature of Content Modification | | (6) what was the nature of the content modification (adding/removing elements, using different materials, etc.) Ex: tailoring/tweaking/refining, changes in packaging or materials, adding elements, removing skipping elements, substituting, loosening structure, departing from the intervention ("drift") followed by a return to the protocol within the encounter, Drift from protocol without returning |
| | Fidelity-Consistency | | (7) to what extent were the modifications fidelity-consistent “Fidelity-consistent modifications are defined as those that preserve core elements of a treatment that are needed for the |

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| | | | intervention to be effective. In contrast, fidelity-in-consistent modifications are those that alter the intervention in a manner that fails to preserve its core elements” (Wiltsey Stirman et al., 2019, p. 5). |
| | Reason for the Modification | | (8) what were the reasons for the modifications: Sociopolitical, Organization/Setting, Provider, and/or Recipient |
| | | Socio-political | Socio-political factors may be important determinants of modifications. Ex: Existing laws, mandates, policies, regulations -- political climate -- funding policies -- historical context -- societal/cultural norms -- funding or resource allocation/availability |
| | | Organization/Setting | “Organizational/setting factors—including organizational culture and available resources—may necessitate a variety of modifications even to interventions with a strong evidence base in specific contexts” (Wiltsey Stirman et al., 2019, pp. 6-7). Ex: Available resources (funds, staffing, technology, space) -- competing demands or mandates -- time constraints -- service structure -- location/accessibility -- regulatory/compliance -- billing constraints -- social context (culture, climate, leadership support) -- mission -- cultural or religious norms |
| | | Provider | “Providers of psychosocial interventions frequently modify interventions for a variety of reasons, including perceived client preferences, providers’ preferences or self-efficacy, and efforts to maintain a good therapeutic alliance. Factors such as provider gender and cultural beliefs may also impact decisions about delivery of the intervention. Additionally, some provider factors, such as previous training and experience, may lead to changes to training and evaluation” (Wiltsey Stirman et al., 2019, p. 7). Ex: Race -- Ethnicity -- Sexual/gender identity -- First/spoken languages -- Previous training and skills -- Preferences -- Clinical |

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| | | | Judgement -- Cultural norms, competency -- Perception of intervention |
| | | Recipient | <p>Recipient needs, available resources, and cultural values/norms may necessitate modifications to promote optimal levels of engagement and attain ideal outcomes.</p> <p>Ex: Race; Ethnicity -- Gender identity -- Sexual orientation -- Access to resources -- Cognitive capacity -- Physical capacity -- Literacy and education level -- First/spoken languages -- Legal Status -- Cultural or religious norms -- Comorbidity/Multimorbidity -- Immigration status - Crisis or emergent circumstances -- Motivation and Readiness</p> |
| Mutual Adaptation | | | <p>a “change process that is flexible and negotiated between the developers and teachers, and its design reflects local needs but still holds true to the nature of the innovation” (Kezar, 2011, p. 241).</p> <p>Mutual adaptation is achieved through three mechanisms: deliberation and discussion, networks, and external support and incentives. (Kezar, 2011)</p> <p>Through deliberation and discussion organizational members are able to learn and understand why change is necessary and how an intervention will lead to change. Moreover, this process creates ownership and internal motivation among members because they come to this understanding on their own instead of being mandated to adopt an intervention. Networks provide implementers with access to others with similar ideas and goals, which can lead to greater support as networks can provide strategies or resources to navigate contextual challenges. External support and incentives provide the material resources needed to help implementers sustain change such as funding, awards, and recognition.</p> |
| Sustainability/ Institutionalization | | | |

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| | Mechanisms of Sustainability & Institutionalization | | |
| | | Legitimacy | The process or actions that lend for the scholar programs to be recognized as respectable and/or credible allowing them to be sustained and institutionalized. |
| | | Emergent Forms of Sustainability | New mechanisms of sustainability not shown in Cobian and Ramos (2021) framework or related existing literature. |
| | | Advancing Institutional Goals | Programs are sustained because they are advanced institutional goals and priorities. They become contributors or central pieces to achieving institutional missions and strategic goals |
| | | Evidence Based Success | Research evidence can lead to creating buy-in leading to greater sustainability of the program. The programs are sustained because there is evidence that they work and they are attaining their goals and objectives. |

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