Creating A Model STEM Cohort Program: Understanding Best Practices for Underrepresented

Minorities to Thrive in STEM

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Acronyms

AIAN: American Indians or Alaska Natives

APACS: Association of Professional Administrators for CSTEP and STEP

CSTEP: Collegiate Science Technology Entry Program

FGLI: First Generation-Low Income

HBCU: Historically Black Colleges and Universities

HSI: Hispanic Serving Institution

IPEDS: Integrated Postsecondary Education Data System (IPEDS)

MSI: Minority Serving Institution

NSF: National Science Foundation

NYSED: New York State Education Department

PEERS: Program for Excellence in Education and Research in Sciences at UCLA

PRISM: Program for Research in Science and Mathematics at CUNY John Jay

PWI: Primarily White Institutions

S&E: Science and Engineering AAP

SSS: Student Support Services Program

STEM: Science, Technology, Engineering, and Mathematical fields

STEP: Science Technology and Entry Program

UMBC: University of Maryland at Baltimore County

URM: Underrepresented Minorities

URP: Undergraduate Research Program

Abstract

This research explores the lack of representation of Black, Hispanic, and American Indians in post-secondary STEM education and the overall STEM workforce. Such disparity may be attributed to the lack of STEM degrees attained at the collegiate level which is discussed in Part I. This is heavily correlated with the "chilly climate" theory, whereby underrepresented minorities often feel isolated in higher education's STEM environments.

Part II highlights the role of mentorship cohort programs. These services create a sense of belonging that keeps minorities in STEM. The research evaluates four cohort programs at institutional, state, and federal levels: PEERS at UCLA, Meyerhoff Scholars at UMBC, CSTEP, and PRISM in NY State, and the Federal TRIO programs.

In Part III, a model program that incorporates components and best practices of each of these programs discussed previously is proposed. This is built off a comprehensive literature review and discussions with program directors, staff, faculty, and students. Some shared best practices throughout all programs include institutional support, dedicated staff, academic and social advising, and financial support.

In Part IV, this research explores obstacles faced by some of these programs and considers potential roadblocks for a model cohort program. Two of which are funding and institutional buy-in of cohort programs. Current models sometimes miss the specific needs of institutions which may be effectively tackled through in-person communication and several grant streams. Additionally, some institutions are reluctant to back mentorship programs. To address this, the research recommends policies to bolster both financial and social support for these programs.

Limitations with both the model program and public policy are addressed in the conclusion. These include factors such as lack of legislative consistency, over-stressing a results-based approach, sustainability, and data and privacy. Future research can focus on how grant-based programs survived various changes in legislation and unpacking nuances within different STEM majors for a more effective, targeted approach.

Introduction and Personal Stake:

As a Black student at a Primarily White Institution, I felt quite disconnected from the academic community in STEM when I came in. I didn't immediately know who to go to for academic help, what resources were available to me, or how to build out my Pre-Med plan. It was hard to ask for help when no one in the class looked like me. This phenomenon is very common throughout higher education. Black and other underrepresented minority students face unique challenges in navigating the STEM fields in higher education. As I will discuss further, a lack of representation, resources, and support often leads to feelings of isolation and disconnect within the academic community.

Currently, there exist several programs that offer mentorship for underrepresented minority students, such as the Program for Excellence in Education and Research in the Sciences (PEERS) at UCLA, Collegiate Science Technology Entry Program (CSTEP), Meyerhoff Scholars at UMBC, and Federal TRIO programs. I aimed to understand the best practices of these programs to understand how they achieve success. I also created a model program based on what I learned from peer-reviewed studies and these program directors, faculty, staff, and students. I then highlighted ways in which legislators and public policy can implement this model program. Furthermore, I brainstormed ways legislation can mitigate the financial and institutional obstacles faced by current programs. My goal is to contribute to the creation of a

more inclusive and equitable STEM environment that increases URM representation in post-secondary education enrollment and in the workforce.

Part I: Understanding The Issue

Part I Executive Summary:

There continues to be a disparity for underrepresented minorities (URM) in both the STEM workforce and post-secondary STEM education enrollment. A link to this phenomenon may be correlated with lower rates of STEM degree graduation at the college level as Black and Hispanic students are more likely to switch to non-STEM degrees. This has been associated with the chilly climate theory: a series of negative social factors that make the STEM environment in higher education isolating for underrepresented minorities. However, creating a sense of belonging, through proper academic and social mentorship, advising, and representation has been shown to effectively combat this negative environment.

The Lack of a Diverse STEM Workforce and STEM Post-Secondary School Population

According to the National Science Foundation, the Science, Technology, Engineering, and Mathematics (STEM) workforce comprised approximately 34.9 million adults in 2021. This marked a 20% increase over a decade and has led the STEM workforce to constitute 24% of the total U.S. workforce.[1] Unfortunately, this seemingly positive trajectory hides significant disparities in representation, particularly for underrepresented minorities (URM). These by the NSF are defined as Hispanics, Blacks, and American Indians or Alaska Natives (AIAN). Despite making up 37% of the college-age population, URM account for only a fraction of those in the STEM fields, both in the workforce and in graduate education. Individual ethnic groups such as Blacks, Latinos, and AIAN contribute 8.6%, 15%, and 1% respectively to the total STEM

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[1]NCSES. "Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023." NSF 23-315, 2023.

workforce.[2] In Science and Engineering (S&E) graduate education, underrepresented minorities represent just 25% of master's students and 19% of doctoral candidates.

Black representation among master's students was lowest in engineering (6%) and physical and earth sciences (5%). Patterns of Black enrollment are slightly different at the doctoral level. Black students were most prevalent in social or behavioral sciences (10%) and multidisciplinary sciences (9%) and had the lowest representation in physical and earth sciences (4%). In terms of enrollment status, Black graduate students in S&E fields are less frequently enrolled on a full-time basis compared with students from other racial and ethnic groups. Hispanic graduate students are concentrated in social and behavioral sciences at both the master's (20% of students in 2021) and doctoral (14%) levels). Hispanic representation was lowest in mathematics and computer sciences: 11% of master's students and 9% of doctoral students were Hispanic. American Indian or Alaska Native graduate students accounted for 0.4% of master's and doctoral students across all S&E fields in 2021. At the broad field of degree level, they had the highest representation in social and behavioral sciences at both the master's (0.5%) and doctoral (0.7%) levels. American Indian or Alaska Native students accounted for 0.4% of graduate students in agricultural and biological sciences and natural resources. Still, within this field, they accounted for a relatively higher share of enrollment in natural resources and conservation: 0.9% of master's students and 1.8% of doctoral students.

URM in Higher Education

How and why these populations occupy such percentages of both the STEM workforce and STEM post-secondary graduate degrees can be correlated with the number of underrepresented undergraduates in STEM. For example, Black graduate students in S&E fields

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[2]NSB, NSF. "The STEM Labor Force of Today." NSB-2021-2, 2021.

are less frequently enrolled on a full-time basis compared to other racial and ethnic groups. Data

from the Integrated Postsecondary Education Data System (IPEDS) shows that underrepresented

minority groups collectively earned significantly fewer degrees across all levels in S&E fields

compared to their White and Asian counterparts.[3] As stated by the NSF, "Underrepresented

minority groups collectively earned 43% of associate's degrees, 26% of bachelor's degrees, 24%

of master's degrees, and 16% of doctoral degrees in the five broad S&E fields of study." In 2020,

White students accounted for 70% of S&E doctoral degrees, and Asian students accounted for

11%.[4] The number of underrepresented undergraduates in STEM may indicate future

employment trends in related fields. Demographic inequities in S&E education thus not only

reflect current imbalances but also potentially perpetuate a cycle of underrepresentation that

could shape the future landscape of the STEM workforce and post-secondary enrollment in the

United States.

Disparities in Higher Education

While the STEM dropout rate is concerning across the board, it's particularly troubling

among underrepresented minority students according to Bradford et al.[5] Nearly one-third of all

students who enter STEM fields in college end up leaving by the end of their first year.[6] Among

URM students who start college intending to study STEM, only about one-fifth eventually earn

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[3] NCSES. "Women, Minorities, and Persons with Disabilities in Science and Engineering: 2017." NSF 17-310, 2017.
[4] NCSES. "Workforce Statistics." NCSES 22-203, 2022.
[5] Bradford et al. "University STEM Summer Bridge Program Effectiveness." 2021.
[6] NSB. 2018. Major switching. Available at https://www.nsf.gov/statistics/2018/nsb20181/data/tables

the STEM degree.[7] In contrast, approximately one-third of White students and nearly half of

Asian students complete their STEM programs.[8]

This disparity reflects deep-seated systemic issues according to Reigle et al.[9] STEM is

the only field where Black and Latina/o students are significantly more likely to switch majors

than their White peers. For Latina/o students, social class background explains the difference.

For Black students, this disparity remains pronounced and significant even when controlling for

factors such as high school preparation.[10] These findings showcase that systemic factors

significantly influence the trajectories of these students, and how merely addressing academic

preparedness is not enough. The challenges faced by URM in STEM majors may be due to a

combination of institutional, social, and psychological barriers that aren't as pronounced in other

fields.[11]

Understanding The Cause:

According to Palid et al., for over four and a half decades, research has highlighted the

disparity in racial diversity within STEM fields.[12] The Pew Research Center emphasizes that

despite concerted efforts, the current trajectory of STEM degree attainment seems unlikely to

substantially bridge these racial gaps.[13]The causes that influence these issues have been linked to

a lack of mentorship experiences, academic outlooks, negative attitudes toward STEM, and

pertinent familial socio-economic obligations. [14][15]

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[7]NSB. "Major switching among first-time postsecondary students." 2018.
[8]Higher Education Research Institute. "Degrees of success." University of California, 2010.
[9]Riegle-Crumb et al. "Does STEM Stand Out?" 2019. 133–144.
[10] Hershbein & Kearney. "Major decisions." Brookings Institution Press, 2014.
[11]Hershbein & Kearney. "Major decisions." Brookings Institution Press, 2014.
[12] Palid et al. "Inclusion in practice." IJ STEM Ed 10, 2 2023.
[13] Fry et al. "STEM jobs see uneven progress." Pew Research Center, 2021.
[14] Kanny et al. "Investigating forty years of STEM research." Journal of Women and Minorities in Science and Engineering 20(2) (2014): 127–148.
[15]Palid et al. "Inclusion in practice." IJ STEM Ed 10, 2 2023.

Central to understanding STEM persistence and success is the concept of academic mindset: the internal psychological framework of a student.[16] It is the "sense of belonging" in STEM. This is a sentiment of acceptance and alignment with the field.[17] A student's sense of belonging is gauged by their feelings of acceptance, inclusivity, and their perception of being a valuable part of an academic setting.[18] A student's sense of belonging also encompasses their feeling of being recognized and integrated by peers and educators in academic spaces. As a result, they view themselves as vital contributors to the classroom's dynamics and activities.[19]

Colleges are vital arenas where students' interests and capabilities in STEM are shaped.[20] Unfortunately, studies reveal that educational settings often fall short of nurturing a diverse STEM community.[21] According to Palid et al, the literature zeroes in on a variety of factors contributing to this issue, ranging from an alienating academic atmosphere for students of color and women to subpar academic preparation available to minority students.[22]

It's concerning, but hardly surprising, that many minoritized students find the atmosphere of higher education STEM programs rather inhospitable. The "chilly climate" theory, introduced by Hall & Sandler in 1982, is still resonating over 40 years later in discussions about inclusivity in higher education.[23] Many minoritized students encounter prejudice throughout their college journey—from peer interactions to engagements with faculty and administrative staff.[24] The unwelcoming culture within these environments often subtly sanctions bias and antagonism.[25]As

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[16] Rattan et al. "Leveraging mindsets." Perspectives on Psychological Science 10(6) 2015: 721–726.
[17] Ito & McPherson. "Factors influencing high school students' interest." Frontiers in Psychology 9 2018.
[18] Goodenow. "Classroom belonging." The Journal of Early Adolescence 13(1) 1993: 21–43.
[19] Palid et al. "Inclusion in practice." IJ STEM Ed 10, 2 2023.
[20] Fouad & Santana. "SCCT and underrepresented populations." Journal of Career Assessment 25(1) 2017: 24–39.
[21] Lent & Brown. "Social cognitive career theory at 25." Journal of Vocational Behavior 115 2019.
[22] Lee et al. "Racial microaggressions in STEM education." International Journal of STEM Education 7(1) 2020.
[23] Hall & Sandler. The classroom climate. Association of American Colleges, 1982.
[24] Bottia et al. "Factors associated with college STEM participation." Review of Educational Research 91(4) 2021.
[25] McGee. "Devalued Black and Latino racial identities." American Educational Research Journal 53(6) 2016.

Palid et al. note, Lee and McCabe's study in 2020 vividly portrays this, revealing how "gendered expectations," sometimes even propagated by faculty, create a classroom scenario where female students might often hesitate to voice their opinions in STEM settings.[26]

Lord et al. vividly put it, "If the climate has been characterized as 'chilly' for women […] the terrain is 'icy' for minority women."[27] Although the term "chilly climate" initially aimed to spotlight the struggles of women in higher education, its scope has broadened to echo the challenges faced by men from marginalized racial and ethnic backgrounds too.[28] While many label it the "chilly climate," others refer to it as the discriminatory environment within STEM. Some have taken a sharper stance on higher education's prevailing atmosphere, suggesting that we confront the prevailing biases head-on, labeling them as outright racist and sexist rather than employing milder terms like "chilly." The underlying issue is a pervasive culture that subtly but actively permits bias and antagonism.[29] As Palid et al. state, regardless of the terminology—be it "chilly climate," "discriminatory environment," or another phrase—the impact remains notably negative for students from marginalized backgrounds pursuing STEM majors.

Potential Solutions: Social and Academic Integration

When combatting this negative environment, many scholars look to Vincent Tinto.[30] Samoila et al. offer a theoretical framework for understanding how to improve student retention.[31] Their research suggests that students are more likely to graduate when they're both

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[26] Lee et al. "Racial microaggressions in STEM education." International Journal of STEM Education 7(1) 2020.
[27] Lord et al. "Who's persisting in engineering?" Journal of Women and Minorities in Science and Engineering 15 2009.
[28] Hall, R. M., & Sandler, B. R. (1982). *The classroom climate: A chilly one for women?* Association of American Colleges. https://eric.ed.gov/?id=ED215628
[29] Rolin. "Gender and physics." Science & Education 17(10) (2008): 1111–1125.
[30] Tinto, V. (1993). *Leaving College: Rethinking the Causes and Cures of Student Attrition, 2nd Edn.* Chicago, IL: University of Chicago Press.
[31] Samoila ME and Vrabie T (2023) First-year seminars through the lens of Vincent Tinto's theories of student departure. A systematic review. *Front. Educ.* 8:1205667. doi: 10.3389/feduc.2023.1205667

academically and socially integrated into their institutions.[32] This notion of integration involves personal and psychological characteristics of students, academic elements like teaching quality and relevant coursework, and social factors like peer and faculty interactions.[33]

Tinto's model breaks down the key determinants of student integration during their inaugural academic year into three pivotal areas: personal and psychological attributes of the student, academic elements (embracing pedagogy and guidance), and factors related to social interactions and relationships.[34] Within Tinto's interactive model of student departure, those psychological and personal characteristics spotlight the individual determinants that push a student either to continue their studies or abandon them.[35]

Academic integration, according to Tinto, goes beyond merely passing classes. It often requires tailored academic counseling and instruction that align with the student's career and educational aspirations.[36] Tinto's model pushes for institutions to consider ways in which to ease the academic transition for students. As for social integration, Tinto dives into the nuances of interactions students have with peers, faculty, and the broader academic community to create a cohort. This cohort-style model fosters a sense of belonging, anchoring students more firmly to their institutions.

Strayhorn's comprehensive research review highlights how a pronounced sense of belonging aligns with higher academic achievement, college retention, and persistence.[37] These effects are particularly dramatic among marginalized student groups.[38][39] Within the STEM

[32] Tinto. Leaving College. University of Chicago Press, 1993.
[33] Tinto. "Moving from theory to action." Coll. Student. Retent. 2 (2012c): 251–266.
[34] Tinto. "Through the eyes of students." J. Coll. Stud. Retent. 19. 2017a.
[35] Tinto. "Learning better together." High. Educ. Monograph Series. 1 2003.
[36] Engle & Tinto. Moving Beyond Access. Pell Institute, 2008.
[37] Strayhorn, T.L. College students' sense of belonging. Routledge, 2012.
[38] Smith et al. "When trying hard isn't natural." Personality and Social Psychology Bulletin 39(2) 2013: 131–143.
[39] Walton & Cohen. "A brief social-belonging intervention." Science 331(6023) 2011: 1447–1451.

framework, it's noteworthy that women and students of color have frequently reported a diminished sense of belonging compared to White men and women.[40] Mentoring has had a particularly positive impact on underrepresented groups in STEM.[41] Through peer and faculty mentoring, students can receive the academic support they need.

Krikorian et al. collected data from student surveys to understand what factors cultivate a strong STEM identity.[42] A concerning finding was that two-thirds of these STEM students didn't feel they belonged in the field or considered themselves a "STEM person." Only 30% felt that their classmates were like them, highlighting a disconnect that could contribute to attrition from STEM majors. These feelings appear to take root early on. About one-third of respondents recollected that, as children, they didn't think people like them pursued careers in STEM. This phenomenon may lead to feelings of alienation and dropping out of STEM programs.

This is where having a mentor who looks like their mentees is pivotal. They can relate to the experience of their mentees and become role models to them. Whether these mentors are met in traditional face-to-face settings or digitally via various platforms, the impact on a student's sense of belonging and identification with STEM can be significant. Thus, further exploration into establishing more relatable mentorship programs is not just recommended but crucial. The potential of mentorship in fortifying STEM identities, especially among minority students, is an avenue that warrants deeper exploration and investment.

Continuing with this analysis on fostering belonging in STEM, it becomes evident that certain program features can alleviate the "chilly climate" of STEM. Cohort programs tailored to uplift URM in STEM can make a significant difference by providing students with environments

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[40] Good et al. "Why do women opt out?" Journal of Personality and Social Psychology 102(4) 2012: 700.
[41] Steinke, J. "Adolescent girls' STEM identity." Frontiers in Psychology 8 2017.
[42] Kricorian et al. "Factors influencing participation." International Journal of STEM Education 7(16) 2020.

to collaborate with peers who understand their unique experiences and challenges.[43] Palid and colleagues took a deeper dive into this topic: they methodically reviewed 82 articles focusing on STEM intervention programs in the U.S. As a result, they were able to highlight six essential components for success in STEM retention: supplemental learning, mentorship, skill-building, financial aid, socializing opportunities, and bridge programs. Importantly, these elements can be viewed as targeted institutional supports specifically designed to redress the historical missteps of excluding underrepresented minorities from STEM.

Plaid et al. discuss a study on the University of Michigan's Women in Science and Engineering program revealed that when the environment was imbued with reminders of success within the student's ingroup, concerns about stereotypes were significantly reduced.[44] This aligns with Holcombe and Kezar's findings, which emphasize the need for integrated programs that offer both curricular and co-curricular support, requiring a synergistic effort from faculty and student affairs professionals.[45] This adds to Tinto's model of academic and social integration by offering a robust solution to the challenges faced by underrepresented students.

These programs also go the extra mile by offering concrete institutional support.[46] Features such as financial aid, supplemental learning, skill-building exercises, and bridge programs go beyond merely tempering the "chilly climate" in STEM; they offer tangible educational resources that can help students succeed in a competitive field. This adds to the broader research on educational practices that are particularly impactful for student success and inclusion. Learning communities, first-year seminars, and undergraduate research can significantly help URM have been linked to fashioning a sense of belonging and commitment to

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[43] Tsui, L. "Effective strategies to increase diversity." The Journal of Negro Education 76(4) (2007): 555–581.

[44] Ramsey et al. "Academic environment intervention." Social Psychology of Education 16(3) (2013): 377–397.

[45] Holcombe & Kezar. "Ensuring success." American Behavioral Scientist 64(3) (2020): 349–369.

[46] Valencia, R. "Deficit thinking." Taylor & Francis, 2010.

the STEM field.[47] According to Kuh et al., the most effective colleges and universities are those that intentionally design these kinds of programs.[48]

       The key to success for these targeted STEM programs is ultimately multifaceted. However, what is shared throughout is that these cohort programs reduce the "chilly climate" by creating a sense of belonging and addressing academic and institutional gaps that could otherwise hinder student success.

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[47] Finley & McNair. Assessing underserved students' engagement. AACU, 2013.
[48] Kuh, G. D., et al. Student Success in College. San Francisco: Jossey-Bass. 2010.

Part II: A Comprehensive Overview of Effecting Programs

Table 1. Part II Executive Summary of Successful Mentorship Programs

Program	Students Eligibility	Program Offerings	Funding Model
Program for Excellence in Education and Research in Sciences at UCLA (PEERS)	All incoming students who identify as FGLI, or experience social/environmental barriers	Personal academic advising, peer tutoring, collaborative learning workshops, research and networking initiatives, and freshmen transition seminars	Institutionalized (All funds are distributed from UCLA and non-grant based)
Meyerhoff Scholarship at UMBC	GPA requirement, SAT requirement, and a strong interest in community service	Financial scholarship for students, summer bridge, study groups, tutoring, summer research, networking, and mentorship	Institutionalized (All funds are distributed from UMBC, and non-grant based.)
General Collegiate Science and Technology Enhancement Program (CSTEP)	NY resident, and URM or low-income	Tutoring, research experience, and potential work-study opportunities	Funds are grant-based (pay per number of student model) at the state level
Program for Research in Science and Mathematics PRISM (CSTEP at John Jay)	For general programming, all students. For Junior Scholars, eligibility follow CSTEP eligibility and guidelines. For URP: sophomores with a GPA requirement	Mentorship, financial resources, tutoring, academic advisement, and graduate networking opportunities	Funds are grant-based but are received from multiple sources to accommodate all students
Federal TRIO: Student Support Services Program	FGLI and students with disabilities	Summer bridge, mentorship, financial resources, tutoring, academic advisement,	Funds are grant-based (pay per number of student model) at the federal level
Federal TRIO: McNair Scholars	FGLI and students with disabilities in at least their sophomore year (institution dependent)	Mentorship, financial resources, tutoring, academic advisement, graduate networking opportunities	Funds are grant-based (pay per number of student model) at the state level

Preface:

In this section, I take a closer look at existing cohort programs, focusing on what has made them successful. When I discuss "best practices," I'm referring to the US Department of Education's standards that emphasize the importance of evidence in determining the effectiveness of a program component.[49] Here, "evidence" is defined by several benchmarks: Significant increases in persistence among URM students in college STEM programs, higher graduation rates of URMs with STEM degrees, and the successful integration of URM graduates into both the STEM workforce and post-secondary institutions for further studies are the metrics I will be using. These outcomes can be compared to control groups and/or standardized against the current national averages for URMs in STEM to prove their success. My goal is to understand these successes to shape the model program I introduce in Part III.

Program for Excellence in Education and Research in Sciences at UCLA (PEERS)

Overview:

The Program for Excellence in Education and Research in the Sciences at UCLA is a distinguished two-year initiative aimed at nurturing exceptional students committed to academic excellence in the life or physical sciences.[50] PEERS' mission is to cultivate a closely-knit academic community. In doing so, the program hopes to provide students with a profound comprehension of their chosen discipline by their graduation from UCLA. During their first two years, the program aims to expand student horizons, assist them in acclimatizing to the UCLA campus, and showcase the diverse science career pathways available. Specific objectives include aiding students to achieve elevated grades in Math and science courses, maintain an exemplary

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[49]Interagency Working Group on Inclusion in STEM. "Best Practices for Diversity and Inclusion in STEM." September 2021.
[50] UCLA Undergraduate Education. "PEERS Program." 2023.

cumulative GPA, immerse themselves in undergraduate research, and expedite their graduation timeline.

Student Eligibility:

Strong interest in Science and Math Careers + Experienced social or environmental barriers that might affect your academic experience or performance + Low Income + First Generation.[51] According to Dr. Paul Barber who is the Director Undergraduate Research Center at UCLA and leads PEERS, there are around 225 freshmen that enroll every year and a total of roughly 400 students across both first and second years.

Staffing and Funding

PEERS is institutionalized with a dedicated staff of faculty and counselors. A PEERS counselor helps during orientation to schedule them with fall quarter courses and help them navigate their first two years of university.

PEERS is unique in that it is no longer grant-based and is fully institutionalized within the UCLA undergraduate research center according to Dr. Barber. This means that it has a consistent stream of funding and does not rely on external funding to sustain itself. This unlike other programs discussed later is not the case.

Program Offerings[52]
Academic Support
      a. Personalized Academic Advising: Central to the PEERS mission is its commitment to individualized academic counsel. This guidance is aligned with student ambitions, enabling them to excel in their respective science majors. Such

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[51] UCLA Undergraduate Education. "PEERS Program." 2023.
[52] UCLA Undergraduate Education. "PEERS Student Handbook 2023-24." 2023.

attentive support frequently allows PEERS students to graduate more efficiently and with competitive GPAs which will be discussed further below.

b. Collaborative Learning Workshops: Anchored by experienced graduate facilitators, these workshops are pivotal to PEERS' methodology. They focus on math, chemistry, life sciences, and physics to sharpen problem-solving capabilities. Beyond academic support, these bi-weekly meetups nurture a spirit of community among attendees.

Research & Networking Opportunities

c. Networking and Research Initiatives: PEERS champions future researchers by offering them opportunities of scientific study. There are biannual networking events and engagements directly with the UCLA research community. They also assist with identifying faculty mentors and acquiring research funding. As a result, many PEERS alumni have gone on to participate in Maximizing Access to Research Careers, UC LEADS, and CARE Scholars.

Resource Integration and Professional and Emotional Well-Being

d. Freshman Transition Seminars: The "Research Practice/EE BIOL 97XA" seminar is specifically designed to integrate new STEM students into UCLA. Through weekly sessions, students grasp essential skills ranging from time management to effective study strategies. More than an academic aid, it's a space for freshmen to share concerns and adapt to UCLA's demanding academic environment.

e. AAP Integration: With the integration of the Academic Advancement Program (AAP), students gain access to specialized academic advice, peer tutoring, and a

myriad of additional resources. This partnership enriches the academic experience and creates the sense of community.

f. Emotional Support: Recognizing the multiple challenges of university life, PEERS serves as a haven of emotional support. It's a space where mental health is emphasized, relationships are nurtured, and shared experiences foster a genuine sense of belonging.

g. Route to Graduation: PEERS' combined efforts in collaborative workshops and academic counseling often streamline the graduation path for its students, culminating in both academic and personal growth milestones. PEERS alumni are now in top graduate and professional schools across the country.

Results on PEERS

The PEERS program at UCLA was assessed to determine its effect on academic performance and retention of underrepresented students in STEM fields by Toven-Lindsey et al[53] and Sellami et al.[54] Two studies compared PEERS participants with a control group of non-participants, ensuring both groups were similar based on their chosen major, SAT math scores, and some life challenges they might face.

The first study conducted by Toven-Lindsey et al. showcased that PEERS seemed to work.[55] In evaluating the PEERS program's efficacy at UCLA, several key indicators of academic success stood out. Firstly, in terms of academic performance, students enrolled in PEERS consistently surpassed their peers in the control group, especially in foundational science courses. Their enhanced performance was evident with higher grades across the board, particularly in chemistry and math. This uplift was, in part, attributed to the program's

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[53] Toven-Lindsey et al. "Increasing Persistence in Undergraduate Science Majors," Life Sciences Education (2015).
[54] Sellami et al. "A Unique and Scalable Model," CBE—Life Sciences Education (2021).
[55] Toven-Lindsey et al. "Increasing Persistence in Undergraduate Science Majors," Life Sciences Education (2015).

collaborative-learning workshops. In addition, when considering cumulative GPAs over the initial two academic years, PEERS participants not only outperformed the control group but also those with high SAT math scores. This trend of performance remained consistent even when matched against a propensity-matched control group. Furthermore, when it came to retention of science majors, PEERS students showcased a greater tendency to remain in their chosen field, with a notable number taking significantly more science classes during their early college years compared to other groups.

Delving into factors predicting academic outcomes, both high school GPA and SAT math scores were found to positively influence performance according to Toven-Lindsey et al. The standout predictor for enhanced GPA and more extensive science course completion was, undeniably, membership in the PEERS program, especially evident in the matched sample group. Over a two-year period, 90% of PEERS students remained committed to their science majors, a figure that surpassed the control groups. In direct comparisons, PEERS students showed a positive trend, outdoing the control group in 10 of 11 categories. This consistency extended across multiple control groups, suggesting that the influence of the PEERS program wasn't merely a product of self-selection.

Sellami et al. conducted a similar study in 2021, and there, PEERS students had the highest levels of undergraduate research engagement of any comparison group. They were almost twice as likely as the propensity-matched control group and 33% more likely than non-URM students to engage in undergraduate research.[56] Furthermore, when examining graduation rates, 83% of those involved in the PEERS program finished with a science major within five years.

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[56] Sellami et al. "A Unique and Scalable Model," CBE—Life Sciences Education (2021).

In contrast, the rate for URM graduates was 39%, and the 2009 national average was notably lower at 20%. Such data underscores the importance of robust evaluation methods and meticulous data interpretation. In a comparison based on SAT math scores, PEERS students held their own against, and often exceeded, the performance of high-achieving students from the control group. These PEERS participants not only secured comparable math grades but also displayed stronger performance in several chemistry courses. Their cumulative GPAs were marginally higher, and they undertook more science classes. Remarkably, the rate at which PEERS students left STEM majors was 50% less than their counterparts. Moreover, external factors like high school GPA and SAT math scores were positively linked to academic success, while being female or being a major in physical sciences were factors that correlated with a slight dip in GPA.

Similarly, because PEERS provides a cohort-type experience that has been shown to improve outcomes for URM college students, it is possible that PEERS students persist because this cohort experience results in a better student experience and higher student satisfaction.[57] To test this possibility, they compared student satisfaction with their undergraduate experience using data from the UCLA College Senior Survey. Results indicated that there were no differences between groups and that students were generally satisfied with their academic experience, campus life, and overall college experience.[58]

It is difficult to say which program offering correlated with which result and there seems to be a claim that it is a combination of all these program offerings that create these results. The PEERS program ultimately offers considerable support, enhancing both the academic

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[57] Toven-Lindsey et al. "Increasing Persistence in Undergraduate Science Majors," Life Sciences Education (2015).
[58] Sellami et al. "A Unique and Scalable Model," CBE—Life Sciences Education (2021).

performance and persistence of students in STEM, especially considering the myriad of challenges they often encounter.

Meyerhoff Scholarship Program at University of Maryland Baltimore County

Overview:

In 1988, Freeman Hrabowski, president of the University of Maryland, Baltimore County (UMBC), collaborated with philanthropists Robert and Jane Meyerhoff to establish the Meyerhoff Scholars Program.[59] UMBC, founded in 1966 as an "historically diverse" institution, was believed by Hrabowski to be an ideal environment for nurturing talented minority students in science and engineering fields. Seeking the Meyerhoffs' support, Hrabowski envisioned a scholarship scheme aimed at molding young African American men for prominent careers in scientific research. In response, the Meyerhoffs not only pledged financial aid but also ensured their consistent personal interaction with the scholars according to the website.

The Meyerhoff Scholars Program has earned its reputation as one of the most successful efforts aimed at bolstering STEM diversity. Initially rooted in supporting the success of Black students in the sciences, especially in obtaining PhD or MD/PhD degrees, its objectives have expanded over time.[60] The program now welcomes students from all backgrounds.[61] Meyerhoff's unique approach sets it apart from other programs. It focuses on nurturing exceptionally gifted students who are driven to emerge as leading research scientists and engineers. As part of the program, Meyerhoff Scholars engage in various enriching activities: they participate in research, attend conferences, gain from paid internships, and explore study-abroad experiences.[62] These

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[59] Suran, Melissa. "Keeping Black Students in STEM," PNAS (2021).
[60] Stolle-McAllister, Kathy, et al. "The Meyerhoff Way," Journal of Science Education and Technology (2011).
[61] UMBC Meyerhoff Scholars Program. "Benefits and Eligibility," 2023.
[62] UMBC Meyerhoff Scholars Program. "Our Scholars," 2023.

opportunities not only fortify their academic prowess but also enrich their worldview by acquainting them with diverse cultures and perspectives.

Program Offerings and Key Elements of Success:[63]

The Meyerhoff Scholars program, driven by its proven formula for success, is rooted in 13 foundational components.[64] Unlike top scholars at various institutions who thrive in competitive atmospheres, Meyerhoff students flourish through a unique paradigm of mutual support. They continually inspire each other to push boundaries, cultivating an atmosphere that can best be described as positive peer pressure.

Program Values:

From its inception during the recruitment phase, the Meyerhoff Scholars Program underscores its primary objective: guiding scholars toward a research-based Ph.D. This overarching goal is coupled with a set of core values that the program consistently emphasizes. Scholars are encouraged to set ambitious academic goals and to proactively seek assistance, whether it be tutoring or advising, from a diverse array of sources. Furthermore, an ethos of giving back is instilled, with scholars being expected to actively participate in community service projects.

Recruitment:

As mentioned previously, the Meyerhoff Scholars Program has a rigorous recruitment process. Each year, they receive around 2,000 nominations but enroll only about 50 new students. The most outstanding 100-150 applicants, along with their families, are invited to a special on-campus selection weekend. During this event, they can interact with the faculty,

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[63] UMBC Meyerhoff Scholars Program. "13 Key Components," 2023.
[64] UMBC Meyerhoff Scholars Program. "Model," 2023.

administration, program staff, and current Meyerhoff Scholars in both formal and informal settings. This meticulous screening ensures that selected students align with UMBC's standards.

Financial Aid:

Meyerhoff Scholars benefit from a generous four-year merit-based scholarship. To ensure the continuation of this financial support, scholars are required to uphold a B average in their science or engineering major and adhere to all conditions specified in the Meyerhoff merit award agreement. For in-state students, the scholarship amount ranges between $5,000 and $15,000 per academic year.[65] Meanwhile, out-of-state students can expect an award ranging from $10,000 to $22,000 annually. These funds assist with covering tuition, mandatory fees, and other educational expenses.

Summer Bridge:

Each incoming cohort is required to attend a mandatory six-week Summer Bridge Program before their freshman year.[66] This encompasses courses in math, science, and the humanities so that scholars are ready for the expectations and requirements of college courses. To foster a close-knit peer group, social and cultural events are integral to the program. Students wear name tags and are encouraged to introduce themselves before answering questions in class, which facilitates learning each other's names and promotes a cooperative learning environment.[67] Emphasizing teamwork, scholars' study in small groups, with their grades uniquely structured to be contingent on the performance of the lowest-scoring group member. Beyond the academic and

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[65] Lee, Diane M., and Keith Harmon. "The Meyerhoff Scholars Program: Changing Minds, Transforming a Campus." (2013).
[66] Maton, Kenneth I., et al. "Outcomes and Processes in the Meyerhoff Scholars Program," CBE Life Science Education 15, no. 3 (2016).
[67] Mervis, Jeffrey. "Diversity of U.S. Academic Scientists," Science Insider Education (2019).

social aspects, Scholars receive training in essential social skills. This includes conflict resolution, diversity appreciation, communication, and social leadership. Additionally, they are guided through professional training that covers resume and application writing, professional dress and etiquette, and interview and public speaking skills.[68]

Study Groups:

Within the Meyerhoff Scholars Program, the practice of studying in groups is not just suggested but fervently championed by the program staff. Recognizing its significance in science, math, or engineering majors, this approach is seen as pivotal for academic success. Meyerhoff Scholars uniformly acknowledge study groups as a cornerstone of their positive experiences, consistently ranking them among the program's most beneficial facets. As highlighted by Bennet et al, these collaborative sessions not only foster robust study habits but also hone skills like engaging in meaningful academic discussions and tapping into the collective wisdom of peers.[69] Moreover, peer study groups serve as platforms where students internalize a critical lesson: that academic success isn't necessarily about swift problem-solving, but rather, it's about persistence until challenges are overcome.

Program Community:

At its core, the Meyerhoff Scholars Program goes beyond academic enrichment, crafting a tight-knit, family-like community both socially and academically on campus. In their initial year, students are housed within the same residence hall, fostering deep bonds, and they continue to reside on campus in the subsequent years. To further cultivate this sense of unity, staff

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[68] Maton, Kenneth I., et al. "Outcomes and Processes in the Meyerhoff Scholars Program," CBE Life Science Education 15, no. 3 (2016).
[69] Stolle-McAllister, Kathy, et al. "The Meyerhoff Way," Journal of Science Education and Technology (2011).

orchestrate regular group assemblies aptly termed "family meetings." This ensures they are well-integrated into both academic and social spheres.

Personal Advising and Counseling:

The Meyerhoff Scholars Program provides a comprehensive support system for its students. A dedicated full-time academic advisor, in tandem with the program's executive director, director, and assistant director, is actively involved in regularly tracking and offering guidance to students. However, their role isn't limited to just academic oversight. These counselors are equally attentive to any personal challenges or concerns the students might face, ensuring a holistic approach to student welfare and development.

Tutoring:

The Meyerhoff Scholars Program deeply emphasizes academic excellence. Scholars are not merely urged to achieve but to consistently strive for academic success — targeting not just A grades, but the highest possible marks. While all scholars are encouraged to leverage both departmental and university tutoring resources, many Meyerhoff Scholars also play a dual role by serving as peer tutors to both Scholars and general STEM students.

Summer Research Internships:

The Meyerhoff Scholars Program believes in experiential learning. Scholars are introduced to research at an early stage, fostering a hands-on approach and providing a lucid comprehension of scientific study. Through an expansive network, program staff coordinate summer internships in science and engineering both at UMBC and prestigious partner institutes such as the Howard Hughes Medical Institute and the National Institutes of Health. These internships serve as a dual conduit: reigniting students' inherent interest in STEM careers and

facilitating mentorship avenues. Many who host these internships transition into long-term

mentors for the scholars. Furthermore, scholars are actively encouraged to engage in professional

congregations, often presenting their research findings alongside esteemed faculty members.

Mentors:

Mentorship is the cornerstone in the Meyerhoff Scholars' journey. Every scholar is

matched with a mentor, often hailing from professional spheres in science, engineering, or health

within the Baltimore and Washington regions.

Faculty Involvement:

The success of the Meyerhoff Scholars Program hinges significantly on the active

participation of the faculty. Department chairs and faculty members also aid with recruitment,

teaching, mentoring, research, and orchestrating special events.

Administrative Involvement and Public Support:

The Meyerhoff Scholars Program receives unwavering backing across the various

echelons of the university. Scholars and researchers emphasize the significance of such holistic

support as a crucial determinant of the success of intervention programs. Over the years, the

program has partnered with the National Science Foundation, NASA, IBM, AT&T, and notable

foundations like Sloan, Lilly, and Abel.

Family Involvement:

Family involvement is integral to the Meyerhoff Scholars Program's mission. Parents

remain consistently updated about their child's academic journey. They are not only looped into

their child's milestones but are also summoned for specialized counseling sessions should any

concerns arise. Beyond academic updates, parents are cherished participants in various program

events. Acknowledging the pivotal role of families, the *Meyerhoff Parents Association* has been

instituted. This association not only provides mutual support but also spearheads fundraising initiatives.

Eligibility:

The Meyerhoff Program at UMBC distinguished itself through an unconventional approach from its inception.[70] Unlike many diversity programs that target students from underrepresented groups, who might otherwise struggle to earn an undergraduate degree, and that are often confined to a single discipline or college within a university, the Meyerhoff Program is markedly different. They recruit high-achieving students with demonstrated exceptional capabilities: at least a 600 on the Scholastic Aptitude Test, excellent high school grades, and a declared intention to major in a STEM field.[71]

Once accepted—UMBC enrolls between 60 to 90 Meyerhoff Scholars each year—students are free to pursue a degree in any STEM discipline. Candidates for the Meyerhoff Scholars Program can be nominated by their high school administrators, guidance counselors, or teachers. These scholars are then awarded four-year scholarships. For the 2023-2024 academic year, the program hosts a total 263 students, with 71% hailing from underrepresented racial and ethnic groups and the remaining 29% from non-underrepresented backgrounds.

Results According to Website:

Since its inception in 1993, the Meyerhoff Scholars Program has showcased remarkable achievements. By June 2023, over 1400 students have graduated under its auspices. Delving into the specifics as mentioned in the Meyerhoff website:

[70]Mervis, Jeffrey. "Diversity of U.S. Academic Scientists," ScienceInsiderEducation (2019).
[71] UMBC Meyerhoff Scholars Program. "Benefits and Eligibility," 2023.

- The program has proudly produced 426 Ph.D. alumni, which encompasses 74 M.D./Ph.D.'s, a DDS/Ph.D., and a D.V.M./Ph.D.

- Further adding to its accolades, the alumni have been awarded over 160 M.D. or D.O. degrees.

- More than 330 of our graduates have secured master's degrees, predominantly in fields such as engineering, computer science, and related disciplines.

- The institutions from which these degrees were conferred include globally recognized names such as Harvard, Stanford, M.I.T., Berkeley, Duke, University of Michigan, Yale, Georgia Tech, Johns Hopkins, Carnegie Mellon, Rice, University of Pittsburgh, NYU, and the University of Maryland.

- A testament to the program's commitment to academia, 71 of its alumni have joined the faculties of revered institutions such as Duke University, University of Michigan, Stanford University, Johns Hopkins University, and the Harvard T.H. Chan School of Public Health.

- The current academic scenario showcases over 200 alumni actively pursuing graduate and professional degrees.

Peer-Reviewed Research Studies:

The Meyerhoff Scholars program stands as a testament to the profound impact of a well-structured initiative on increasing diversity in STEM fields as it has been replicated across other institutions.[72] Its foundation lies in a strength-based approach, providing support, resources, and

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[72] UMBC Meyerhoff Scholars Program. "Model," 2023.

mentorship to underrepresented minority students which integrated into other programs like the

Millennium Scholars (MLN) and Chancellor's Science Scholars (CSS).[73]

Maton et al. studied these programs to understand why the Meyerhoff model works.

While bearing unique variations, maintain their core objectives and outcomes, there are tangible

metrics that attest to the success of this program model. Over time, cohort sizes have expanded

and URM participation has surged. Remarkably, STEM retention rates achieved by MLN and

CSS mirror those of the original Meyerhoff Scholars program. Furthermore, the average GPAs of

MLN and CSS students have even surpassed those of Meyerhoff, a resounding validation of the

efficacy of these initiatives in bolstering the academic accomplishments of URM students. The

success isn't just due to academic support; it's rooted in the comprehensive nature of the program

that addresses multifaceted challenges URM students face.[74] The incorporation of study groups

facilitates academic collaboration, which previous research links to academic improvement. In

essence, the program's structure addresses diverse areas of need for minority students,

contributing to its sustained success.

Collegiate Science and Technology Entry Program (CSTEP):

Overview:

   Initiated in 1986 through an amendment to the New York State Education Law (Chapter

31, Article 130, § 6455), the Collegiate Science and Technology Entry Program (CSTEP) is

designed to improve educational access for minority or economically disadvantaged students in

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[73] Maton, Kenneth I., et al. "Outcomes and Processes in the Meyerhoff Scholars Program," CBE Life Science Education 15, no. 3 (2016).

[74] Georges A. Keeping what we've got: effective strategies for retaining minority freshmen in engineering. NACME Res Lett. 1999;9:1–19.

New York.[75] The program's focus is on preparing students for a post-secondary education in STEM or for employment in STEM.

In the 2019-20 program year, CSTEP was allocated a budget of $11.9 million, supporting 55 projects. Funding would be expected to continue at similar levels in the coming years. The current Request for Proposal (RFP) is for a five-year funding cycle, from July 1, 2020, to June 30, 2025.[76] This RFP requires a 25% funding match from CSTEP program recipients, which could be sourced from institutional contributions or other non-New York State funds. According to § 145-6.6(b) of the Commissioner's Regulations, eligible institutions for this program include degree-granting postsecondary institutions (nearly all City and State Universities in New York and Private higher education institutions, provided they offer approved undergraduate or graduate programs of study.

Student Eligibility:

To qualify for undergraduate support through a universities' CSTEP program, a student must be a resident of New York State and meet specific criteria. They must be either economically disadvantaged or belong to a minority group that has been historically underrepresented in scientific, technical, health, and health-related professions. As per § 145-6.6(b) of the Commissioner's Regulations, the term "minorities historically underrepresented" in these professions is defined as residents of New York State or permanent resident aliens residing in New York State who are Black, Hispanic, American Indian, or Alaskan Native.[77]

In addition, the student must show an interest in, and potential for, a professional career when provided with special services. Maintaining good academic standing is a requirement, and eligible students must be enrolled full-time in a program of study approved by the Regents.

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[75] NYSED Access, Equity and Community Engagement Services. "CSTEP," 2023.
[76] NYSED Access, Equity and Community Engagement Services. "CSTEP Webinar Overview," 2023.
[77] NYSED Access, Equity and Community Engagement Services. "CSTEP Fact Sheet 2022," 2022.

Program Offering:

While the specifics of the CSTEP Program can differ among New York state institutions, there are core requirements set by the grant program. One of the primary expectations is to provide instructional support for "gateway courses." This entails offering small group tutorials or supplemental instruction in foundational subjects such as Biology, Chemistry, Physics, Calculus, and other pre-professional prerequisites for first year and second-year students. Support should extend with tutoring for more advanced courses tailored for third year and fourth year students.[78]

An emphasis is placed on deepening student engagement with research and internships as well. It's a program that mandates that every participating student gains hands-on experience through coordinated research or an internship prior to their graduation. Beyond academic support, CSTEP programs also aim to foster professional growth. They do so by offering various professional development activities, like workshops, poster presentations, and opportunities for students to get published in professional or research domains. This is geared towards motivating students in the STEM career fields,

CSTEP also emphasizes community engagement. Institutions are encouraged to organize, execute, and evaluate a Day of Service, where CSTEP students can contribute to their local community or the community surrounding their institution.[79] The program may also consist of a spectrum of services that covers tutoring, academic counseling, remedial and specialized summer courses, supplemental financial aid, student recruitment, academic enrichment, career planning, and exam preparation for those heading into scientific, technical, and licensed professions.

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[78] NYSED Access, Equity and Community Engagement Services. "CSTEP Webinar Overview," 2023.
[79] NYSED Access, Equity and Community Engagement Services. "CSTEP Fact Sheet 2022," 2023.

Impact of CSTEP:[80]

During the 2021-22 academic year, New York State had 58 CSTEP programs with a total enrollment of 8,195 students. Out of these participants, 972 or 12% were enrolled in other opportunity programs. CSTEP students undertook 137,943 internship hours and participated in 169,362 research hours. Impressively, 56% of the participants were first-generation higher education students. By spring 2022, 21% of CSTEP participants graduated, and out of these graduates, 75% chose to pursue STEM fields.

CSTEP at CUNY John Jay College of Criminal Justice:

The Program for Research Initiatives in Science and Mathematics (PRISM) program at John Jay College stands as a notable example of a CSTEP initiative in action.[81] It was established in 2006 to support the diverse undergraduate student body at John Jay; now, PRISM continues to prepare students to become professionals in STEM, health, and education. PRISM is a collaborative effort by individual faculty members and John Jay College's administration to centralize and improve retention and graduation rates for students majoring in forensic science at John Jay.

At its core, PRISM emphasizes relationship-building between students, faculty mentors, and PRISM staff members. The program engages students in hands-on scientific activities and provides academic support through peer cohorts and professional development opportunities. This approach is designed to set students up for success. Crucially, PRISM acknowledges and values the unique backgrounds of the students it serves at John Jay College.

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[80] NYSED Access, Equity and Community Engagement Services. "CSTEP Fact Sheet 2022," 2023.
[81] CUNY John Jay School of Criminal Justice. "Program for Research Initiatives in Science & Math," 2023.

PRISM Student Eligibility:

Like the Program for Excellence in Education at UCLA, PRISM is institutionalized by CUNY John Jay. It serves as the main hub for academic support at John Jay. As a result, it serves all students, not just of those marginalized backgrounds. This office is funded through multiple grant initiatives to sustain itself as a result it can allocate various resources accordingly to student needs.[82] According to Dr. Edgardo Sanabria-Valentin, the Associate Director of PRISM, while this program cannot run by CSTEP alone, they have no trouble recruiting for the students that fall under CSTEP guidelines because of this institutionalized and centralized academic support office.

PRISM Program Offerings:

Junior Scholars Program at John Jay

The PRISM Junior Scholars Program, supported through an NYSED Collegiate Science and Technology Entry Programs (C-STEP) grant, is designed to equip eligible students with the necessary resources and guidance to become proficient professionals in the science, technology, health, and NYS-licensed sectors.[83] Although the program ideally commences in a student's freshman year, it extends its support to scholars across all academic years, contingent upon their adherence to the NYSED-determined eligibility criteria.

Emphasis on Mentorship

Dr. Anthony Carpi, PRISM's founder, alongside his team, highlights the pivotal role of the student-mentor relationship. [84] This relationship spans from 1 to 3 years, fostering an

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[82]CUNY John Jay School of Criminal Justice. "Program for Research Initiatives in Science & Math," 2023.
[83]CUNY John Jay School of Criminal Justice. "Junior Scholars," 2023.
[84] Carpi, A., et al. "Cultivating Minority Scientists," Journal of Research in Science Teaching 54 (2017).

enriching collaborative environment.[85] Given John Jay's predominantly undergraduate focus, the program facilitates a direct engagement between students and mentors.

Fostering a Community Spirit

Central to PRISM's methodology is the spirit of community. The program curates an atmosphere where students can regularly share insights, engage in group deliberations, and embark on educational field trips. [86]

Mitigating Financial Obstacles

PRISM recognizes the financial strain students may have. This is why enrolled students are awarded stipends of up to $300 after meeting program requirements each semester.[87] Participants also have discounts on select Kaplan® products. They are also eligible for reimbursements of up to $500 annually, for expenses affiliated with post-graduate program applications, such as examination and application fees.

Professional Development and Academic Support

Beyond research, PRISM focuses on the overall professional growth of its scholars. Initiatives begin right from a proposal submission process that mirrors authentic scientific proposal drafting. Furthermore, participants benefit from specialized academic advice, tutoring in math and science via the Math & Science Resource Center, and workshops centered on study skills enhancement, professional decorum, and optimizing their tenure at John Jay.

Undergraduate Research Program

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[85] Carpi, A., et al. "STEM Retention Strategies at a Hispanic-Serving Institution," Journal of Hispanic Higher Education 12, no. 3 (2013).
[86] Carpi, A., et al. "Cultivating Minority Scientists," Journal of Research in Science Teaching 54 (2017).
[87] CUNY John Jay School of Criminal Justice. "Junior Scholars," 2023.

As part of the Undergraduate Research Program (URP), PRISM offers students in science and math majors the opportunity to conduct research.[88] Upon entering John Jay College in their sophomore year, students are made aware of the URP initiative through substantial outreach. Through structured information sessions and academic seminars, they are introduced to the potential of research within PRISM. Recognizing academic achievements, eligible sophomore students undergo a 1-week faculty-led research training. This training concludes with students pairing up with faculty mentors to collaboratively draft a research proposal and later allows students to partake in lab research. In a move to integrate academic commitments, students can also fulfill their bachelor's degree capstone requirement by dedicating 400 hours to guided research.[89]

Planning Beyond the Bachelor's degree

PRISM aims to guide students beyond their undergraduate studies.[90] The program promotes postgraduate opportunities through mentorship and formal events featuring representatives from graduate programs. Senior students and alumni also play roles in advising younger peers on various academic and professional aspects. PRISM provides support in graduate school applications, ensuring students are equipped to navigate the process effectively.

Results Graduation and Further Studies

Since adopting comprehensive research mentoring, undergraduate graduation rates in the sciences at John Jay have tripled, according to the Program website.[91] This growth includes a four-fold rise in Black and Hispanic student graduations. Additionally, there's a notable uptick in

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[88] https://new.jjay.cuny.edu/research/office-advancement-research/program-research-initiatives-science-math/prism-programs/undergraduate-research-program

[89] Carpi, A., et al. "Cultivating Minority Scientists," Journal of Research in Science Teaching 54 (2017).

[90] Carpi, A., et al. "STEM Retention Strategies at a Hispanic-Serving Institution," Journal of Hispanic Higher Education 12, no. 3 (2013).

[91] CUNY John Jay School of Criminal Justice. "Impact," 2023.

undergraduates pursuing postgraduate programs in STEM and health fields: a ten-fold increase

for programs like Ph.D., MD, DO, and VMD, and a fifteen-fold increase for a broader range of

postgraduate STEM and health fields.

Over the last decade, more than 90 undergraduate researchers from John Jay, with a

significant majority being women and nearly half from minority backgrounds, have entered

postgraduate programs in STEM and health fields. Their alumni network now includes medical

doctors and researchers at various respected institutions, research corporations, and government

labs.

Recognition in Latinx STEM Education

PRISM has earned national distinctions like the PAESMEM and has been evaluated in

academic journals such as the Journal of Hispanic Higher Education and the Journal of Research

in Science Teaching. Within PRISM, students frequently present at conferences and contribute to

academic publications, often outpacing other nationally recognized programs.

With its continued efforts in STEM education, John Jay College shows promise in

becoming a leading institution for Latinx undergraduates transitioning to STEM Ph.D. programs.

In August 2023, John Jay College was distinguished by "Excelencia in Education", a paramount

national initiative dedicated to spotlighting and bolstering evidence-based practices that drive

Latino student success in higher education.[92] Since its inception in 2005, "Excelencia in

Education" has acknowledged over 400 impactful programs out of more than 2,000 submissions

and has committed over $2 million to ensure their continuity. These recognized initiatives serve

as guiding examples for educational institutions aiming to devise and maintain practices

specifically tailored to their students and communities.

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[92] Excelencia in Education. "Programs Positively Impacting Latino Students," 2023.

CSTEP Funding:
CSTEP Project Funding Guidelines:[93]

1. **Minimum Requirement:** A CSTEP project must annually serve a minimum of 30 students.

2. **Funding Tiers:**

   o Projects serving **30 to 99 students** annually can request up to **$2,000** per student.

   o Projects serving **100 to 199 students** annually can request:

     ▪ **$2,000** for the first 99 students (a base of $198,000).

     ▪ An additional **$1,500** for each student above 99.

       ▪ Example: A project for 100 students would have a budget cap of $199,500 ($198,000 base + $1,500 for the extra student).

       ▪ A project for 199 students would have a budget cap of $348,000 ($198,000 base + $150,000 for the additional 100 students).

3. **Previously Funded Projects (2015-2020 cycle):**

   o Those serving **200 or more** students annually can request:

     ▪ **$1,000** for each student over 199, up to a maximum budget of **$450,000** per year.

       ▪ Example: A project for 200 students would have a budget of $349,000 ($348,000 base + $1,000 for the extra student).

   o The maximum budget for any previously funded CSTEP project is **$450,000** annually.

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[93]NYSED Access, Equity and Community Engagement Services. "CSTEP Webinar Overview," 2023.

Potential Issues with Funding Model

The CSTEP funding allocation system is clearly designed with the intent of distributing funds in an equitable manner, maximizing the number of students served across the state, and ensuring a balance between infrastructure and administrative costs. Its strategy centers around awarding more funds to projects serving fewer students, acknowledging the higher per-student administrative expenses these smaller projects often face. Yet, as projects grow, the additional funding per student gradually decreases. This may be due to the idea that larger projects can achieve economies of scale.

While the funding model has its merits, there are notable concerns. For instance, the tiered funding structure could inadvertently discourage some programs from expanding too quickly, given the decreasing per-student funding as more students are enrolled. If a program has 97 students, the marginal benefit of recruiting 3 more (to reach 100) is significantly diminished due to the reduced funding per student. This may strain existing resources and lead to a dilution of service quality. There's also a risk that the model might oversimplify the nuances and unique challenges faced by different projects, particularly those in areas with distinct demographic or socioeconomic profiles.

Federal Trio Programs:

Overview:

The Federal TRIO Programs (TRIO), established at the national level, offer a suite of outreach and support initiatives for disadvantaged individuals.[94] Spanning eight programs, TRIO aids low-income, first-generation college students and those with disabilities throughout their educational journey, from middle school to postgraduate studies. Much like CSTEP, TRIO's grants are awarded not to individual students but to entities such as higher education institutions,

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[94] U.S. DOE Office of Postsecondary Education. "Federal TRIO Programs," 2023.

public and private agencies, and organizations experienced in assisting disadvantaged youth.[95]

For my research, I'll concentrate on two TRIO programs: Student Support Services and McNair

Scholars Program.

Student Eligibility:

During the 1980 reauthorization of the Higher Education Act (HEA), the TRIO

community actively contributed to drafting eligibility criteria. Their goal was to prioritize

students with the greatest needs while also ensuring inclusivity for anyone meeting specific

family income and parental education criteria. Thus, in HEA:80, most TRIO programs set their

eligibility standards as those with incomes at or below 150% of the poverty level and those who

are the first in their family to attend college. This concept is referred to as "first-generation

college, "meaning neither parent has earned a bachelor's degree.[96]

Student Support Services Overview:

Established in 1968 as Services for Disadvantaged Students and later rebranded as

Student Support Services (SSS), this initiative emerged as the third TRIO program.[97] SSS'

distinct mission focuses on aiding both traditional and nontraditional students in achieving

college completion. SSS aims to increase graduation rates and post-secondary enrollment,

particularly for low-income, first-generation college students, and students with disabilities.

Starting from the 2010-15 funding cycle, the program expanded its reach, introducing grants to

cater to a broader student demographic, such as those in STEM, health sciences, teacher

preparation, and English as a second language (ESL) learner. SSS program offers a

comprehensive suite of services tailored to the specific needs of its participants. Central to its

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[95] U.S. DOE Office of Postsecondary Education. "Fast Facts Report," 2016.
[96] U.S. DOE Office of Postsecondary Education. "Federal TRIO Programs," 2023.
[97] The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.

mission are academic tutoring, guidance in postsecondary course selection, and providing valuable information on both public and private scholarships and financial aid programs.

For those attending four-year institutions, there's a specialized focus on supporting applications to graduate and professional programs. Conversely, students at two-year institutions receive dedicated assistance in transitioning to four-year programs, including securing the necessary financial support. To further address the disparity in educational outcomes between economically advantaged and disadvantaged students, the SSS program has introduced initiatives such as summer bridge programs or grant aid opportunities.[98] In terms of statistics, 22% of four-year institutions have implemented a summer bridge program, compared to 16% of two-year institutions. Grant aid, funded through the SSS program, is prominent, with 79% of four-year institutions and 69% of two-year institutions taking advantage of these funds. Both types of institutions prioritize offering guidance on course selection and disseminating information on federal financial aid.[99] Specific to the institution types, four-year attendees see around 20% receiving assistance for graduate program applications, whereas a third of two-year attendees get support in their transition to four-year institutions. Overall, most participants receive their services directly from the grantee institution rather than through external referrals, emphasizing the direct impact and reach of the SSS program.

SSS Student Population:
The Pell Institute's findings affirm that TRIO programs effectively cater to their target demographics.[100] A breakdown of participant demographics reveals the program's diverse reach: at four-year institutions, 30% of the participants were African American and 25% were Hispanic,

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[98] U.S. DOE Office of Postsecondary Education. "Fast Facts Report," 2016.
[99] U.S. DOE Office of Postsecondary Education. "Fast Facts Report," 2016.
[100] The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.

compared to 27% African American and 21% Hispanic participants at two-year institutions. [101]

Whites represented 34% and 43% of the participants in four-year and two-year institutions,

respectively. [102] Furthermore, the core objective of the SSS program, which mandates that two-

thirds of its participants at each institution be both low-income and first-generation students, is

clearly being met. A substantial 66% of participants at four-year institutions and 69% at two-year

institutions met both these criteria. This showcases the program's steadfast commitment to

supporting its intended audience.[103]

SSS Institutional Demographics:

From 1997 to 2021, the SSS program experienced a notable growth of 44%, increasing

the number of its projects from 796 to 1,149.[104] Each of these SSS grants operates on a five-year

grant award cycle, according to the Pell institute. A standout feature of the program's institutional

demographics is its higher representation of Historically Black Colleges or Universities

(HBCUs) among grantee institutions, when compared to national averages. Specifically, while

4% of four-year institutions and less than 1% of two-year institutions nationally are HBCUs, the

figures are 10% and 1% respectively among SSS grantee institutions. Additionally, the program

also supports Hispanic learners, with 10% of its four-year grantee institutions and 13% of its

two-year grantee institutions recognized as Hispanic-serving.

establishments.[105]

[101] U.S. Department of Education. "Talent Search Program," 2016.
[102] U.S. Department of Education. "Student Support Services Program," 2016.
[103] The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.
[104] The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.
[105] U.S. Department of Education. "Student Support Services Program," 2016.

SSS Performance Metrics and Outcomes:

The efficiency of the Student Support Services Program is gauged primarily by tracking the persistence in postsecondary education and the degree completion rates of its participants who continue their education at the grantee institution by the Federal TRIO program itself. According to the Pell Institute, for those entering 2-year institutions, SSS participants exhibited a marked advantage: they were 78% more likely to either obtain an associate degree or certificate or to transition to a 4-year institution within four years.[106] Specifically, 50% of SSS participants achieved this milestone, in contrast to the 28% national average. SSS participants starting at 4-year institutions also fared better, with a 23% higher likelihood of securing a bachelor's degree within a span of six years. Here, 49% of SSS participants reached this accomplishment, compared to the 40% national statistic, as indicated by Pell.

In terms of specific fields of study: 26% of those who earned a bachelor's degree specialized in social, behavioral, and economic sciences (SBE) fields such as psychology, sociology, and economics. When it comes to science, technology, engineering, and mathematics fields, the percentage was slightly lower, with 17% of bachelor's degree recipients. This includes life sciences (9% of degrees), engineering (3%), physical sciences (2%), computer/information sciences (2%), and mathematics (less than 1%).

Funding Overview for SSS 2021:[107]

Total Allocation	$363222465
Number of Awards	1149
Total Participants	207699
Average Award per Institution	$316121

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[106] The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.
[107] U.S. Department of Education, Office of Federal TRIO Programs. "Student Support Program Funding."

SSS. Historical Growth and Decline in Funding Per Participating Institutions:

From 1997 to 2021, there was a 44% rise in the number of SSS projects, moving from 796 to 1,149, according to the Pell Institute.[108] When adjusted for inflation to 2021's economic conditions, the overall funding for TRIO saw a growth of 7% during this period. This took the budget from $1,011.6 million in 1997 to $1,078.9 million in 2021. Within this, the specific funding increase for SSS was 4%. However, there's been a noticeable reduction in funding per SSS participant over the years. Starting from $1,960 per participant, the amount dwindled to $1,749.

SSS Obstacles:

The Student Support Services program, a key component of TRIO, has achieved notable success in supporting disadvantaged students through their educational journeys. However, as with any program, it's essential to identify and address potential obstacles to further enhance its effectiveness. The number of SSS projects has shown a commendable increase of 44% from 1997 to 2021, reflecting the program's scalability and the growing recognition of its importance. However, a closer look reveals that the total TRIO funding, when adjusted for inflation, has only increased by a modest 7% during this period.[109] Specifically, for the SSS program, the increase is even more minimal at 4%.[110] This growth rate might not be sustainable in the long run, especially as the program expands and the demands increase. Another challenge arises when examining the reach of the program. Given current funding levels, the more intensive TRIO programs, including SSS, serve only about 1% of the eligible population. This suggests there's a vast number of students who might benefit from the program but remain untouched by its

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[108] The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.
[109] The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.
[110] The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.

resources. A subtle discrepancy in the timeline presents yet another potential challenge. The SSS program's success is measured largely by graduation outcomes. However, these grants are awarded on a five-year cycle. This becomes especially relevant considering that many students, especially those at four-year institutions, take up to six years to graduate. A potential gap in support during the vital final phases of their degree could affect students' success trajectories.

McNair Scholars Program:
The purpose of the Ronald E. McNair Postbaccalaureate Achievement (McNair) Program is to award grants to institutions of higher education for projects designed to provide disadvantaged college students with effective preparation for doctoral study.[111] All McNair projects must provide the following activities: opportunities for research or other scholarly activities; summer internships; seminars and other educational activities designed to prepare students for doctoral study; tutoring; academic counseling; and activities designed to assist students participating in the project in securing admission to and financial assistance for enrollment in graduate programs.[112] McNair projects may also provide the following additional activities: education or counseling services designed to improve financial and economic literacy of students; mentoring programs involving faculty members at institutions of higher education or students, or any combination of such persons; and exposure to cultural activities. All McNair Program grant awards are made for five-year grant award cycles.[113]

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[111] U.S. Department of Education. "Ronald E. McNair Program." 2023
[112] U.S. Department of Education. "Ronald E. McNair Program FAQ," 2023.
[113] U.S. Department of Education. "Ronald E. McNair Program FAQ," 2023.

McNair Grant Awards and Historical Growth

The McNair Program, focusing on elevating disadvantaged college students towards doctoral aspirations, has an average grant award of roughly $220,000 annually, according to the Pell Institute.[114] This fund is designated to serve a minimum of 24 students every year per grant awarded. A significant performance indicator for the McNair Program is the heightened percentage of its participants both enrolling in and consistently attending graduate school.

From its inception, the number of McNair projects has experienced an 89% increase, escalating from 99 to a total of 187 projects by 2021-22. In that year alone, 5,242 McNair scholars were supported across these 187 sites.[115] It's also noteworthy that funding per participant for McNair, a standout among the TRIO programs for its intensity, has decreased by approximately 43% since 1997, moving from $16,678 to $9,505 by 2021. This funding decline over the years is one of the challenges the program faces, especially when considering its reach is to about 0.1% of the total potential eligible population.[116]

Evaluation Metrics and Results:

The McNair Program employs two primary performance measures to assess its effectiveness:

1. Three-Year Graduate School Enrollment Rate: This metric measures the percentage of McNair bachelor's degree recipients who enroll in a graduate program within the three years following their undergraduate completion.

2. One-Year Graduate School Persistence Rate: This reflects the percentage of McNair participants who, upon enrolling in graduate studies for the first time, continue into their subsequent academic year.

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[114]The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.
[115]The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.
[116]The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.

The McNair Scholars Program has showcased notable results, especially when examined against broader national averages. Analyzing against a control group, McNair Scholars shone brightly with a commendable 69% graduate school enrollment rate within the same three-year period as those of similar background which ranged between 44% to 46%.[117] This implies that McNair Scholars was 50% more likely to pursue further education than the national average (69% vs. 46%). Meanwhile, McNair Scholars showed a 18% higher enrollment rate when compared with students of highest family income quartile, showed a (69% versus 51% enrollment rate.)[118] The One-Year Graduate School Persistence Goal: the one-year graduate school persistence rate for McNair participants who were first reported as graduate students in 2019–20 was 85.7 percent.[119]

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[117] The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.
[118] The Pell Institute. "Indicators of Higher Education Equity," 2022, 247-286.
[119] U.S. Department of Education. "McNair Program Performance," 2023.

Part III: Creating A Model Cohort Mentorship Program

Part III Executive Summary:

From discussions with experts, the foundation of a successful program lies in institutional buy-in by having a dedicated staff, faculty, and space to support it. A program should also consider the socio-economic barriers many URM face in higher education by allocating its students a stipend for participation. As for the program offerings, a model program should prioritize creating a sense of belonging through creating a collectivist mindset and proper representation. This is on top of providing a summer bridge program, academic support, research experiences, career opportunities, and flexibility surrounding student needs. As for the students eligible for the program, there is not a one-size-fits-all and a mentorship program should be able to accommodate as many marginalized students to the amount their dedicated staff can handle. Finally, the evaluation of any mentorship program should have quantitative and qualitative assessments to constantly innovate and improve.

Preface

After extensively researching the Program for Excellence in Education and Research in the Sciences (PEERS) at UCLA, the Meyerhoff Scholarship Program at UMBC, the Collegiate Science Technology Entry Program (CSTEP) in New York State, and two Federal TRIO programs, I will now transition to understanding the best practices of each program to create a model program. To do so, I have spoken with experts who play a critical role in facilitating the success of these programs. I have also spoken with adjacent faculty members and students to understand how they participate and benefit from these existing support systems. Best practices are defined by what the experts from these successful programs in Part II associate with their success. When creating my model program below, I am mindful of the fact that there will undoubtedly be limitations such as funding and institutional reluctance when implementing this model. I will explore these limitations in the second section of Part III and brainstorm ways in

which public policy and legislators can not only help mitigate these limitations but alleviate current obstacles faced by these programs today.

Institutional Buy In:

To effectively increase underrepresented minorities in STEM through tutorship programs, it is paramount to have administrators on board according to Patrice Darby. She is the Meyerhoff Scholars Program Coordinator of Special Projects and the Program Lead of Recruitment and Inter-Institutional Partnerships. Moreover, she was previously a Meyerhoff Scholar Alumni herself and has received her Master's in Biological and Biomedical Sciences from Harvard University. Ms. Darby emphasizes the need for extensive institutional support. She points out, "Number one, there has to be support from the top down. It can't just be one person at an institution who is rallying to try and change the culture of that place. There needs to be vertical support." Ms. Darby further recounts the initial challenges the Meyerhoff program faced at UMBC. Yet, the culture changed with time. She adds, "It was not accepted at first until...people started seeing the outcome. Like, wow, these people are going to grad school. Wow, they are leaders on campus." However, it's not just about acceptance within an institution. Dr. Anthony Carpi, the founder of PRISM and Dean of Research at John Jay College, recalls the skepticism he faced from outsiders when describing his efforts. "I remember going to one of my first conferences [and] some old guy raising his hand and he said, but you're cheating. You're paying for that. You're paying them to do research with you." This reflects the broader misconceptions and prejudices that many initiatives face when striving to elevate minority students in STEM fields. The need for institutions to combat these stereotypes is apparent.

Finding Primary Actors and Finding Champions

When initiating a mentorship cohort program, primary actors are necessary to find. They are often the linchpins holding educational support programs together, serving as both advocates and executors of program objectives. Dr. Anthony Carpi provides a compelling perspective on the need for these key individuals. As he explains, even at institutions where financial resources are stretched thin, having a 'primary actor' can be invaluable. These individuals serve as constant advocates for the program and ensure its smooth operation. "You need a person who's going to keep annoying other people and, you know, keep advocating," states Dr. Carpi. This advocacy is particularly critical in the early stages when programs haven't yet proven their efficacy.

The primary actors are the ones who start the movement, but it is these champions "who believe in your mission." Champions do not have to look like the students they serve but they must "have accesses to spaces [primary actors and students] don't have access to and they carry" that visibility to bring that mission into the institutions. Indeed, champions "are respected, they might not be liked, but they're respected." They have the wisdom, and they have the experience.

An example of one is the Provost of CUNY John Jay who was able to help primary actors Dr. Anthony Carpi and Dr. Nathan Lents create PRISM. Dr. Nathan Lents is one of the original founders and a Former Co-Director of PRISM. He states "We would not be able to do what we do without institutional buy-in." They had a vision through their own lived experience and wanted to help create PRISM, but, according to Lents, it was "the fact that we had a Provost, a Provost that was super supportive, who wanted to do it, who was willing to invest in it." She wanted to ensure that this was going to happen and to ensure that faculty were going to be on board with it, so she made it a part of the tenure process. According to Dr. Lents, "This came up in our tenure process. Some were like, wait a minute, should this [self-studies on student learning] count as research? Because it's not really in their area. They weren't hired to do that.

That should count for teaching or something like that. There were all these conversations about how it should count or if it should count. And the provost came in really firmly and said, yes, it counts as research, and yes, it counts as teaching. I am more than willing to double count that." That's how much the provost wanted to support this. "And so, student mentoring, especially in this PRISM model, became highly visible. It counted, you could talk about it in the research, and you could talk about it in your teaching." This is an excellent way of garnering faculty-wide support for cohort mentorship programs. But it can only start from the top down. It would not have worked without the help of the provost who championed this initiative.

Dedicated Faculty:

Students from all backgrounds have cited poor support from STEM faculty as a major reason for leaving STEM according to Bradford et al.[120] Dr. Nathan Lentz, one of the founding members of PRISM, discusses the importance of mentoring students from various underrepresented backgrounds. He recalls one of his students early on in his career, an undocumented Latina woman who was asked if she was interested in going into graduate school after CUNY John Jay. "She told me no one had ever asked her that question before. No one, not one person. No one had mentioned the possibility of graduate school for her specifically, you know. She knew it existed but because everyone saw her first as an undocumented Latina, nobody guided her toward the kind of things that she really did have the potential to do." This story is quite common throughout marginalized communities. Many URM do not see post-secondary education as an option for them, and thus they leave. This is why committed faculty members are important. these as options for many underrepresented minorities. By providing

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[120]Bradford, B. C., Beier, M. E., & Oswald, F. L. "A Meta-analysis of STEM Summer Bridge Program Effectiveness." CBE—Life Sciences Education. 2021.

timely advice about students' strengths, weaknesses, and career prospects, faculty nurtures these students' growth and development.[121]

Still, it is not just about a faculty member guiding these students academically or professionally that is essential to their success in STEM. A deep personal connection between faculty mentors and student mentees is cited to be a cause of their retention.[122] According to Dr, Lents "There's no substitute for the personal relationship that you can develop." Thus, he invites his research students over for a barbeque once a week and goes on outings to get to know his students on a human level. "I really want it to be a relationship, not a transaction." He speaks. According to Dr. Lents, "It's transformed the way I think about my own research. Like I love research, I'm passionate about it, but now I do it as a means to train students. It's just made me get much more out of my research." Ultimately, for any cohort program to succeed, it needs a dedicated faculty at the intro level and advanced courses across the STEM departments. They need to be willing and excited to take on students for research positions. Such an engaged faculty involvement cultivates a nurturing academic environment, encourages meaningful interpersonal relationships, and sets higher expectations for the academic performance of minority students.[123]

Dedicated Staffing:

A strong foundation in any initiative aimed at supporting underrepresented minorities in STEM lies in its staff structure. Ms. Darby emphasizes this by highlighting, "The reason Meyerhoff works is because of our dedicated staff. Faculty members have their commitments like research and teaching, and we need them to do these things. It's the Meyerhoff staff that can be hands-on because it's their sole focus." Even though faculty play a crucial role in molding

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[121]Hong, B. S., & Shull, P. "Faculty Dispositions Impact on Engineering Students." College Student Journal 44(2): 266–279. 2010.
[122]Seymour, E., & Hewitt, N. M. Talking About Leaving. Boulder: Westview. 1997.
[123]Herndon, M., & Hirt, J. "Black Student Success in College." Journal of Black Studies 34(4): 489–513. 2004.

scholars, it's the consistent involvement of the staff that keeps the program robust. Any mentorship program needs a Program Director, an Assistant Director, an Alumni and Family Relations Coordinator, a Recruiting and Outreach Coordinator, an Events Planner, a Research and Evaluations Director on top of multiple faculty advisors.

Dr. Tama Hasson, one of the leaders of the Program for Excellence in Education and Research in the Sciences (PEERS) at UCLA, sheds light on her experience. She advocates for committed roles rather than relying on volunteers, "You need individuals who are mentally and emotionally invested in the student's success, not just an office space. You need people who are committed to responding to 400 emails a day." There's a substantial amount of work that goes into a mentorship program that cannot be left to the whims and fluctuating responsibilities of volunteers. Indeed, officially recognizing these roles within an institution offers clarity and focus." Dr. Lents adds to the discussion by talking about how PRISM needed a committed staff "So like the position of Edgardo. We kept screaming that 'we need this' on college money. We cannot be on soft money because you can't have the same person for very long when they're worried about where their salaries are coming from and if the grant will be renewed." After hiring Dr. Edgardo, "there was somebody permanent, full-time, who was invested in it and dedicated only to it." This streamlined all the program processes and was a key factor in making PRISM what it is today. Thus, having a dedicated staff is crucial for a model mentorship program.

Dedicated Space:

Creating a nurturing environment goes beyond staffing and outreach; it often comes down to providing a dedicated space. For underrepresented minorities in STEM, having a communal area where staff, faculty, and students can gather is crucial. Such a space should be more than just an office—it needs to exude a sense of belonging, almost resembling a home. Dr.

Lents from PRISM adds on to mention how such a space is extremely important for physically

bridging administration and the students themselves. He says, "You have students that are like

'Where are you going?' 'Oh, I'm going to go to the PRISM office.' I found that to be like, really,

important. Because at that point, it's not necessarily the institution that's pushing this, but then

you're also getting the students that like using this as a resource." That's how you change the

culture "when the bottom up and the top-down meet." Thus, by having that space available, the

administration allows for that community to physically be built and be a part of the institution.

The students, on the receiving end, see a place where they are welcomed and where they can go

for support.

Financial support:

One often overlooked, but critical, aspect that plays a significant role in students'

educational trajectories is financial barriers. Research has shown this to be a detrimental obstacle

in retaining URM in STEM enrollment and graduation rates.[124] The cost of education isn't

limited to tuition fees; there are ancillary expenses that can deter regular attendance and

participation, especially for students from underrepresented backgrounds. Before we can even

consider a model program, we must understand the financial barriers that many of these

underrepresented minorities' face. Dinorah, a computer science student from CUNY John Jay

who participates in PRISM, held a candid remark that shed light on the gravity of the situation:

"Some students cannot afford to go to school, so they prefer to enroll in online classes." While

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[124] Gandara, P., & Maxwell-Jolly, J. Priming the Pump. New York: College Board. 1999.

online education might offer some flexibility, it may not always cater to every academic need or preference.

She notes that "Sometimes [schools] don't have the online classes, or what they do have isn't suitable. They'd rather wait and [delay] graduation." Such decisions aren't based on academic disinclination but a sheer financial necessity. She adds, emphasizing the cost of daily commuting, "If you commute every day to school, especially from Monday to Friday at 2.90 a swipe. That's a lot of money that we don't have." Dr. Nancy Campos who leads the CSTEP initiative at SUNY New Paltz states "Our students are also hungry. Some of our student's experience homelessness. Some of our students have all kinds of medical and health bills that they must pay. They are suffering from things and then they can't go to the doctor." According to Brian De Los Santos, a Computer Science PRISM student at CUNY John Jay, "At the end of the day, money is one of the biggest factors in our lives and really influences how easy or hard the college process could be." This highlights the socioeconomic barriers that many of these students face and the inequitable realities of education. "Whenever you take an unpaid opportunity, it really takes away from" your obligations according to De Los Santos. That is why "a major part of the solution would be through stipends as that gives people more flexibility to attend sessions" like what PRISM does.

Program Offerings:

When trying to understand what has made these programs successful, twelve key themes were shared among experts. These include academic support through peer/faculty mentors, a summer bridge program, creating a sense of belonging and community, working with one another, personal advising, research experience, career development, family involvement,

creating an alumni network, having a presence on campus, and flexibility to meet students where they are at.

Summer Bridge:

The Summer Bridge Program, recognized by many educational institutions, is a powerful tool to ensure students transition smoothly into higher education, equipped with the necessary tools to succeed.[125] This unique model emphasizes early intervention to ensure that students start their academic journey with a solid foundation, addressing disparities in educational backgrounds.[126] Dr. Tama Hasson underscores the challenges associated with cohort programs. As the Assistant Vice Provost for Undergraduate Research and the Director of UCLA's Undergraduate Research Center for the Sciences, she is also one of the leaders of the Program for Excellence in Education and Research in the Sciences (PEERS). "In a cohort program, the challenge is that, depending on the university and the population they are serving, the students are coming in at different levels of actual classes. So, at UCLA all students must start with calculus, but other institutions start with algebra," she states. This disparity in starting points implements cohort programs more complex.[127] "If you want to create a cohort program, all the students need to start at the same place," she further adds. In this context, Summer Bridge Programs can play a pivotal role in equipping students with foundational skills, ensuring a baseline for an incoming cohort.

[125]Bradford, B. C., Beier, M. E., & Oswald, F. L. "A Meta-analysis of STEM Summer Bridge Program Effectiveness." CBE—Life Sciences Education. 2021.

[126]Zuo, C. et al. "First-generation College Student Success." In Feldman, R. S. ed., The First Year of College. New York: Cambridge Univ. Press. 2018.

[127]Estrada, M. et al. "Improving Minority Student Persistence in STEM." CBE—Life Sciences Education 15(3): 1–10. 2016.

Ms. Patrice Darby points out various tragedies of senior students being unaware of key requirements for graduate or medical school. "The saddest thing to me is finding a student who's a senior who has great grades, who wants to go to graduate school or go to medical school and didn't know that they had to do X." Addressing this issue, she emphasizes, "In the summer between high school and college, that is where we start and explain to them all the things they need to get into graduate school." This early exposure ensures that students are fully aware of requirements like clinical hours or research experience from the get-go.[128] A defining feature of the Summer Bridge Program, as highlighted by Ms. Patrice, is its ability to level the playing field. "One of the great things about our summer bridge program is we call summer bridge the great equalizer. It doesn't matter if you come from a private school with $50,000 tuition a year or come from inner-city Baltimore and haven't had as many opportunities, everyone ends up on an equal playing field. Everyone gets access to the same skills. Everyone gets equal access to resources."

Creating A Sense of Belonging: Creating A Supportive Cohort Program

While robust resources are a critical part of the equation, they're not enough to fully address the deep-rooted societal barriers that many students face. Ms. Patrice Darby expands on these challenges: "There are so many years of research that point to systemic barriers that underrepresented minorities face in STEM, from "low societal expectations to academic isolation and impacts of deep negative stereotypes." She emphasizes that societal prejudices aren't just something to be acknowledged—they're challenging that demand action. This is why it's so important for these programs to really get to know the students they're helping. It's not just about

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[128] Wheatland, J. A., Jr. "Summer Bridge Program's Impact at Morgan State University."

giving opportunities; it's about knowing who the students are and what they need to do well. When you know that, you can make sure every student gets the help they need, even if they're starting with fewer resources.

More importantly, this isn't just about better grades; it's also about growing as a person. According to Dr. Sto Domingo, the Meyerhoff program heavily believes in the saying "If you want to go fast, go alone. If you want to go far, go together." That's the heart of why programs that focus on a group of students work so well. They understand that the smartest kids aren't always the ones with the most advantages. But put them in a supportive group, and they can really shine. The Meyerhoff program exemplifies an approach that looks beyond academic metrics. As Ms. Darby highlights, the core philosophy of the program transcends mere academic success. "We are invested in the complete development of each student" because "once a Meyerhoff, always a Meyerhoff."

Creating A Collectivist Mindset

Thus, for any academic mentoring program to thrive, creating a genuine sense of connectivity and support among its students is pivotal in a cohort program.[129] A sense of belonging, as many experts emphasize, can make all the difference in a student's journey.[130] Take, for example, Dr. Stephanie M. Breen's case study research on the University of Maryland, Baltimore County (UMBC) McNair Scholars Program. She studied a group of 14 students over varying graduation points spanning 4 years. She notes that for students who graduated between 2018, "There wasn't an alumni network or dedicated funds to facilitate alumni-student interactions." As a result, many were confined to attending program events merely to gather

[129]Sellami, N. et al. "Model for Increasing STEM Engagement." CBE—Life Sciences Education. 2021.
[130] Finley, A., & McNair, T. B. Assessing Underserved Students' Engagement. Washington, D.C.: Association of American Colleges and Universities. 2013.

information on graduate school applications and financial aid. This absence of inter-cohort connectivity often rendered the academic experience cold and impersonal according to Breen.

However, Breen insists that the culture within the UMBC McNair Program has changed drastically. There is now a "collectivist mindset," she emphasizes, which is not just about study groups or academic collaborations. It's more profound. When a student expresses the need to collaborate on a project or seeks someone to review their work, the community "leans into that and supports that student," she suggests. After the 2019 cohort, students stated that they "were actively encouraged to engage and lean on one another," underscoring the collective spirit of academia. But creating such an environment isn't solely the responsibility of the students. Leadership plays a pivotal role. They not only need to advocate for such a culture but also adamantly believe in it. The journey of a student, especially one aiming for higher education, is filled with challenges. High expectations for these McNair Scholars can be quite daunting. Breen states you are "managing applications to grad schools, working, taking care of family, and more."

It's essential to recognize that with high expectations should come high support. While the academic journey is undeniably rigorous, with collective effort and support from dedicated staff, students will thrive. At the McNair Scholar program, there are fee waivers that they provide. There are templates for personal statements, how to rate faculty advisors, what's the script when you are meeting a potential faculty advisor or what are some questions you need to ask. They want to "meet you where you are." As a first-generation student herself, Dr. Breen underscores the value of these resources: By equipping students with the right tools and taking on systemic societal barriers head-on. This support, as Breen mentions, manifests in various forms—be it through peers, academic advisors, or faculty. She emphasizes. "We got you."

The Power of Representation

Dinorah, a PRISM student from CUNY John Jay, offers a revealing perspective on this through her experience with the PRISM program. Dinorah articulates, "In PRISM I see people like me... Dr. Edgardo is Puerto Rican, I'm Dominican... I see someone like me." This simple yet profound connection makes all the difference. Here, it's not just about the academic support, but about seeing someone who mirrors your background in a leadership role. It's about the subtle reminder that success in STEM is attainable, regardless of one's cultural or ethnic background. Moreover, Dinorah touches on the unique cultural atmosphere within PRISM, mentioning, "Everybody in PRISM speaks Spanish. So, it kind of feels a little bit like home." This familiarity provides a comfort zone, a space where students can focus on their academic aspirations without feeling culturally adrift.

She adds, "Dr. Edgardo may have the same background as [me]. So, I'm like, you know, I can be something like that one day." It's clear that for Dinorah, and likely many others, having role models that resonate on a cultural level is not just a bonus, but a foundational aspect of their academic journey. In designing programs aimed at fostering talent in STEM, it's essential to recognize and prioritize these intangible aspects. Academic resources are undeniably crucial, but the sense of belonging, fostered by seeing oneself in mentors and peers, can be a powerful catalyst for success. Meyerhoff places emphasis on matching scholars with mentors who bear physical resemblances to them.[131] This strategy is rooted in findings, like a 2018 Strada-Gallup survey, which revealed that graduates from underrepresented backgrounds often gravitate towards and find mentorship more beneficial from mentors of their own race or ethnicity.[132]

[131] Suran, Melissa. "Keeping Black Students in STEM," PNAS (2021).
[132] Strada Education Network and Gallup, Inc. Strada-Gallup Alumni Survey. 2018.

These mentors come with diverse experiences, from elite universities to national labs, and are often esteemed members of the alumni network.

Working With One Another

Academic success often thrives within an environment that emphasizes community and mutual accountability. Dr. Breen emphasizes the significance of boot camps, particularly the Saturday Academy, a space where students meet once or twice a month she saw in her research. Students in the UMBC McNair Scholar Program, in particular, devote these hours to working on graduate school materials or other academic needs. These sessions not only provide a structured setting for students to zone out external distractions and focus solely on their tasks but also an environment rich in mutual support and camaraderie.

Beyond boot camps, the physical presence of a space dedicated to programs like TRIO on campus plays a pivotal role in nurturing a sense of belonging among students. Dr. Breen mentions, "TRIO staff are really well known for connecting students to academic and student affairs offices on campuses that can address various needs and opportunities." She sheds light on the challenges of establishing such dedicated areas due to varying levels of institutional support. Yet, even when such formal spaces were not available, UMBC McNair Scholars didn't let it deter them. On their own accord, they would rally together, urging each other. This self-motivated drive showcases their deep-rooted sense of responsibility towards not only their personal academic growth but also the collective progress of their peers.

Dr. Breen further sheds light on an enlightening phenomenon observed among these students: rather than competing against each other, especially in high-pressure environments like STEM, they uplifted each other. There was an unwavering sentiment of 'if they can do it, I can do it.' Dr. Breen recalls, "Students really felt motivated by the person next to them... even if they didn't get the [school] opportunity, they're like, 'I'm glad you did.'" This shared enthusiasm and

genuine happiness for another's success is a refreshing break from the often-cut-throat competitive atmosphere of academia and is possible when there is a dedicated home for these students. Such a robust support system, underscored by a community of shared intellectual interests, aids in holistically integrating students both academically and socially.[133] When academically gifted peers, especially those of the same ethnicity, come together, it combats feelings of isolation and fosters an environment that bolsters student outcomes[134] By immersing themselves in this expansive community, students find themselves more deeply rooted within both the broader university and the STEM fields.

Family Commitments and Involvement

For many students, particularly from underrepresented minorities, familial bonds play a pivotal role in their educational journey. Dr. Gladys Palma de Schrynemakers, the Chief Academic Officer of the School for Labor and Urban Studies and a seasoned leader in the CSTEP community, emphasizes the practical challenges many first-generation students face. She shares, "Families have to be part of their student's educational process... the reality of multiple competing commitments has to be resolved before the student can have the opportunity to succeed."

Beyond the academic pressures that are universal to all students, they often carry additional responsibilities and obligations at home, sometimes rooted in cultural expectations or economic necessities. College for many isn't just an individual journey. It's a family journey. Families, particularly in close-knit communities, often share in the successes, challenges, and aspirations of their student members. Understanding this, mentorship programs mustn't see students in isolation but recognize the broader context of their lives. Many first-generation

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[133]Treisman, P. U. "Improving Minority Students in College Mathematics." Innovation Abstracts, 5. 1983.
[134]Seymour, E., & Hewitt, N. M. Talking About Leaving. Boulder: Westview Press. 1997.

students face practical challenges, some of which may be unknown to their academic mentors. Recognizing this integral connection, various programs have made efforts to include families in their initiatives to make them a part of the program. At John Jay College, the Program for Research Initiatives in Science and Math (PRISM), founded by Dr. Anthony Carpi, Professor of Environmental Chemistry and Dean of Research, emphasizes the importance of family involvement. Dr. Carpi elucidates, "We have an undergraduate research symposium. We invite our families. We put out the program in English and Spanish, our students all speak English. Some of their parents don't, so we try to recognize the familial bonds. These are intentional activities we're thinking about our specific population." The balancing act that many students from underrepresented backgrounds face is a genuine struggle. By including families in mentorship programs, institutions foster a more supportive environment for their students. Families can gain a better understanding of the academic journey, and students can feel that their two worlds – home and school – are working in unison rather than at odds. When families are involved and informed, they can better support their students, easing the strain of balancing academic and familial duties.

Presence on Campus

Visibility plays a pivotal role in determining the success and outreach of any program. Dr. Nancy Campos, who directs CSTEP at SUNY New Paltz emphasizes this sentiment, highlighting the strategic importance of publicity and consistent engagement. Reflecting on her program's tactics, Dr. Campos shared, "Publicity is a big thing. That's something that we do. As part of our program, we work closely with our communications and marketing department. They write a story about our program at least once a year, even through COVID." This partnership with the

communications department ensures a consistent spotlight on the program, reaffirming its importance within the institution.

She notably discusses, "We were one of the first offices to have a very visible presence on social media, just as the campus itself was trying to get their social media act together." During challenging times like the pandemic, the program's online outreach became even more prominent. Campos iterates the importance of acknowledging the legacy and success stories that the program has built over the years. "We post a lot about our students, our alumni, we're always making sure that people know, we don't just graduate students out of here, we get them to medical school, we get them to, you know, these really great places in their careers," she states. These narratives, capturing both the present achievements and past successes of its students, help fortify the program's reputation and, more importantly, its impact.

Building upon Dr. Nancy Campos's insights on the significance of visibility, it's essential to draw connections between increased visibility and administrative support. When a program maintains an active and noticeable presence, it becomes integrated socially within the institution. As a result, the stronger it is accepted, the more secure its longevity, stability, and the assurance that it will continue to be prioritized in the coming years by administrators. As a model program, achieving this level of institutionalization is paramount.

Academic Support:

Diving into the realm of academic support, it's crucial to emphasize the role of tutoring, mentoring, and mid-semester evaluations in enhancing student success. Dr. Stephanie M. Breen points out the mutual growth achieved when students assist each other. She recalls, "In the UMBC McNair Scholars program, student ambassadors play diverse roles—from communication to data collection, and from strategic initiatives to engagement. The program encourages students to contribute through work-study or stipends, valuing their dedication. This

approach not only offers financial assistance but also fosters a learning environment where students gain insights from their peers. They don't just passively receive knowledge; they actively engage, with many feeling an intensified draw towards academia due to the enriching experience of mentoring and teaching." Practical aids, like tutoring for exams such as the GRE and specialized subjects, ensure that students are well-equipped to face academic challenges head-on. A fundamental component must be being able to communicate and learn the essential material from others through peer tutoring is needed in an academic support program.[135] This communication between tutor and student allows students to cultivate specific skills vital for success like effective study habits and being able to utilize campus resources according to Stole-Mcallister et al. [136]

There's also a mentality of paying it forward, Dr. Breen emphasizes, "So by default, [the students she interviewed said], 'I want to give that back. And that's a very trivial mentality, like, you want to give forward." Meanwhile, Dr. Nancy Campos, the CSTEP Program Director at SUNY New Paltz, provides a perspective on the significance of representation. She states, "Are they going to find people who look like them in their major? Are they going to get the support that they need? And so, you know we provide those study groups where our upper-division students facilitate the study groups which has been showcased as a marker for success.[137] According to Dr. Campos, "So then on top of it you know they're seeing students who were with them for like a year or two before you know who are now helping them through these classes. And so, you know it is it kind of has that whole feel of like you know the students are now

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[135]Bennett, A. et al. All Students Reaching the Top. North Central Regional Educational Laboratory. 2004.
[136]Stolle-McAllister, K. et al. "The Meyerhoff Way." J Sci Educ Technol. 2011.
[137]Bennett, A. et al. Strategies for Closing Academic Achievement Gaps. North Central Regional Educational Laboratory. 2004.

competing to be study group leaders and then they get to help the other students and then the students coming in are getting to be part of this study group experience. And then one day they could be study group leaders as well." Such a phenomenon occurred with Patricia St. Fleur, a Biology PRISM student, who wanted to give back to the women who helped her by becoming a mentor herself. Having both students and faculty support is crucial as students will be able to look up to both as role models for success.

Advising and Mentoring

Advising is not merely an administrative function but a cornerstone of academic success and personal growth in higher educational programs like Meyerhoff. Ms. Patrice Darby speaks to the style of advising offered, saying, "They say that we have a sort of intrusive advising and why do they say that? Because we're not just asking what classes you're going to take next semester. We want to know what are you doing with your time? Are you in study groups? Do you really understand what a study group is? Are you interacting with your professor? Are you going to office hours?" This 'intrusive' approach does more than scratch the surface; it digs deep into students' habits and needs, ensuring they are equipped for both academic and real-world success. Ms. Darby further expands on the need for this detailed advising, "We make sure that our students are doing all the things that make them successful because you can get, as you know now, right, getting into medical school, there are plenty of people with 4.0s who don't get it. Because there's so much more you need than just good grades." The statement reflects a more holistic understanding of education which acknowledges that academic success is just one piece of the puzzle. The program recognizes the gaps that can exist if a student comes from a background where they may not have mentors in the traditional sense.

Ms. Darby goes on to say, "If your parents don't come from a background where they can tell you and no one ever tells you, how are you supposed to know?" Meyerhoff's advising approach does not just focus on academics but also aims to fill in the gaps in cultural and social capital that students may not even realize they have. Ms. Darby elaborates on the advising structure, explaining, "We have our first-year advisor who also runs our summer bridge program. So, she gets to know them over the summer and she's the one who is having a high touch with them in their freshman year." This initial connection ensures students get to know a faculty member closely right from the start, facilitating a smoother transition into their academic journey. One of the key features of the freshman year is the "first-year experience." As Ms. Darby describes it, "They meet every week for a class. It's a non-credit-bearing class. We go over best practices, time management, organization, personal statements, things like that." These meetings are not just academic touchpoints but sessions that impart critical life skills.

At PEERS in UCLA, first-year years will take Freshman Transition Seminars that are very similar to Meyerhoff's non-credit bearing class. According to Dr. Paul Barber, who is one of the leaders of PEERS, said, "This course helps them get to the point where they can create a realistic schedule that they're going to need to follow to succeed." He says that first-year students will come in saying they "were going to study for three to four hours" but they don't realize "that there are all of these things that they didn't put in their schedule" that take a chunk of their time like eating, working out, etc. While it is an extra class, they can practice these critical life skills like time management and organization throughout their first year.

Complementing this structure is a peer-advising system. Ms. Darby adds, "But then they also have a peer advisor who is two years ahead of them and in the same major." This creates a mentorship structure, ensuring that fresh students receive guidance from those who have just

navigated the challenges they are about to face. Furthermore, one-on-one sessions reinforce personal attention. Ms. Darby points out, "So typically, you meet with your advisor about once a month, one-on-one. You have your first-year experience also with your advisor every week. We have monthly cohort meetings. So, we're bringing everyone together to talk about something once a month. And then we have family meetings twice a semester." Moving on to the practical application and preparing students for research roles, Ms. Darby sheds light on how Meyerhoff supports its students, "As second-semester freshmen, we explain, how do I find a lab? How do I reach out to a PI? Now, of course, we're not calling PIs for them. They have to fish. We teach them how to fish and we let them know what they should be looking for." At this point, they are equipping students with a strong foundation to be leaders, thinkers, and researchers. The advising system doesn't handhold them, but instead instills the tools necessary to enter post-secondary education and the STEM workforce while creating that community to support which is crucial in any model program,

Research Experience

As noted by many experts, research opportunities offer benefits that go far beyond acquiring technical skills. Dr. Stephanie M. Breen elaborates on how research is integrated into each McNair Program. Students "get funding for conducting the research. They get research opportunities, connections to faculty," she notes. The program provides a curated list of trusted faculties across various departments. "Students who have not had the opportunity to engage in research can be paired with a trusted faculty member within their department that can help pilot research projects," Dr. Breen adds.

Ms. Patrice Darby adds to Dr. Breen by stating, "During the second year is also when most Meyerhoff scholars will start their sustained research." The Meyerhoff Scholars Program is explicitly designed to prepare students for advanced academic pursuits like PhDs and MD-PhDs,

"You cannot get into an MD or PhD [program] without research experience," Ms. Darby confirms. Students specializing in the life sciences may begin their research as early as the fall of their sophomore year.

Ultimately, research can create a transformative experience that empowers students with the financial resources, mentorship, and skills necessary for long-term success in STEM fields as mentioned with Dr. Lents previously. It can significantly improve socioeconomic barriers through financial resources and provide emotional support.

Professional Development
STEM education often grapples with the challenge of retaining students. However, through early exposure to career and graduate school opportunities, a model program can triumph. Ms. Patrice Darby is involved with a program known as "Campus Connections." It functions like a graduate fair. About 15 institutions are invited during each session, allowing students to learn about potential summer programs and graduate studies. Ms. Darby points out that these interactions between students and professionals add to their self-worth. Being noticed and recruited by such institutions can act as a subtle reinforcement for students, reminding them of their capabilities and their fit within the STEM field. "When people want you actively or seeking you, it helps you realize, like, wow, I really can do this. Like, I really am a scientist." Ms. Darcy notes. Through Campus Connections, students are provided with a clearer understanding of the opportunities available to them. This ultimately allows them to look beyond the classroom and understand the STEM world more holistically.

Alumni Network:
Am alumni network serves as an essential lifeline for students navigating academic and career landscapes, especially in challenging times. Dr. Breen emphasizes the importance of alumni engagement and peer mentoring in the McNair Program In the context of the UMBC

McNair Program,students said that they "met with alumni often and had peer mentoring across cohorts." For them, "it was pivotal to [their] experience, and students said they didn't know how they would have graduated without them." A lot of these students had finished their programs during the pandemic, so having the McNair network for those students was a very powerful space explains Dr. Breen. Alumni networks are especially beneficial for URM. They offer tailored guidance, emotional support, and professional opportunities. Such networks create a sense of community that extends beyond the campus which allows current students to have role models who empower them to succeed like the alumni themselves.

Program Flexibility and Innovation

Dr. Breen emphasizes the impact leadership culture that meets students' needs has on the students she interviewed. "It was leadership culture for sure and students agreed to that. While some students may be interested working independently rather than community with others, some students may be seeking community and a leader should tap into that and curate an environment to reflect their needs and interests." Expanding on this sentiment, Dr. Mariano Sto. Domingo, the Associate Director for Evaluation and Research for the Meyerhoff Scholars program, sheds light on the ever-changing nature of student populations. "Generations change. The values of professionalism, inclusive excellence, respect, and community might remain consistent, but people and their preferences evolve. There could be programmatic changes through the years," he states. Dr. Sto Domingo shares, "Meyerhoff has pivoted in several ways. While we've always prioritized the first-year experience, we're recognizing the unique needs of our second-year students. This semester, we're launching a second-year experience. We've come to understand that these students require a specialized approach to ensure they maintain their

commitment to advanced studies in STEM." The leadership must be flexible to effectively serve URM in a model program. This ensures that students feel heard and valued in a supportive environment.

Dinorah, a student in CUNY John Jay's PRISM program, speaks emphatically about the significance of specific certifications in the cybersecurity sector. She highlights the high cost of obtaining necessary certifications. Dinorah explains, "There's this entry-level certification that's essential for most cybersecurity jobs. But the problem is, the entire study package and the certification can cost almost a thousand dollars' Recognizing this barrier, Dinorah approached PRISM with a request. "I told them our students are at a disadvantage because of the cost." Even if PRISM could assist a few students who qualify for financial aid, it would make a difference in their post-graduation job prospects, according to Dinorah.

PRISM's response was both timely and impactful. They provided vouchers for these certifications to those students who needed them. Dinorah gratefully acknowledges their support, stating, "Thanks to PRISM, I and several other students received the vouchers." With PRISM's assistance, these students no longer face the delay of saving up for the certification over several years. Instead, they can acquire the needed certification during college, making them immediately eligible for many jobs and internships. This adaptability is essential for any program seeking to effectively serve underrepresented minorities. By consistently reassessing the needs of their students and adjusting the program accordingly, model programs can ensure they're providing optimal support at every stage of the academic journey.

Support Through Transitioning

Dr. Campos reinforces the overarching goal of supporting student success, irrespective of their programmatic decisions. On advising students, she says, "We advise them through their

STEM majors, but also help advise them into other areas of interest." Her commitment to ensuring students' academic success is evident when she adds, "If you decide to switch your major, we still try to help place them properly because we still want them to graduate." This is key because while the goal is to produce more STEM scholars, we must look at the students holistically and what they want as well.

Students

Recruitment

In discussing how to recruit for such a model program, Dr. Nancy Campos offers a perspective from the front lines. She emphasizes that the recruitment focus is primarily on first year and incoming transfer students. As she notes, "Our recruitment is focused on first year and incoming transfer students. That is why we really try to get into the program. We do take students in later on, but it is a lot harder once they've already been [here] for a year or two." This approach aims to bring these students into the fold and to provide an early foundation for academic success. Campos also highlights the challenges of navigating GPA dynamics, particularly in the early stages: "That initial GPA, it's a lot harder to bring up the GPA than it is to bring it down."

Dr. Hasson offers an insightful perspective on her recruitment process for PEERS. She asserts, "We want them to apply so that they decide to be a part of it. Rather than just assigning them to this because it's not remedial." Dr. Lents from PRISM supports this with his program's recruiting style, stating "PRISM does all kinds of outreach just to get students just sort of not force them but to really make it easy for them to have at least the initial conversations with faculty members." He does not want to force students to attend but instead offers the program as a way for them to better succeed. This ensures that students are active participants in their academic pursuits. Ultimately, this fosters a more engaged and motivated cohort.

Eligibility:

It's paramount to consider the nuances in the target populations for these academic support programs. Each has a distinct focus but overlaps in some areas, thus forming an interconnected web of opportunities for various student demographics. Take TRIO, for instance. The program targets low-income, disabled, or first-generation college students. Meanwhile, the PEERS program casts its net a little differently, encompassing not just low-income or first-generation collegegoers, but also those who have experienced social or environmental barriers. This allows the program to be inclusive in its approach outside of just socio-economic or educational factors.

On the other hand, the Meyerhoff Scholars Program doesn't exclusively target specific backgrounds. While they do emphasize recruiting students from diverse environments, this is not a stringent requirement. The program sets academic benchmarks, focusing on the student's capacity for rigorous academic work. CSTEP takes a slightly different path. It provides eligibility specifically for students of historically marginalized backgrounds or URM. This special focus has allowed programs like PRISM, an extension of CSTEP at John Jay College, to cater to a wider range of needs. PRISM serves as the primary academic support program at John Jay, meeting the needs of marginalized students and the general student body alike.

As discussions around diversifying the student base gain traction and allow for a category of "historically underrepresented" to be eligibility criteria, Mr. James Davis, Director of TRIO Student Support Services, brings up a poignant concern: "I think it is never going to hurt. I think certainly the program could benefit from adding that, from adding other categories to the program, but I would be a little concerned about stretching that federal dollar even further." His

concerns highlight the balancing act institutions face between broadening their reach and ensuring the quality of resources and support for these students. While in an ideal world, this program would be open to underrepresented minorities as mentioned in the introduction; in this modern academic era, as traditional racial-based affirmative action faces challenges, innovation in recruitment strategies becomes imperative. Ultimately, however, first-generation, and low-income students often overlap with underrepresented minorities as indicated in the TRIO section of Part II. By having this be the eligibility criteria, it may also lead to more institutional acceptance of a model program as well.

The Case for All Students:

Educational support programs across the board hold a shared vision: fostering inclusivity. However, how they accomplish this and the tools they employ differ. For PEERS at UCLA, Dr. Tama Hasson stresses that PEERS has a holistic approach when recruiting. She mentions, "We choose students that have so much potential, that are the best in their high school, but who may not be ready for college based on their challenging life experiences... They make their friends with PEERS, and it makes them more connected to the university. If they need a letter of rec, they just ask, and I write a letter for them. I've written upwards of 180 letters of rec a year because that's what they need." This emphasizes the foundational support her program offers, ensuring that as many students who want to be a part of it can be and feel deeply supported by it.

Similarly, Dr. Breen also champions a multi-faceted approach to student selection and support. "I'm a both-and type of person. I see things from a very holistic lens. For example, GPA could tell us some things about a student, but other information could be conveyed through other student applicant materials such as portfolios and recommendation letters...There are different ways that can show a student's readiness or ability to achieve something." Her perspective resonates with Dr. Hasson's. For them, it is about the broader context of a student's capabilities,

experiences, and potential. Adding yet another perspective, Dr. Anthony Carpi from PRISM at John Jay emphasizes the power of exposure. "We have looked, and there's no difference in GPA between our students and the kids that don't do the program. But what we realize is there is a difference in career intentions and ambition. ... One of my former students once summed this up for me one time when they said 'Getting a Ph.D.? I never thought of it before. It's like, I never thought of cooking Chinese food tonight for dinner." He articulates that potential doesn't always manifest in conventional academic metrics. Instead, the opportunity to dream and envision one's future can be equally, if not more, impactful.

While the strategies differ, the combined insights of Dr. Hasson, Dr. Breen, and Dr. Carpi Anthony encapsulate the essence of an evolved educational support system. One that is inclusive, responsive, and deeply attuned to the multi-dimensional needs and aspirations of every student.

The Case for An Exclusive Program

Educational support programs face a challenging decision regarding the scale of their operations versus the quality of individual attention they can provide. Meyerhoff's perspective, as expressed by their program coordinator, Patrice Darby, illuminates the intricacies of this challenge. Patrice Darby shares about the high-touch approach of the Meyerhoff program, emphasizing, "Ideally, that's a great idea. But when you think about what we do as a staff, about high touch... We can't have a cohort of 200 kids. We would not be able to give the 200 kids the necessary attention that they all need." This spotlights a real risk that the quality of mentorship and guidance could be diluted if programs expand beyond their capacity. She further highlights this by discussing faculty-student ratios, "It's just like when kids are looking at the staff, the faculty-to-student ratio, that type of thing is really, really important. So, while I would love for every STEM student in the country to have this experience, I wouldn't love for them all to come to Meyerhoff because if we had a cohort of 200, Meyerhoff would be very different."

It is crucial to consider how the size of the program can significantly influence its effectiveness. Dr. Breen captures the sentiment eloquently: "I think I would get lost in the program and feel like, well, who do I go to? Where's my connection? Where can I find a community?" She emphasizes the nurturing potential of smaller programs, specifically citing the McNair Scholars Program's one-on-one mentorship as instrumental in making students feel heard and supported. However, the Meyerhoff program has tried to address this with an innovative solution. Darby reveals, "We have what's called our friend of the program option. So, we have limited funding. We can only fund so many students, but we want our resources and our support that are non-financial to be open to more students." This model allows Meyerhoff to extend its beneficial reach without compromising the essence of their program.

Finding A Balance Between Perspectives:
Dr. Sto Domingo suggests that there's room for both universal and targeted approaches to access the scalability and specialization of educational programs. "If you have a more universal goal, that's fine. It may be more challenging because you will be opening your program to all kinds of students. It also depends on how much resources you have," Dr. Sto Domingo explains. This observation aligns with other experts like Patrice Darby and Dr. Tama Hasson, each pointing out that resource constraints can shape a program's scope and outreach.

Dr. Sto Domingo respects more inclusive programs, asserting that they "are more open to students from different tiers, different abilities, but who can still support and successfully coach them to complete degrees. As Dr. Breen points out, "With increased students in a cohort, more capacity to support them will be needed. They must be invested." It is paramount to ensure that each team member is deeply committed to student success when increasing manpower.

Considering the varied perspectives from different experts, including Dr. Sto Domingo, Patrice Darby, and others, the overarching sentiment is clear: There's no one-size-fits-all answer.

Programs must remain flexible, evolving in tandem with changing student demographics and needs, while maintaining their foundational mission. Thus, while each program—be it PEERS, TRIO, CSTEP, Meyerhoff, or others—has its unique advantages and challenges, the comments from Dr. Sto Domingo suggest that flexibility and adaptability could be key factors in a program's success as mentioned in the Program offerings section. Opting for a more universal or targeted approach to their recruitment may ultimately depend on their goals and resources. When discussing a model program, ideally it will serve as many students as eligible; however, in practice, it is important to be mindful of the diversity and evolving needs of the student populations for long-term efficacy. This ensures that the program is not spread thin.

Setting Proper Evaluation Metrics

It's crucial to account for the uniqueness of each institution when evaluating its effectiveness. Dr. Sto Domingo underscores this by saying, "You cannot impose just a single goal or standard for all universities, for all organizations, because they are working in different contexts of populations." This suggests that each educational program should have the liberty to set its performance benchmarks tailored to its unique challenges and assets. This customization can range from a focus on faculty involvement to direct student support, as institutions differ in where they place their emphasis. UMBC, for example, prioritizes student-centered approaches, making faculty allies in that mission, as noted by Dr. Sto Domingo.

Despite these institutional differences, there are baseline metrics that can provide a universal assessment framework. Dr. Sto Domingo identifies "*the metric of retention and graduation of minority students*" as a standard that could apply across various universities, acknowledging their different settings and missions. The evaluation should incorporate qualitative data and qualitative data as mentioned below.

Quantitative Assessments:

       Meyerhoff's approach highlights the importance of rigorous qualitative assessment in their program model: "The reason that we can say that Meyerhoffs are five point three times more likely to get a Ph.D. than the people who don't come and join us is that we have regular evaluation," according to Ms. Patrice Darby. Though such rigorous evaluation can be time-consuming, as noted by the Meyerhoff alumni, its value in providing concrete, actionable data is undeniable. But data doesn't just exist in the form of post-program evaluations or end-of-year tests. When launching a new program, especially with first-year students, it's equally crucial to develop a formative assessment strategy. Such assessments are not merely about measuring success or failures but are designed to inform real-time program adjustments. Dr. Sto Domingo also emphasizes the need for "leading indicators of success like high school GPA or other scores."

       Formative assessments during the initial year are about understanding the cohort's unique needs, strengths, and weaknesses. This is particularly crucial for a diverse group of students who come from varying backgrounds. Recognizing that some of these students may not have had prior access to mentoring or tutoring, formative evaluations help program organizers and educators pivot their teaching strategies and support mechanisms accordingly.

       Dr. Sto Domingo highlights the importance of early intervention in students' academic journeys. At UMBC, faculty will submit performance indicators as early as the sixth or eighth week to see how Meyerhoff Scholars are faring in the middle of the semester. These early indicators act as a litmus test and allow for preemptive measures to target students who might be struggling or in danger of underperforming or even withdrawing. Such a strategy, nevertheless, hinges on fostering strong relationships between various departments and administrators within an educational institution. As Dr. Sto Domingo articulates, "relationships are important." It's

about ensuring seamless collaboration between the academic units, program coordinators, and faculty to collect these crucial data points and act on them promptly. On a parallel note, Dr. Tama Hasson champions the importance of rigorous program evaluation for peer institutions and the wider academic community. This ensures that these investments poured into PEERS bring real value to both the students and the institution at large. Moreover, there's "a lot of love involved" and a genuine commitment to the social science aspect of evaluating educational interventions in STEM fields. Both from a preventative perspective, as discussed by Dr. Sto Domingo, and from an evaluative angle, as emphasized by Dr. Hasson, data-driven decision-making is central.

Qualitative Assessments

While quantitative metrics are crucial for evaluating educational programs, Dr. Sto Domingo emphasizes the importance of qualitative approaches, specifically through focus groups and interviews. These methods serve as platforms for students to articulate their experiences and suggestions, bringing invaluable perspectives to the table that the program coordinators or faculty might not have considered. Beyond mere numbers and retention rates, he proposes, "we mostly do qualitative evaluation or assessment. So, we do interviews, we do focus groups to see how the program is working, how the students are failing, and how they think they can be helped." This methodological shift puts students at the heart of the feedback process. It's an empathetic lens that acknowledges that "we're also limited in our perspective being the program delivery folks."

Student perspectives allow program coordinators to know how students are adapting to the program and how the program can be tailored to better fit the students' needs. Domingo suggests that this sort of iterative approach is especially crucial in the early stages of a program, which he refers to as a "trial basis." He articulates that "you are still trying to see whether what

you are doing, your interventions are working." Sto Domingo also brings forth an essential

question: "It could be that you designed the program poorly, right? It could be that the students

you recruited do not fit the program you designed. So, there should be a fit between the program

design and the student characteristics." By integrating both quantitative and qualitative

evaluation methods, administrators can ensure that they're not only meeting statistical goals but

also fulfilling the unique needs and aspirations of their student body. This allows for a holistic

view of student success and program efficacy.

Constant Revaluation and Innovation

Dr. Edgardo Sanabria-Valentin underscores the significance of a regular evaluation and

innovation cycle within educational programs especially for PRISM at John Jay. He is the

Associate Director of PRISM, and in addition, serves as an Adjunct Assistant Professor of

Biology at the JJC Department of Sciences. Dr. Sanabria-Valentin emphasizes the value of

periodically reevaluating approaches to allow for innovation. He notes, "You [need] a moment to

reassess what you're doing and innovate too. Otherwise... they get stale doing the same thing

over and over." He emphasizes the importance of avoiding a rigid status quo but also of

constantly thinking outside of the box. These decisions shouldn't be driven solely by external

mandates such as governmental legislation. He notes, "And not only that, but we also don't just

do things because the New York State application department tells us; we follow best practices in

the field... that provides a good backup with theoretical and experimental data." This ensures that

educational programs stay dynamic as they are well-informed by research and real-world

experience.

Part IV: Current Program Issues and Public Policy Recommendations

Part IV Executive Summary:

Two primary challenges are foreseen when discussing a model program: Funding and Institutional Buy-In. Presently, there's a significant gap in funding for these programs, which directly impacts the resources available at the institutional level. Funding is necessary to support any model program by offering students financial support and hiring a dedicated staff for a cohort program. The prevailing pay-per-student model, while straightforward, overlooks the unique needs of individual institutions, their faculty, staff, and students, often leading to inequalities. By meeting with institutions one-on-one to their social, financial, staffing, and student needs, there lies a potential solution to allow for a better funding model. Regarding Institutional Buy-In, many institutions hesitate to support mentorship programs fully. This reluctance stems from an institutional culture that may perceive such programs as giving certain students an undue advantage. Additionally, the benefits of these programs often become evident over a more extended period, making immediate buy-in challenging. Strategies such as fostering healthy competition and showcasing success stories from existing programs have the potential to mitigate these concerns and drive institutional commitment.

Preface:

After carefully examining the essential elements needed for an effective tutorship program—including establishing a national organization, securing institutional support, arranging financial aid for students, and curating specific program offerings—I will delve into the pressing challenges these programs currently grapple with. I aim to inform public policy initiatives that can alleviate these challenges and ensure the success of a model program. After discussing each challenge, I will suggest public policy recommendations aimed at resolving these persistent issues.

How Governmental Funding Currently Works For TRIO
Dr. Edgardo Sanabria Valentin, Associate Director of PRISM at CUNY John Jay

Department of Sciences, sheds light on the intricacies of state budget allocation and how political

dynamics often influence the funding of tutorship programs. Dr. Sanabria Valentin states, "The

politicians use the legislative process when it comes to setting up their state budget for these

programs. Unfortunately, it has often been treated as a political tool." He recalls these programs

are wielded as leverage by politicians against CUNY and SUNY institutions where most of the

CSTEP and STEP programs are housed. Additionally, advocating for the appropriate allocation

of funds presents its own set of challenges. "Our students are constantly occupied, and it often

falls upon us to persistently remind them, through emails and texts, about the importance of

engaging with these legislative processes," mentions Dr. Sanabria Valentin. The commitment

required to drive change is immense. It often demands students to dedicate time from their

rigorous schedules, classes, or work, to engage with politicians who might not always provide

the desired outcome. He acknowledges the central role of APACS (Association of Professional

Administrators for CSTEP and STEP) in this regard. Dr. Sanabria Valentin believes, "APACS

has been instrumental in advocating on our behalf and liaising with politicians." However, he

emphasizes that there is a disconnect, as the very people who understand the nuances and stakes

of these programs are often left out of the decision-making process. He asserts that those directly

involved and impacted by these programs should have a significant say in the decisions, rather

than relying solely on elected representatives.

Mr. James Davis, Director of TRIO Student Support Services, offers a unique and

enlightening perspective on the processes that often go unseen. "So, I'm not sitting at the

congressional table. Just as an advisor. What I do and what my agency would do is, make a

congressional justification, it's called a congressional justification. We justify the needs for each

of our programs, and I do that for [Student Support Services] SSS. And as I said, if Congress

approves a $400 million budget for SSS, they know that we need at least that much to continue

all the grants over the five-year cycle." Davis' comments shed light on the aspect of justifying the

budget through a written proposal. However, there is no educator in the boardroom making these

decisions. It's up to the politicians to decide how much the total amount of funding for programs

like TRIO receive which trickles down to how much each institutional grant is given.

Funding Is Needed

Dr. Anthony Carpi highlights the substantial financial demands of the PRISM program.

He describes PRISM as a "monster that we have to feed," indicating the continual need for funds

to maintain the program's standards and quality. However, this isn't just about pouring money, it's

about investing in student development, research, and their broader academic journey. Dr. Carpi

emphasizes that the funds help students in multifaceted ways. He mentions, "It's a ton of money

that we're funneling through this program to students and to the research they're doing. [To be]

able to give students stipends, to be able to pay for research supplies and the sciences, to be able

to help them travel to conferences, it's a lot of money." This funding is used to provide essential

resources and experiences to the students.

Funding is Needed for Students and Staff

Dr. Campos elaborates more on the importance of funding when offering financial

assistance to students at SUNY New Paltz. She says, "And then if I wanna hire study group

leaders, so I took out a lot of the bulk to make sure that I can keep paying my study group leaders

a better wage." By offering her a competitive wage, students are less likely to seek multiple jobs,

ensuring that they can strike a balance between work and academic commitments which was

mentioned as a roadblock by both Dinorah and Brian in Part III. She provides an honest

perspective on the monetary challenges faced by the staff. She states, "We're underpaid, so that's another thing. We're heavily underpaid." This reality is further compounded by additional expenses tied to employment. However, it isn't just about having staff on board. It's also about having enough dedicated staff to ensure the program runs effectively. Campos indicates that a director and an assistant director or coordinator are typically required for these programs, yet even this often falls short of the actual need.

Proper Funding Can Lead to Proper Outreach

Dr. Stephanie M. Breen, from the Pell Institute for the Study of Opportunity in Higher Education, sheds light on the constraints faced by programs like TRIO, specifically due to the limitations in funding. TRIO's association with the Department of Education binds it to the financial parameters set by the federal government. Dr. Breen points out the fundamental issue by saying, "Not being able to serve a lot of students is most likely due to funding. Our funding is allocated from the Department of Education so there's only so much we can do with the funds that we have." With more financial backing, the scope and reach of such programs may be vastly improved. Given the large number of first-generation students, there remains a substantial untapped audience due to the funding constraints. In Dr. Breen's words, "If more funding was allocated our reach would be expanded because there are many first-generation and low-income students who could benefit from our programming. So that can be a pitfall of not having the expenditures that you need to support all the students that you could." The reputation and impact of TRIO are evident, as universities recognize its value. It connects students to crucial opportunities and networks. However, the disparity in the presence of TRIO across institutions can be concerning. As Dr. Breen states, "TRIO is well known and valued and cared for by

universities that see the value of TRIO. But institutional support and capacity often limits our reach."

Issues With Grant-Based Funding Allocation

There are layers of complexities that can often lead to inequities. A significant component of these challenges lies in the 'one-size-fits-all' approach that some funding models advocate. It becomes evident that the needs of institutions are as varied as their locations, student populations, and academic focuses.

The nuanced challenges of institutional mentorship programs are deeply rooted in the very essence of how these funds are distributed. The current models, as many experts suggest, are overly simplistic and fail to capture the varying needs of diverse student bodies. Dr. Palma de Schrynemakers provides a candid perspective on this, criticizing the one-dimensional nature of certain funding models. She states, "STEP and CSTEP are funded on a headcount formula. This type of one-size-fits-all does not make much sense. Individual students come with different learning needs and the budget has to be reflective of the different types of services and one student may require multiple services." It's evident from her insights that the practice of distributing funds on a strictly per-student basis can be restrictive and fail to address the distinct requirements of individual students. When policies don't evolve to reflect the multifaceted realities students face, they risk becoming obsolete.

Funding based on a strict per-student calculation, as noted by Dr. Kim Overrocker, could disadvantage schools that cater to a more diverse or needy student body. Dr. Kim Overrocker is an Associate in Higher Education Opportunity who has previously provided technical assistance to higher education institutions that have been awarded NYS Education grants for STEP and/ CSTEP (Opportunity Programs) and now provides leadership and oversight of NYS STEP and CSTEP program legislation. She has seen institutions that have had to make difficult choices

between offering comprehensive support to a smaller group or diluting services to cater to a larger group within the same budget. The unpredictability of the budgeting process exacerbates the strain on these programs. Dr. Gladys Palma de Schrynemakers sheds light on the trials of keeping these programs afloat, recounting years when programs like CSTEP were excluded from the budget altogether. She recalls the collective action required to vouch for the program's effectiveness, "Every year we send busloads of people to advocate for programs that have been historically and currently successful. Why not save the funds for the students!" The fact that professionals, deeply committed to the success of their mentees, face such uncertainties about their job security underscores the dire need for reforms.

This sentiment of a disconnect between the funding mechanisms and the ground reality is echoed in Davis' statement: "That second point was really where a lot of people have been resonating, where it's like, how can you tell me what my people want when you don't even know my people, and what they need." It's a reminder that while bureaucracy and procedures are necessary, they can sometimes create a rift between intent and impact. The system's reliance on broad-stroke categorizations might not always capture the diverse needs of specific communities, which can lead to inequities in resource distribution. Moreover, the very act of justifying, while necessary, can sometimes mean that programs spend more time advocating for their existence rather than focusing on their primary objectives.

Issues With Evaluating a Mentorship Model:

Mr. James Davis speaks to the core issue of evaluation metrics in Student Support Services, noting, "We have some prescriptive targets that grantees have to meet, and those targets are how we determine whether or not the grants are being successful or not." His call for making federal TRIO programs less prescriptive may yield better outcomes as institutions might not

align well with blanket legislative requirements. Still, Davis acknowledges the inherent

challenge lawmakers face; they seek to ensure that federal money is spent judiciously by setting

uniform standards. Though well-intentioned, this tension could be better managed through more

direct communication and collaboration between educational bodies and policymakers as noted

in the next section.

Finding A Solution:

In a world where targeted and specific interventions often yield the most effective results,

a "one size fits all" approach to budgeting can result in missed opportunities. When the voices of

program directors and educators are not actively engaged in these discussions, there's a risk that

the very mechanisms designed to support them may inadvertently become barriers to their

program's success. Dr. Overrocker's insights into the relationship between institutions and the

New York State Education Department, NYSED provide a hopeful direction. Recollecting past

experiences, she observes, "NYSED was looked at as you don't want them to visit you, you

don't want them to call you." This previous stance of evasion has gradually transitioned into one

of collaboration and trust, as Dr. Overrocker mentions, "We've now become partners with our

projects, and we're allies." This relationship is not about pointing fingers but about finding

solutions. By meeting with Presidents, Provosts, and Faculty, a unified voice could advocate for

the continued support and expansion of programs geared toward equitable education. Dr.

Overrocker's approach, founded on trust and guidance, may indeed offer a way to navigate and

potentially reform the existing system.

Trusting The Institution:

Building such trust-based relationships could be instrumental in evolving beyond the

rigid and often ineffective funding models, creating avenues that truly cater to student's diverse

needs. Dr. Overrocker points out that engagement at the campus level allows for a nuanced

understanding of student and program needs. "We see things from a different perspective than if they hired someone who knew nothing about STEP and C-STEP," she remarks. Dr. Gladys Palma de Schrynemakers complements this idea, emphasizing mutual trust. She suggests, "Trust the institution to say, we need to service X number of students in our program. This is how we're gonna service them, and this is what it's gonna cost." The direct, in-person approach may solve the issues highlighted previously. Institutions have unique needs and challenges. This is why a standardized approach may overlook these nuances, leading to ineffective resource allocation. Direct interactions ensure that resources are effectively utilized. Moreover, Dr. Gladys's idea of trusting institutions to dictate their needs and costs promotes a more tailored approach. This ultimately may benefit students more holistically.

Public Policy Recommendations to Ensure Proper Funding:

This section will go over ways Public Policy can be instituted to address institutional needs to ensure a current and future mentorship program thrives.

Feedback-driven Approach to Funding:

Legislators should be committed to understanding their institutions. By engaging students, faculty, and staff in discussions through surveys, town hall meetings, and focus groups, they can provide invaluable feedback to fine-tune these dual funding models. This ensures that the specific needs of each institution are met. This feedback loop, involving everyone from faculty to students, would make the funding process more transparent and actionable.

Localized Funding Control:

The closer decision-making is to the action, the more impactful and efficient it tends to be. If institutions, or even local communities, have a more significant say in how funds are managed, we're more likely to see resources being channeled where they're genuinely needed.

Envision regional boards, inclusive of representatives from various schools, coming together to allocate funds. Such proximity often translates to more accurate and timely decision-making.

Tiered Funding System and Flexible Grant Application Process:
      Not all institutions have the same needs, so, a custom-tailored approach is essential. Public Policy could be used to provide flexibility in grant applications that would enable institutions to outline their specific requirements. Institutions could potentially identify unique regional socio-economic challenges, disparities in the local cost of living, or other issues that a more generic model might overlook. Then, by grouping institutions based on their unique challenges and adjusting funding norms accordingly, we ensure both fairness and utility. On top of regular reviews, this ensures that resources are being used efficiently and effectively.

Equitable Matching Grants:
      To drive fundraising initiatives at the local level, matching grants can be pivotal. This would ensure that the onus of fundraising isn't just on large institutions with vast resources, but that smaller entities too have a fighting chance.

Collaborative Grant Programs & Inclusivity Initiatives:
      Encouraging collaboration between institutions can foster an environment where resources are shared. On a parallel note, institutions that prioritize diversity can be offered additional incentives, ensuring a holistic, inclusive learning environment for all students.

Balanced Funding Streams:

Dr. Anthony Capri points out the need for two funding streams. Firstly, a *Steady Base Funding* that ensures programs and institutions have the resources they need to maintain their current operations. Secondly, for those aiming higher, an *Innovation Fund* should exist. Dr. Anthony refers to this as a pot of money for projects that aim to break barriers and pioneer new methodologies. While the steady base funding supports the foundational aspects of an institution, the innovation fund acts as an incentive for institutions to strive for excellence and innovation.

Crisis & Contingency Fund:

Institutions shouldn't be at the mercy of unforeseen financial strains. A dedicated fund, accessible in times of crisis or unexpected events, can act as a buffer, providing stability and assurance.

Direct Student Grants & Scholarships:

Sometimes, the best way to ensure equitable education is to fund the students directly. Scholarships, grants, and financial aid programs, especially for marginalized communities, can directly uplift those who might otherwise miss out.

Post-Funding Evaluations:

Once funds are disbursed, it's crucial to assess their impact. Such reviews should be grounded in trust and collaboration. They can determine the efficacy of funds, ensuring they are used most judiciously in the future. Funding educational institutions is about recognizing the diverse needs and challenges of each institution. In this journey towards a more equitable model, we need to start by addressing the most impactful changes and then flesh out the broader context. Note: This isn't about holding institutions accountable in a punitive sense but understanding the efficacy of the funds. Dr. Overrocker's emphasis on trust can be a cornerstone here, ensuring institutions view this as a collaborative review process rather than a judgment.

Transparent and Holistic Evaluation Metrics:

As James Davis has touched upon, the true success of an institution isn't just in numbers. By employing evaluation metrics that consider a broader spectrum of success indicators, including student well-being, engagement, and community involvement, a clearer and more holistic picture emerges.

Institutional Buy In:

For a tutorship program to genuinely make an impact within an educational institution, institutional buy-in is paramount. When an institution stands with a program, it magnifies the effects of the program on students' academic and personal growth.

In brainstorming ways to bolster institutional commitment, there are ways in which public policy can play a role. For instance, the federal government can offer tangible incentives to the institution for fostering institutional commitment and involvement. These awards would not only improve the image of the receiving institution but also indirectly promote the essence and importance of mentorship, pushing other institutions to potentially adopt similar programs. A government initiative that sponsors a select number of new programs, Breen states, may stir interest and ignite a competitive spirit among institutions, "People love incentives, people like recognition and so how great would it be if this government-sponsored 10 new programs that applied for this grant to do internships or mentorships." The goal is not to make institutions compete aggressively with each other but to encourage them to think creatively. Having a federal award for the institution who performs the best, or highlighting successful faculty, students, and staff members sparks that interest and creativity.

Policy Recommendation on Implementing Institutional Buy-Ins:

Grants for Mentorship Programs:
      A grant focused on mentorship programs could drive more institutions to prioritize these initiatives. This alongside periodic evaluations can ensure that institutions are not only initiating these programs but are also dedicated to their continuous improvement.

Faculty and Staff Recognition:
      There may also be a category within these incentives that recognizes outstanding faculty and staff members for their mentorship contributions. This may convince faculty members who are reluctant to partake in a mentorship program to now do so. Moreover, when the government acknowledges these faculty members, it can spark competition and creativity. This ensures the mentorship programs' success at both institutional and individual levels.

Spotlight Success Stories:
      The government can utilize social media, a federal website, or other forms of communication to create a platform that showcases the success of all parties involved. This is a simple way of celebrating these success stories on social media or a public website, but it acts to increase exposure and appreciation for a mentorship program.

Pilot Program Competitions:
      There can also be a competition for institutions to propose innovative mentorship or tutorship models or additions. The top 10 or 20 with the most compelling ideas with support promised for the most compelling ideas can be awarded to develop groundbreaking mentorship initiatives.

Conclusion

      As we endeavor to create a more equitable STEM Landscape, the role of mentorship in educational institutions is paramount. The 'Chilly Climate Theory' mentioned in Part I has indicated that certain educational environments can be unwelcoming to minority groups. To

effectively combat such a negative environment, institutions need to create a sense of belonging. Dr. Breen, Dr., Hasson, and Dr. Carpi have showcased that mentorship isn't just about academic guidance but extends to emotional and psychological support.

Mentorship programs should include not only academic advising but also tackle financial challenges, career guidance, research experiences, and more, adapting the learning from theories on stigmatization for underrepresented minorities. Evaluating the success of these mentorship programs, as Dr. Sto Domingo puts it, requires tailored metrics rather than a one-size-fits-all approach. To that end, legislators should understand these intricacies and work with educational institutions to understand their specific circumstances. Dr. Overrocker's in-person approach not only showcases the need for flexibility but also the efficiency in ensuring these programs survive. By creating a sense of belonging and providing holistic support for minority students, they are more likely to persist in STEM disciplines. Hence, they will be more prepared to go on to post-secondary STEM education and contribute to the STEM workforce.

Limitations of Model Program

When implementing a mentorship program, we need to consider the potential risks and flaws that may arise. While my model is based on best practices highlighted by these experts and recent literature, best practices identified in one context or institution might not seamlessly translate to another due to differences in infrastructure, student demographics, faculty expertise, and institutional priorities.

This model is rooted in the 'chilly climate' theory; nevertheless, there's a risk of becoming too defensive, and too reactive. It's equally crucial to proactively cultivate a positive environment rather than just defending against a negative one. As the main intent is to foster a sense of belonging for URMs, the uniqueness of each URM's experience means that a single mentorship

model might not always encapsulate these distinct challenges. There are nuances between these groups, and these finer distinctions, if overlooked, can hinder the overall efficacy of the program.

Moreover, the program's focus on building a diverse STEM workforce and bolstering post-secondary URM representation might bring about an inherent risk: by placing a strong emphasis on these two outcomes, there might be undue pressure on participants. The outcome-based focus could inadvertently lead to overlooking the journey, the personal growth, and the myriad non-academic benefits that mentorship brings. Mentorship should consider personal development as a factor for growth on top of professional advancement.

Any model, regardless of its foundational strength, is only as effective as its buy-in and adequate staff. Internal dynamics cannot be ignored. While many might support these programs, there could be groups within institutions that view these initiatives as potentially diverting resources from other priorities. Without full institutional support, from faculty, administration, and even the student body, URM may feel outcasted by a program. Finally, a note on staffing as often with a handful of dedicated individuals becomes the linchpin of such initiatives. Overburdened, they might face exhaustion, thereby diminishing the efficacy of these programs.

Limitations of Public Policy Recommendations:

Political landscapes are anything but constant. Today's priority can be tomorrow's afterthought. Changes in government, policy priorities, or even economic downturns can jeopardize continuous funding as highlighted by Dr. Nancy Campos. A mentorship program, especially one that leans heavily on governmental support, can find itself on shaky ground when faced with policy reversals or changing governmental priorities. The whims of political dynamics can introduce inconsistencies, leading to fragmented implementations, potential rollbacks, or even complete halts.

Additionally, bureaucratic processes, albeit necessary, can sometimes be slow, not keeping pace with the rapid needs of dynamic educational environments. Given the climate, with race-based Affirmative Action no longer in place in higher education, regulatory challenges can further complicate matters when it comes to supporting these students.[138] Even when intricately crafted, Public Policy cannot foresee every global eventuality such as pandemics, geopolitical tensions, or unforeseen economic challenges. For URMs, whose journey in STEM is already riddled with unique challenges, these spontaneous politics impact these vulnerabilities. When mentorship programs anchor themselves too tightly to public policies, they might find themselves ill-equipped to navigate these unpredictable terrains, as Dr. Sto Domingo aptly noted.

And not to be overlooked are concerns regarding data privacy and ethical standards. The mentorship of URMs in STEM isn't just about academic trajectories; it's deeply personal. While academically sound, by collecting, analyzing, and potentially sharing these narratives, we risk breaching trust. Even with the best intentions, without foolproof policies and stringent data protection measures, the potential for misuse, unintentional breaches, or even exploitative practices remains.

An additional primary concern regarding the integration of public policy into the realm of mentorship programs is the sustainability and potential overreliance on governmental funding. When institutions become deeply intertwined with governmental grants and awards, they inadvertently tether their sustainability to the uncertainties of the political realm. Often, these funding cycles are short-term, and once exhausted, there could be a significant lag before subsequent rounds of funding materialize, if at all. This interim period can stall progress by hindering the continuity of programs.

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[138] Students for Fair Admissions, Inc., No. 20–1199.

Moreover, while federal mentoring awards can indeed spur institutions into action, there's a fine line. On one side, you have innovation driven by the desire to achieve; on the other, a potentially unhealthy race to the top where the journey's quality can get compromised. These awards, if not carefully structured, can inadvertently become mere 'badges of honor,' with institutions aiming for the spotlight, sidelining the real goal: genuine mentorship. There's also the risk of institutions warping their objectives to align more closely with governmental priorities to secure these funds, which can detract from the genuine needs of their student population. Strict guidelines on fund utilization might not always resonate with on-ground realities, creating potential conflicts. Institutions might streamline their efforts not necessarily for the holistic development of underrepresented minorities in STEM but for the periodic and often short-lived accolades that come with governmental recognition.

Next Steps and Closing Remarks:

While current research has laid a foundational understanding, there's always more to be done and more perspectives to consider. Future research can help expand understanding of how mentorship dynamics play out across different STEM disciplines and compare student, faculty, and staff experiences. By asking questions such as "Do the challenges faced by URMs in physics parallel those in biotechnology?" we can create tailored strategies to meet these needs

As the political climate may heavily influence mentorship initiatives, it would be beneficial to speak with more policymakers on a state and federal level to see how a program like this can be implemented. Moreover, we can expand this research on public policy by conducting longitudinal studies on programs like CSTEP and TRIO. This would allow us to understand how these programs have adapted and transformed in response to shifting governmental policies and societal attitudes.

Ultimately, merely pointing out gaps isn't sufficient. Active participation in bridging these gaps is essential. As Dr. Gladys powerfully notes, "You cannot highlight a problem, and not be a part of the solution because then you become a part of the problem." This work, although illuminating, is but a chapter in an ongoing narrative. There's a need for constant revision and adaptation to ensure that the mentorship strategies deployed are not only effective but also sustainable and adaptable to the changing dynamics of public policy and URM needs. Through further evaluation and implementation of such a program, we can take meaningful strides toward a STEM environment that embraces the richness of diversity and equity.

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Dr. Kim Overrocker who is an Associate in Higher Education Opportunity who has previously provided technical assistance to higher education institutions that have been awarded NYS Education grants for STEP and/ CSTEP (Opportunity Programs) and now provides leadership and oversight of NYS STEP and CSTEP program legislation.

Dr. Nancy Campos who is the AMP & CSTEP Program Director at SUNY New Paltz

Program for Research in the Sciences (PRISM) at CUNY John Jay College of Criminal Justice

Dr. Edgardo Sanabria-Valentin is the Associate Director of PRISM, and in addition, serves as an Adjunct Assistant Professor of Biology at the JJC Department of Sciences

Dr. Anthony Carpi is the founder of PRISM and is a Professor of Environmental Chemistry and Dean of Research at John Jay College

Dr. Nathan Lents who are one of the original founders and a Former Co-Director. He is a Professor of Biology, and previous Director of the Honors College.

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Mr. James Davis is the Director of TRIO Student Support Services and Child Care Access Means Parents in School Division

Dr. Stephanie M. Breen is a Research Associate at the Pell Institute for the Study of

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