

**The National Society of Black Physicists  
and  
The Harlem Gallery of Science Mentoring Program  
Progress Report  
2020-2021**



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# Introduction

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The *Harlem Gallery of Science Mentoring Program* was conceived in the summer of 2020 as a result of the need to address pressing challenges related to those experienced by youth who have been estranged from science, technology, engineering and mathematics (STEM) content and its related practices. It also recognized and made efforts toward addressing the very serious concerns related to the ongoing stresses and the effects of loneliness during the coronavirus pandemic. A partnership between the not-for-profit organization, *Science and Arts Engagement New York* (SAE-NY) and the City College of New York (CCNY) together with The National Society of Black Physicists (NSBP) created the NSBP x HGS Mentoring Program<sup>1</sup>.

## Underrepresentation in STEM and Future Projections

The 2020 base population of Black<sup>2</sup> or African Americans and Hispanic<sup>3</sup> or Latinos in the United States, as reported by the U.S. Census, was approximately 41.1 million and 62.1 million, respectively (U.S. Bureau of the Census, 2020). Population projections are such that by 2043, the “minority” population in the U.S. is projected to become the numerical majority – an important consideration when planning for how to best serve the future face of science, technology, engineering and mathematics (STEM) now and, who will be needed at the forefront of STEM in the future. While the call for diversity in STEM has been ongoing for years, and some strides have been made to answer that call, stronger and more focused efforts are needed in order to make significant impacts. Ferris-Mundy who wrote for *Science* magazine, one of the world's top academic journals, has maintained that, “Diversity of perspectives, ideas, and priorities comes from varied backgrounds, experiences, and cultures, and can help shape science and engineering” (2013, p. 278). The entire April 2013 volume of the magazine was dedicated to exploring “The Grand Challenges of Science Education.” Unearthing and exploring those challenges continue to call educators at all levels to seize opportunities that will help to develop and strengthen our diverse current and future scientific communities around the globe. Alexander (2021) argues that, “diversity in science is not just a social justice concern, but that it enhances the quality of the science we accomplish.” Within diverse spaces, a variety of perspectives, ideas and cultural lenses

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<sup>1</sup> While the mentoring program is officially referred to as the NSBP x HGS Mentoring Program, in this document, the mentoring program is more often referred to as The HGS Mentoring Program.

<sup>2</sup> The term Black is used to refer to people of the African Diaspora and to such populations that reside within the United States.

<sup>3</sup> While it is widely accepted that Hispanic people are those who originate from Spanish speaking countries; Latino people descend from Latin-American countries, but their language is not necessarily Spanish; and that Latinx is a gender-neutral, pan ethnic identifier, this report uses *Hispanic* as an identifier, to include all aforementioned identifiers for simplicity.

coalesce, enhancing scientific enthusiasm and advancement. An emphasis on the importance and impact of inclusivity is clearly outlined in the National Academies of Science, Engineering and Medicine document, *The Science of Effective Mentorship* (<https://www.nationalacademies.org/our-work/the-science-of-effective-mentoring-in-stemm>). It maintains that, “Creating a culture of inclusive excellence requires academic institutions to identify where student success is not equal across all demographics, discover which educational practices succeed in addressing those inequities, and work intentionally to build from those practices in a way that sustains change” (2019, p.3).

In 2021, the National Science Foundation reported that in 2018, 57.9% of science and engineering bachelor’s recipients were White; 15.1% were Hispanic, and 8.5% were Black. Pew Research found that among STEM professionals, a mere 8% were Hispanic and 9% were Black; 67% were White. The diminutive proportions of Blacks and Hispanics in STEM disciplines have led to these groups being classified as underrepresented minorities National Center for Science and Engineering Statistics. The imperative for more inclusivity and attention to the quality of Black and Hispanic youth’s experiences in STEM, therefore, is critical. As this demographic continues to steadily increase, these youth in particular will have an even more significant role in contributing to scientific advances in the United States and all over the world. Yet, opportunities for these students to envision themselves as significant contributors to STEM and the scientific enterprise today are oftentimes extremely limited. What Black and Hispanic students, and all students for that matter, commonly see are White males as being those privileged people who engage in STEM. The face of STEM will undoubtedly be changing over the years, and since the demographics in the United States is represented by increasing percentages of People of Color, it behooves the educational community at large, and the STEM community specifically to become adequately prepared to help shape this special group of youth. They will be the people who will contribute greatly to advance the future of STEM.

### **Unified Visions of the National Society of Black Physicists and The Harlem Gallery of Science to Create a Mentoring Program**

The National Society of Black Physicists (NSBP) was founded in 1977 at Morgan State University as a response to systemic racism in the physics community. In 1972, African American physicists curated an event celebrating the successes of African American physicists. These meetings led to the creation of a national organization for Black physicists

eventually known as the NSBP, which aims to promote the wellness of Black physicists and scientists by developing and supporting efforts that increase their opportunities in physics.

The Harlem Gallery of Science was created by Science and Arts Engagement New York, Inc. (SAENY), a not-for-profit organization, in collaboration with the City College of New York (CCNY), as a free access interactive cultural space, brings science and technology alive through programs and interactive exhibitions. The goal of HGS is to facilitate access and engagement of underrepresented communities to STEM fields. The HGS achieves this by creating STEM counterspaces (Ong et al., 2018), or “safe spaces” that incorporate the cultures of the communities that HGS serves. Aside from this mentoring program, some examples of HGS programming include exhibits “Dunk! The Science of Basketball”, “The Science of Music: From Jazz to Hip Hop”, and the “Game Design Project.” CCNY, founded in 1847, is recognized as being the first tuition free public institution of higher education in the U.S., and is known best for its programs in architecture, engineering, education and the liberal arts and sciences. It is the founding institution of the City University of New York (CUNY), and is the home of eight schools and divisions. It is also renowned for its enablement of social mobility.

Together, the Harlem Gallery of Science (HGS) and the National Society of Black Physicists (NSBP) forged a vision, utilizing a model developed by Dr. Stephon Alexander, a Black Trinidadian-American theoretical physicist, that is dedicated to support youth who have been estranged from STEM. Through their brainstorming and collaborative efforts, the **HGS Mentoring Program** was launched at the height of the coronavirus pandemic, when concerns about the loss of face-to-face STEM class time, and the wellbeing of students at all levels and in all contexts were rapidly intensifying. Given these concerns and the consequences of their realities, providing support to engage in STEM through new and innovative ways in the program has not only been relevant, but also has been timely. Addressing the concerns became imperatives for the program, as has been the broad and overarching goal of facilitating underrepresented youth and those in their communities to engage in STEM in ways that are meaningful to them, and are aligned with the unique cultures and norms of the communities.

The counterspaces created through the HGS Mentoring program serve as critical spaces where the feeling of belonging is a key element upon which STEM content and practices can be understood and enacted in new and relatable ways. They serve those at the margins of traditional STEM experiences, and are vastly different from traditionally favored

competitive, individualistic, and solitary practices. The program emphasizes the value of tapping into the wealth of resources and experiences that the youth's communities have in an effort to strengthen the sense of belonging, and as a means to advance experiences in and exposures to STEM.

The HGS Mentoring Program utilizes a sociocultural lens in its overall planning and enactment in an effort to help understand the intricacies of events that unfold in the program. Through sociocultural awareness, the HGS Mentoring Program is exploring new ways to address radical differences in STEM opportunities that have plagued underserved youth in New York City – especially those being educated in the Harlem, Upper Manhattan and the South Bronx. It does so by providing high quality culturally embedded mentoring, and rich STEM experiences that are synergistically aligned to urban youth culture and its affiliated communities – communities that have great value in supporting and understanding youth's lived experiences.

Opportunities to envision the possibilities that exist from engaging in STEM academically, with the special support of mentors whose images, dispositions and experiences serve as resonant structures for youth in the program, and in carving out careers in STEM and STEM-related fields, are invaluable to both youth identified as mentees in the program as well as their undergraduate and graduate mentors.

### **Overarching Project Foci**

The HGS Mentoring Program has aimed to have several levels of impact that include:

- **servicing** middle and high school students from underserved communities by matching them with undergraduate and graduate STEM student mentors who “reminded them of themselves” as a result of sharing similar interests, social, ethnic and/or socioeconomic backgrounds.
- **embedding** the program in culturally relevant contexts
- **spearheading** the mentoring program virtually, that emphasizes addressing concerns both inside and outside of the domain of STEM, including issues related to race, culture, ethnicity, gender, language and learning styles

- **creating** a sense of belonging by sustaining positive emotional energy that could ameliorate feelings of loneliness, uncertainty about the future, and being estranged from STEM that has worsened as a result of the coronavirus pandemic
- **strengthening** academic success, while cultivating and increasing youth's interest in STEM disciplines and their real-world applications.

## Understanding Support Factors

In order to more accurately understand factors that mediate the lack of participation of those who have been marginalized as a result of being vulnerable to systemic inequalities in STEM and society at large, an accurate understanding of the factors that prevent participation in STEM is important, as is understanding those factors that support students. The realities of discrimination and alienation experienced as a result of dismissive attitudes commonly hurled upon marginalized youth as well as underrepresented professionals in STEM have grave effects. As posited by Makgoba (2020), “These realities include differences in the way young people are encouraged (or discouraged) to pursue scientific careers, the lack of role models, not having access to meaningful career guidance and mentorship, and not being plugged into influential career networks” (p. 884). The HGS is woefully aware of these realities, as mentors and mentor leaders have experienced them first-hand.

In the United States, there is a strong emphasis in STEM education research that details the complexity of the educational opportunity gap<sup>4</sup> in STEM, specifically as it relates to Black and Hispanic students. Among other factors, the educational opportunity gap results from disparities in gaining and sustaining access, for example, to high quality schools and the needed resources that are fundamental for academic success. Resources include access to early childhood education, highly prepared and effective teachers, college preparatory curricula, equitable instruction, and high quality human and material resources. Disparities in academic performance, because of the educational opportunity gap, readily get ascribed to the performance gaps among students who have been marginalized because of their race, ethnicity, language differences, gender, class and ability. The blame for academic disparities commonly and wrongfully gets placed on those students, their families and communities that often, through no fault of their own, bear the brunt of having been marginalized. Harper (2010) posits that when considering Black and Hispanic students' experiences in the United States,

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<sup>4</sup> The term *educational opportunity gap* is used instead of achievement gap or academic opportunity gap because the circumstances that people are born into often determine life opportunities, and can have a limiting effect on the development of potential.

not enough emphasis has been placed on examining explanatory insights that account for the successes of these students. He emphasizes that instead of using a deficit-oriented question, such as, Why do so few Black and Hispanic students pursue STEM majors? one could ask, What stimulates and sustains these students' interest in demonstrating competence and attaining degrees in STEM fields? (2010 p.65). The use of anti-deficit laden questions and anti-deficit laden ways of being in the world, are be measures that could lead to a deeper and more affirmative understanding of the complexity of Black and Hispanic students' experiences in STEM.

### **Addressing Loneliness as a Result of Pandemic Isolation**

It has been through the development of respectful and caring relationships that the HGS Mentoring Program has found to be significant in combating feelings of isolation, helping to strengthen participants' self-efficacy, agency and academic success, while at the same time cultivating and increasing interest in and knowledge of STEM disciplines.

Research conducted by Reid and Moore (2008) evidenced that engaging in extracurricular activities and having active, caring mentors, help to facilitate college readiness amongst first generation students. Participating in extracurricular activities has also been found to help students develop needed skills requisite for their academic and career trajectories, along with aiding in providing them with an introduction to a variety of career paths (Hines et al. 2019). Research further reveals that students foster better relationships with mentors who they can identify with (Ensher and Murphy 1997, Armakan et al. 2012, Gershenson et al., 2021) on several important levels.

Throughout the 2020-2021 academic year of the piloted HGS Mentoring Program, mentors and mentees held weekly virtual meetings that were organized into two 12 weeks sessions (fall and spring semesters), as a means to build sustained, academic focused relationships. Conversations generated during these meetings were designed to help empower mentors and mentees to be successful academically, professionally, socially, and emotionally. Both academic and professional development workshops, which brought together details about STEM disciplines while valuing youth culture, were organized throughout the course of the year.

Grass root efforts that helped to start and run the program have included local support from community members, teachers, professors, and students' family members. Some



modest support from private donors and crowdfunding also helped fund different aspects of the program. Science and Arts Engagement New York and the National Society of Black Physicists provided additional financial support. Middle and high school students were recruited from Eagle Academy of Harlem, Hamilton Grange Middle School, New York Math Academy and Coaching Services in Harlem. Brian Simmons, Dean of Mindfulness and Restorative Interventions at Food and Finance High School in New York City, considered to be a pioneer in the development of mindfulness programs in public schools, donated his time to support the program. A promotional company, *SwagUp*, donated backpacks and other supplies for the mentors and mentees during the course of the program.

### **Guiding Questions**

The NSBP x HGS Mentoring Program has been examining several levels of impact. Overarching questions that have helped to guide this work include:

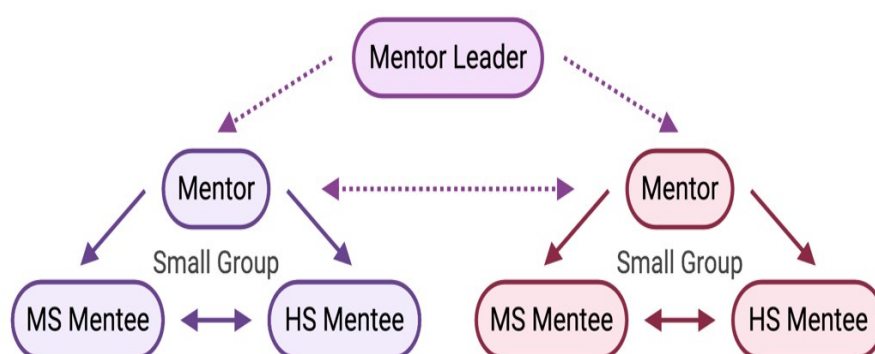
1. To what extent do youth from under-resourced communities identify with positive role models?
2. How have relationships between mentors and mentees developed?
  - Detail if and how they have been meaningful, and if and how they have been sustained.
  - What activities have helped mentor-mentee relationships to be more academically focused?
3. In what ways have awareness of and interest in STEM careers been fostered?
4. What evidence is there of community/family development that specifically combats loneliness associated with the coronavirus pandemic?
5. How has the modeling of positive professional development for youth unfolded?
6. To what extent have mentors and mentees strengthened individual and collective agency and empowerment?

# Methodology

A review of the program structure, its participants and their roles, activities, and initial findings from transcript excerpts of mentor-mentee discussions follow. Additionally, key impressions from a teacher who detailed the impact that the program had on one of his students, letters that express the value of the program experienced by mentees and mentors, along with sentiment from an appeal letter written by a parent to an elected official are included below.

## Program Structure

The NSBP x HGS Mentoring Program utilizes a multi-level group mentoring model (see Fig. 1). At its base, the program matches one middle (MS; 6-8th Grade) and one high school (HS; 9-12th Grade) mentee with a university STEM student mentor. Mentors can be either undergraduate or graduate students. Within this structure, mentees interact vertically with their mentor (Keller and Pryce 2010), but also horizontally with their K-12 co-mentee.



*Figure 1. Schematic of the multi-level mentoring model used by NSBP x HGS Mentoring Program. MS denotes middle school students, HS denotes high school students.*

A single group consisting of one mentor with two mentees is identified as a mentoring nucleus or small group. There is some degree of flexibility to this structure based on mentee needs and mentor availability. Members of each mentoring nucleus are matched based on common interests and sociocultural backgrounds. Matching information is extracted from surveys that are part of the mentor and mentee application processes.

The next level within the model matches groups of two to four mentors with a mentor leader. A mentor leader is a university student who is very experienced in mentoring. The

primary role of the mentor leader is to guide mentors in building and sustaining strong mentoring relationships with their mentees. Mentor leaders also run mentor training workshops and cohort events, and provide additional support advising mentees.

Mentor leaders are group-mentored by the leadership team of NSBP and SAENY who are also university faculty members. In a number of cases as leaders of NSBP and SAENY these individuals provided oversight of the program and worked closely to guide the mentor leaders programmatically and administratively. In a number of cases, they were asked to write letters of recommendation for mentors and mentees. Mentor leaders also interact with mentees when needed. By the conclusion of the mentoring program's year 1 pilot (2020-2021), the entire cohort consisted of 18 mentees, 12 mentors, and 4 mentor leaders.

## **Participants**

### **Mentees**

Mentees in the NSBP x HGS Mentoring Program are sourced from institutions based in the Harlem neighborhood of New York City. Harlem has been known to be a great hub of Black and Hispanic culture, but also of communities that are underserved (Opie 2008; Gill 2011). Three source institutions consist of a public middle school – Hamilton Grange Middle School, a public middle and high school – Eagle Academy of Harlem, and a local outside-of-school academic support program – New York Math Academy and Coaching Services.

During Phase I of the pilot (Fall 2020 semester), mentees were recruited by their teachers. The criteria for recruitment were based on a student's demonstration to show potential in character development, and in strengthening academic interest and competence. It was found that recruiting in this way led to some who were not fully committed. The following semester (Spring 2021), potential mentees were given in-class presentations about the mentoring program and subsequently applied based on their own personal interest. Mentor Leaders accepted mentees based on mentee applications, teacher recommendations, and mentor availability. This process helped to increase student engagement, interest and positive emotional energy.

Of the 18 spring mentees, 10 were high school students and eight were middle school students. Seven mentees identified as male and 11 identified as female. In terms of ethnicity and race, 10 mentees identified as Black, seven as Hispanic/Latinx, and one as Caucasian (Fig. 2a). Ten mentees identified as being first or second generation immigrants; Regions of origin include West Africa, Latin America, and the Caribbean.

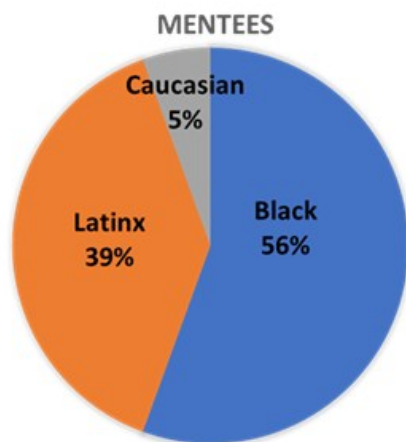


Figure 2a.

*Racial distribution of program mentees*

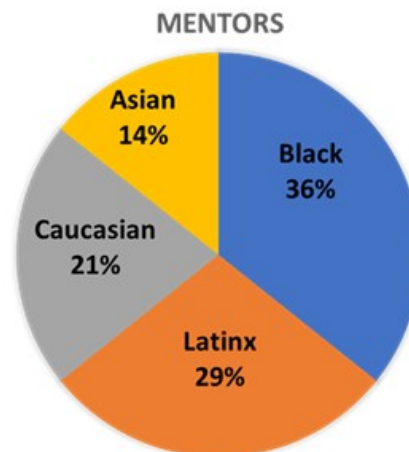


Figure 2b.

*Racial distribution of program mentors*

### Mentors

Mentors consisted of five undergraduate and seven graduate students from seven universities across the United States. Roughly 50% of the mentors were students associated with the NSBP. The other 50% are affiliated with HGS and neighboring universities, particularly The City College of New York. Mentors applied to the program by responding to program solicitation emails. They were then interviewed and selected by mentor leaders. Mentors were selected based on their commitment to helping others, as well as their dedication to building community and advancing the inclusivity of STEM spaces.

The 12 mentors are diverse in terms of gender, ethnoracial background, and major within STEM disciplines. Fifty percent of the mentors are female and 50% are male. Five mentors identified as Black, four as Hispanic/Latinx<sup>5</sup>, three as Caucasian, and two as Asian (Fig. 2b). Two mentors identified as multiracial. Mentors are affiliated with the following institutions of higher education: Columbia University, The City College of New York (CUNY), The Graduate Center (CUNY), Michigan State University, University of Dayton, Fisk-Vanderbilt, Brown University, Williams College and University of Chicago. Amongst majors, 7 mentors majored in physics. Three mentors majored in the earth science related fields of hydrology,

<sup>5</sup> Mentors of Hispanic and/or Latino backgrounds have self-identified in this program as Latinx – a term used as a gender-neutral alternative to Latino or Latina.

oceanography, and geochemistry. One mentor majored in mechanical engineering and one mentor was an undeclared college freshman.

### **Mentor Leaders**

The four mentor leaders were split between two representatives from NSBP and two from SAENY/HGS. Mentor leaders were graduate students very experienced in mentorship, volunteered their time and were dedicated to the program's mission of advancing diversity within STEM. For the inaugural year, mentor leaders were hand selected by the presidents of NSBP and SAENY respectively. One mentor leader, Veeshan Narinesingh, had a greater level of commitment and responsibility than others. He connected with schools in the program, organized a host of mentor meetings and workshops, and led fund raising and donation efforts. He also served as a liaison to the organizer of this report and other members in the program.

During the fall semester of the program, two mentor leaders were female and two were male. In the spring semester three mentor leaders were female and one male. The races of the mentor leaders included Black, Asian, and Caucasian with two mentor leaders identifying as mixed race individuals. Mentor leaders' areas of scholarly specialization included nuclear physics, high-energy physics, biophysics, atmospheric physics, branding and integrated communications and STEM education.

### **Leadership Team**

The leadership team of NSBP and SAENY is comprised of three university professors, all of whom provide oversight of the program and help to mentor the mentor leaders. They have also provided strong letters of recommendations on behalf of both mentors and mentees as they navigate the process of admissions into programs and higher education institutions. The leading member is Dr. Stephon Alexander of Brown University.

Dr. Alexander is a Trinidadian-American physicist who grew up in The Bronx, New York. He serves as the 2020-2021 President of the National Society of Black Physicists and is also the Executive Director of the Harlem Gallery of Science.

Dr. Stan Altman is a Professor at CCNY, former Dean and interim President at Baruch College and President of Science and Arts Engagement NY (SAE-NY), the parent organization of the HGS. Dr. Altman is trained as an electrical engineer and grew up in New York City's South Bronx region. He is of Greek and Eastern European descent.

Dr. Brian Schwartz is a CUNY Professor of Physics and SAE-NY Board Chairman. Dr. Schwartz grew up in Brooklyn, New York to parents who immigrated from Poland. Throughout his decorated career Dr. Schwartz has been a leader in STEM outreach and social justice.

### **Modes of Supportive Engagement**

To help students become more empowered, socially and academically, as well as help to cultivate their interest in STEM pathways, this program has engaged mentees, mentors, and mentor leaders in several ways. These modes of supportive engagement are designed to be cogenerative (Emdin 2011); mentors and mentees collaborate with mentor leaders to generate agreed upon programmatic content. The various cultures, including ethnic cultures, youth culture and cultures of STEM within the cohort are incorporated, and have been celebrated. This effectively creates a STEM counterspace, a STEM space, "at the margins for groups outside [of] the mainstream of education" (Ong et al., 2018).

### **Mentor Training**

In August 2020, mentors engaged in a series of five monthly mentor-training workshops, each lasting 90 minutes. These workshops had been developed and conducted by the mentor leaders. Mentor training workshops were designed to train mentors in building and sustaining successful mentoring relationships, as well as building a sense of community and camaraderie amongst those involved. The mentors cogenerated workshop topics. Input and requests by mentors were considered during workshop development.

A curriculum map of the mentor training workshops is found in Table 1. Each workshop began with a mindfulness exercise. The first three workshops were designed to prepare mentors for their first contact with their mentees. These initial workshops were focused on teaching mentors the makings of a good mentor, the expectations of the program, and the nuances of cultural sensitivity. After the mentors began mentoring, the fourth and fifth workshops focused on maintaining and sustaining mentoring relationships.

Workshop	Objectives
<p><b>Workshop 1:</b> Orientation: What are the makings of a good mentor?</p>	<ol style="list-style-type: none"> <li>1. Meditate</li> <li>2. Meet: Fellow mentors</li> <li>3. Define: Mentoring</li> <li>4. Discuss: The makings of a good mentor</li> <li>5. Outline: program structure</li> </ol>
<p><b>Workshop 2:</b> Cultural Sensitivity</p>	<ol style="list-style-type: none"> <li>1. Meditate</li> <li>2. Recap: 1<sup>st</sup> workshop</li> <li>3. Explore: Challenges students face and how mentors can support to overcome them</li> <li>4. Set: Boundaries for the mentoring relationship, between middle and high school mentees and their mentors</li> <li>5. Learn: Cultural Sensitivity</li> </ol>
<p><b>Workshop 3:</b> Makings of a good mentor revisited - Prelude to first contact</p>	<ol style="list-style-type: none"> <li>1. Meditate</li> <li>2. Recap: Workshops 1 and 2</li> <li>3. Discuss: What is the key to starting up a successful mentoring relationship?</li> <li>4. Revisit: The makings of a good mentor</li> </ol>
<p><b>Workshop 4:</b> Meta Aspects of Mentoring</p>	<ol style="list-style-type: none"> <li>1. Meditate</li> <li>2. Discuss: How is the mentoring going?</li> <li>3. Brainstorm: What is working, what is not?</li> <li>4. Look introspectively: What can be improved?</li> <li>5. Learn: Mentoring sustainment and resilience</li> </ol>
<p><b>Workshop 5:</b> Reflection</p>	<ol style="list-style-type: none"> <li>1. Meditate</li> <li>2. Follow up: How have can challenges be overcome?</li> <li>3. Reflect: The experience as a mentor</li> <li>4. Discuss: How to continue or conclude the mentoring relationship</li> </ol>

*Table 1: Curriculum Map for Mentor Training*

Mentor training workshops model what Lave and Wenger (1991) refer to as "communities of practice." They posit that learning takes place in and is an integral to, and inseparable from aspects of cultural and social situations. They insist that an examination of the specific types

of social engagements, like those in the NSBP x HGS Mentoring Program, provide a proper context for learning, instead of relying on traditional cognitive processes and conceptual structures.

As such, these workshops have been very active, where mentors and mentor leaders frequently interacted. To create this engaging environment, thought-provoking discussion prompts; breakout rooms and chat boxes were utilized. All individuals were given the opportunity to take part in discussion, and the mentors were able to build a support system amongst their peers. The value of these interactions lie in the fact that experiences in these co-constructed spaces were shaped and challenged by mentor and mentor leaders, thus creating a community whereby each person gained increased access to participatory roles.

### **Weekly Meetings**

The consensus of participants in the program was that the most important parts of the program were the weekly meetings with the mentors and mentees. These group conversations lasted at least 30 minutes and most frequently were held virtually on Zoom. These conversations centered on the mentees' academic goals, professional development and personal experiences. Mentors had the freedom to freely discuss any topic with their mentees, but they were provided guidance by their mentor leaders and during their training prior to the start of the program. Mentor leaders provided conversation weekly starters, which included icebreaker questions, material resources and topics to guide the mentors. Mentors were also trained in cultural sensitivity and professionalism during a series of workshops so that conversations with their mentees created a safe space that did not cross any professional boundaries.

### **STEM Kits**

In response to mentees' desire for more activities with their mentors, "STEM kits" were introduced into the program's spring semester. To reinforce engagement and weekly participation, "STEM Kits" containing various STEM-related activities were mailed to all mentors and mentees. The goal of the STEM Kits was to expose students to new ideas, broadening their understanding of science-related material. The program gave each mentoring nucleus the option to choose from a predetermined list of kits. Example topics included ornithology, learning to code, building a microscope, and botany.



Mentors were sent the same kits as their mentees, enabling easy guidance through web interaction. Working together, students could learn problem-solving skills demonstrated by their mentors. In addition, groups were allowed to use open resources as a reference. The kits helped to reinforce active scientific questioning, research skills, and application of the scientific method. Once completed, students were able to keep all of their materials and the finished product.

### **Cohort Events**

The program also held tri-weekly social, academic, and professional development events for the entire mentor-mentee cohort. These cohort events were inclusive and celebratory of the various cultures within the cohort. Events were typically cogenerated and co-led by mentor leaders, mentors, and mentees. Each semester began with a kickoff event, welcoming members, while engaging them in orientation activities and interactions with special guests.

Cohort events were hosted with the goal of exposing mentors and mentees to science in their daily lives as well as to develop skills and introduce career paths. The inaugural cohort event was “The Physics of Hip Hop” led by Dr. Stephon Alexander. New York City Councilman Mark Levine, who has a physics degree spoke to the group about the career flexibility it has provide him. Other examples of cohort events included: “How to Be a Strong Scholar”, “The Art of Hustle and Success”, “Career Day”, and an “End of The Year Fete”.

### **Mindfulness Practice**

This mentoring program implemented mindfulness practices to promote the psychological well being of all involved – mentees, mentors, and mentor leaders. For those from underserved communities, rife with unique stressors, mindfulness can be a powerful tool for mental regulation (Mendelson et al. 2010). Enhanced cognition and attention (Brefczynski-Lewis et al. 2007), as well as a better ability to manage negative emotions and stress are all potential outcomes of mindfulness (Brown and Ryan 2003; Arias et al. 2006; Ospina et al 2007). Mindfulness is also especially helpful given the stress associated with the COVID-19 pandemic (Conversano et al 2020).

Mindfulness practices have permeated throughout the NSBP x HGS Mentoring Program. Mindfulness sessions were led by a skilled and seasoned mindfulness instructor, Brian Simmons. Instruction in mindfulness typically involved 10-15 minutes of guided meditation sessions and reflective discussion. Mindfulness sessions were held during mentor training workshops as well as cohort events. Outside of instruction by Simmons, mentors were encouraged to incorporate mindfulness during their weekly mentoring meetings.

# Findings

To investigate the outcomes of this piloted mentoring program on mentees, their accounts were collected through weekly meeting reports, surveys, cohort event recordings, and focus group interviews. Consent by mentees' parents to photograph and possibly use their images, film and videotape their children during the mentoring program was acquired (for educational purposes) through the New York City's Department of Education's Office of Communication and Media Relations. All mentors' and mentees' names as they appear in this report are pseudonyms.

Outcomes of this piloted inaugural program centered around three superordinate themes that emerged from transcript analyses: emotional and social support, paths to success, and connections to STEM. These superordinate themes were then organized into various subordinate themes (see Table 2), as described below. The transcript excerpts included here serve as rich examples of being able to successfully gain insights into experiences while in the mentoring program.

Superordinate Themes		
A. Emotional and Social Support	B. Paths to Success	C. Connections to STEM
Subordinate Themes		
<ul style="list-style-type: none"> <li>emotional support with mental health</li> <li>family-like bonds and inclusivity</li> </ul>	<ul style="list-style-type: none"> <li>demystifying success</li> <li>skills for success</li> </ul>	<ul style="list-style-type: none"> <li>general interest in STEM</li> <li>careers in STEM</li> </ul>

Table 2. Emergent themes from transcript analyses

## Transcript Evaluation

### **Emotional and Social Support**

The mentoring program had positive effects on providing emotional and social support to the mentees. Within the superordinate outcome, two subordinate themes were extracted: emotional support with mental health, and family-like bonds and inclusivity.

### *Emotional support with mental health*

Mentees reported that the mentoring program provided emotional support in the midst of the pandemic. This support gave mentees the opportunity to express their concerns, receive feedback, ease anxiety, and build self-confidence.

Within one of the focus group interviews, high-school student, Taneisha, had the following response when asked what she got out of the program:

*It's good, like, it's something to look forward to at the end of the week [...]. Especially because it's like Corona now and you can't really do nothing. [...]. I can tell her [the mentor] about how my days go during the week and whether there was any problems*

Taneisha has expressed her desire to remain in the program because with her mentor Lisa, “I can also talk to her about anything that is bothering me.”

Another high school student, Rhonda, described how her meetings with her mentor Alyssa taught her “not being hard on yourself and being honest with yourself.” Rhonda also described the meetings as opportunities to “vent” despite being self-described as someone who does not like talking about their emotions. Rhonda says her mentor has:

*helped me grow in a way that she's helped me be able to express myself more, be comfortable with myself and be comfortable with my feelings and not be afraid to say it. I'm so glad that she's made our Zooms like a safe space for us to tell her anything.*

Meeting with mentors also helped mentees deal with anxiety and build confidence. In one account, Lisa described a movie night that her middle school mentee, Jayde, was initially reluctant to attend:

*[...] and I was like listen, you're not gonna study the night before your test, there's nothing more you're gonna absorb in your brain. So I think you should take a two-hour break and watch this movie. And at first she said, “no” [...]. And then she joined and said, “Ms. Lisa” I need a break; I want to watch the movie.*

Regarding this, when Jayde was separately asked about her favorite part of the program she responded:

*The movie was very inspiring because the next day I had [...] a major test that impacted my grade [...]. I'm a person who is indecisive, self-conscious, and have a lot of anxiety and I guess that was the perfect day to show me that film because I was a person that didn't really believe in myself and the message of the movie and the encouragement of Ms. Lisa was really amazing and that gave me a lot of confidence. [...]. It was a reminder that I should never doubt myself and that I know what I am doing and just believing and trusting in me and who I am I will achieve success.*

Other mentees also expressed receiving emotional support, which was very important – especially during the trying time of the pandemic. Ayanna, a student in middle school, described the weekly meetings as “very comforting” because “right now not everyone has someone to talk to.” High school student, Aya, reported that she grew “relationship wise” and “friendship wise” and asked if mentees could spend more time with mentors. Regarding mindfulness, high school student, Lorenzo, mentioned how he “learned how to calm down more from the meditation.”

#### *Family-like Bonds and Inclusivity*

One of the main goals of the program is to build social skills by engendering feelings of family-like bonds and inclusivity. Evidence from the mentees suggests that this goal was achieved. When surveyed on what they got out of the program, some mentees explicitly mentioned that the program “helped build social skills” and made them “more confident in my speaking skills.”

In terms of building family like bonds, when asked about his mentor, high school student, Abdullah stated, “I don't see him as a mentor, I see him as a big brother.” Ericka, Alyssa's middle school mentee, described her relationship with Alyssa as “Incredible, I really love Alyssa.” Rhonda shared similar sentiments in one of the focus groups. Rhonda described Alyssa as an “older sister,” and the entire program as like “a second family.” She went on to describe the program:

*It's a more laid-back kind of vibe, it's like a family, and you know with your family you don't put up an act or character because they're your family.*

Students also explicitly described feelings of inclusivity within the program. Mentees were asked if they felt part of the community/family within the program. High schoolers Lorenzo and Justin stated, “Yes. I feel that I am a part of the family because everyone feels so inclusive,” and “Yes, because people are very nice and include people in everything.” Another student described their experience as being “very well welcomed” and the program as “a community that cares for each other.” Rhonda also specifically mentioned inclusivity in her interview:

*The program was very inclusive and they didn't make me feel like I had to act a certain way.*

### **Paths to Success**

“Paths to Success” is the mentoring program’s effect on the academic and professional development of mentees. This development centered around two subordinate themes: demystifying success and skills for success.

#### *Demystifying Success*

Students from underrepresented groups often face the barrier of not having parents who have successfully pursued higher education (Hines et. Al 2020). One outcome of this mentoring program has been to show mentees that going to college and securing a STEM career are indeed attainable goals for them. The mentors, after all, are living examples of this -- demystifying success, and serving as human resources that are aligned with many aspects of their lifeworlds and lived experiences.

In one of the focus group interviews, high schooler Lorenzo described how his mentor Starling helped ease some of Lorenzo’s concerns when it came to attending college:

*One thing that I have gotten out of it so far is I always thought that once you finish high school it is just going to be a bunch of complicated stuff. You are going to have no idea about what you want to do. [...] What I saw when Starling was talking to me about the*

*stuff that he did; he made it seem more streamlined, like what you can do and the way that it flows. [...] It makes me less anxious about finishing high school and going to college.*

When asked about his favorite aspect of the program, Lorenzo then went on to talk about how the mentors inspired him due to their relatability:

*[...] With the mentors because you find out a lot of relatable things. You find out that they weren't no crazy prodigy. That they were just a normal student that put in work, had good opportunities, and took them.*

Abdullah shared similar sentiments. During one of his cohort event presentations, he described the effects of his interaction with a mentor leader:

*I want to thank Garlin. He has motivated me in order to believe in myself because he came from nothing to something. [...] I would like to thank this program for putting me on the right path to success in life.*

For some students success was demystified by the nature of success being redefined completely. For example, the pre-program survey from high schooler Sherence initially described success as “Having a good job, being successful and happy.” For the post survey, his definition changed to, “I would describe being successful as being where you set yourself to be. If you feel successful, you feel like you have achieved your goals, and are content with where you are.” In a focus group interview, Rhonda had this to say about how the program helped her redefine success:

*The program has helped me not be too hard on myself and it gave me a new understanding of what success is. I feel like especially for my family, this way of thinking, and especially having parents that are immigrants, their idea of success is when you do your school work you have to get all A's [...] so you can become a doctor or lawyer [...] But being in the program has showed me success is not in regards of money, it's not only in regards of grades, because grades don't define who you are [...] You can be successful because you were able to achieve a goal for yourself that you*

*think you wouldn't be able to achieve. You can be successful because you were able to help somebody*

### *Skills for Success*

The NSBP x HGS Mentoring Program helps to equip mentees with some of the skills necessary for academic and professional success. As such, weekly mentor meetings and cohort events center around topics such as goal setting, time management, communication and general studentship.

Goal setting skills are heavily emphasized within the program. Middle schooler Ayanna had this to share:

*"I also learned important things, one of them being realistic goals that you can get done. Cuz most of the time as humans we set unrealistic goals that we do not get done, that brings a very unhealthy feeling to us. So that is a thing I practice now."*

Another middle school student, Shirley, shared, "I feel like I'm a lot more organized in goal setting", when asked about the program's impact. High schooler Reina was asked if this program helped with being successful academically, she responded:

*It's helped me set goals when it came to school. When we first started this part of the program we had to set goals [...] I set goals [...] to help me better understand my coding class. I was able to talk to my mentors and we would catch up on it and it actually helped get a better grade in that class.*

Not only were students setting goals, but also taking the necessary steps to attain them.

Time management was also emphasized. High schooler Taneisha was very expressive about the program's impact on her when it came to this. In a focus group with her mentor Lisa the following dialogue unfolded:

*Taneisha: [...] We were working on, [...] procrastination. We was working on that because I procrastinate a lot.*

*Lisa: Time management, yeah.*



*Taneisha: Yeah [...] and I'm getting better at it. But, I mean for real. I am really doing better. In my Spanish class we started semester two yesterday. [...] my Spanish teacher... he put up 20 assignments that was due before the second semester [...] So now I got five assignments left. I did it in two days!*

Taneisha was even able to offer advice to fellow high schooler Lorenzo, who asked about combatting procrastination at a cohort event. This was her response:

*Uh yea. Me and Lisa have talked about it and we were saying that we could do a checklist kind of. [...] Write out what you have to do and cross each thing out as you do them. So like it's getting done, and having your phone off or in another room or something so you can't hear it when it goes off.*

Lorenzo then went on to report that with his mentor he, “formed a little day schedule that I go through, it feels more organized.” Shirley also reported the following when asked what she gained from the program, “ I think the biggest thing was my organization with time and goals and stuff. I got a calendar and everything.”

Mentees reported developing other essential skills as well. In his cohort event presentation about studentship, Abdullah, who is an ESL student, spoke of the program's impact:

*The third bullet point is for elevating my leadership and communication skills. I was not able to do presentations 3 months ago, I was very shy and look at me right now, I'm presenting some topics, stuff like that, in front of many people. [...] I couldn't even write proper emails..*

In another example, Sherence described how the program enhanced his general studentship. He described his favorite cohort event in the post survey:

*My favorite event was how to be a good student. I liked this because it taught me to be better in class. I upped my grades across the board, I took more notes, and I was able to focus more, and improve all my tests*

## **Connections to STEM**

Two subordinate themes emerged upon analyzing mentees' connections to STEM as a result of this program. The first was general interest in STEM, and the second theme was careers in STEM.

### *General Interest in STEM*

Many of the mentees had pre-existing interests in STEM. This is likely due to them being recruited by their science teachers or during science class by the mentor leaders. Still, through this program mentees were able to further explore those interests. Jayde for example, described how science connected to her everyday life in a focus group interview:

*[...] The leader of this program [Dr. Alexander] and he was talking about how music and science relate to one another, and I didn't really know that. [...] But also in our sessions too, we learned about astronomy and we learned about you being physicists. [...] And we learned about the different sciences [...] I get to know more about science, which helps me a lot with you know the science I do and math as well. So it is really interesting to know that there is a lot of different ways that science has proceeded and it is really awesome!*

The STEM Kits also provided opportunities for students to cultivate their interests in STEM. In one of Jayde's meeting reports, she noted that for her group's botany experiment, "we had a good time and had fun discovering/exploring together." Abdullah and his mentor even put together a highlight reel of their laser optics kit and proudly presented it at the end of the year celebration event. For Shirley and Ayanna, their microscope kits were interesting experiences and their first time ever interacting with such devices. Ayanna noted that it was her favorite part of the program and she shared the experience with her family. Ayanna went on to report how it helped within the classroom as well:

*The microscope did help me to get a better understanding of what I was learning in school with atoms molecules and all those things that I remember taking tests on.*

## *Careers in STEM*

The program also helped reaffirm mentee interest in STEM careers, excite interests in other STEM fields, and helped guide mentees further along STEM pathways. Shirley's mentor nominated her for the program's STEM Kit Innovation Award, citing how the kit nurtured Shirley's career interests:

*[...] After receiving the kits, Shirley has been increasingly interested in biology and creative with using the kit in her everyday life. This first time experience of being introduced to a science project she had no exposure to, reinforced her desire to pursue a science career in becoming a neonatologist*

Others expanded their interests in STEM. In his pre-program survey, middle schooler Manuel originally listed scientist as his career interest. As the year progressed, however, Manuel's interests grew to data scientist, teacher, physician, physicist, and astronomer. Abdullah originally applied to college as a finance major, but ultimately ended up switching to mechanical engineering once he was accepted. Lorenzo had the following to say when asked if the program made him more interested in STEM and STEM careers:

*[...] Right now I'm just in the process of trying different things [...] I told you guys I like gaming a lot, you guys got me into a good gaming program [...]. It's like you take my interests and you expand on them. [...] I wouldn't say I have a final decision like I want to do something that involved STEM, but it's more like I want to try out things more that involve STEM*

Mentees also reported being able to further their pursuit of STEM careers. In one of the focus group interviews, Reina recounted her interactions with the presenters during career day:

*I was already interested in STEM so seeing people actually achieved their goal and being able to ask questions to people that work in this field also made me more interested in it and made me want to do it even more.*

Shirley's mentor had a more structured approach to career exploration. She outlined this in one of her weekly meeting reports:

*[...] we did further research in becoming a neonatologist such as finding what kind of education and skills are required. We discovered that you would need a bachelor's degree, at least 4 years of medical school, residency training in general pediatrics, and a fellowship of additional training in newborn intensive care. The skills required are strong communication skills, ability to make analytical decisions and dedication to take care of at-risk babies. Finally, we watched a YouTube video on a day of the life of a neonatologist.*

In addition, Lorenzo and another high school mentee, Tristan, were able to take part in paid summer research internships as a result of connections made within the mentoring program.

### **Transformations Ascribed to Mentee Participation**

In a telephone conversation with a teacher who taught one of the mentees in his advanced placement environmental science class, details were shared about the growth of the mentee academically and personally. The teacher talked about the progress he observed in the mentee's attitude, competence in project based activities, participation, confidence level and communication skills throughout the time that he was in the HGS Mentoring Program. The teacher could see that the mentee's role in the school was expanding into one of a talented orator and leader. He invited the mentee to share his thoughts and offer suggestions related to best ways to redesign the high school in a professional development opportunity geared toward school teachers, administrators and staff. He did so eloquently, and "with heart," which, the teacher relayed, gave proof to the transformative nature and the ripple effects that the HGS can have in many aspects of a student's life – inside and outside of school.

### **Letters Written**

Letters that describe lessons and skills learned, personal growth, the connection to not only STEM content, but others involved in the program, along with a parent's appeal to council members for support, proved to be invaluable in gaining insights into mentees', mentors' and parents' perspectives and experiences with and in the HGS Mentoring Program.

A student letter, written by a twelfth grade mentee details not benefits that he gained, but the benefits that were also gained by other mentees. What is shared in the letter includes learning about how to be a successful student, especially one who is a new immigrant; the

bonding that took place while dealing with being lonely as a result of living through the coronavirus pandemic; learning how to decrease anxiety; feeling aligned with mentors; “growing” needed skills; and being guided well through the college and scholarship application process.

Three mentors also wrote a letter on behalf of all of the mentors in the program that expressed a shared sense of purpose to give back to the mentees and their communities – especially since they resembled communities within which they once lived, or currently live. Reference to being a first generation student studying oceanography at an Ivy League college, and sometimes feeling like an imposter; feeling honored to guide mentees – often times in many different ways from which they had or had not been guided; learning from mentees as they cultivated agency in seeking out and securing opportunities are some examples of experiences mentors had while working with mentees in the program.

Finally, a letter written by the parent of a mentee that was addressed to an elected official described many aspects of the program and the value that both her son and she experienced by being involved in the program. An appeal by the parent was made to the City Council to support the HGS, as the benefits of doing so will not only benefit her son, but it will certainly benefit others involved in the program.

## Key Takeaways

The following quote from Jayde holistically represents the mentoring program's effect on mentees:

*When I first got into this program I thought it was all about science and math and how you help, but it turns out it's a lot more than that... it's about, reaching social skills, building up this foundation, and also, reaching that goal ... I think it is a really good program that really sets a mutual relationship and it really nurtures students, and teaches them different skills*

Positive outcomes pertaining to three superordinate themes were identified as a result of the NSBP x HGS Mentoring Program. The first of these themes is *Emotional and Social Support*. Mentees reported that conversations with mentors helped provide engagement, ease anxiety, and gave mentees opportunities to express their feelings. Mentees also reported feeling family-like bonds between mentors and other program members in a safe, inclusive space.

The second superordinate theme centered on *Paths to Success*. Given that mentors come from similar sociocultural backgrounds as mentees, mentors serve as living examples of the mentees' future selves. Mentors not only show mentees what it takes to succeed in STEM career pathways, but also that success is actually attainable. In addition, the program has helped to develop the social, academic, and professional skills of mentees.

The third superordinate theme pertains directly to mitigating underrepresentation, focusing on student *Connections to STEM*. The program members were able to foster mentees' interest and knowledge in STEM topics. This was achieved primarily through cohort events and the STEM kit activities. Mentees were also educated about careers in STEM. Some mentees gained new-found interest regarding specific STEM careers, while others had their interests affirmed and learned of the next steps necessary to achieve their career goals.

## Improvements and Future Plans

Based on mentor and mentee feedback, several areas for program improvement were identified. One suggestion from mentors was to intensify the recruitment of students who need support in order to activate their innate potential. One way to improve this is to have teachers recommend students from their previous year who demonstrated potential, cover a range of levels of academic achievement, and have strengths in other important personal qualities like community building, demonstrating great leadership skills, and evidencing high levels of self-efficacy.

Mentees suggested that the program create better opportunities for mentee-mentee interaction. Mentees noted that though they created deep bonds with their mentors, their relationships with the other mentees were not as strong. Some mentees suggested the idea of a mentee debate “so we can see how everybody thinks” (Rhonda), and because “it will push kids into knowing how to work as a team” (Ayanna).

In terms of future plans, and pending funding, the program hopes to expand and eventually replicate this virtual model in both formal and informal learning environments. This program is of value even when the coronavirus pandemic is finally over, because adolescents will always face challenges around loneliness, isolation, and their desire to achieve stronger and sustained academic success. The mentoring program also seeks to provide further insight into optimal ways to support young people from underrepresented and underserved populations in successfully navigating STEM academic and career pathways. NSBP x HGS Mentoring Program can plan to hold a STEM Kit symposium/competition, and further refine their mentoring model during the 2021-2022 cycle of The National Society of Black Physicists and The Harlem Gallery of Science Mentoring Program.

**A note about the organizer of this report:**

Gillian Bayne is an associate professor of Science Education at Lehman College of the City University of New York, and has served as a consultant on this project. She has over 30 years experience as a science educator at the secondary, undergraduate, graduate, and doctoral levels. Her research expertise includes utilizing student voice, cogenerative dialogues and coteaching to improve teaching and learning of STEM in diverse learning environments; examining trajectories of underrepresented scientists of color; and addressing equity issues in STEM. She also has led leadership workshop activities with professional Ethiopian women who are STEM faculty at Mekelle University in Ethiopia.

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