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"STEMcx…Just Connects the Dots": Characterizing the Impact of STEMcx on STEM Career Trajectories of High School Students Using Reflexive Thematic Analysis

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ABSTRACT: This paper reports the findings of a qualitative intrinsic case study exploring how a STEM high school internship program with six tracks in Baltimore, MD (USA) promotes inclusive excellence in STEM careers; orients high school students to participate in their social and professional communities in college; and provides students with immersive STEM experiences that reinforce their confidence and academic preparation. The study was guided by two specific research questions: 1) How does this STEM internship program shape high school students' perception of STEM careers? and 2) What are the features of these STEM internships that most contribute to high school students' formation of their early career trajectories? The data came from semi-structured interviews with 11 high school interns participating in these STEM internship tracks during June—August 2024. The data were analyzed using reflexive thematic analysis. Three themes were identified: 1) these STEM internships help participants "connect the dots" between their prior experiences, interests, and skills to their career trajectories; 2) these STEM internships help the interns find their voice and use their resources with confidence and agency; and, 3) these STEM internships help the interns learn how STEM "really works" in practice.

INTRODUCTION

The United States faces a critical need for technologists, scientists, and engineers from every race, gender, and demographic background represented in our population, yet Black, African American, and Hispanic young men and women continue to be underrepresented in STEM careers (National Center for Science and Engineering Statistics (NCSES), 2023). Significant technological advancements such as artificial intelligence, genome engineering, climate change, renewable energy, resilient infrastructure, and many others are having societal impacts that can only be addressed by producing diverse generations of well-rounded STEM visionaries. These visionaries must not only have the potential to create and utilize technologies, but they must also be able to understand and project the societal and economic impacts of these technologies. To equitably share in the benefits of these advances while avoiding unintended injustices attributable to these advances, these visionaries must represent all of our nation's backgrounds. It is only possible to achieve this by promoting equity in access to the innovation ecosystems producing these technologies while also expanding representation of all of our citizens so that their diverse interests are protected (Institute of Medicine, 2011).

While we need to expand STEM achievement, representation, and access, many young people from underrepresented backgrounds remain unaware of the diversity of opportunities in these spaces and how to access them (Harden, 2024). This lack of awareness reinforces socioeconomic barriers to entry into these professions, which in turn restricts our ability to meet society's needs through STEM innovation. For example, some students from underrepresented populations:

(a) may feel that one needs to be a certain type of person to pursue STEM careers; (b) may not have access to knowledgeable mentors in STEM careers; (c) may view STEM careers as non-responsive to community or cultural concerns; and, (d) may not have out-of-classroom experiences to explore STEM aptitude or capabilities (Wong et al., 2022).

Research Questions. The objective of this paper is to explore the role of high school summer STEM internships on college readiness and career trajectory. This research is conceived as a qualitative intrinsic case study (Stake, 2000) exploring how the STEMcx (**STEM C**onference and E**x**position) high school internship program in Baltimore, MD (a) promotes inclusive excellence in STEM careers; (b) orients high school students to participate in their social and professional communities in college; and (c) provides students with immersive STEM experiences that will reinforce their confidence and academic preparation.

This case study is guided by two specific research questions:

1. How do the STEMcx internships shape high school students' perception of STEM careers?
2. What are the features of the STEMcx internships that most contribute to high school students' formation of their early career trajectories?

Literature Review: Impacts of High School Summer STEM Internships and Programs. The literature suggests that STEM summer internship programs can have significant impacts on the development of high school students' career trajectories. On the one hand, these programs may help to influence high school students' STEM identities, self-efficacy, and future STEM outcomes. On the other hand, STEM summer internship programs can provide students with skill building opportunities and venues to integrate experiential learning with classroom learning. These programs can potentially have even greater impact for high school students from underrepresented backgrounds. These programs have the potential to positively impact underrepresented minority high school students' persistence through their future STEM majors, improve their academic preparation, provide access to STEM professional preparation programs, and initiate high school students to participation in STEM professional communities.

In the literature, high school STEM internships and summer STEM programs are understudied. Most research describing the impact of summer STEM programs on student success focuses on undergraduate students. These studies explore the effects of pre-college summer STEM bridge programs for entering undergraduates, and STEM summer, research, or professional programs for undergraduate students. Both studies focusing on high school STEM programs and internships and studies addressing the undergraduate context may be instructive for understanding the impact and best practices for high school STEM internship programs as the findings of these studies share many similarities.

Recent reviews characterize STEM internship and summer programs by identifying the most critical or influential STEM program characteristics, or the ways these programs address the institutional or cultural barriers and obstacles to underrepresented minorities' participation in STEM. For example, Palid et al. (2023) identify critical characteristics of STEM programs aimed at addressing the participation of underrepresented minorities in STEM. Their systematic review of diversity-focused STEM programming in the United States identified six common program components: opportunities for learning STEM content outside of courses; peer, faculty, and professional mentorship opportunities; opportunities for learning professional skills in context; financial aid; opportunities for promoting connections across peers, faculty, and professionals; and bridge programs before first year of undergraduate studies. Moreover, Palid et al. (2023) discuss four institutional and cultural factors that might be related to the underrepresentation of certain backgrounds in STEM: the "chilly climate" that tacitly facilitates discrimination against marginalized individuals; the lack of adequate academic preparation of some marginalized individuals (from both a deficit and anti-deficit lens); the lack of access, financially, to high-quality selective public institutions that non-marginalized populations are more likely to attend and graduate from; and a lack of adequate mentoring, role modeling, and cultural mismatch.

Tsui (2007) suggests these institutional and systemic factors can be addressed through the development of multi-dimensional programs that support students by emphasizing that the programs must not solely address the students and their needs but also must address the need for broader institutional and systemic change. The STEMcx program—standing outside of the university context—addresses these necessary systemic changes by constructing a system of extra-curricular supports (National Academies of Sciences, Engineering, and Medicine, 2016) that help to provide opportunities for underrepresented high school students to obtain the types of experiences and assets described in Institute of Medicine (2011) as essential to broadening participation in the American STEM enterprise. STEMcx interns acquire knowledge and STEM habits of mind; obtain opportunities to put discourse knowledge and habits of mind to reflective practice; develop a personal sense of competence and progress; develop a motivation to participate in and identify with the field; and obtain information about the stages, requirements, and career opportunities in the field.

It is important to characterize the impacts of the STEMcx internship program, because if it is successful, it has the potential to solidify the STEM interest of underrepresented

minorities (URM, defined here as Black, African-American, or Hispanic high school students) who have already developed an intention to pursue STEM careers, and help attract or identify URM STEM talent that may not have been intentionally considering STEM careers when they entered the internship program. Green & Sanderson (2018) suggest that it is critical to reach high school students before they enter undergraduate studies in order to develop their interest in STEM. Blustein et al. (2013) indicate the potential for a STEM enrichment/career development program—even as short as 2 weeks—to have an impact on students' construction of their career trajectory. Their findings indicated that students continued to explore STEM fields and identified barriers and obstacles to pursuing these STEM fields while also retaining strong identifications with their racial or gender background. Related to this is the cultural compatibility perspective described by Whaley & Noël (2012) which suggests that African-American culture possesses characteristics that could facilitate academic achievement. This contradicts the perspective of cultural incompatibility, that indicates identification with African-American culture and identity may undermine academic performance. Rather, programs like STEMcx might be indicated by the cultural compatibility perspective to help students construct a community of individuals with shared racial or gender identity who also are pursuing academic achievement. This community may, in turn, help the student to "see" the features of the African-American community that help to support, rather than undermine, academic achievement. This suggests that STEM enrichment programs have the potential to help students to attain social and cultural assets among a broader community of STEM interested individuals who share other facets of their identities.

Thus, in addition to helping address institutional and systemic factors, the STEMcx internship program may help participants integrate their parental and community support with their emerging STEM interests. For example, VanMeter-Adams et al. (2014) explored how early experiences in hands-on research attracted students to pursue STEM undergraduate degrees. Students in the study were participants in a summer internship program for high school and undergraduate students which required 300 hours of summer research. They found that the influence of relatives or family and childhood experiences were the most important factors initiating students' interest in STEM. While hands-on lab work did not initiate their interest, these experiences did sustain their interest in pursuing STEM careers. Garriott et al. (2014) explored the role of parental involvement and investigative learning experiences on development of math and science interest among underrepresented students. They concluded that parental support enhanced learning experiences, STEM self-efficacy, and STEM interest among underrepresented high school students. At the same time, parental involvement did not necessarily predict high school students' goals or outcome expectations (Garriott et al., 2014, 2017). Thus, while parental and community support may be sufficient for some high school students to initiate their STEM trajectory, more targeted and intentional experiences are required in order for them to develop a more sophisticated and realistic understanding of the demands of their chosen career path.

Other studies support the idea that programs like STEMcx may help their participants develop a more realistic understanding of their career trajectory. Thiry et al. (2011) identify specific domains of knowledge gains influenced by out-of-class experiences: gains in skills; clarification, confirmation, and refinement of career/graduate school plans; enhancement of career/graduate school preparation; collegial relationships with peers; development of collegial relationships with professionals; increases in confidence; developing an identity as a scientist; understanding professional practice; developing independence; and "thinking and working like a scientist." Although these findings were obtained from a study of undergraduate students, they broadly support those obtained from our phenomenological analysis of the high school students participating in the STEMcx internship.

However, some investigations may seem to contradict this idea. For example, Hsu et al. (2010) found that students participating in summer science "authentic experiences" may participate in scientific teamwork and complex collaborations, but that their representations of the science practice may be incomplete. These representations may report the results of their scientific practice as the outcome of work accomplished by individual practitioners. However, the difference between the reporting and the nature of the work experienced may have been due to the different goals of the reporting requirements of the internship and the participation requirements of the internship. At the same time, Hsu (2018) points out through their analysis of cogenerated dialogs that it is important to address the quality of the science, science instruction, and intern participation in these interactions to maximize the benefits experienced by participants. Thus, the Hsu et al. (2010) and Hsu (2018) studies support the need for out-of-classroom experiences for high school students that will help them develop a fuller understanding of their career trajectories.

Finally, the literature suggests that programs like STEMcx may provide opportunities for their participants to demonstrate creativity and autonomy in ways that may not be possible in the classroom. These programs should be designed with relatively open-ended, authentic STEM experiences in mind. In one example, Enderling et al. (2020) discusses the need to increase the preparation of interdisciplinary scholars at the undergraduate level in order to increase the number of individuals prepared for graduate-level interdisciplinary study. Their investigation evaluated a program for high school students that provided a structured introduction

to integrated mathematical oncology and included hands-on experiences. It was designed to help expose high school students to interdisciplinary educational activities early in their career and to motivate their awareness and pursuit of an interdisciplinary education. This program contrasted with what they considered to be the "undergraduate silos" most trainees experience in traditional training routes. In another example, Maker et al. (2023) argue for a change from a STEM talent identification to a STEM talent cultivation model. In this model, exceptional talent in STEM is indicated by possession of three elements: (a) ability to solve complex problems; (b) ability to solve varied types of problems; and (c) having an integrated and complex knowledge structure across multiple STEM domains. They note that problem solving is a unifying concept for general STEM abilities (see Figure 1 in Maker et al., 2023), although open-ended problems involve a broad set of factors that are best related to talent development. Thus, Maker et al. (2023) support the idea that not only might high school students benefit from hands-on STEM experiences, but they also would benefit from open-ended problems that require them to navigate interdisciplinarity and appropriate levels of autonomy.

In summary, studies of high school and undergraduate summer STEM programs and internships suggest that programs like the STEMcx internships can provide broad support to high school students from underrepresented backgrounds in several related areas:

- These programs can increase the likelihood of URMs pursuing STEM majors and careers by fostering early exposure to and identification with STEM (Green & Sanderson, 2018; Hammerness et al., 2024).
- These programs can help to integrate parental support or other community and cultural wealth assets to support the development of STEM interest or identity (Fletcher & Carroll, 2024; Garriott et al., 2014; Ozturk et al., 2024).
- These programs have the potential to sustain high school students' attraction to STEM careers, which is often initiated through family or community influences (VanMeter-Adams et al., 2014). In fact, failure to integrate culturally relevant experiences or identity may discourage underrepresented students' participation in STEM outreach programs and undergraduate majors (Fletcher et al., 2023).
- These programs have the potential to improve students' ability to imagine possible future STEM careers and pathways (Fletcher & Carroll, 2024; Przymus et al., 2021), and to increase the likelihood that underrepresented minorities will graduate with STEM degrees (Cohodes et al., 2022) and identify with STEM professions (Blustein et al., 2013).
- These programs provide opportunities for high school students to demonstrate creativity, autonomy, and perseverance in ways that typical high school internships or classroom experiences do not require (Hsu & Venegas, 2018). Additionally, summer internships and authentic STEM experiences may also introduce students to the complex collaborative and teamwork-oriented work practices of STEM professionals in ways that traditional schooling may not (Hsu et al., 2010).

Context: What is STEMcx? STEMcx (https://www.stemcx.org/) is a faith-based organization in Baltimore, MD (USA) that inspires underrepresented minority (URM) students to pursue careers in STEM by offering academic support, hands-on learning, and interactions with STEM professionals of color. New Psalmist Baptist Church (NPBC) formed the Transforming Lives Community Development Organization (TLCDC) nonprofit in 2015. Shortly thereafter, STEMcx, a division of TLCDC, was established. STEMcx began with a free, one-day conference exposing 250 Baltimore-area students to STEM through fun workshops and interesting speakers. In the past five years, STEMcx has grown to offer tutoring in math and science, book clubs, camps and workshops, field trips and six 8-week paid high school internships.

The high school internships are an important component in STEMcx's efforts to change the representation of Blacks and Hispanics in the STEM workforce with a bachelor's degree or higher. STEMcx aims to:

- counteract the negative experiences many URM students have with math and science subjects;
- contextualize students' STEM learning by demonstrating the integration of STEM experiences with students' personal interests and the interests of their communities; and
- counter the lack of STEM role models available to many URM high school students interested in pursuing STEM careers while at the same time showing participants that they belong to, and can participate in, the STEM communities of interest to them.

The STEMcx organization was conceptualized by and is currently directed by individuals with extensive industry expertise in the areas of systems engineering and control systems engineering; all STEMcx internship programs include industry participation and exposure. In this way, these programs help to foster awareness among underrepresented student groups of what a range of STEM careers look like, and what is necessary to enter those careers. The six high school internships that are the context for the data reported in this paper are: Computer Coding/Cybersecurity, Environmental

Justice, Healthcare and Health Inequities, Real World Engineering, Space Exploration, and Architecture.

Each internship includes classroom instruction in important concepts or key skills required to complete open-ended projects in the respective internships. The health inequities and computer coding internships involved individual projects of the students' choice, while the space exploration, environmental justice, real world engineering, and architecture internships involved team-based projects to which the interns were assigned. In addition to the classroom instruction and project-based learning components of the internship, interns: (a) conducted field trips to observe STEM professionals at work in their respective disciplines and places of employment; (b) participated in a week-long college tour of the institutions in or near the Research Triangle, NC (USA); (c) participated in college preparation and professional skills workshops; and (d) participated in an integrative personal care products manufacturing case study led by a local manufacturing company that hosted all six of the internships on one of their manufacturing floors.

METHODS

To answer our research questions, we employed a constructivist qualitative case study design based on semi-structured interviews, participant journals, field notes, and anecdotal observations of interns' work and field trips. Our methodological choices are described in the remainder of this section.

Research Orientation. This work is inspired by a transformative worldview (Charmaz, 2014) that is informed by my interpretation of conscientizão (Freire, 2000). The transformative worldview asserts that people must be awakened to the realities around them to then act on this reality as intelligent subjects. I adopt this orientation in order to center the experiences and voices of Black and under-represented students who reflect on the cultural and institutional factors that influence their experiences and transform those experiences to meet their own personal or social objectives. Furthermore, this work is situated within the constructivist theoretical framework. Strauss & Corbin (1998) describe the constructivist framework as one where researchers construct concepts and theories from accounts that are constructed by participants from their own experiences.

Sensitizing Conceptual Framework. Our work is informed by Wenger's (1998) communities of practice framework. Communities of practice is a theoretical framework based on social theories of learning. The social theory of learning defines learning as becoming; thus, in Wenger's theory, learners are engaged in four socially oriented dimensions that are directed toward a transformation in the learner's identity. These four dimensions are: practice, meaning, learning community, and professional identity. The practice dimension deals with the shared frameworks, tools, and perspectives used by competent members. The learning community are the groups, enterprises, and organizations that provide the principal social context defining the community's knowledge base and standards of competence. Meaning refers to the shared sense of purpose of the community. In this dimension, learning means sharing this sense of purpose with the broader community. Finally, professional identity refers to the individual history (i.e., the trajectory) through which a learner has come to identify with the community of practice. Therefore, the communities of practice framework orients the interns' experiences to both the community and the interns' own construction of the beginning of their career paths.

Participants. A purposive sample of 12 interns (two from each internship) was recruited to be individually interviewed at the end of their internship and to complete reflective journals during the research or project component of their internship. To identify the sample of 12 interns, the STEMcx chair consulted with the internship leads, the student coordinators, and STEMcx leadership to select two students from each internship. I then met the 12 students as a group to discuss the study goals and objectives, the tasks they would complete while participating in the study, and the $25 incentive they would receive after completion of their interviews and reflective journals. Of these 12 students, 11 students completed reflective journals and engaged in a semi-structured interview. These 11 students were assigned a pseudonym and are described in Table 1.

Data Collection: Semi-Structured Interviews and Reflective Journals. The semi-structured individual interviews involved three parts: (a) questions related to demographics, high school preparation for STEM careers, and family or community assets that are available to support the interns along their STEM career trajectories; (b) questions related to the impact of the STEMcx internship on the interns' STEM career trajectories and their understanding of their respective STEM communities of practice; and, (c) questions related to the interns' participation in the design and implementation of their project work during the internship.
In the first two parts of the individual interview, prompts focused on interns' professional goals and interests, formulation of career pathways, influences and sources of information, and other factors that influence career direction and professional identity development. In the third part of the individual interview, prompts focused on judgments that were required to conduct the projects, including research design choices, obstacles, improvisation or planning engaged to overcome obstacles or take advantage of emerging opportu-

Table 1. *Description of STEMcx Interview Participants.*

Pseudonym	STEMcx Internship	High School Class	What is your racial or ethnic background?	What is your gender?	What is(are) the major(s) you are considering in college?
Sandrine	Environmental Justice	Senior	Black/African-American	Female	Mechanical Engineering
Brian	Health Equity	Senior	Black	Male	Biochemistry Major and African-American Studies Minor; MD-PhD
Jamal	Real World Engineering	Senior	African-American	Male	Mechanical Engineering, Systems Engineering, or Computer Engineering
Chioma	Real World Engineering	Senior	Nigerian/African-American	Female	Computer Science or Software Engineering
Tavon	Architecture	Junior	African-American	Male	Computer Science and Landscape Architecture
Mireya	Space Exploration	Senior	Latin; Dominican Republic	Female	Mechanical Engineering Major, English or Journalism Minor
Trevor	Coding	Senior	Black	Male	Computer Science— Cybersecurity
Imani	Architecture	Senior	African, Black African-American	Female	Architecture or Computer Engineering
James	Space Exploration	Junior	Black/African-American	Male	Mechanical Engineering and Electrical Engineering
Amaya	Environmental Justice	Sophomore	African-American	Female	Biology, Zoology, Veterinary Track Courses
Ngozi	Coding	Senior	African	Female	Cybersecurity

nities, communication practices, interactions among interns and instructors, and other factors that relate to the ways engineering practice was enacted throughout the internship. Each interview was conducted after the participants completed their internship, lasted between 30-60 minutes of recorded duration, and was conducted virtually via Zoom teleconferencing software. The audio recordings were then transcribed using noScribe software (https://github.com/kaixxx/noScribe/tree/main#readme). Transcription was conducted using an "intelligent verbatim" approach. Under this approach, some of the pauses, repeated words or phrases, and transition words used in conversation were omitted to improve readability of the transcript. Each transcription was manually verified and identifying details were removed by the author before the transcript was analyzed using the Atlas.ti 9 software (https://atlasti.com/).

Reflective journals were also collected. During the last two weeks of their internship, the participants received a journal prompt every other day at the end of the internship day. The prompts were designed not only to corroborate the semi-structured interview questions, but also to explore the real-time ways the interns' experiences were contributing to the construction of their career trajectories. These journals provided reflective data that helped to contextualize the interview data alongside the interns' design and implementation of project work. Each intern who completed an interview returned at least 5 entries. Other data sources that potentially influenced the interpretation of the data included the author's field notes, unstructured observation of intern field trips, and informal conversations between the author and the STEMcx chair.

All aspects of the study design and data collection procedure were conducted under the oversight of the author's institution's Institutional Review Board (IRB) to ensure safe and ethical research practices involving adolescent participants (GWU IRB #NCR245907). The IRB-approved individual interview protocol, including the questions used to guide each interview, are provided in the Appendix.

Data Analysis: Reflexive Thematic Analysis. The data collected for this case study were analyzed using reflexive thematic analysis (Braun & Clarke, 2021). The general procedure of data analysis was as follows. First, after the audio recording was transcribed and verified, a first-pass set of *a priori* codes for the interview data were created. These *a priori* codes were generated during the transcript checking phase and reflected preliminary themes that were explored in a preliminary memo. These preliminary codes were evaluated, regrouped, and refined before final analysis of the transcript. This process yielded five themes, three of which are reported in this manuscript.

Researcher Positionality. I am an African-American male systems engineering professor who is passionate about introducing pre-college students to the multidisciplinary fields of environmental science and environmental systems engineering. Moreover, I am especially interested in exploring how underrepresented pre-college students are impacted by programs that involve them in hands-on STEM experiences such as STEMcx. Additionally, I have attended the church that provides the institutional support for the nonprofit organization where STEMcx is housed, and my son has attended STEMcx elementary school programs in Scratch coding, lawn rocket launches, and STEM fiction book clubs. The data in this paper were collected during my third year as the environmental justice internship lead instructor, and my first

as a STEMcx program evaluator. At times, I have chosen to use the first-person singular pronoun in this paper to emphasize the fact that I am both researcher and instructor in this context, and that the STEMcx internship experience is also transformative for me. I am influenced and shaped by my interactions with the environmental justice interns (and those whom I have interviewed for this study) as well as my reflection on the conversations I have had with them in semi-structured interviews and throughout the program, such that I believe it is inappropriate to write in the third-person for the appearance of objectivity when there is none possible.

RESULTS

Reflexive Thematic Analysis. Analysis of the 11 interviews yielded five themes, three of which are discussed in this manuscript:

- Theme 1—STEMcx "Connects the Dots."
- Theme 2—STEMcx helps the interns find their voice and use their resources.
- Theme 3—STEMcx helps the interns learn how STEM "really works."

These three themes are each discussed below.

Theme 1 – STEMcx "Connects the Dots." This theme explored the interconnected interests and personal factors that combine to form the nucleus of the interns' emerging career trajectories. While all of the 11 interns who were interviewed expressed a desire to pursue STEM careers, Mireya and Imani also expressed interests in arts, humanities, and literary fields. They were unclear whether their interests could be considered STEM interests. A majority of the interns had influential prior professional experiences that helped deepen their interests in STEM. While these experiences motivated them to consider the STEMcx program as a valuable opportunity, they eventually realized the unique strengths of STEMcx compared to those prior experiences. Moreover, the STEMcx program helped the students to develop awareness of other potential factors driving their interest in STEM, including professional work-life balance and financial rewards. Imani put it this way:

> *I feel like STEMcx, it just kind of like connects the dots, like, like things that were there beforehand they're still there but it connects the dots and how you can use them in like your professional life or your academic life. Like that's—it shows you like what can you do with these skills instead of just saying they're just hobbies. Like, how can you integrate that?*

STEMcx, generally, helped the students to continue to connect the dots among their interests, prior experiences, academic skills, and future goals. This sentiment was reported by most of the participants in this study. The hands-on experiences combined with field trips, book clubs, college prep resources, and community service provided a very strong stimulus for prompting the interns to think about how all of their experiences and interests connected.

But what kinds of candidates are attracted to the STEMcx internship programs in the first place? Most of the STEMcx interns across the cohorts held career or academic interests that spanned multiple disciplines. For example, consider how Imani describes her desire to combine STEM with art:

> *I'd say like, I like to draw like I'm a creative like I always needed to find like a profession that allowed me to kind of use my hands. For me the computer engineering part came in because of the building but the architecture came out because of the building and the drawing and like the discussions and stuff. Like, that's like what I'm strong at. Like I'm academically strong, but I'm creatively way stronger so I felt like I like STEAM better where it kind of like mixes are like the science, engineering, and math. That's why I chose architecture.*

How might STEMcx have helped her further integrate her interests in the arts into possible future career paths? For her, the hands-on experience provided a strong stimulus:

> *Um, so, uh, the first one that comes to my mind is definitely the sketching thing like I'm used to drawing like people animals, like scenes like I wasn't really used to like drawing like houses and stuff like that, but it was able to like kind of like tie in and then like stuff like floor plans and blueprints like I enjoyed in my engineering class but like it just showed you like how to tie it in and stuff like AutoCAD like I work with computers in school, but to be able to like use a program in a way that combines math and art was just, it was like interesting. Like it just connects the dots and it shows you like where you could go in the future like with that information knowledge.*

In the interview with Imani, she expressed some concern that her skills might not be considered STEM skills or particularly relevant in the engineering space. For example, she describes not being interested in pursuing college:

> *I mean for me before I was just genuinely just tired of school honestly for a long time I just didn't even want to go to college, honestly, and I felt like that wasn't an option given my household but I was just I was just so exhausted but then after I seen like STEMcx I'm like, you know, even if I do go to*

> *college like the experience of being in college, that still holds value in itself.*

On the one hand, she knew that her household (i.e., her parents) wouldn't permit her not to attend college. Yet, she felt that schooling was exhausting because she didn't see many of her interests represented in viable or interesting career paths. For example, elsewhere in the interview, when asked about how STEMcx impacted her ability to participate in STEM fields, Imani responded:

> *Well, it definitely made me feel like, okay, maybe, maybe I could be good in STEM, like, like I thought for a minute I was about to, I was thinking like major in art major in music and I was just like, now I feel like I'm like qualified for like STEM fields like there's something in there for me, you know...*

Indubitably, STEMcx helped to make it clear to Imani how her interests cohere in a career path in STEM. Moreover, it is clear from her words that she may have had trouble envisioning herself along a STEM career path if not for STEMcx.

Additionally, study participants had salient personal or professional experiences that sparked their initial interest in STEM. These experiences with culture and the arts, video games, family or community, community service, or affinity groups play broad roles in sparking a practical curiosity in STEM that prompted the interns to explore these career paths more deeply (Gaskins, 2021). Such experiences provided interns with a personal connection to the types of impact their future careers could have on the world around them in a tangible way (Barton & Tan, 2009; Bonsignore et al., 2013). For example, Mireya describes the impact of watching the movie Hidden Figures on her consideration of mechanical engineering as a possible career path:

> *So at that point I watched Hidden Figures and that was a really big portion. Um, cause I watched Hidden Figures and when I saw Mary Jackson and how she was one of the engineers and the trio, I realized that that was what I wanted to do and that I really want to build things. Um, and especially build things that can fly as I don't know. I just, I'm amazed by, like, things that can fly and flying objects.*

And Tavon described how the Minecraft video game influenced his consideration of how his interests could lead to a STEM career:

> *It came about because I would do a lot of things where I would really be creative in like building things and not just like houses. But also, I would love to focus on like, let's say for example, I used to play Minecraft a lot because of the creativity I had in my mind, because I'm a really creative person. And so, I would like landscaping things, even if they were on the building, and really get into detail. That's what really sparked my interest and really wanted to be a landscape architect is the way how they build the environment, like they help the environment come along with the buildings.*

Trevor described how his experience of having his video game account hacked led him to consider cybersecurity as a career path. After doing online research into the best methods for accelerating his video game progress (in order to recover some of his losses), he noticed that the same skills could be used to improve security measures. This drew him toward ethical hacking after watching a documentary about several ethical hackers:

> *Um, yeah, I listened to, like, a lot of documentaries about like former hackers. Actually, before I got on the meeting, I was listening to a documentary about a guy, a teenager who…started hacking Instagram accounts for, like, rare usernames. And so like, that's, that's probably like the biggest influence that I have.*

On the other hand, prior research, internship experiences, or affinity groups provided a different introduction to possible STEM career paths by providing the interns enough of a glimpse of possible futures to prompt further exploration (Vela et al., 2020). For example, Sandrine describes her participation in STEM affinity groups at her high school:

> *So that school and Poly and some people from Western, I think we started getting people from Western last year.* [...] *We're like going to Park and then we're figuring out how to like help the Arctic. So like there's like the different groups. There will be like the science group, which is like the DNA where they're working in the lab, being like what DNA is like the best for that environment and stuff like that. They have the GIS group. And I think they're—actually that group is going to a conference soon for their stuff. And then my group was the engineering group and we did like we were building probes to dig deep into like the frozen dirt that's in the Arctic.* […] *They were trying to see like how many caribou are in the Arctic and how they can help them. Oh, and then the PR group is just like trying to figure out like how can we grow isomer as a whole. So they're like different groups. And we go there like every Monday.*

Similarly, James also was able to use the STEMcx program to build on his high school's resources:

> *They offer this thing called Project Lead the Way. It's like an engineering type class where you can like*

> *build it. They help you like be more creative. And it helps you like build different things. Like they have a thing where we build a game by ourselves in groups and everything. And* […] *we got to choose whatever game you wanted to build or make your own game. And then they offer this challenge where you try to like use like a blow dryer and try to have like this car and try to make sure that the car can travel with the blow dryer and stuff like that.*

These interns, and several others who were interviewed, attend high schools with substantial STEM resources and broad exposure to a range of affinity groups and extracurricular activities that provide exposure to pre-professional experiences. These experiences were instrumental in helping these interns construct STEM identities, which then prompted them to seek out opportunities like STEMcx to continue developing their professional repertoire.

Theme 2 – STEMcx Creates a STEM Community of Color That Helps the Interns Find Their Voice and Use Their Resources Effectively. This theme explored the question, "How does STEMcx help its internship participants find their professional voice and expand their STEM self-efficacy and/or professional agency?" In this context, "find their professional voice" refers to the ways that STEMcx interns experiment with their emerging STEM professional identities during their internship experiences. Professional identity refers to the ways that students assume the particular ways of speaking and acting recognized by the STEM disciplines they are interested in. Some researchers refer to these ways of speaking and acting as discourse identity (Berkenkotter et al., 1988) or identity production (Tonso, 2006a, 2006b). We use the phrase "find their professional voice" because it better reflects the colloquialisms used by the students themselves and the STEMcx staff supporting them. STEMcx provides a unique opportunity for the interns to explore new skills, potentially make mistakes learning those skills or navigating technical judgments, and develop confidence in one's professional voice by overcoming those challenges. Moreover, while developing their voice the interns are doing so in the context of a unique community of interns of color. The interns value the new friendships and community they forge throughout the program, and these communities within and across internship cohorts help the interns to find strength in the critical mass of other high school students of color pursuing STEM careers (Hrabowski, 2018). As Brian said, "I felt like, yeah, after the whole summer STEMcx, became a new community."

Clearly, this community development was one of the strongest impacts of the STEMcx program. There were a range of activities that helped to build and strengthen these bonds, but Chioma cited the North Carolina college tour as a shared experience that really strengthened the relationships among the interns:

> *I think, like, after* [the trip] *to North Carolina, we all got a little bit closer. So, it was easy to, like, talk to them and, like, ask for help, as opposed to the beginning where we were just meeting each other.*

From Chioma's account, we see that the connections matured throughout the program. After the North Carolina trip in week six, it was easier for her to talk with her peers and ask different types of questions or be open to seeking help. This idea is reflected in the broader literature which shows that a sense of belonging is positively correlated to STEM achievement (LaDue et al., 2024). Because STEM identity development is situated within community, it is a prerequisite that the interns experience belonging to the broader group. If the interns did not sense a connection or a sense of belonging, they would not be able to take the personal risks necessary to learn (Pierrakos et al., 2009).

Another reason belonging is so important is that the connections the interns built with each other helped them to start looking toward the future. As Brian noted:

> *And then for the, like, overall internship—I guess maybe I guess like a big success was just making, like, lasting connections with people. Like I met—I don't—aside from* [the interns from my high school] *I didn't know anyone in my internship group coming in. But like everyone's just incredibly supportive of each other and I hope that we can stay in touch.*

However, whatever potential resources the community holds remain inaccessible until one senses they belong to the group. Sandrine said:

> *…it was easier to talk to other people, if that makes sense. So like if, like the more I started to like get out of my shell, that's what I'll say, get out of my shell with talking to new people and people with higher experiences than me.*

Once a sense of belonging was established, the community could provide resources to the intern to help them in the future. In other words, it was possible for the interns to think about accessing their community in the future since they had experienced connection and belonging to the group. Having the ability to foresee one's participation in this community into the future had concrete benefits. For example, Amaya described thinking about the value of having STEM peers who were going to be a few steps ahead of her along the college process:

> I *think it adds connections because the people I made friends with during the internship, they're*

> *going to go to college as well. Especially because they're older than me. I think I was the youngest one in the whole entire internship. So* […] *most of the people that I made friends with or like have their contact information are going to be going to college next year. So I can definitely ask them questions about like college or like how their major going if I end up like choosing something* […] *that they're majoring in currently.*

But as Ngozi noted, belonging also helped the interns to take risks and engage with their subject matter more authentically as they became aware that their struggles and challenges were not necessarily unique among their peers: "I was like, oh, so I'm not the only one that feels this way."

This sense of security allowed the interns to be appropriately vulnerable. They were able to try difficult things and participate openly in the group meetings. They were able to ask questions. They were able to find their voices and express themselves through the STEM fields they were learning. For example, the hands-on experiences in each internship put students into scenarios where they had to make difficult choices about how to proceed. These choices might not resemble their prior experiences, and so they had to rely on the experience of others to get started. Consider Brian's experience:

> *…I guess just like not completely knowing where to start was it because I've never really done I've never done a project like with, like, racial disparities and cancer stuff so I didn't really know where to start at first. But I was kind of guided like just to look things up and then just like on Google Scholar and then like go from there.…I think that…getting unstuck is a big thing* […] *there was another challenge with the methods section because I was just doing basically a literature review. So I did have to get help from Dr.* [name redacted]. *She's the person that runs the whole program so I did have her help for, like, writing my methods because I wasn't completely sure what to do.*

In Brian's cohort, the interns were required to do individual projects under the guidance of a graduate student and the program director. Thus, they needed to develop a sense of trust with those leaders. In the case of the space exploration and coding internships, the interns worked in teams alongside their peers. For example, Ngozi describes how asking questions went counter to their usual experience of doing everything themselves:

> *And I tend not to, like, ask questions. I usually try to do everything by myself and research by myself. So I was a bit nervous about if I was going to get it to actually work.* [...] *But I think the thing that I did differently this time compared to any other time that I would do a project was to utilize my resources, the people that were actually there to help me.* [...] *I mean, they did put a lot of emphasis on, like, if you need help, don't sit there silently.*

Ngozi was able to overcome her fears of appearing unprofessional or unprepared and realize that her peers and instructors "were actually there to help [her]." However, in order to receive this help, she was required to speak up and not "sit there silently"—she would be required to find her voice. Mireya was more explicit about the hesitation one might feel when it comes to speaking up:

> *…with questions come speaking, and I have a bit of an issue with speaking up, because I don't want to come off as rude or interrupt a person. But the internship, especially my intern lead, she, I don't know if her being a psych major also helps, but she likes to tell us that we also have to advocate for ourselves, because this is also a job. So if we have a project, if this is our project, and our objective is to understand what we are doing, we have to advocate for ourselves and learn. So I feel like she definitely—the program definitely helped that skill advance—for me to not be afraid to ask questions.* [...]

In Mireya's interview, she described some of the challenges that came with utilizing math to design her rockets that was not yet taught in her school. Through that experience, she was able to reflect on the importance of asking questions and seeking different explanations from her friends, fellow interns, and instructor. She felt she "had to take that on [herself] to learn so that way [she] can better understand" since the project had to be built and executed, and ultimately presented at the closing ceremony. Therefore, although she was aware of some of the potential negative perceptions associated with asking questions, she was aware both of the strength of the STEMcx community and the deeper understanding she would gain of the mathematical concepts. These positive benefits outweighed any potential negative perceptions.

Revisiting Ngozi's experience, we can see how some of the positive consequences the interns experienced when speaking up could contribute to building their individual agency. In finding her voice, she was empowered to use other resources available to her. Belonging to the community and finding her voice not only empowered her to seek help from other people, it also empowered her to assess and utilize all of her resources independently:

> *So I utilize my resources. So, yeah, I'm just really happy that I got it to work. There were times where I was just like, I don't know the code that I'm supposed*

> *to use. I don't know how to apply this thing that I've learned. I don't know what I'm supposed to do. I try to search it up on Google, but it doesn't really match with what I'm trying to do. I had to figure out how I was going to search it up on Google to figure out what I wanted to like get from it exactly.*

In other words, finding her voice and gaining the confidence to admit she did not know where to start also gave her the confidence to find and utilize other resources independently. This process yielded overall success in her coding project.

Theme 3 – STEMcx Helps the Interns Learn How STEM "Really Works." This theme explored the questions: "How does STEMcx programming and internship design help students gain clarity about their career trajectory?" and "What does STEMcx help students learn about the 'true' nature of STEM careers and professions?" This theme captured the ways that the hands-on experiences and field trips not only solidified the interns' interests in STEM, but also helped them better conceptualize the breadth of opportunities in STEM. At the same time, the hands-on experiences and field trips helped open the interns' eyes to career realities and provided opportunities to develop relevant experience and expertise in their chosen STEM pathways. Chen et al. (2024) suggest that these experiences shape students' self-concept and their subsequent motivation to pursue STEM careers.

Jamal's words provide an introduction to this theme: "[the STEMcx internship] revealed that... I didn't really know how the engineering worked." This is a good summary, but one should be careful not to read this pejoratively. Instead, consider this statement as a fact about the prior exposure many of the interns had to STEM careers. The interns all expressed that the STEMcx internship was instrumental in helping them develop a more accurate understanding of the everyday nature of STEM careers. For example, Jamal noted how the STEMcx internship illuminated the role of teamwork in engineering:

> *I didn't know if you work in teams, if you work alone. So it revealed that you mostly work in teams and you have to use communication skills to make sure you know how every part is working and make sure that you just know what's going on and you're not just sitting there.*

Similarly, Sandrine expressed surprise at the range of careers available in the field:

> *That one, the water plant does way more than what they take credit for. I thought, I learned a lot at the water plants.* […] *Before we started here, I didn't even know that the Secretary of the Environment was a thing. I didn't think about that. So learning that there are other careers out there in the same field, that was kind of cool.*

Brian's words showed that convincing the interns that they belonged in these professions was just as important as providing them with an accurate picture of the everyday on-the-job realities:

> *I guess those things just, I guess altogether kind of show me that it's possible and like the different routes I can take to get there and then also like offering support in that. Yeah.*

On the one hand, this sense of capability affected their ongoing STEMcx work as the interns reflected on how the practices they were engaging in might resemble their professional futures. Jamal put it this way:

> *It definitely influenced my ability to work in STEM fields because we did basically what engineers do just on a smaller scale. So, for example, our train system was almost exactly like the Amtrak train system, just on a smaller scale.* […] *I feel like it helped just understand everything that we needed to do and just giving me a better view of what engineers do.*

And James noted:

> *Building that rocket also showed me what to expect with working in a team. Like how everybody has different things to do. How there's even a deadline. We had a deadline for it had to be done in within that week. And so that also was a good simulation of how to what to expect in the future for me.*

Observing the engineers and STEM professionals in their workplaces helped the interns to make judgments about what professional and technical skills they were learning during their internships, and how these compared with the skills they observed the professionals utilizing in practice. Another impact of these experiences with STEM professionals in their real-world on-the-job contexts was to broaden the STEMcx interns' perspectives about the breadth of opportunities available in their fields of interest. For example, Chioma's reflected:

> *A lot of the field trips we went on were in different careers with engineering. So like, our project was trains, so we went to a lot of transportation institutions.… So like, seeing how coding and engineering worked in their daily lives was like a different aspect than what I was used to. Because for career-wise, I was only interested in coding. I didn't really know a lot about engineering.… So I wasn't*

> *really sure what to expect. So I would say it really opened my eyes and gave me like a different view on what, on different careers that you could go to and what else coding applied to.*

Many STEM interested students express an appreciation for math and science or have some capability in coding or problem solving. What these types of students may sometimes lack is an awareness of specific career trajectories within STEM (Zhang & Barnett, 2015). This intern illustrated this pattern. She said that "career-wise, [she] was only interested in coding" but that the STEMcx internship "opened [her] eyes" to the different careers coding made available to her.

Much of the impact of the STEMcx internship was to help the interns realize that their chosen STEM professions were possible for them, personally. For example, Imani had been thinking that STEM fields were not for her. However, after learning about the practical realities of landscape architecture, she felt qualified to consider these fields:

> *Well, it definitely made me feel like, okay, maybe, maybe I could be good in STEM, like, like I thought for a minute I was about to major in art, major in music, and I was just, like, now I feel like I'm like qualified for like STEM fields like there's something in there for me, you know.*

This was a critical impact of the STEMcx internship programs. Without the range of programmatic elements that exposed the interns to practical realities in the fields they were interested in, interns like Imani might not have considered further pursuit of STEM careers. Moreover, their decision not to pursue these careers would have been based on incomplete or inaccurate information about the ways their interests are reflected in these professions (Zhang & Barnett, 2015). Therefore, not only did the interns gain a more complete understanding of their desired STEM trajectory, they also received the benefit of learning from the role models they observed in the process:

> *Some of the advice I would say is kind of like believing more in my…like having confidence in myself. I feel like that was more the whole thing of STEMcx, that you're able to do it, that you don't have to follow this certain path. You can be successful in whatever path that you choose, because at Racsol, there was one lady…. She was she's a—she'd been a software engineer there for I don't know how many years, a while. And she basically told her story about what she's done, what she's been through. She was like kind of like the person that I aspire to be like, you know. So she was more so like believe in yourself because it can get tough, especially being a woman in STEM. It can get tough. There are going to be people that don't, like, see that you're capable of doing something, you know.… So the best advice that I would say that they gave me was just to like have more confidence in my like skills and expertise.*

In this case, the advice Ngozi gleaned from her participation in STEMcx ended up giving her more confidence in her skills and expertise. Surely this confidence will help to promote her entry to, and persistence within, the computer science trajectory she is seeking.

Admittedly, most of the candidates pursuing STEMcx internships were interested in STEM and felt they were qualified for STEM careers before pursuing these internships. However, even these interns had their career interests crystallized after interacting with professionals in their fields of interest during the STEMcx internship. For example, Brian knew he was interested in pursuing an MD, but the prior programs he'd participated in did not provide an opportunity to shadow doctors or other healthcare professionals as closely:

> *And then I think that STEMcx kind of combined the two in a way because it was, I guess like a different kind of research, but it was a whole other environment…. Actually, I didn't get to really shadow doctors very easily through my hospital experience before this and STEMcx just made it a whole lot easier to do that kind of stuff. And also, it just kind of reinforced what I wanted to do with my life.*

Not only did the STEMcx program reinforce what Brian wanted to do with his life, but it also provided insight into the potentially difficult parts of this job:

> *When I was first interested in medicine, I kind of thought about it, like, just like a happy thing but I guess this program…it kind of just introduced the aspect of death in medicine so just being aware that things aren't super just happy if that makes sense… And just being aware before you go into things was very helpful for me at least.*

The realization that he would be confronted with death in his profession did not deter Brian's interest. On the contrary, he found it helpful to be aware that he would encounter death in medicine. By being exposed to this aspect of medicine before being confronted with it in his training, there is the potential that he will be more likely to persist in the profession.

In summary, the STEMcx internship program provided engagement with STEM professionals in real-world ways that solidified the interns' interests in STEM and helped them to bring their futures, as Ngozi said, "more to reality":

> *So I feel like the internship kind of brought it more to reality. Like, I feel like with my career and my future, it was more like in my head, like, this is what*

I'm going to do.… But being able to talk to, like, you know, professionals and people that actually work in the field. And like [it] *was able to give me like a perspective because there are courses that I've taken and I'm like, I don't know if I could do this in the future.*

DISCUSSION AND CONCLUSIONS

Analysis of the 11 interviews indicated the broad impacts that STEMcx made on high school participants' understanding of their trajectories into STEM careers. STEMcx programming helped the interns connect the dots among their personal interests, academic schooling, college preparation, and professional skill development. Additionally, the programming fostered the creation of a dynamic, inclusive STEM community of color that provided a safe space for technical and professional skill development. Furthermore, the design of the internships included components that supported interns' college and pre-professional preparation processes. It is important to point out that although the student population that was the subject of this research is URM, it is the conviction of the author and STEMcx that the challenges faced by these particular students generalize well to other populations. All STEM interested individuals will benefit from (a) real-world internship experiences that help them connect the dots between their interests and STEM careers; (b) high school internship experiences that help them develop their professional skills and confidence; and (c) exposure to the day-to-day realities of STEM careers as described by practicing STEM professionals. The themes described by our research participants allude to best practices in the design of high school internships that will be beneficial to all pre-college STEM interested individuals.

The data presented this paper demonstrate that STEMcx fosters the development of new friendships and community. This facet was among the most consistently impactful feature highlighted across the participant experiences reported in this paper. All of the interns who were interviewed revealed that STEMcx gave them unique opportunities to foster friendships with other underrepresented high school students interested in the STEM pathways represented by the internships. The interns found belonging and encouragement through the friendships and relationships they built through the programs, and many indicated a clear intention to continue these relationships beyond the close of the internship.

Additionally, STEMcx promotes broad awareness of possible STEM career pathways. Although it is no surprise that most of the interns who were interviewed intend to pursue STEM majors in college, all of the participants commented that they were not aware of the breadth or scope of the careers available in the spaces they were interested in. This is a key strength of the design of all six of the internship programs. For example, although a space exploration intern might be interested in pursuing aerospace engineering, the space exploration internship presented the work of practicing aerospace professionals in a way that could lead the intern to understand the diversity of engineering pathways one could take to arrive in the aerospace industry. One of the space exploration interns stated this explicitly, describing how they knew in advance of the internship that they wanted to pursue aerospace, but left the internship knowing that they could focus in school on systems engineering, electrical engineering, or mechanical engineering and still end up in aerospace. This way, they would be able to preserve the flexibility of career paths offered by those additional engineering majors they could now consider if in the future they decided to shift their focus. The ability to help widen the awareness of possible STEM career pathways is a strength of the current internship design.

STEMcx helped the interns envision themselves in STEM professional practice. Along with helping the interns become aware of the breadth of STEM pathways, even within a specific academic major or professional community of practice, the STEMcx internship helped the interns imagine *their own futures* within professional practice. For example, the environmental justice internship was almost all women (7 of 8 interns), and the visit with the Maryland State Environmental Secretary Serena McIlwain at the Maryland State Capitol—mentioned by both of the environmental justice interns who were interviewed—helped these women to clearly envision themselves in technical leadership. Additionally, it opened their eyes to be able to "see" the other women in leadership and technical capacities at DC Water, Patuxent Environmental and Aquatic Research Laboratory, Baltimore City and other field trips. More importantly, the women were able to see themselves in these fields and reflect on the type of life they would want for themselves, not primarily the exclusion of women that is often emphasized in these spaces. In addition, STEMcx creates safe spaces for technical exploration. While it is difficult to say which technical, hands-on experiences will best transfer to interns' college and professional careers, all of the interns who were interviewed had opportunities to learn from practicing or emerging (in the case of the health equities program) professionals. The hands-on projects, field trips, and other experiences provide safe spaces for the interns to explore new skills or opportunities while having the support of hard-working peers who could help overcome gaps in knowledge or hesitancy with trying new skills.

Finally, STEMcx gave the interns opportunities to experience positive teamwork. The interns who participated in internships with team or partnered projects mentioned the value of these experiences in contrast to their typical team project and class experiences in STEM high school courses. While STEM courses in school usually emphasize individu-

al achievement, the interns observed professionals working in teams. Moreover, some of the interns who had participated in teamwork at school mentioned that school-based team projects usually included an uneven distribution of effort where hardworking students are penalized by being forced to work with students who may not share the same values or work ethic. In contrast, the environmental justice, real-world engineering, space exploration, and architecture interns participated in team based or partnered projects and observed professionals in these spaces working in teams. Their STEMcx peers participated in their projects equitably. When asked whether they experienced conflicts or unmet expectations during their team projects, most interns did not report any conflicts, and only one intern indicated potential disagreements about work direction with their colleague. No interns reported unequal distribution of effort or workload in the interviews. The combination of their internship projects and field trips helped them to understand the importance of teamwork to their STEM professional futures in a positive way.

In summary, the STEMcx internships programs provide strong opportunities for the interns to experience personal and professional development. They provide opportunities for the interns to participate in engaging, yet challenging, hands-on experiences that combine the application of technical skills with personal development and community building essential to successful entry to STEM professions.

ASSOCIATED CONTENT

Supplemental material mentioned in this manuscript can be found uploaded to the same webpage as this manuscript.

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ABBREVIATIONS

BGE: Baltimore Gas and Electric; IRB: Institutional Review Board; NCSES: National Center for Science and Engineering Statistics; NPBC: New Psalmist Baptist Church; STEMcx: STEM Conference and Exposition; TLCDC: Transforming Lives Community Development Organization; URM: Underrepresented Minorities

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