The Chronicle of Mentoring & Coaching,
2024, Vol. 8, No. 1
doi: 10.62935/yg5404

The Chronicle of Mentoring & Coaching

Developing a Career-Focused, Diverse Mentoring Program for Underrepresented STEM Undergraduates

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The racial and gender composition of the STEM workforce and holders of advanced degrees still has low representation from those traditionally underrepresented groups (URGs) in STEM. Having little representation of URGs in the STEM workforce, especially among academic faculty, perpetuates the issue of STEM students having few, if any, diverse STEM faculty to engage which has been shown to hinder retention in STEM. While involving STEM students from URGs in research mentoring experiences with non-minority faculty mentors addresses this issue to some extent, it also may limit a student's exposure to STEM careers beyond academic research which may help retain them. Thus, the UMBC STEM BUILD program developed and implemented a career-focused mentoring program that included a broad array of STEM professions from URGs to support career development of 2nd year STEM students.

Keywords: mentoring, career development, STEM

Acknowledgement: This work was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Numbers TL4GM118989, UL1GM118988, and RL5GM118987. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Introduction

Some progress has been made in increasing the number of undergraduate, graduate and professionals in science, technology, engineering, and mathematics (STEM) from underrepresented groups (URGs) due in part to long-term strategic investments in interventions over decades that support the recruitment and retention of URGs in STEM (Estrada et al., 2016; Summers & Hrabowski, 2006). In the past ten years, URGs obtaining science and engineering degrees at the associate's level increased by 13% while at the bachelor's level and beyond, the increase in degrees obtained by URGs was only 3-6% (National Center for Science and Engineering Statistics [NCSES], 2023). Furthermore, the composition of the STEM workforce showed very little change regarding gender, race and ethnicity, and disability status between 2011 and 2021. For Hispanic/Latino STEM workers, there was a 4% increase while for Black/African Americans, there was a 2% increase over those ten years. Females, who earn half of the science and engineering degrees conferred, make up 35% of the STEM workforce (NCSES, 2023). Although more people from URGs are earning science and engineering degrees than were earned ten years ago, especially at the associate degree level, this fact has not translated to more advanced degrees nor STEM careers as was expected. Retention of URGs within the STEM education and career pathway is still a major challenge (Martin et al., 2013; Park et al., 2021).

One issue contributing to this challenge is the lack of strong interactions between URGs and STEM professionals (Martin et al., 2013; Park et al., 2021), with many of those professionals not mirroring the diversity of the students. The most immediate and consistently strong interaction of all STEM students that leads to greater retention and degree attainment is with the major-relevant faculty (DeAngelo, 2014; Flynn, 2014). But the existence of STEM faculty that mirror the diversity of the students is extremely low. Of the 10.4% of faculty positions in all fields held by underrepresented racial and ethnic groups, 73% are contingent positions and in the STEM field a small percentage, 8.9%, of contingent positions exist (Fitzmorris et al. 2020). This means that there are very few STEM faculty from URGs overall and even fewer, if any, tenure-track faculty. When it comes to cross-racial student-faculty interaction, STEM students from URGs may experience a comfort barrier as discussed by Park et al. where Black students experienced more discrimination by faculty (2020).

One way to address the barrier of student-faculty engagement to help retention of URGs in STEM, despite a non-diverse faculty corps, is through the well-proven intervention of faculty mentoring of STEM students (National Academies of Sciences, Engineering, and Medicine, 2019; Saddler, 2010). This is typically done by faculty who lead students in a research project for academic achievement while also providing career advice and engagement (Estrada et al., 2018). Selected academic faculty mentor students through a hands-on research experience involving collaborative activities such as project planning and problem-solving (Atkins et al., 2020; Pfund et al., 2016). This type of mentor-

protégé engagement has been widely used and can increase self-efficacy, science identity, grade point averages, and academic goal clarity of STEM students from URGs. These increases are found especially when students are mentored directly by a research faculty mentor instead of postgraduate researchers in the laboratory (Aikens et al., 2016; Estrada et al., 2018; Hurtado et al., 2009; Tsui, 2007).

However, this widely used mentoring method for URGs in STEM can limit the student's view of academic research careers and STEM occupations overall. The STEM workforce consists of a wide array of jobs that go beyond those focused on conducting research for the advancement of knowledge. To start, research in academia varies along the research continuum of basic, applied, translational, and clinical research (Austin, 2021; Organization for Economic Co-operation and Development [OECD], 2015), essentially moving from research for knowledge advancement to research for practical application. Furthermore, research-focused occupations at a private company or government agency look quite different than those in academia. While the faculty mentor may have some awareness of the STEM careers outside of their academic research areas, they may be limited in their ability to provide advice and insight on broader STEM careers. As an example, in Johnson's study, Black, Latina, and American Indian women science students were discouraged by the faculty's narrow focus on the science itself instead of practical applications and their limited time to provide career advice (2007). Thus, a faculty mentor's inability to advise students on the full breadth of STEM careers in research and beyond could impact a student's ability to see how their STEM career goals can align with their personal and cultural values. For women in STEM, achieving their altruistic and communal goals through STEM is important, but without seeing that in their education and research experiences, many exit STEM (Diekman, 2015; Johnson, 2007).

A variety of factors increase retention of STEM undergraduate students and foster their sense of belong in the academic community. The risk of attrition for STEM students typically occurs during the first year when the curriculum is particularly challenging; however, first-year students credit the advice and guidance from an engaged mentor as bolstering their academic self-efficacy and performance (Apriceno et al., 2020). Diverse students pursuing STEM as a career credit inclusive learning and interactions with matched-background mentors with strengthening feelings of STEM belongingness (Kricorian et al., 2020). The importance of these linkages to improve the persistence of URGs in the STEM workforce is why recommendations on writing exercises and connecting students to community-based learning opportunities have been proposed (Estrada et al., 2016).

Given the success of faculty mentoring in improving the outcomes of STEM students from URGs, we proposed broadening the use of the mentoring model to having STEM professionals beyond those in academic researcher mentor students related to career aspirations. Interestingly, there are many STEM professionals that can serve in this capacity. Of those with a doctorate degree in STEM who are typically expected to transition into a faculty position at a 4-year institution, only 39% held such positions in 2019 (National Science Board, 2021). This means the majority of STEM professionals, even at the doctoral level, are pursuing other STEM jobs besides academic research. While the pool of STEM professionals from URGs is small, the importance of having diverse mentors is important given the literature suggesting that students prefer mentors from the same race and gender, feeling that they receive more help from them (Blake-Beard, 2011).

The proposed career-focused diverse mentoring program was developed for the STEM Building Infrastructure Leading to Diversity (BUILD) program at the University of Maryland, Baltimore County (STEM BUILD at UMBC). Launched in 2014, the NIH-funded STEM BUILD program aimed to scale proven interventions for URGs in STEM to an institutional level for lower division undergraduates with the goal of yielding more STEM baccalaureates and those pursing STEM careers and advanced degrees. Interventions included enhanced academic advising, a STEM living learning community, research courses, and faculty development. While the development of cultural sensitivity and inclusive pedagogy in faculty was encompassed in STEM BUILD, this did not fully address the issue of having the presence of STEM faculty who represent the diversity of the students. UMBC is making efforts to increase the number of full-time URG faculty through the Fellows for Faculty Diversity Program, Natural Sciences Pre-Professoriate program and, more recently, the NIH Common Fund's Faculty Institutional Recruitment for Sustainable Transformation (FIRST) program (Culpepper et al., 2021). However, until these faculty diversity programs produce significant results, STEM BUILD students still face the same potential barrier of engaging with faculty who don't mirror their diversity. Thus, the mentoring program was developed to provide an opportunity for students in the STEM BUILD at UMBC program to receive career-focused mentoring from STEM professionals from URGs.

Methods

The mentoring program was initially conceptualized to leverage UMBC's diverse STEM alumni professionals and affiliates by providing a supplemental intervention to students in the STEM BUILD Training Program (BTP), which was a major component of the overall STEM BUILD at UMBC initiative. Each year, approximately 20 first-year admitted STEM students were enrolled in the BTP and received two years of financial support and interventions such as enhanced academic advising,

a STEM living learning community, and research courses. While BTP trainees were not exclusively from URGs, the program prioritized diversity in STEM and STEM BUILD interventions focused on those that help URGs specifically. Each group of BTP trainees was considered a cohort. After two years in the BTP, trainees transitioned from active to affiliate status, and, although they no longer received financial support, they continued to have access to academic assistance such as advising and support for attending conferences.

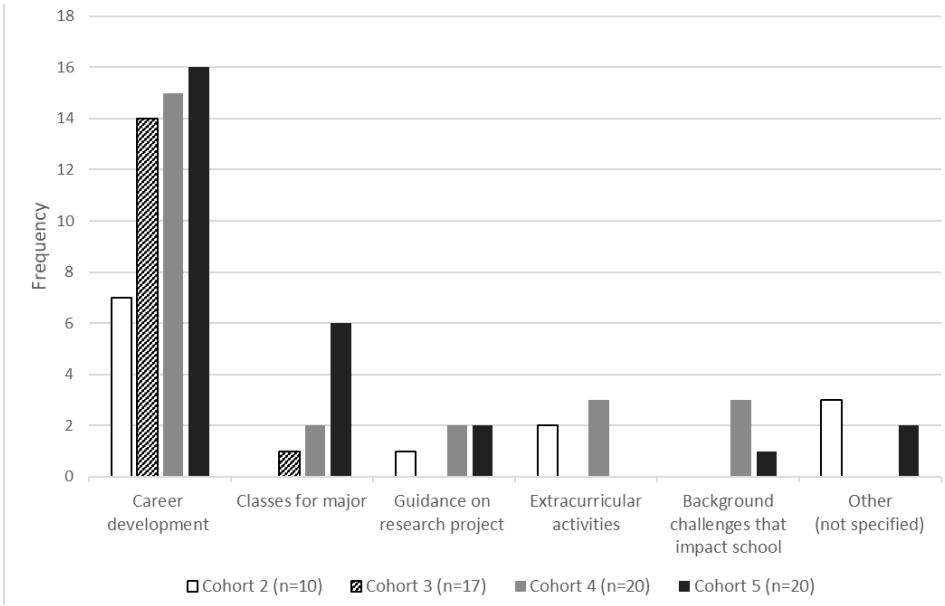
To begin the development of the mentoring program, BTP trainees over four cohorts were surveyed to understand what mentorship they sought from a STEM professional. Figure 1 shows that, for each cohort, the majority of trainees were interested in receiving career mentoring. In addition, most Trainees indicated that they wanted one-on-one, face-to-face mentoring until they graduated (data not shown). However, these parameters were weighed against factors that would make mentoring feasible for the mentors. Previous UMBC staff of alumni mentoring programs at UMBC noted the frustration mentors often experienced when their sole mentee did not show up for meetings (personal communications). Thus, for the STEM BUILD career mentoring program, each mentor was assigned three to four mentees to meet with as one group with optional individual meetings taking place on occasion as needed in between the group meetings. The program was also designed to mentor Trainees in their second year in the BTP program to prepare them for subsequent years with less support as BTP Affiliates.

In addition to soliciting input from the students, it was critical to build a platform for regular feedback from STEM professionals. Thus, an advisory committee of UMBC alumni or affiliates from URGs working in STEM was formed with the chair of the committee being a UMBC faculty affiliated with the STEM BUILD program. Committee members were identified primarily by leveraging a long-standing UMBC program for increasing URGs in STEM, the Meyerhoff Scholars program, that has over 1400 alumni (Meyerhoff Scholars Program, 2024). Personal connections and feedback from the alumni engagement office was also used to identify and finalize committee members. This committee provided input on the program structure, gave feedback on the curriculum, and served as the first group of mentors. Following the launch of the mentoring program in September 2020, the advisory committee met twice per year to discuss the mentoring program implementation and recommendations for improvements going forward.

Identification of Mentors

Mentors were alumni or affiliates of UMBC who worked in STEM, were from URGs, and had the ability to attend one in-person meeting on campus. Almost all mentors held a PhD or other STEM-related terminal degree. Mentor recommendations came from the mentoring program's advisory committee, Meyerhoff Scholars program, STEM BUILD staff and faculty, and UMBC's alumni engagement office. Following the generation of the list of potential mentors, the mentoring

Figure 1
Primary mentoring interest area of UMBC BTP Trainees



Note: Some respondents selected more than one answer

Table 1
Demographic of STEM BUILD mentees and mentors

Group	Race/Ethnicity		Gender		
	Black/Latine	White/Asian	Man	Woman	Non-binary
Mentees	30 (53.6%)	26 (46.4%)	22 (39.3%)	33 (58.9%)	1 (1.8%)
Mentors	9 (90%)	1 (10%)	4 (40%)	6 (60%)	0

Highest Degree of Mentors: PhD – 6; MD/PhD – 1; ScD – 1; PharmD – 1; M.S. - 1
Occupations Held by Mentors*: Academic Research Professor – 1; Academic Teaching Professor – 2; Biotechnology Product Developer – 3; Government Science Administrator – 3; Government Science Researcher - 1; Medical Physician – 1; Medical Writer -1; Professional Dancer – 1; STEM Program Director/Manager – 2
*Some mentors have held multiple occupations

program's advisory committee chair conducted informal conversations with potential mentors to explain the program and gauge their interest and experience in mentoring. In addition to their interest and experience in mentoring, the mentor's career alignment with the needs of the mentees, engagement with UMBC, and availability, along with racial and gender balance, were considered in the final selection of mentors which was done by the committee chair.

Matching of Mentors with Mentees

BTP Cohort 5 students who were entering their second and final year in the BTP became the initial group of mentees. The last BTP Trainees mentored for a full year at the time of publication was Cohort 7. The STEM BUILD program staff matched mentors with mentees by reviewing the background of the mentors and leveraging their knowledge of the BTP Trainees. Mentee groups were assigned a mentor primarily based on their major and career goals. Secondary considerations included racial and gender alignment with the mentor and balance among the groups.

For each of the three STEM BUILD mentoring years, 18-19 Trainees were mentored by 5-6 mentors for a total of 56 mentees and 10 mentors participating in the program over the three years. Table 1 shows the demographics of the mentees and mentors that participated in the program over the three years. Self-reported gender identity was captured for the demographic information of mentors and mentees. Mentees were fairly evenly distributed by whether or not they were a member of an URG (Black and/or Latine, in our sample). Thirty students (53.6%) were Black and/or Latine and 26 students (46.4%) were White and/or Asian. There were 22 men (39.3%), 33 women (58.9%), and 1 non-binary person (1.8%) in our sample. Mentors were mostly Black or Latine with six women and four men representing a variety of STEM degrees and careers as shown in Table 1.

Development of Career-Focused Mentoring Curriculum

A career-focused mentoring curriculum was developed and provided to the mentors to facilitate the mentor/mentee engagement for the year. Some of the training and curriculum materials were leveraged from the Entering Mentoring training curricula from the Center for the Improvement of Mentored Experiences in Research (CIMER) at the University of Wisconsin-Madison (Pfund et al., 2014). The rest of the materials were developed/adapted as described below. Table 2 provides an outline of the mentoring program curriculum including overall topics, meeting agendas, anticipated themes of discussion, and homework assignments for the six meetings within the year.

The curriculum was designed to lead the mentor in helping students think more specifically about their STEM career goals. The first meeting of the curriculum, designed to be in-person, began in a plenary format with all mentors and mentees to introduce the mentoring program. Following the introduction of the program, mentors met with their groups for the first time to conduct ice breakers and discuss expectations for the mentoring year. In this meeting, students were also able to hear about the overall career journey of their mentor, giving them initial exposure to the varied paths of STEM careers. The rest of the meetings were scheduled by each mentoring group autonomously and generally occurred online using a platform of the mentor's choice.

Prior to the second meeting, students completed a career assessment tool: the Knowdell Career Values Cards (https://www.knowdellcardsorts.com/). Created by Richard Knowdell, these 54 cards each depict a career value such as intellectual status, stability, advancement, moral fulfillment, family and profit which users then prioritize into five categories ranging from always valued to never valued. Career value cards placed in the always valued category are limited to ten. Cards in the always valued category are then used to evaluate current or possible future occupations for alignment to the eight most prioritized career values. The mentees' results were shared with their

Table 2
Outline of the STEM BUILD career mentoring curriculum for the academic year

Mtg #	Topic	Brief agenda	Anticipated themes of discussion	Assignment for next meeting
1	**Orientation & Getting to Know the Group**	Introductions Ice Breaker Mentor Shares Career Path	Growth Mindset Inclusiveness	Complete Career Assessment Tool Consider 2-3 career options related to overall career goal
2	**Exploring Specific Career Pathways**	Discuss Results of Career Assessment Tool	Dynamic nature of careers Balancing science identity with personal identity Work/life balance	Identify 2-3 people or organizations to network with, interview, or explore to learn more about career paths identified.
3	**Career Guest Speaker**	Guest speaker shares career journey	Dynamic nature of careers Balancing science identity with personal identity Networking	Send list to mentor of summer internship opportunities pursuing
4	**Networking**	Debrief on networking assignment by discussing the following questions: -What person/org did was important to network with in order to learn more about career path? -Share how networking/informational interview meetings went -What hindered you (if applicable) from networking?	Imposter syndrome Internal & external biases Informational interviews	Complete the Work/Life Balance Assessment
5	**Health and Wellness**	Discuss Results of Work/Life Balance Assessment	Physical and mental health Resilience Importance of hobbies and relationships	Update mentor on summer internship pursuits
6	**Closeout of Mentoring Year**	Wrap up the mentoring year by discussing the following questions: -Have you narrowed down or refined your career goals? -What has changed with how you view your career? -What have you learned about yourself?	Committed to changing Self-trust	

mentors. The mentors completed the Knowdell Career Values Cards exercise as well.

In the second meeting, the mentors began by sharing with their groups how their career values aligned with their current or previous STEM jobs. Then each mentee in the group reflected on their respective results which was followed by a discussion on STEM career options. In the discussion, mentors pointed out career options that students were unaware of that blended their STEM interest with non-STEM interests and cultural values. Mentees were then instructed by the mentor to further investigate the careers they are considering after the meeting, particularly for career value alignment, by doing informational interviews with STEM professionals in that area or researching organizations related to the careers. The mentor also used the discussion with the mentee group to think about someone that could serve as a guest speaker for the third meeting.

In the third meeting, mentors invited a guest speaker to further broaden the exposure of students to diverse STEM professionals. Mentors selected the guest speaker for their group based on the career conversation from the previous meeting. The guest speaker may have had a career in which most mentees expressed interest or may have worked in an area that is new, unknown, and relevant to the mentees' career interests. This also provided an opportunity for mentees to expand their network of diverse STEM professionals.

Networking was the topic of the fourth meeting. Mentees were asked to share their experiences from their informational interviews. Talking about their experiences lead to a discussion on the mentees' level of comfort with and barriers to networking. Themes of experiencing imposter's syndrome where students don't feel worthy enough to talk to professionals in STEM often arose in this conversation. The mentors then shared their own networking stories and how they developed those skills, with the hope of demystifying the process

and helping students feel less intimidated by networking.

In the fifth meeting, mentors focused on how to maintain health and wellness while being in STEM. Prior to the meeting, mentors and students completed the Four Way View of Work/Life Balance from the Total Leadership program (Friedman, 2008). Reflecting on each mentees' results led to a discussion on what activities and relationships are important for maintaining physical and mental wellness while navigating through challenging STEM courses. Having this discussion midway through the spring semester was timely with the pressure of internship applications increasing along with class workload.

The final meeting of the mentoring year was intended to circle back on the careers explored, themes of STEM challenges discussed, and follow-up on internship opportunities being pursued. Mentors were also asked to assist their mentees as requested in obtaining an internship even after the final meeting. Often, this resulted in the mentor providing ideas on where to apply and letters of recommendation.

Monitoring the Mentoring Program

As part of the overall evaluation of STEM BUILD at UMBC (Institutional Review Board protocol number 172Y19KM20130), brief implementation and formative measures were instituted - a quick mentor check-in and student survey items – to track mentoring meetings and student perceptions of the program. All data were collected by the program evaluator and results were de-identified and aggregated prior to sharing them with the mentoring program advisory committee and STEM BUILD staff.

The two goals of the mentor check-in were to monitor the implementation of the small group mentoring meetings and to serve as a reminder to mentors about their meetings. We sent an online survey to each mentor for each mentoring module. The survey asked mentors to indicate if they had met with their mentees, how many mentees were present, the format of the meeting (online, in-person, etc.), the duration of the meeting, if they had covered the meeting topic(s), and if they had scheduled their next meeting. The survey also had space for mentors to make comments or express concerns. Mentors were sent up to two reminder emails to complete the survey. The survey was initially administered via REDCap and then changed to the Qualtrics platform. A total of 102 mentor check-ins to the 10 mentors were sent over the course of three years. Data was downloaded to SPSS where frequencies and descriptive statistics were analyzed.

At the end of the academic year, and as part of the overall evaluation of STEM BUILD at UMBC, the 56 mentees were asked to respond to 10 items about the mentoring program. The survey items related to the connection between mentors/mentees and peers; their personal and science identity; and career goal clarification and feeling able to be successful in a STEM career. Students responded using a 5-point, Likert-type scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Data were collected via Qualtrics, downloaded to SPSS, and analyzed using frequencies and descriptive statistics.

Results

Mentors

Over the course of the three years of mentoring, all 10 mentors remained in the program for the full year. Two of the STEM professionals mentored all three years, three mentored for the first two years, and five served as mentors for one year – four of whom were new in the third year of the program. Meetings typically occurred once during the months of September, October, November, January, February, and March. During the first year of the mentoring program, the 2020-21 academic year, the COVID-19 pandemic occurred, necessitating a switch of the first meeting to online. In year two, the first mentoring meeting was hybrid, with some mentors participating in person and others joining synchronously online. By the third year, all participants were able to join in-person for the first meeting. Following the first meeting, almost all meetings took place online for all three years. Mentors were given autonomy to schedule the group meetings with their mentees for a mutually beneficial time which could result in meetings taking place in a different month than expected and in some cases having two meetings per month to make up for missed meetings.

The mentor check-in surveys had a 74.5% response rate (76 responses out of 102). Of those mentors who responded to the survey, 84.2% (64/76) indicated that they had met with their mentees. The meetings lasted an average of 55 minutes (SD 12.4) and the overwhelming majority were held online with only one mentor reporting meeting in person with their mentees outside of the 2021 and 2022 inaugural meetings. For most of the meetings (68.8%), mentors reported complete attendance on the part of the mentees. For some of the other meetings, one of the three or four mentees were reported missing (N=15, 23.4%) and, in only a few instances were two (N=4, 6.3%) or three (N=1, 1.6%) mentees not in attendance. One of the more difficult aspects of the mentoring sessions was being able to schedule the following meeting; only 50% of the mentors reported having their next mentoring meeting on the schedule. One of the most consistently mentioned issues on the survey as well as in advisory board discussion was the lack of responsiveness of students to emails and lack of attendance.

Mentees

The response rate to the end of year mentee survey was very high at 96.4% with 54 of the 56

Figure 2
Mentee end of year survey results on the STEM BUILD career mentoring program's effect on their connection to their mentor and BTP peers. Data shown as the frequency of responses in each category from 1 (strongly disagree) to 5 (strongly agree).

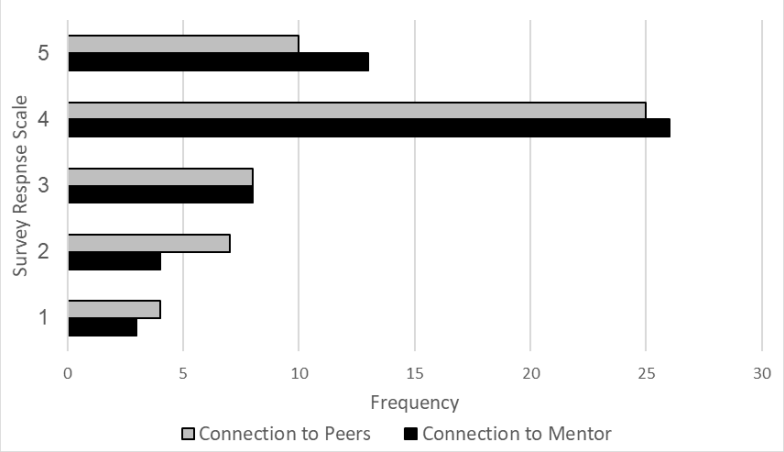
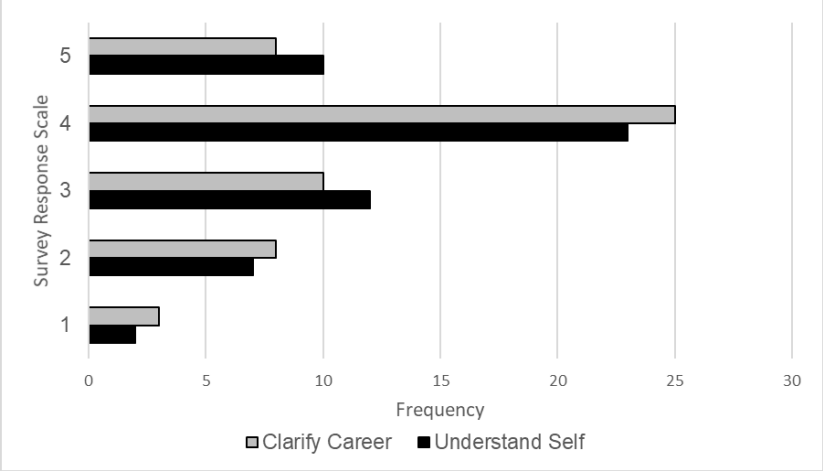


Figure 3
Mentee end of year survey results on the STEM BUILD career mentoring program's contribution to the clarity mentees gained about themselves and their STEM career goals. Data shown as the frequency of responses in each category from 1 (strongly disagree) to 5 (strongly agree).



mentees answering all items. Each survey item used a 5-point, Likert-type scale that ranged from 1 (Strongly Disagree) to 5 (Strongly Agree) with a neutral point of 3 (Neither Agree nor Disagree). Because the sample size was small, ANOVAs were initially run to make sure that there were no statistically significant differences in responses by gender or race/ethnicity to address reporting ratings by demographic groups. Mean scores on the survey items ranged from 3.5 to 3.8 with very large standard deviations between 1 and 1.2; therefore, frequencies are reported here as they are more informative. Overall, mentee responses were favorable to the mentoring program and they indicated that they perceived various benefits.

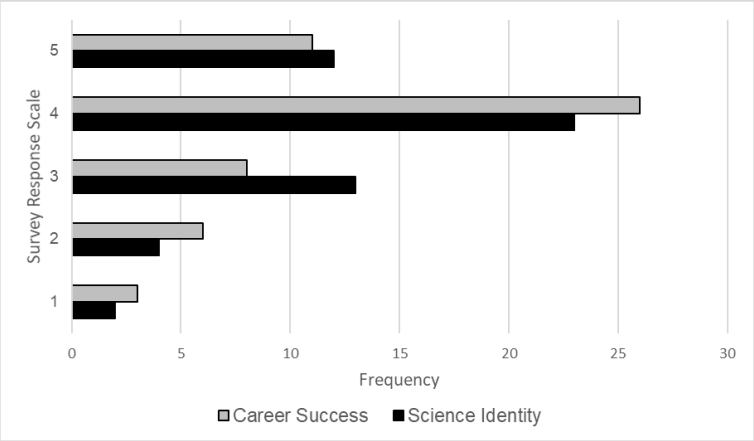
Connection

The survey asked two questions about mentees' feelings of connection to their BTP peers and their mentors. Students were asked to respond to these two statements: "I feel a connection to my mentor" and "I feel a connection to my peers." Respectively, 64.8% and 72.2% of mentees assigned a value of 4 or 5 to the statement about their connection to their mentors and peers. Figure 2 shows the distribution of responses.

Clarity

Mentees also answered questions about learning

Figure 4
Mentee end of year survey results on the STEM BUILD career mentoring program's contribution to increasing their science identity and belief in their ability to achieve in a STEM career. Data shown as the frequency of responses in each category from 1 (strongly disagree) to 5 (strongly agree).



about themselves and science careers. One of the goals of the mentoring program was to help students understand their own values as well as the possible STEM careers available to them. To that end, students responded to these two statements: "The mentoring program helped me understand myself better" and "The mentoring program helped me clarify my career goals." Again, the majority of students (61.1%), responded with a 4 or a 5 to both statements. The distribution of the answers varied slightly but, overall, most of the students felt that the program was beneficial to them in terms of gaining insight into themselves and their careers. Figure 3 illustrates the distribution across all five answers.

STEM success and identity

As a result of the mentoring program, most of the students also indicated that they had a higher sense of science identity and confidence in their ability to succeed in a STEM career. To the statement, "The mentoring program helped me to feel better about my ability to succeed in a STEM career," 68.5% of students responded with a 4 or 5. Similarly, 64.8% of students also agreed that they "feel more confident in [their] science identity." Figure 4 shows the frequencies for each response point. Overall, the mentees responded favorably to the career-focused mentoring program and the majority of students reported benefits in terms of the connections with their mentors and peers, a deeper understanding of themselves and potential STEM careers, and a higher sense of career confidence and science identity. It is also clear that some students did not perceive the mentoring program as helpful, given the wide range of responses to the survey items. Although there were no statistically significant differences in mean scores by race/ethnicity or gender, it would be interesting to see if there are certain students for whom the program was particularly successful.

Discussion

While the mentoring program showed promise, there were limitations in the organization, implementation, and evaluation of the program. In regards to the organization of the mentoring program, identifying a sufficient number of STEM professionals from URGs as mentors who worked in areas related to the mentees' interests and were willing to commit about 10-15 hours of time and mental effort over one year proved challenging. In the first two years, the mentors were also members of the advisory committee who helped shape the mentoring program so their commitment and relevance to the mentee's career interests was high. However, successful recruitment of these STEM professionals occurred after approximately five months of many conversations with UMBC staff, faculty, alumni, and prospective advisory members and depended heavily on personal relationships. Such a recruitment process is not sustainable.

When recruiting STEM professionals from URGs to serve as mentors, it is important to also recognize the "minority tax" that they experience (Padilla,1994; Rodríguez, 2015; Trejo, 2020). For our career-mentoring program recruitment, this resulted in some prospective mentors who were already overcommitted to other diversity and volunteer efforts and thus declined to participate in our mentoring program. Being aware of the "minority tax" also led us to exclude some highly successful STEM professionals from URGs who we knew had little volunteer capacity.

With these limitations in mentor recruitment, it was challenging to optimize mentors for the mentees. To start, the mentors should represent the

career aspirations of the mentees. In our case, many students were interested in becoming physicians, but we didn't have an adequate number of mentors in that area. That said, exposing students to related careers like biotechnology was also important and we intentionally and successfully recruited mentors in that area. In addition, studies indicate that mentees from URGs prefer having a mentor of the same race and gender (Blake-Beard, 2011). Our mentors represented the Black race well, but were lacking in other categories, particularly non-binary genders. Other factors such as economic background could also allow for broader diversity among the mentors for matching and improved relationships between mentors and mentees. Lastly, the limitations in mentor recruitment didn't allow us to fully assess the mentors for other attributes that we know are important for an effective mentoring relationship such as interpersonal skills or professional networking capabilities (Pfund et al., 2016; Mondisa, 2020).

The implementation of the mentoring program occurred during the height of the COVID-19 pandemic which affected our mentors, mentees, and meeting schedule. Our first meeting was planned to be in-person but changed to an asynchronous online meeting in year one, hybrid in year two, and in-person in year three. Feedback from mentors was that the lack of an initial face-to-face meeting hindered how they felt the mentees connected to them. There may have been other significant, confounding pandemic factors at play that affected the behavior and resulting experience of the mentees in the mentoring program. Several sources suggest that college students experienced increased depression, anxiety, sluggishness, financial challenges, worry about health, and other stressors due to the COVID-19 pandemic and lockdown (Camacho-Zuniga et al., 2020; Molock & Parchem, 2022; Nepal et al, 2024; Birmingham et al., 2021) with racial concerns due to the George Floyd incident being an additional stressor for URGs (Molock & Parchem, 2022). These pandemic-related impacts on students would certainly affect their receptivity to the mentoring program and view of its benefit which could explain some less favorable evaluation scores. Challenges from the COVID-19 pandemic were felt by all, including presumably the mentors, which may have affected their ability to execute their mentoring duties as they would have prior to the pandemic.

Evaluation of the mentoring program provided some indication that the program benefitted the students, but the data was limited. The limited number of cohorts evaluated resulted in a small sample size. This hindered the ability to measure career clarity and career self-efficacy. Having additional information would have made it possible to link to the career development literature and social cognitive career theory. The ability to draw correlations between the mentee results and their respective mentors and career self-efficacy as factors in career plans and persistence was impeded. A more extensive survey of the mentors would allow greater insight into the characteristics and practices of mentors that yielded greater success in a mentoring relationship. Another limitation was that the mentee groups were not limited to URGs so interactions within the group could have affected the outcomes. Lastly, evaluation of each element of the curriculum would provide insight into the effectiveness of the curriculum itself and allow for more targeted change.

From verbal feedback, in combination with the trend of the mentee data related to gaining clarity on their career, the career assessment tool used was likely not appropriate for the student population. The career assessment tool used for this program focused on various career values such as money, societal benefit, family, or status, that one may prioritize when choosing a career. This concept was likely too advanced for 2nd year students at a 4-year university. Maybe an assessment tool that provided career options based on the student's strengths, interests, or personal tendencies such as the Myers-Briggs Type Indicator, O*Net Interest Profiler (Career Center, 2024), or Future Life Map (Whitehead & Alves, 2022) would have been more digestible for the mentees and more effectively opened mentor/mentee discussions on various STEM career options.

While not a primary purpose, we were pleased to see indications that mentees felt a greater connection to their peers at the end of the mentoring year. This shows promise that the small group model may provide benefits of informal peer mentoring such as increasing commitment to STEM, improved self-efficacy and diminished feelings of isolation (Driscoll et al., 2009; Holland et al., 2012). While group mentoring was introduced to reduce the burden on the mentor, the possible additional benefit of greater peer connection is worth acknowledging and exploring further. In fact, Dahlberg and Byars-Winston, indicate that more studies should be done on non-dyadic mentorship structures in STEM (2020).

The mentoring of STEM students from URGs by other STEM professionals from diverse groups should be considered as a possible intervention to help with retention of STEM students in the education and career pipeline. Knowing the wide array of careers in STEM that could align with their diverse personal values could have a significant impact in their persistence in STEM. This career mentoring program offers a starting point for developing such university programs.

Additional Acknowledgements: The authors would like to thank the mentors who served in this program, especially Earnestine Baker who served as a mentor all three years.

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