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Increasing Faculty Self-Efficacy in Mentoring through Training in Inclusive Mentoring and Course-based Undergraduate Research

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Encouraging diversity in biomedical fields is especially important and begins at the undergraduate level. Culturally competent mentorship and high impact practices, like involvement in research, play important roles in fostering success among undergraduates from historically underrepresented groups. The current study followed 20 biomedical faculty as they completed two semester-long trainings, one in mentoring and one in course based undergraduate research (CUREs) as part of the NIH Diversity Program Consortium Dissemination and Translation Awards initiative. Comparisons of pre- and post-training survey data showed increased self-efficacy for mentoring biomedical research trainees and for mentoring diverse groups of biomedical trainees. These results suggest that focused, formal faculty training can be effective for improving mentoring, and consequently success of biomedical students.

Keywords: faculty training, culturally-competent mentorship, student research, historically underrepresented groups

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Introduction

Encouraging diversity in biomedical fields presents many advantages that can greatly improve scientific advances in the treatment of diseases like cancer, quality of patient care, and health disparities among underserved populations (Odedina et al., 2019). Unfortunately, there are too few individuals from historically underrepresented groups (HUGs, as defined by NIH in NOT-OD-20-031) in Science, Technology, Engineering, and Math (STEM) fields broadly (National Science Board, 2020) and biomedical fields more specifically (Odedina et al., 2019). Among factors that impact the success of diverse undergraduates are culturally competent mentorship (NASEM, 2019) and high impact practices like involvement in classroom-based undergraduate research (Bangera & Brownell, 2014). A broad definition of mentorship includes any faculty-student interaction that goes beyond answering course content questions during office hours. As part of the NIH Diversity Program Consortium Dissemination and Translation Awards initiative, we designed an intervention aimed at improving the experience of students, through improved preparedness of faculty.

The NIH's Diversity Program Consortium (DPC) set out to advance understanding of individual and institutional factors that affect the training experiences and career development of biomedical researchers who come from a wide variety of backgrounds. Within it, the Dissemination and Translation Awards (DaTA) initiative provided funding for institutions not currently part of the DPC to apply existing DCP methods and findings in the design of research capacity building interventions (see DPC data elements/survey instruments and hallmarks of success).

Enhancing Diversity in Biomedical Fields

Although diversity is important to the success of any academic field, it is especially critical in biomedical areas, in which a diverse student body contributes to innovative advances in healthcare delivery to underserved populations and to reduce health disparities (Odedina et al., 2019). While the number of HUGs in STEM-related fields rose from 9% in 2003 to 13% in 2017, they still represent only 17% of the college-educated workforce (National Science Board, 2020), partly because of attrition in undergraduate graduation rates (Garrison, 2013; Odedina et al., 2019). Reduced numbers of students from HUGs pursue biomedically relevant majors in college, perhaps due to a preference for "practical" careers (e.g., business) over those that require additional financial investment and years of training (e.g., medicine), and poor K-12 education that renders students unable to cope with the rigor of STEM disciplines in college. Whatever the cause, research suggests that intentional and targeted mentoring can aid in overcoming these barriers.

Faculty, serving in the role of mentor, is a key factor in achieving academic persistence and success among undergraduate students (see

Crisp & Cruz, 2009 for a review). Whether formal or informal, mentorship is characterized by a faculty mentor providing students with guidance, assistance, and encouragement on professional and academic issues, frequently in the context of academic advising or research training. Within biomedical disciplines, effective mentoring also supports students in developing their identities as scholars and essential contributors to their disciplines (NASEM, 2019). Quality mentoring is associated with enhanced performance (Kendricks et al., 2013), stronger STEM identities, positive attitudes about their discipline, greater belonging, and increased self-efficacy (Estrada et al., 2008; Kuchynka et al., 2023). However, poor mentoring can be particularly damaging to HUG STEM students, leading to self-doubt, reduced psychological well-being, and lower academic and professional performance (NASEM, 2019).

Lacking a critical mass, HUG students can feel isolated, which places greater importance on emotional support, connection, and trust in their mentoring relationships; mentors who provide these factors improve the experience of HUG students (Kuchynka et al., 2023). Furthermore, when mentors acknowledge and are willing to address and validate students' racial and ethnic backgrounds and the roles these play in their academic experience, HUG students report greater satisfaction with their mentoring relationships (Byers-Winston et al., 2023). By contrast, when mentors lack cultural competence, the benefits of mentoring for HUG students is undermined (NASEM, 2019).

Among mentoring interventions, pairing mentors with mentees based on demographic qualities (e.g. pairs of the same gender identification or race) have shown to improve these aspects of the mentor-mentee relationship (Blake-Beard et al., 2011; Ortiz-Walters & Gilson, 2005), but the impact on academic success and pursuit of graduate studies are inconclusive (Hernandez et al., 2017; Morales et al., 2021). In particular, women tend to provide greater psychosocial engagement, career support, and psychological closeness in their mentoring (Kuchynka et al., 2023), which leads students to seek them out as mentors and often results in inequitable and unsustainable mentoring workloads for females (Aubrey et al., 2021; Misra et al., 2012). These and other data highlight the importance of offering specific training to all STEM and biomedical faculty to prepare them to mentor students from HUGs.

Faculty Mentoring Training

Quality mentoring relationships have a positive impact not only on those being mentored, but also on the mentor (Pfund et al., 2016), including increased research productivity (Dolan & Johnson, 2009), a sense of meaning and purpose (Laverick, 2016) and satisfaction in one's work (Adedokun et al., 2010). Training has been shown to enhance faculty participants' mentoring self-efficacy, defined as confidence in their ability to competently engage in behaviors that facilitate positive mentoring relationships and outcomes (Gandi & Johnson, 2016). Students mentored by faculty who have attended mentoring training report a better mentoring experience (Pfund et al., 2014), including increased motivation and confidence, clearer expectations, and acknowledgment of their contributions (Young & Storms, 2020). Furthermore, the literature on this topic suggests several aspects as key to successful mentoring of HUG students in STEM and biomedical fields.

Skill Development & Career Support

Providing an environment in which students can develop key academic and discipline specific skills is essential. Some of the most widely used and researched mentoring training resources, such as the Entering Mentoring curriculum (Pfund et al., 2014), are centered around facilitating students' understanding of scientific research and promoting career development. When students participate in mentored research experiences, they report improvement in research skills, productivity, and retention in STEM and medical disciplines (Linn et al., 2015; Sadler and McKinney, 2010). Pfund et al. (2014) found that mentors who participated in the Entering Mentoring training increased not only in their overall scores on the Mentoring Competency Assessment, but also in the three subscales: assessing communication, establishing expectations, and career development.

Cultural Competence

Mentors addressing and validating the cultural backgrounds of their students promote a variety of positive outcomes that include higher graduation rates, increased involvement in research, a greater sense-of-fit in research and science identity (Haeger et al., 2016), and greater intentions to pursue graduate school (Morales et al., 2021). Mentors who undergo training that includes cultural competence report greater self-efficacy in addressing the needs of students from diverse backgrounds (Gandi & Johnson, 2016), greater perception of the importance of race/ethnicity in mentoring relationships (Byers-Winston et al., 2023), recognize their own biases (House et al., 2018), gain a deeper understanding of students' challenges within and outside of higher education, and improve their own communication practices in addressing issues of race/ethnicity with their mentees (White-Lewis et al. 2021). These mentors are also perceived by their students as having higher cultural awareness (Byers-Winston et al., 2023).

Providing Critical Feedback

Providing feedback is critical for students to accurately assess and develop their academic abilities and professional skills, but it needs to be offered intentionally. When there is no critical mass, HUG students may question their belonging in their academic disciplines, and negative stereotypes about aspects of their racial, ethnic, or gender identity can further undermine their self-confidence and scientific identity (Cohen et al., 1999). Stereotype-threat can occur when an individual, aware of a negative stereotype attached to the group they belong to, becomes anxious about confirming the stereotype (Steele, 2010). For example, when students believe that their racial or ethnic group are less intelligent, they may worry that asking questions will indicate ignorance or inability to understand the material, thus reinforcing the stereotype, stopping them from seeking help and using campus resources (Steele, 2010). It can also cause students to perceive critical feedback about their academic skills and development as threatening and react with disengagement (Cohen et al. 1999). To avoid this, Cohen and colleagues (1999) developed a successful strategy, buffering critical feedback with a reminder of the high standards set for students' performance and explicit assurance of their capability to meet those standards. Use of this approach resulted in increased motivation and identification with the task and reduced the perception of bias in the feedback (Cohen et al., 1999).

The Present Study

The current study followed 20 biomedical faculty as they completed two semester-long training sessions. One was aimed at developing faculty's mentoring skills, focused on students from HUGs. The other introduced faculty to course-based undergraduate research experiences (CUREs), explored its elements, and involved faculty in developing a syllabus to use CUREs in a future class.

CUREs are authentic research experiences embedded into courses (ideally in entry level courses) designed to offer larger numbers of students an opportunity to participate in research. For Bangera and Brownell (2014) and Frankowski (2023), CUREs are especially well-suited when high teaching loads and limited resources reduce students' involvement in research. Similar to independent research, students who participate in CUREs demonstrate enhanced interest in research and science, self-confidence (Brownell et al., 2012), and understanding of how to "think like a scientist" (Brownell et al., 2015). The majority of faculty who participate in CUREs report enjoying it and that it supports their roles as scholar-teachers, allowing the integration of teaching and research and even aiding in publications, tenure, and promotion (Shortlidge et al., 2016).

Faculty participants completed a pre-survey and post-surveys for each training module to assess eight of the DPC faculty hallmarks for success, as follows: (1) frequently mentors students on biomedical related issues, (2) uses evidence-based practices in teaching and mentoring, (3) shows high self-efficacy as a biomedical instructor, (4) as an instructor to a diverse group of biomedical students, (5) as a mentor to biomedical research trainees, (6) as an mentor to a diverse group of biomedical research trainees, (7) as an independent biomedical researcher, and (8) to act as a change agent to enhance diversity in biomedical research and research training environments.

The goal of this study was to determine whether these trainings would increase participants' self-efficacy around mentoring, particularly of diverse groups of undergraduate biomedical students, and their implementation of CUREs in future semesters. Self-efficacy is an effective tool for evaluating professional development trainings because domain specific self-efficacy has been shown to correspond to people's ability to perform real-world tasks (Sommers et al., 2000). Mentor trainings have been shown to increase faculty self-efficacy, and modules designed to enhance cultural competency have increased self-efficacy around mentoring diverse student groups specifically (Gandi & Johnson, 2016). Thus, we hypothesized that participation in the mentoring training would increase participants' self-efficacy, particularly as a mentor to biomedical research trainees and to diverse biomedical research trainees, as well as to act as a change agent. We also predicted that the number of students faculty reported mentoring and their positive perceptions of mentoring would increase following the trainings. In addition, we hypothesized that participation in the CUREs training would increase participants' use of evidence-based practices in teaching. Although not hypothesized to impact mentoring, Dingle and Punti (2023) found that students reported greater likelihood of seeking out mentors whose teaching activities they found engaging. Since CUREs require students to be more actively engaged in hands-on research and requires more instructor-student interaction, it is possible that the addition of CUREs to courses could positively impact faculty mentoring.

Materials and Methods

Participants

The study was approved by the CSUCI IRB (#IO5822). Informed consent was obtained from all participants prior to participation in the trainings and data collection.

A priori power analyses for a repeated-measures design with a small to medium effect size (Cohen's f = .2 , between small to medium effect size) yielded a recommendation of 24 total faculty (16 participating in the trainings and 8 control). Faculty were eligible for participation in the trainings if they taught at least one course (3 units) in one of the following biomedical majors: Biology, Chemistry, Health Sciences, Mathematics, Physics, or Psychology. Recruitment emails were

Table 1
Demographics

Demographic Characteristic		Percent (n = 17)
Gender	**Women**	52.9%
	Men	47.1%
Race/Ethnicity	**White**	70.6%
	Hispanic/Latinx	17.6%
	Asian	11.8%
First Generation College Student Status	**First Generation College Students**	29.4%
	Continuing Generation College Students	70.6%
Academic Program	**Health Sciences**	29.4%
	Psychology	23.5%
	Mathematics	17.6%
	Biology	5.9%
	Chemistry	5.9%
	Physics	5.9%
	Anthropology	5.9%
	Nursing	5.9%
Rank	**Lecturer faculty**	41.2%
	Assistant Professor	29.4%
	Associate Professor	11.8%
	Professor	17.6%

sent out to eligible faculty at the beginning of each semester between Fall 2021 and Spring 2023. All interested faculty that signed up for participation via a Qualtrics survey, were included in the program. From a pool of 120, 18 faculty chose to participate. Two additional faculty from Anthropology and Nursing were included because their research interests aligned with biomedical fields. Participants' demographics are in Table 1.

Nineteen participants completed both the mentoring and CUREs training and one completed only the CUREs training. Out of 20, 17 participants completed the initial survey, 13 completed one follow up survey, and 6 completed both follow up surveys. Of the 13 participants who completed at least one follow-up survey, 10 participants reported attending all of the training sessions, one missed one session, and two missed two sessions.

Interventions

The interventions for this study were two semester long trainings of 12 hours (6 sessions) each, one focused on mentoring and the other focused on developing CUREs. Upon enrollment, faculty were randomly assigned to participate in either the CUREs or mentoring training, and then all switched trainings the following semester.

None of the participants had previous experience with CUREs. Moderators for the CUREs-training sessions were two experienced biomedical faculty from a different institution, with many years of experience implementing CUREs and publications documenting the success of the approach. Under their direction, participants explored what defines a CUREs project and developed a syllabus for implementing a CUREs in a course for a future semester.

None of the participants had previously received any formal training on mentoring. The moderator for this training was a well-prepared faculty member from another institution, himself a HUG, who had experience implementing this training in different institutions. The delivery was interactive, and the content included skill development around listening and providing constructive feedback, celebrating differences, developing social and intellectual communities, and inclusive mentoring practices. The participants were presented with case studies and also had an opportunity to discuss their own experiences.

Survey Measures

The pre-intervention questionnaire collected information about demographics, education, and employment background, professional experiences (including evidence of scholarly productivity, professional recognition, service advancement to next career stage, and advancement to leadership positions in biomedical research and training), professional development experiences, and teaching and mentoring practices (including the use of evidence based practices in teaching) from the Higher Education Research Institute (HERI; Stolzenberg et al., 2019) survey. Participants' overall experience of working with undergraduates on research was rated from 0- I have not worked with undergraduates on research projects to 4 – Excellent). Experience presenting with undergraduates at conferences, publishing with undergraduates, engaging undergraduates on faculty led and student led research projects was also rated on a 5-point Likert-type scale (1- not at all to 5 – to a very large extent).

In addition, participants completed the STEM and Mentoring modules from the HERI Survey (Stolzenberg et al., 2019). The STEM module is comprised of 14 Likert-scale questions (1- Not at all to 5 – A Very Large Extent; $\alpha = 0.916$) that assess the extent to which faculty in STEM disciplines are employing active learning strategies in their classes. Four additional questions measure faculty's sense of their own Science Identity (1- Strongly Disagree to 5- Strongly Agree; $\alpha = 808$).

The Mentoring Module's 12 items (1- Not At All to 5- To a Very Large Extent; $\alpha = 0.846$) assess the degree to which faculty mentors are promoting academic growth among the students they mentor. Another two items assess how many undergraduates each faculty mentors and the frequency with which they meet.

From the DPC DaTA Consortium-Wide Evaluation Plan (Diversity Program Consortium, 2019), participants completed measures designed to assess the relevant Hallmarks of Success. Six self-efficacy scales measure faculty mentors' confidence and competence teaching and mentoring different groups of students.

- Self-efficacy as an Instructor in a Biomedical Field is composed of 24 Likert-scale items (1-Not at all Confident to 7- Extremely Confident; $\alpha = 0.940$) and includes questions that assess an instructor's confidence in a range of teaching behaviors, including choosing course materials and activities, assessing student learning, and facilitating student learning.

- Self-efficacy as a Mentor to Biomedical Research Trainees is composed of 26 Likert-scale items (1- Not at all to 7- Extremely or 8- NA, $\alpha = 0.964$) that assess a mentor's confidence in their ability to perform different mentoring behaviors like working to set clear expectations and working with mentees on setting goals. None of the participants chose NA in response to any of the pre- or post-survey scale items for this scale, so analyses were conducted on participants' average scores.

- Self-efficacy as a Mentor to a Diverse Group of Biomedical Trainees is composed of 7 Likert-scale items (1 -Never to 5- All of the time or 6 – I choose not to answer; $\alpha = 0.875$) that assess how frequently a mentor addresses issues of race/ethnicity in their mentoring relationships.

- Self-efficacy as an Independent Biomedical Researcher is composed of 26 Likert-scale items (1 – No Confidence to 10 – Total Confidence; $\alpha = 0.987$) that assess faculty's confidence as researchers. Questions evaluate a range of behaviors related to developing areas of research, securing funding for research, and publishing results. Average scores for this scale were calculated for each participant after removing the "I choose not to answer" responses, and analyses were performed on these average scores.

- Self-efficacy to Act as a Change Agent to Enhance Diversity in Biomedical Research and Training Environments is composed of 5 Likert-scale items (1- Most Likely Cannot to 7 – Most Likely Can; $\alpha = 0.829$) that assess faculty's certainty that they can positively impact the diversity and equity of their campus community.

At each follow-up, participants also completed questions from the DPC DaTA Consortium-Wide Evaluation Plan (DPC, 2019) about the quality of the mentoring they were providing to students (1 Very Low to 7 Very High), their satisfaction with their mentoring relationships (1 Not at all to 7 Completely), and the extent to which they felt they were meeting mentee's expectations (1 Not at all to 7 Completely).

Data Analysis

Average scores were computed for each scale for each participant at each time point. Analyses for pre-survey measures are reported for the 17 participants who completed the initial survey. Pre-post analyses were run on participants who completed the pre and at least one follow-up survey (n = 13). Since the only follow-up survey data for some participants was after they had completed both trainings and everyone had completed a follow-up survey after participating in the mentoring training, to maximize statistical power we opted to run analyses comparing pre-survey scores to scores on whichever post-survey participants had completed. For the six participants who completed both follow-up surveys, average scores for the two surveys were used for analyses. Paired samples t-tests were run for each of the above survey measures and one-sided results are

Table 2
Pre and Post-intervention Comparisons on Outcomes

Outcome Variable	Sample size n	Pre-survey Mean (SD)	Post-survey Mean (SD)	Mean Difference	95% Confidence Interval		P
					Lower	Upper	
Number of undergraduates mentored	12	7.92 (5.44)	8.58 (4.80)	-0.67	-3.75	2.41	0.322
HERI STEM module	12	3.84 (0.78)	3.72 (0.44)	0.55	-0.20	0.31	0.325
HERI STEM science identity	12	4.23 (0.63)	4.41 (0.58)	-0.18	-0.50	0.15	0.127
HERI Mentoring module	13	3.88 (0.62)	3.82 (0.39)	-0.01	-0.35	0.34	0.481
Self-efficacy for mentoring biomedical research trainees	12	5.06 (1.03)	5.37 (0.76)*	-0.32	-0.69	0.61	0.046
Self-efficacy for mentoring diverse groups of biomedical trainees	11	3.36 (0.75)	3.70 (0.63)*	-0.35	-0.76	0.65	0.045
Self-efficacy as an instructor in a biomedical field	12	4.04 (0.55)	4.18 (0.51)	-0.13	-0.45	0.19	0.190
Self-efficacy as an independent biomedical researcher	12	7.82 (1.13)	8.15 (0.99)	-0.35	-1.01	0.31	0.135
Self-efficacy as a change agent	12	3.45 (0.79)	3.43 (0.97)	0.35	-0.29	0.36	0.409

reported, reflecting the directional nature of our hypotheses.

Results

Pre-Survey Descriptives

Participants' experience mentoring undergraduates in research prior to participation in the trainings showed that faculty mentored between 1 and 16 students with an average of 7.92 (SD = 5.44). Participants had the most experience working with undergraduates on faculty led research (M = 3.06, SD =1.638), followed by student led independent research (M = 2.65, SD = 1.367), presenting with undergraduates at conferences (M = 2.41, SD =1.543), and publishing with them (M = 1.76, SD =0.970). When asked to rate the overall experience of working with undergraduates on research, two participants reported that they have not worked with undergraduates on research, and the average score for those participants who had worked with undergraduates indicated positive experiences (M = 3.33, SD = 0.82).

Impact of the trainings on mentoring practices

To determine what impact the trainings had on the quality and quantity of mentoring, paired samples t-tests were run to compare pre and post survey responses. Results showed no change in the number of students mentored from pre to post intervention (Table 2). Following the trainings, participants reported mentoring between 3 and 16 students with an average of 8.54 (SD = 4.59). Following the trainings, participants reported high ratings for the quality of the mentoring they were providing to students (M = 5.92, SD = 0.67), satisfaction with their mentoring relationships (M = 5.96, SD = 0.80), and the extent to which they felt they were meeting mentee's expectations (M = 5.31, SD = 0.63).

Analyses of the HERI STEM module revealed no significant changes in participants' use of active learning strategies in their courses or their scientific identity. Separate analyses were run on the specific question assessing integration of authentic research experiences into lab courses to determine whether participants had begun using CUREs. Results indicated an increase from pre (M = 3.33, SD = 1.30) to post-survey (M = 3.75, SD = 0.99) responses ($t(11) = -1.42$, $p = 0.092$, $d = -0.409$ [95%CI:-0.99, 0.19]) that was not statistically significant. Similarly, analyses of the HERI mentoring module revealed no significant changes in mentoring following the trainings (Table 2).

Faculty Self-Efficacy

Paired samples t-tests were again run to compare pre and post ratings for five different areas of self-efficacy: instructor in a biomedical field, independent biomedical researcher, mentoring biomedical research trainees, mentoring diverse groups of biomedical trainees, and self-efficacy as a change agent. Following the training modules, participants expressed significantly greater self-efficacy for mentoring biomedical research trainees ($t(11) = -1.84$, $p = 0.046$, $d = -0.53$ [95%CI:-1.13, 0.09]) and for mentoring diverse groups of biomedical trainees ($t(10) = -1.87$, $p = 0.045$, $d = -0.57$ [95%CI:-1.19, 0.86]). Self-efficacy as an instructor in a biomedical field, as an independent biomedical researcher, and as a change agent were not impacted by the trainings

Discussion

Our results suggest that faculty trainings in CUREs and mentoring can be an effective intervention for enhancing faculty self-efficacy for mentoring biomedical students. The faculty trainings resulted in significant improvements in self-efficacy for mentoring biomedical research trainees and for mentoring diverse groups of biomedical trainees, which demonstrate that the trainings were effective in improving their targeted focus on inclusive mentoring and emphasis on cultural competence. Improvements in self-efficacy as an instructor, independent biomedical researcher, or change agent were not observed, likely because the trainings did not intentionally address these areas.

Given the relevance of cultural competence in mentoring (NASEM, 2019), particularly for HUG students, this aspect of the trainings and associated improvements in self-efficacy are especially important. Research demonstrates that faculty can be uncomfortable or reluctant to address issues of race and ethnicity in mentoring and that this can negatively impact the experience of HUG students (NASEM, 2019). Improving faculty's confidence in addressing issues of gender, race, and ethnicity and raising awareness of how these aspects of identity can impact academic experiences, is essential to improve the retention, and success of HUG students. These trainings offered an opportunity for faculty who may not have a HUG lived experience, to gain confidence in mentoring students with these backgrounds. This can contribute to expand the pool of faculty providing effective mentoring, reducing the service burden and cultural taxation frequently experienced by faculty from HUGs.

Measures completed immediately following the trainings were not expected to detect an increase in the number of students mentored by participating faculty. Notably, while 23.5% faculty were not mentoring any students before trainings, 100% reported mentoring at least 2 students after the trainings. This result alone strongly supports the importance of offering formal training and associated increase in self-efficacy to encourage faculty in mentoring undergraduates. Interestingly, positive perceptions of mentoring undergraduates did not increase following the trainings, suggesting perhaps that participants already valued working with undergraduates, leaving little room for further improvement.

Following the trainings, faculty rated their perceptions of the quality of their mentoring, satisfaction with their mentoring relationships, and ability to meet their students' expectations very positively. To understand whether faculty perceptions align with students' perceptions of mentoring, we have started to collect data from students mentored by participating faculty, to be reported in a follow up analysis.

The hypothesized improvements in the use of evidence-based practices for teaching and mentoring and participants' science identity measured by the HERI STEM and Mentoring modules were not observed, due perhaps to the survey timeline, since post-survey responses were collected immediately following participation in each training module. There was no change in measures of self-efficacy, that is, in participants' attitudes about their confidence and capability to perform mentoring and teaching. We anticipate needing a longer interval before measuring potential changes in teaching behavior, like using evidence-based practices and high-impact/active learning strategies in courses or implementing CUREs. Although participants expressed intentionality, the questionnaires did not capture actual implementation of CUREs.

Limitations and Future Directions

Although we were able to recruit the target number of faculty participants for the trainings (and exceeded), collecting surveys proved more difficult. This was the biggest limitation to determine which training impacted which outcome. Also, the limited participation of faculty in the follow up surveys, with many only completing one, meant it was not possible to compare between groups. The low survey participation may be explained by email (Segal, 2021) and online survey fatigue (Brown et al., 2024; Porter, 2005), and increases in faculty workload (Horta et al., 2022) that have been documented especially following the COVID-19 pandemic. To analyze long-term outcomes of these trainings, ongoing plans include conducting follow-up focus groups with participants. We anticipate this approach being more successful since participation in the trainings themselves was very high, and some cohorts have continued their engagement by developing communities of practice among their members. We expect participants to welcome an opportunity to connect with others and reflect on their experiences with mentoring and implementing CUREs, more than to answer online survey requests. This limitation also underscores the challenge of performing these kinds of studies in a small-sized institutions, the ones that precisely need them the most.

The lack of a control group is also a limitation of our study. We wonder whether those survey items showing no significant change after training could reflect improvements if compared to faculty that did not receive training. This is an important next step that we are currently undertaking, and we plan to continue recruitment until we reach a sufficient sample size for comparison.

Conclusion

Providing quality mentoring is clearly essential — as highlighted by both anecdotal evidence and rigorous studies, including the present one — if we are to support the success and retention of undergraduate students from HUGs in biomedical careers. By quality, we mean mentoring that incorporates elements such as cultural competency, skill building, career support, psychosocial support, and constructive feedback, as demonstrated by an increasing body of literature. The current study demonstrates that it is possible to improve the self-efficacy of faculty in this specific task of mentoring diverse groups of biomedical students by implementing a yearlong training in mentoring and CUREs. This training can also contribute to increase the number of faculty prepared to offer effective support to HUG students in biomedical majors. An additional benefit of this intervention is alleviating some of the service burden and cultural taxation experienced by HUG faculty.

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