Spring 2022
Volume 13, Issue 1

Enhancing Research Mentors' Cultural Awareness in STEM: A Mentor Training Intervention

Sherilynn Black[1], Angela Byars-Winston[2], Ivan Cabrera[2], and Christine Pfund[2]

[1]Duke University School of Medicine, Durham, NC 27710
[2]University of Wisconsin-Madison, Madison, WI 53726

Email: sherilynn.black@duke.edu

Keywords: Mentor training, STEM, diversity, culture, intervention, mentorship

Abstract

Research mentoring relationships are critical to mentees' persistence in STEM careers. Cultural identity variables (gender, race, ethnicity) influence how mentees experience mentoring relationships, including their developmental needs and expectations of mentors. Research shows that mentees from underrepresented groups in STEM often want to discuss topics related to race and ethnicity and how these factors impact their careers. However, many research mentors are uncertain of their ability to broach cultural diversity issues in mentorship or strategies to engage in culturally aware mentoring practices. To address this need, we developed an evidence-based mentor training intervention for Enhanced Cultural Awareness (ECA) in mentorship. We implemented the two-hour module online with research mentors (N=62) largely from well-represented racial/ethnic groups in STEM who were mentoring undergraduate researchers from underrepresented racial/ethnic groups. Mentors reported significant gains in skills, attitudes, and behaviors related to cultural awareness in mentoring. The majority of mentors found the training valuable, and 97% of mentors reported intending to make changes in mentoring practices post-intervention. Our results indicate that the ECA module is an effective tool to increase mentors' capacity to enact culturally aware mentoring practices. Implications for continued research and mentorship education to enhance mentors' cultural awareness are also discussed.

Introduction

Research mentoring relationships hold great importance in the talent development of emerging professionals in science, technology, engineering, and mathematics (STEM) (Poodry & Asai, 2018; Dolan & Johnson, 2009; Junge et al., 2010; Nagda et al., 1998). In the apprentice model of training, most commonly used in academic research labs (McGee, 2016), research mentors help mentees to form science identity (Chemers et al., 2011), build their research self-efficacy (Byars-Winston et al., 2015), and persist academically (Haeger & Fresquez, 2016), all of which are

significant facilitating factors in their mentees' intent to pursue and the actual pursuit of STEM careers (Estrada et al., 2011). Beyond contributing to academic and career development, strong mentoring relationships can help mentees gain tacit knowledge needed to better navigate the "unwritten rules" of the research enterprise that often limit the persistence and success of emerging STEM professionals (Ragins & Kram, 2007).

The National Academies of Sciences, Engineering, and Medicine (NASEM; 2019) recently issued a consensus study report, "The Science of Effective Mentoring in STEMM," with the second "M" referring to medicine and health sciences. The mentoring relationship is vital to the concept of mentorship, which NASEM defined as "a *professional working alliance in which individuals work together over time to support the personal and professional growth, development, and success of the relational partners through the provision of career and psychosocial support.*" The report highlighted the ways in which mentoring relationships are multi-layered social interactions, and the myriad of variables that influence the effectiveness of these interactions. Such variables include the frequency of interaction, the structure or form of the mentorship relationship, and the duration of the relationship. The report also summarized evidence that cultural identity variables, such as gender, race, and ethnicity, are empirically linked to mentee academic and career development and influence how mentees experience the different facets of the mentorship relationship—including what they need and want from their mentor. In this paper, we report on the effectiveness of a mentor training intervention developed to specifically enhance research mentors' cultural awareness.

Racial and ethnic cultural identity variables can be particularly salient for mentees from racial and ethnic groups that are underrepresented (UR) in STEM, including Latinx/Hispanic, African American, Native American, and Native Hawaiian/Pacific Islander. UR students in STEM are more likely than their peers from well-represented (WR) racial and ethnic groups (i.e., White and WR Asian ethnic groups) to want to discuss topics related to race and how it affects their academic and career development, as well as strategies for managing race-related barriers (Blake-Beard, Bayne, Crosby, & Muller, 2011). This finding is consistent with other studies documenting that stressors like microaggressions and overt bias that UR students in STEM encounter from peers and faculty produce additional layers of race-based pressures throughout their research development (Alexander & Hermann; 2016; Ong et al., 2011).

Despite the need for students to receive support and validation in these challenging situations, many research mentors are hesitant to address cultural diversity issues in their mentoring relationships (Butz et al., 2019). While some mentors may feel comfortable discussing cultural diversity in their research mentoring relationships, others are unsure of how to broach topics related to psychosocial and cultural matters, even if such topics may be clearly affecting their mentees' academic progress. This avoidance to broach the topic of race was observed in a sample of self-identified White/Caucasian and Asian research mentors who avoided discussing cultural diversity topics due to their own discomfort, fear of the possibility of offending others,

or fear of having their good intentions misunderstood (Byars-Winston et al., 2020). These concerns and hesitation are consistent with observations documented by DiAngelo (2011) in her studies of white fragility and cultural avoidance. Further, Prunuske et al. (2013) found that some research mentors also subscribed to a 'neutral' stance toward acknowledging or addressing cultural diversity factors in training environments and adopted "color blind" attitudes. This move towards "neutrality" may result in mentors being less likely to acknowledge the relevance of cultural diversity in mentoring practices, which in turn may lead to mentors missing or dismissing the diversity related experiences of their mentees.

A key finding in the NASEM mentoring report (2019) was that mentors, regardless of their race or gender, can learn to be culturally responsive. Cultural responsiveness is a learned skill set in which one shows interest in and valuing of students' cultural backgrounds and social identities. However, mentors may require learning opportunities through mentorship education to develop strategies and resources to effectively navigate cultural diversity matters in the context of mentored research experiences.

Purpose of Study

The purpose of this research was to evaluate a new mentorship education module developed to build the cultural awareness of research mentors. We designed the module specifically for research mentors from racial groups that are well-represented in STEM who work with undergraduate mentees from racial or ethnic groups that are underrepresented in STEM. The module was designed to augment foundational mentoring competencies covered in an original research mentor training curriculum called *Entering Mentoring* (Handelsman et al 2005; Pfund et al. 2014). The curriculum was designed to highlight for mentors the specific ways that their own cultural attitudes and beliefs can have an impact on their mentoring relationships and on mentees' training experiences, such as how mentors evaluate or give feedback to their mentees. The goal of this curriculum was to equip mentors with tools and strategies to increase the effectiveness of their research mentoring relationships and ultimately help them promote research training environments that are culturally affirming and inclusive for all mentees, those from UR and WR backgrounds alike. The curriculum was intentionally designed so that it could be implemented completely through an online platform to allow for broad dissemination.

In this paper, we describe the development of a new mentorship education module for mentors entitled Enhanced Cultural Awareness Module (ECA). This newly developed ECA module includes experiential activities designed to encourage self-reflection to increase mentors' understanding of their own cultural experiences and their relevance to the research mentoring relationship, specifically on how race and culture influence their mentees' academic development. Self-reflection can help mentors become more attuned to the cultural context of their mentees' development and help them generate strategies for addressing cultural diversity matters that may arise in their mentoring relationships (Byars-Winston et al., 2018).

Intervention Design: Development of the Enhanced Cultural Awareness (ECA) Module

Conceptual Framework and Foundation. We used the Multicultural Competency (MCC; Sue, 2016) model to conceptually frame the connection between mentors' cultural awareness and their mentoring practices. MCC is a counseling psychology framework that specifies three domains of competence necessary for culturally aware practice: attaining *knowledge* of diverse groups, increasing *awareness* of cultural beliefs and norms, and developing *skills* to provide effective interventions (Sue, Arredondo, & McDavis, 1992). These three domains of competence are vital points of consideration as mentors work to effectively mentor students across diverse cultural backgrounds and, thus, guided the key elements we sought to include in the ECA module.

The template for our ECA module is based upon the mentor education curriculum titled *Entering Mentoring* (EM), originally developed in 2005 and evaluated by Pfund and her colleagues (2006). EM is an evidence based, process-based, mentor education curriculum designed to increase effective research mentorship skills through the development of six research mentoring competency areas: (a) maintaining effective communication; (b) establishing and aligning expectations; (c) assessing mentees' understanding of scientific research; (d) addressing equity and inclusion within mentoring relationships; (e) fostering mentees' independence and; (f) promoting mentees' professional career development. EM includes experiential activities, case scenarios for group discussion, and didactic teaching. It is typically offered across eight hours of training, delivered in one full-day session or via several shorter-term sessions.

Pfund et al. (2014) found evidence in a randomized control trial that the EM curriculum is more effective than no mentor training for both new mentors and those that have had more than 15 years of mentoring experience. Using the Mentor Competency Assessment (MCA) (Pfund et al., 2014), they compared two mentor groups, one that received the EM training intervention and a control group that received no training. The intervention group had comparatively higher MCA scores than the control group from baseline to post-test across all six mentoring competencies. Furthermore, the mentees of mentors in the intervention group reported higher composite MCA scores for their mentors than the scores of mentees with mentors in the control group. In the same study, one mentoring competency assessed by the MCA, addressing diversity within the mentorship relationship, had the smallest gains for mentors. Therefore, we sought to give this aspect of research mentor training further attention.

Our enhanced cultural awareness (ECA) module includes experiential activities aimed at mentors 1) engaging in personal cultural self-reflection and 2) learning more about the experiences of UR STEM students. We specified four learning objectives for the ECA module including increased awareness of cultural diversity in oneself, in the mentoring relationship, understanding of the impact of biases, and cross-cultural communication strategies (see Table1).

Table 1: Learning objectives for the Enhanced Cultural Awareness (ECA) module

Learning objectivesMentors will:	Description of module activities	Multicultural Competency
1. Expand their understanding of cultural diversity in mentoring relationships	Debrief iCAM online module; label and discuss ways underrepresentedstudents react to discrimination	Knowledge
2. Recognize impact of biases and assumptions on mentoring relationships; and generate strategies to manage them	Watch animated video that illustrates the experiences of minoritized individuals; discuss research about pros and cons of "colorblind" ideology	Knowledge
3. Increase awareness of cultural diversity in one's self and others	Complete self-assessment of personal broaching styles related to race; work in pairs to critically review and reimagine a challenging interaction with a trainee where race/ethnicity was salient	Awareness
4. Communicate effectively across dimensions of cultural diversity, consider power dynamics	Discuss case scenario in which mentor observes racial discrimination in lab; role play responses to case scenarios with peer observation and feedback	Skills

During the development of our ECA module for EM, several researchers from this project were part of developing an innovative six-hour mentorship education curriculum called Culturally Aware Mentoring (CAM) through the NIH-funded National Research Mentoring Network (www.nrmnet.net). Results from the CAM pilot implementations in 2016 showed that faculty mentor participants increased their personal levels of cultural awareness, their confidence to address cultural diversity in their mentoring relationships, and their willingness to broach topics of race/ethnicity with their mentees (Byars-Winston et al., 2018). These gains suggest that CAM can facilitate effective mentorship through enhanced cross-cultural communication between mentors and mentees. The foundation for the ECA module was built on the empirically-supported EM and CAM mentorship education curricula. The ECA module used several pedagogical approaches to provide content that helped mentors reflect on their cultural identity, including video clips, guided discussion, role-plays, vignettes, as well as an online self-guided cultural diversity module used in the CAM intervention (Byars-Winston et al., 2018), now titled *iCAM* and detailed in the curriculum description section below.

Online Learning Modality. Online learning opportunities are an increasingly attractive medium for upskilling the practice of research mentorship. McDaniels et al. (2016) demonstrated that research mentor training offered in an effective synchronous online learning environment which a) clearly explains how to utilize the online platforms' tools to navigate the environment, b)

prioritizes pedagogy that builds classroom community as well as models open communication, and c) has facilitators who are dynamic and engaging, can achieve the same benefits as face-to-face instruction. Their work demonstrated the ability of such courses to provide deep levels of learner engagement and meaningful instructor interaction, which are key aspects in facilitating cultural diversity awareness mentor education. More recent studies by our team indicated that there are no significant differences in mentor training outcomes between in-person and synchronous online modalities as assessed by the MCA (Gong et al., 2021). Online mentor training, therefore, is likely a feasible alternative or supplemental option to in-person mentor training.

We delivered the ECA module through Blackboard Collaborate Ultra (hereafter referred to as Blackboard). This web conferencing tool allows for creation of a virtual classroom or meeting using synchronous communication with learners anywhere in the world. It includes the following features: sharing live or recorded audio/video lectures and trainings; screen, application, and presentation sharing; a shared virtual whiteboard wherein participants can write in real-time, viewable immediately to all participants; interactive polling; virtual breakout rooms for small group discussion; public and private text chat with emojis for reactions; mobile apps for access from iOS or Android devices; and integrated Telephony allowing for participant call in for audio. We also used Moodle, an open-source online learning platform that is private and secure (instructor access and login required), on which to store all module-related materials including: assignments, mentor biographies, and shared links to mentoring tools, resources, and suggested readings.

Curriculum Design Team and Process. Our curriculum development team consisted of four individuals that identified as people of color, two women who identified as Black, one woman who identified as Indian (South Asian), and one man who identified as Latino. Two of the women were counseling psychologists, the Latino man was a doctoral student in counseling psychology, and one of the Black women received doctoral training in neuroscience.

The curriculum team considered tenets of the MCC when choosing the ECA module content. The *knowledge* goals were: to help research mentors understand how race/ethnicity affects academic and career development, self-perceptions (e.g., research self-efficacy), and the effects of institutional barriers on student development. The *awareness* goals were: to increase mentors' awareness of the influence their own backgrounds/experiences and biases have on their mentoring relationships, and increase awareness of mentors' cultural stereotypes and preconceived notions. Finally, the *skills* goals for mentors were to generate and practice strategies to recognize and reduce racial bias and inequity, and increase cross-cultural communication in their mentorship. The team also considered tenets of social cognitive career theory (SCCT; Lent et al., 1994) recognizing that mentors need to gain confidence in their abilities to enact culturally aware mentoring practices.

The team used their personal and professional experiences with mentorship as well as readings from published research of cultural awareness interventions from various disciplines, including education research and the helping professions, and published research on mentorship, particularly mentorship and cultural diversity.

Our curricular design team met over the course of five months to generate the content for the ECA module. We structured the parameters for the curriculum and selected effective teaching strategies to navigate various cultural diversity topics in an online platform. The parameters that guided the curriculum development were 1) to be deliverable in a synchronous online space (Blackboard) and 2) delivery within a two-hour session. Because the ECA module was delivered within the full EM curriculum, five of the six EM mentoring competencies, described earlier in the paper (see Conceptual Foundation and Framework section) were covered in other online sessions using published EM modules (Handelsman et al., 2005; Pfund et al., 2014). As such, we built the ECA content to augment the EM curriculum with activities aimed at increasing cultural awareness, beyond those in the existing "addressing equity and inclusion" EM competency (Handelsman et al., 2005; Pfund et al., 2014).

We adopted the EM pedagogical practices for teaching adult learners in selecting and developing the learning activities and format for the ECA module. Such practices and learning activities include modest didactic teaching, complemented by process-based collaborative small-group learning through case scenario discussions, group-based critical brainstorming, role plays, and sharing effective practices and resources. The activities for the session are co-facilitated by two trained facilitators.

Enhanced Cultural Awareness Curriculum Description. The ECA module focuses on raising mentors' awareness about cultural diversity in themselves and others by reflecting on the ways cultural diversity can benefit and complicate mentoring relationships. In Table 1, we summarize a description of the activities in the ECA module. During the two-hour session, mentors first debrief the iCAM online self-paced module, which is assigned as homework, and then cover historical and current cultural diversity challenges in STEM and in general. This pre-training module is assigned as a primer to prepare for mentor training focused on culturally responsive mentorship by increasing mentors' understanding of how cultural diversity issues are relevant to research trainees' development, academic outcomes, and success. The iCAM (Byars-Winston et al., 2018) module addresses 4 topics: (1) race and privilege, (2) the experiences of scientists from historically underrepresented groups, (3) the realities of cultural diversity in the sciences, and (4) the role of CAM in trainee outcomes. iCAM is self-directed and takes about one hour to complete.

During the first session, mentors watch a video clip about the experience of UR individuals and focus on perspective-taking to increase awareness of the potential mentorship needs of UR mentees (Byars-Winston et al., 2018). Next, facilitators lead a discussion of the pros and cons of

a "culture-blind" vs. "culture-conscious" approach in addressing cultural diversity matters in mentorship. Working in pairs using the breakout room feature of Blackboard classroom, mentors complete a self-assessment activity on styles of broaching cultural diversity in relationships, and then describe a difficult situation with a mentee when race/ethnicity was salient, or a difficult situation with race/ethnicity that they may anticipate if they have not experienced such a moment with a mentee. They give each other feedback on how they might improve in the future. Finally, mentors discuss a case scenario developed for this module titled "Colorblind or Colorbrave" that is about witnessing race-based discrimination of a UR researcher in the lab group. Working in groups of three in virtual breakout rooms, participants discuss the case scenario two times: first, generating strategies for navigating cultural diversity dynamics in the scenario with both the UR researcher and the lab group, including subsequent implications for mentorship of the UR researcher; second, they practice these strategies in real-time through role play.

Evaluation of the Enhanced Cultural Awareness Module: Methods

Recruitment. We implemented the ECA module with research mentors who were working with undergraduate mentees in the Research Experiences for Undergraduates (REU) program sponsored by the National Science Foundation during the summer of 2017. We recruited from REU programs nationwide, publicizing the study at professional conferences and workshops, and using our personal networks to directly contact REU program directors. The current paper reports initial program evaluation data from the participants who were part of a larger randomized control study (to be reported in a separate publication). We received institutional review board approval to conduct the ECA module evaluation (IRB protocol #2016-1408).

Participants. A total of 94 research mentors from 16 different REU programs engaged in the ECA module. After removing those who only had partial attendance due to attrition or technical connectivity issues, we used data from 62 participants. The demographics of the survey respondents were consistent with the demographic breakdown of the overall participants, and the participant group was represented by mentors at all levels (graduate students through full professors and academic leaders). Mentor participants received the ECA module just before or at the beginning of their REU summer programs. It was implemented as the second of four mentor training sessions in the larger randomized control trial study. The timing of the implementation allowed for the guidance of mentors as they established new mentoring relationships with provision of constant reinforcement, real-time practice, and immediate feedback from their community of peers that they could apply to their current mentorship practices.

There were eight facilitators for the ECA module implementation: five women and three men. Seven facilitators had earned doctoral degrees in the biological and social sciences and one facilitator was an advanced doctoral student earning a social science degree. The racial/ethnic

identification of facilitators included: Black/African American (n=3); Chinese/Asian Indian (n=2); Latinx (n=2); White/European descent (n=1). All facilitators received four hours of training to prepare for implementation of the ECA module and facilitated in pairs.

Data Sources. We used a survey to evaluate the ECA module that consisted of both Likert-type questions and open-ended responses for participants to share their personal experiences and perceptions of both the content and structure of the module. Following an approach used to evaluate other research mentor training modules (Butz et al., 2018). We evaluated the ECA module based on Kirkpatrick's (2016) three levels of evaluation: reaction, learning, and behavior. *Reaction* captures participant satisfaction with the ECA module. We assessed satisfaction using participants' rating of how valuable they perceived the module to be. *Learning* captures participants acquiring knowledge of intended skills relevant to being a culturally aware mentor as a result of the module. We used participants' self-ratings of their skill gains on five items posited to contribute to culturally aware mentoring (CAM) practices, referred to as CAM skill gains (Byars-Winston et al., 2018). Finally, *behavior* captures the impact of training on participants' intended actions and application of what they have learned. We used participants' rating of the likelihood that they would make changes to their mentoring and descriptions of what those intended changes would be. Data were collected using Qualtrics immediately after the ECA module and then again four weeks later at the end of the overall intervention (not discussed in this paper). All data are self-reported.

Analyses

We ran descriptive statistics and conducted a series of paired *t*-tests analyses to evaluate any changes in participants' rating of their CAM skills after the training. We used the effect size estimate Cohen's d_Z to calculate the standardized difference between the paired means. Finally, we include participant responses to open-ended items to illustrate examples of mentors' reactions to the ECA module and their intended changes to mentoring practices.

Results

Reaction. A majority of the participants considered the ECA module to be beneficial, with 96% of the survey respondents indicating that the ECA had value, with nearly 70% indicating that the module was either 'very' valuable or 'extremely' valuable (Figure 1). One of the areas that was most appreciated by the participants was the opportunity to learn from other mentors. Many commented on the benefit of hearing collective voices to normalize the challenges around discussing topics related to cultural awareness in mentoring, and also valued hearing ideas and potential solutions from others in the cohort. A selection of representative comments indicate that mentors found benefit in:

> *"Collectively admitting that we are all at various levels of not-knowing re: how to approach subjects of race, stereotyping, etc."*

"Chatting with others about bias and how one might go about explicitly discussing racial and gender bias with undergraduate mentees."
"I was intrigued by some of the concerns voiced by my fellow participants regarding sensitivity to ethnic/racial differences. Perspectives I had not considered – which ultimately shows me I have inherent biases that I didn't realize."

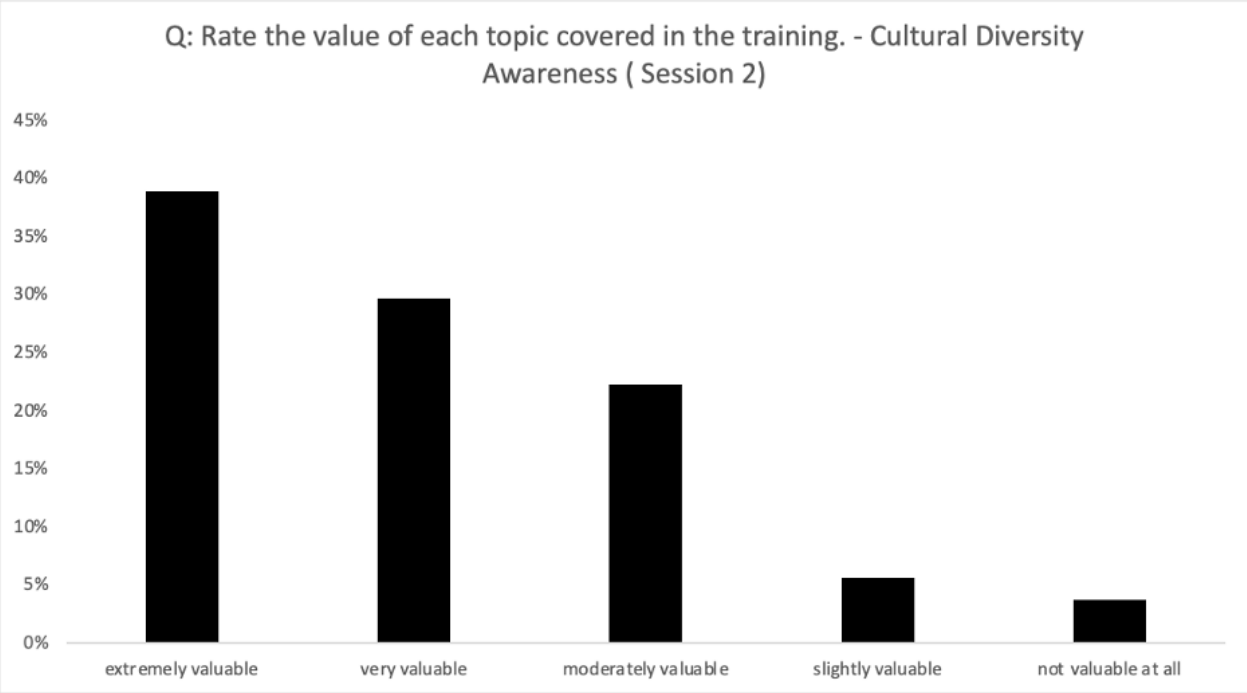

Figure 1: The majority of participants found the ECA module to be a valuable use of their time.

Learning. We used retrospective pre-post items to assess gains in participants' five CAM skills based on knowledge learned from the ECA module. The five items, used in a previous study by Byars-Winston et al. (2018), are: 1) Making a plan to increase my culturally aware mentoring practices; 2) Intentionally create opportunities for my mentees to bring up issues of race/ethnicity when they arise; 3) Encouraging mentees to think about how the research relates to their own lived experiences; 4) Going outside of my comfort zone to help mentees feel included in the lab, and; 5) Respectfully broaching the topic of race/ethnicity in my mentoring relationships.

We observed statistically significant gains in all five CAM skill items as indicated by the difference between pre and post means (M_{diff}[†]), Table 2. Although all skills showed significant gains, the largest CAM skill gain based on the effect size (*dz*) was for the item, "Intentionally create opportunities for my mentees to bring up issues of race/ethnicity when they arise."

Table 2: Perceived culturally aware mentoring skill gains reported by participants

CAM Skills	(*n*=62)				
	Before [mean(SD)]	Now [mean(SD)]	M*diff*[t]	*p*	d_z
Make a plan to increase my culturally aware mentoring practices	3.16 (1.17)	4.55 (1.40)	1.39	<0.001	-2.27
Intentionally create opportunities for my mentees to bring up issues of race/ethnicity when they arise	3.45 (1.34)	4.95(1.57)	1.50	<0.001	-2.65
Encouraging mentees to think about how the research relates to their own lived experiences	3.37 (1.36)	4.40(1.53)	1.03	<0.001	-2.33
Going outside of my comfort zone to help mentees feel included in the lab	2.84 (1.12)	3.89 (1.36)	1.05	<0.001	-2.28
Respectfully broaching the topic of race/ethnicity in my mentoring relationships	3.38 (1.47)	4.66 (1.58)	1.28	<0.001	-2.20

*Mentors were asked "Please rate how skilled you feel you were BEFORE the training and howskilled you feel you are NOW in each of the following items." Responses could range from 1 (not at all skilled) to 7 (extremely skilled).
[t]Mdiff represents the mean difference between mentors' self-reported level of skill thinking backto before the training as opposed to now, after the training.

Behavior. Survey results indicate that 96% of the participants planned to make changes in their mentoring practices as a result of the training (Figure 2). Participants provided open-ended responses that followed the survey question about planned or actual behavioral changes to mentoring. Together, these comments indicate that the ECA module led to increased awareness on mentoring topics related to cultural awareness and increased the mentors' ability to initiate and plan implementation of practical changes in their mentoring practices. Participants highlighted that the ECA module helped to increase their comfort in broaching and discussing topics related to race with their mentees. They also reported increases in their ability to consider how cultural diversity impacts the experiences of their mentees, and in being more aware of how personal identities influence their mentees' experiences during training. A selection of representative comments amplifies these points:

> *"I have become much more comfortable broaching conversations. This extends from somewhat sensitive topics surrounding gender/race/cultural identity to other topics such as performance and expectations. I have also reworked my strategies for assessing understanding and have applied them more frequently."*

"…I have always been quite aware of some cultural differences with Native Americans and feel that I have bridged the two worlds well; however, in the future I may have Black or Hispanic mentees and I will try to help individuals with experiences that they may have with microaggressions- sometimes just a sympathetic ear really helps young people. I have always been pretty encouraging when it comes to students, and I think there is never enough encouragement- including getting them to ask questions about anything that they don't understand."

"Making sure I am more aware of the full student, not just the aspect of the student that works with me."

"I would like to open a conversation about how cultural diversity affects the experience of minority students."

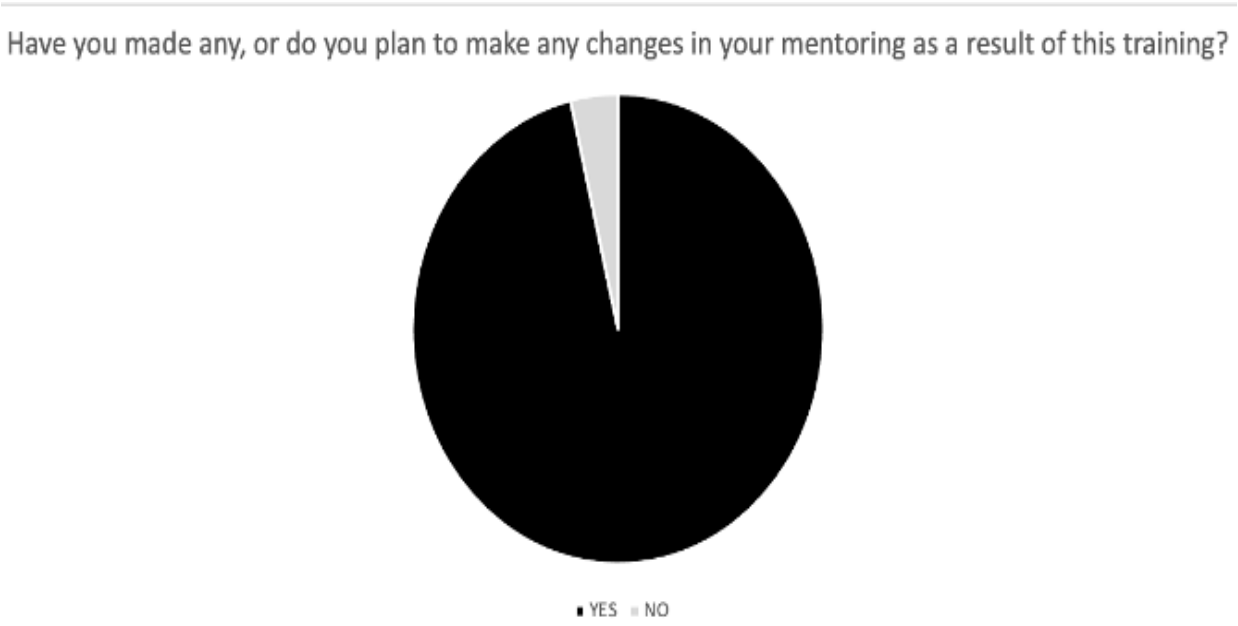

Figure 2: The majority of participants plan to make changes in their mentorship practices after taking the ECA module.

Virtual Learning Platform. We also gathered participant feedback on their experience with research mentor training via a virtual platform. As this study was conducted in 2017, engaging with the online synchronous classroom environment through Blackboard seemed to be a new experience for nearly all of the participants, and they adapted to using it fairly quickly. Many participants indicated that they enjoyed the interaction features in Blackboard that facilitated group engagement, which were especially useful during the parts of the ECA module that required discussion-based engagement such as the case scenarios.

Discussion

A key recommendation of the NASEM consensus study on the science of mentorship (2019) is that all STEMM mentors engage in some form of mentorship education. Some federal agencies and private foundations that fund scientific training programs in higher education are aligned in this approach and now require faculty to engage in mentorship education (Singh, Lorsch, Gammie and Constant, 2019; Asai, 2020). Similarly, cultural diversity trainings are becoming increasingly frequent in academia as universities explore methods to advance institutional diversity, equity, and inclusion (Khalid & Snyder, 2020). In this evaluation study, we introduced a theoretically informed, evidence-based, training module that significantly enhanced mentors' self-reported capacity to approach mentoring practices in a culturally aware manner. The effectiveness of this module and its scalable nature due to its online delivery gives it the potential to reach a large number of individuals through greater accessibility than is typically possible through face-to-face delivery.

Our findings show that participants found benefit and value in the discussion-based design of the ECA module. The module content contributed to mentors' increased cultural awareness and skills to effectively navigate topics related to race/ethnicity in their mentorship. Notably, mentors reported improved confidence to engage in racial/ethnic related discussions with their mentees and being intentional in doing so. These reported skill gains were reflected in their open-ended responses that revealed that after completing the ECA module, mentors immediately began to consider strategies and opportunities to incorporate topics related to racial matters into their research mentoring relationships and training spaces (e.g., labs).

Given the mixed findings from other studies regarding participant reactions to diversity trainings (Chang et al., 2019; Brown, 2020), we are encouraged by the degree to which mentors taking the ECA module-maintained interest and engagement and reported favorable outcomes. It is noteworthy that mentors experienced significant gains in all five of the CAM skills items. This indicates that engagement in the ECA module can change mentors' self-perception of their abilities and behaviors in a number of targeted areas related to culturally aware mentorship. This perceptual shift is critical for mentors, especially those from WR groups, to have the intrinsic belief and confidence that they can effectively enact culturally aware mentoring practices, not just for UR mentees but for all those they mentor. Several factors in the design of the ECA module may have contributed to the observed increase in perceived CAM skill gains.

First, the mixed-pedagogical design of the ECA module that includes personal cultural reflection on one's own time, videos and brief readings, case scenarios, and process-based group discussions with trained co-facilitators may have created a 'safe' learning experience for individuals who often experience concerns over the potential intensity of conversations on race. Studies have described cultural avoidance and a hesitancy by White individuals to broach conversations on race, particularly due to concerns of being labeled as 'racist' or feeling judged for not engaging in an 'appropriate' manner (Byars-Winston et al., 2020, DiAngelo, 2011). Our

qualitative data indicate that when WR participants were provided with practical strategies for evidence-based mentorship practices with racial diversity topics, they were willing to engage and commit to changes in their practice.

Second, and aligned with the first point, is the mentors' reported enjoyment of learning the ECA module content together in a cohort with other mentors. They found the additional perspectives shared from their peers to be important contributors to their own growth and skill gains and appreciated having the opportunity to learn from and hear feedback from their peers on thorny cultural dynamics they may have struggled with on their own. For example, in the open-ended responses, a number of mentors indicated that they enjoyed the practice of 'acting out' how they would respond in different circumstances with their mentees. Studies have shown the benefits of working in a cohort, including peer-to-peer learning, normalization of reactions and responses, a shared set of values and norms, and feelings of accountability towards a shared goal (Saltiel et al, 2002; Scribner & Donaldson, 2001). It may be that working in a cohort normalized feelings of uncertainty and reduced competence in mentors who are used to holding positionality that perpetuates power, privilege, and expertise in academic settings. It may also be that the relative anonymity of learning together with mentors from a wide range of institutions reduced mentors' concerns about judgement that they may have received if they were in groups with familiar colleagues at their home institutions.

The ECA module was implemented in 2017. The year 2020 ushered in extreme social upheaval nationally and internationally. The COVID-19 pandemic has deeply disrupted the ability of many scientists to engage in their research, and mentors and mentees are having to adapt to new ways to make scientific progress, virtually communicate, and conduct remote mentorship (Pfund et al., in press). The world has also been confronted with a seemingly unceasing upsurge in racial violence and intolerance that has been painful for many, especially those who identify as Black and/or African-American (NPR/IPSOS survey, 2020). These challenges have implications for research mentors and mentees in two key ways. First, when we experience heightened levels of stress and anxiety, we are likely to become more egocentric in how we engage with or show empathy for others (Tomova et al, 2014). Second, stress increases the likelihood of relying on our immediate or 'gut' feelings and, therefore, we may unintentionally engage in more biased behaviors (Yu, 2016). Thus, even mentors who may typically be sensitive and attuned to handling racial/ethnic topics in their mentoring relationships may require additional support when engaging these topics in the present social context. In light of the current historical moment, the ECA module may be an especially relevant resource for STEM faculty professional development to advance effective mentorship. Importantly, the ECA module has been implemented both as an additional module to the standard Entering Mentoring curriculum as described in this paper and more recently, as a standalone offering. Early assessment of the standalone version is promising. In addition, the CAM skills assessment (Byars-Winston et al., 2018) as well and other

validated measures of cultural diversity (Byars-Winston et al. 2021) may be useful in a broader context.

Our evaluation study has limitations. All participant data were self-reported. We do not know either the endurance of the observed CAM skill gains or how participants' CAM skills or reported intentions relate to their mentoring behaviors. Womack et al. (2020) conducted a longitudinal follow-up study with faculty who participated in the face-to-face CAM training (Byars-Winston et al., 2018) and found enduring impacts of that training on the actual mentoring behaviors of faculty 18-24 months after CAM participation. Follow up with longitudinal data from ECA participants would help determine if mentors' reported skill gains endure and whether they result in actual changes in their mentorship practices and behaviors. Moreover, a community of practice for mentors who had engaged in mentorship education, including the ECA module, would both support mentors in their practice as well as allow for tracking of such changes. Entities, such as the Center for Improved Mentoring Experiences in Research (CIMER) at the University of Wisconsin-Madison, are working to find resource to support such a community of practice.

There are several directions for future research. Our results demonstrated that diversity-focused mentorship education can be effectively taught online synchronously. This finding is consistent with the work of McDaniels et al. (2016), who demonstrated the effectiveness of the *Entering* Mentoring trainings online with participants reporting increased cultural awareness. House, Spencer, and Pfund (2018) followed up with faculty mentors who participated in *Entering* Mentoring training three months post-intervention and found that few had acted on that increased awareness. The authors emphasized the need for mentor trainings to include "transfer strategies" to facilitate mentors putting into practice new knowledge gained.

Examination of what transfer strategies in the ECA module are effective in helping participants to apply their learning is needed. Further, Byars-Winston et al. (2020) found a mismatch between mentees' desire to bring up discussions about race and their mentors' belief in the appropriateness of such topics. Future research may examine the alignment between how mentees and their mentors who complete the ECA module rate the mentorship practices that their mentors perceive themselves to make.

In summary, the NASEM (2019) consensus study stated that mentors with culturally aware mentorship practices will have more effective mentorship overall which is needed to support the academic and career success of all mentees, regardless of racial or ethnic background. The results in this present study provide support for the ECA module as an effective intervention to increase mentors' capacity for culturally aware mentoring practices. In summary, the NASEM (2019) consensus study stated that mentors with culturally aware mentorship practices will have more effective mentorship overall which is needed to support the academic and career success of all mentees, regardless of racial

or ethnic background. The results in this present study provide support for the ECA module as an effective intervention to increase mentors' capacity for culturally aware mentoring practices. The module can be offered as an addition to the well-documented, evidence-based work in the comprehensive EM (Pfund et al., 2016) and CAM (Byars-Winston et al., 2018) curricula. Given its two-hour duration and effectiveness in being implemented online, the ECA module has the potential for broad dissemination and accessibility.

Acknowledgements

We would like to thank Arpita Ghosh, Nancy Thayer-Hart and Janet Branchaw for their contributions to this work. We also thank our partners from the Center for the Integration of Research, Teaching, and Learning, including Elizabeth Stephens, Miranda Davis, Kitch Barnicle, the module facilitators Kermin Martinez Hernandez, Arpita Ghosh, Amanda Butz, Philip Cheng and Kelly Diggs-Andrews, and the Center for Women's Health Research at the University of Wisconsin-Madison. This work was financially supported by the National Institutes of Health under grants R01 GM094573 and R01 GM094573-S1.

References

Alexander, Q. R., & Hermann, M. A. (2016). African-American women's experiences in graduate science, technology, engineering, and mathematics education at a predominantly white university: A qualitative investigation. Journal of Diversity in Higher Education, 9(4), 307–322. https://doi.org/10.1037/a0039705

Asai, D. (2020). Race Matters. Cell, 181(4), 754-757. DOI: 10.1016/j.cell.2020.03.044

Blake-Beard, S., Bayne, M. L., Crosby, F. J., & Muller, C. B. (2011). Matching by race and gender in mentoring relationships: Keeping our eyes on the prize. Journal of Social Issues, 67(3), 622–643. https://doi.org/10.1111/j.1540-4560.2011.01717.x

Brown, S. (2020). The Trump administration says diversity training can be harmful. What does the research say? The Chronicle of Higher Education. August edition. https://www.chronicle.com/article/the-trump-administration-says diversity-training-can-be-harmful-what-does-the-research-say

Butz, A., Branchaw, J., Pfund, C., Byars-Winston, A., & Leverett, P. (2018). Promoting STEM trainee research self efficacy: A Mentor Training Intervention. Understanding Interventions, 9(1), 3730.

Byars-Winston, A., Branchaw, J., Pfund, C., Leverett, P., & Newton, J. (2015). Culturally diverse undergraduate researchers' academic outcomes and perceptions of their research mentoring relationships. International Journal of Science Education, 37(15), 2533–2554. DOI: 10.1080/09500693.2015.1085133

Byars-Winston, A., Leverett, P., Benbow, R. J., Pfund, C., Thayer-Hart, N., & Branchaw, J. (2020). Race and ethnicity in biology research mentoring relationships. Journal of Diversity in Higher Education, 13(3), 240–253. https://doi.org/10.1037/dhe0000106

Byars-Winston, A., Womack, V. Y., Butz, A. R., McGee, R., Quinn, S. C., Utzerath, E., Saetermoe, C. L., & Thomas, S. (2018). Pilot study of an intervention to increase cultural awareness in research mentoring: Implications for diversifying the scientific workforce. Journal of Clinical and Translational Science, 2(2), 86–94. https://doi.org/10.1017/cts.2018.25

Byars-Winston, Angela, and Amanda R. Butz. (2021). Measuring Research Mentors' Cultural Diversity Awareness for Race/Ethnicity in STEM: Validity Evidence for a New Scale. CBE—Life Sciences Education 20.2 (2021): ar15. https://doi.org/10.1187/cbe.19-06-0127

Chang, E.H., Milkman, K.L., Gromet, D.M., Rebele, R.W., Massey, C; Duckworth, A.L., Grant,A.M. (2019). The mixed effects of online diversity training. PNAS, 116(16), 7778-7783. DOI: 10.1073/pnas.1816076116

Chemers, M. M., Zurbriggen, E. L., Syed, M., Goza, B. K., & Bearman, S. (2011). The role of efficacy and identity in science career commitment among underrepresented minority students. Journal of Social Issues, 67(3), 469–491. https://doi.org/10.1111/j.1540-4560.2011.01710.x

DiAngelo, R. (2011). White fragility. International Journal of Critical Pedagogy, 3, 54-70.

Gong, Xue, Jenna Rogers, Angela Byars-Winston, Melissa McDaniels, Nancy Thayer-Hart, Philip Cheng, Kelly Diggs-Andrews, Kermin J. Martínez-Hernández, and Christine Pfund. (2022) Comparing the Outcomes of Face-to-Face and Synchronous Online Research Mentor Training Outcomes Using Propensity Score Matching. Personal communication in manuscript under review.

Haeger, H., & Fresquez, C. (2016). Mentoring for inclusion: the impact of mentoring on undergraduate researchers in the sciences. CBE-Life Sciences Education, 15(3), ar36. https://doi.org/10.1187/cbe.16-01-0016

Handelsman, J., Pfund, C., Miller Lauffer, S., and Pribbenow, CM. (2005). Entering Mentoring: A Seminar to Train a New Generation of Scientists. Madison, WI: University of Wisconsin Press.

House, S.C., Spencer, K.C., and Pfund, C. (2018). Understanding how diversity training impacts faculty mentors' awareness and behavior. International Journal of Mentoring and Coaching in Education, 7(1), 72-86. https://doi.org/10.1108/IJMCE-03-2017-0020

Johnson, W. B., & Smith, D. (2016). Athena Rising: How and Why Men Should Mentor Women. Bibliomotion: Brookline, MA.

Junge, B., Quiñones, C., Kakietek, J., Teodorescu, D., & Marsteller, P. (2010). Promoting undergraduate interest, preparedness, and professional pursuit in the sciences: An outcomes evaluation of the SURE Program at Emory University. CBE-Life Sciences, 9, 119–132. DOI: 10.1187/cbe.09-08-0057

Khalid, A. & Snyder, J.A. (2020) Why diversity training on campus is likely to disappoint. The Conversation. August edition. https://theconversation.com/why-diversity-training-on-campus-is-likely-to-disappoint-143644

Kim, K.-J., Liu, S., & Bonk, C. J. (2005). Online MBA students' perceptions of online learning: Benefits, challenges, and suggestions. The Internet and Higher Education, 8(4), 335–344. https://doi.org/10.1016/j.iheduc.2005.09.005

Kirkpatrick, D. L. (1998). Evaluating training programs: The four levels (2nd ed.). Berrett-Koehler Publishers, Inc., San Francisco, CA

Kolowich, S. (2015). Diversity training is in demand. Does it work? The Chronicle of Higher Education. November 15 Edition. Retrieved on December 21, 2020 from: https://www.chronicle.com/article/diversity-training-is-in-demand-does-it-work/

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. Journal of Vocational Behavior, 45, 79–122. https://doi.org/10.1145/1340961.1340974

McDaniels, M., Pfund, C., & Barnicle, K. (2016). Creating dynamic learning communities in synchronous online courses: One approach from the Center for the Integration of Research, Teaching and Learning (CIRTL). Online Learning Journal, 20(1). http://olj.onlinelearningconsortium.org/index.php/olj/article/view/518

McGee, R. (2016). Biomedical workforce diversity: The context for mentoring to develop talents and foster success within the 'pipeline.' AIDS and Behavior, 20(2), 231–237. https://doi.org/10.1007/s10461-016-1486-7

Nagda, B. A., Gregerman, S. R., Jonides, J., Hippel, W. von, & Lerner, J. S. (1998). Undergraduate student-faculty research partnerships affect student retention. The Review of Higher Education, 22(1), 55–72. https://doi.org/10.1353/rhe.1998.0016

National Academies of Sciences, Engineering and Medicine (2019). The Science of Effective Mentorship in STEMM. Washington, DC: National Academies Press. https://doi.org/10.17226/25568

NPR/IPSOS National Poll. (2020). White and Black Americans far apart on racial issues.1-19. https://www.ipsos.com/sites/default/files/ct/news/documents/2020-08/topline_npr_racial_injustice_082720.pdf

Ong, M., Wright, C., Espinosa, L. L., & Orfield, G. (2011). Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics. Harvard Educational Review, 81(2), 172–209. DOI:10.17763/HAER.81.2.T022245N7X4752V2

Pfund, C., Branchaw, J.L. and Handelsman, J. (2015) Entering Mentoring. In W. H. Freeman New York, NY 2nd Edition

Pfund, C., Branchaw, J., McDaniels, M., Byars-Winston, A., Lee, S.J., Birren, B. (in press). Reassess-Realign-Reimagine: A guide for mentors pivoting to remote research mentoring. CBE-Life Sciences Education. https://doi.org/10.1187/cbe.20-07-0147

Pfund, C., House, S. C., Asquith, P., Fleming, M. F., Buhr, K. A., Burnham, E. L., & Sorkness, C. (2014). Training mentors of clinical and translational research scholars: A randomized controlled trial. Academic Medicine, 89(5), 774–782. DOI: 10.1097/ACM.0000000000000218

Pfund, C., Pribbenow, C. M., Branchaw, J., Lauffer, S. M., & Handelsman, J. (2006). The merits of training mentors. Science, 311(5760), 473–474. DOI: 10.1126/science.1123806

Poodry, C. A., & Asai, D. J. (2018). Questioning assumptions. CBE—Life Sciences Education, 17(3), es7. https://doi.org/10.1187/cbe.18-02-0024

Ragins, B. R., & Kram, K. E. (Eds.). (2007). The handbook of mentoring at work: Theory, research, and practice. Sage Publications. Thousand Oaks, CA

Saltiel, I.M.,Russo, C.S., Dawson, J. (2002). Cohort programming and learning: improving educational experiences for adult learners. The Canadian Journal for the Study of Adult Education. 16(2). https://cjsae.library.dal.ca/index.php/cjsae/article/view/1882

Scribner, J.P. & Donaldson, J.F. (2001). The Dynamics of Group Learning in a Cohort: From non-learning to transformative learning. Educational Administration Quarterly. 37(5), 603-604. https://doi.org/10.1177/00131610121969442

Sue, D. W. (2016). Multidimensional facets of cultural competence. The Counseling Psychologist. https://doi.org/10.1177/0011000001296002

Sue, D. W., Arredondo, P., & McDavis, R. J. (1992). Multicultural counseling competencies and standards: A call to the profession. Journal of Counseling & Development, 70(4), 477–639. https://doi.org/10.1002/j.1556-6676.1992.tb01642.x

Tomova, L. von Dawans, B, Heinrichs, M., Silani, G. Lamm, C. (2014). Is stress affecting our ability to tune into others? Evidence for gender differences in the effects of stress on self-other distinction, Psychoneuroendocrinology.43, 95-104. http://dx.doi.org/10.1016/j.psyneuen.2014.02.006

Womack, V.Y., Wood. C.V., House, S.C., Quinn, S.C., Thomas, S.B., McGee, R., Byars-Winston, A. (2020). Culturally aware mentorship: Lasting impacts of a novel intervention on academic administrators and faculty. PLoS One. 15(8), https://doi.org/10.1371/journal.pone.0236983

Yu. R. (2016) Stress potentiates decision biases: A stress induced deliberation-to-intuition (SIDI) model. Neurobiology of Stress. 3, 83-95. DOI: 10.1016/j.ynstr.2015.12.006

Zuk, Dorit. Pilot NIGMS T32 Funding Opportunity Announcement. NIGMS/NIH funding announcement, 2018. https://medschool.vanderbilt.edu/wpcontent/uploads/sites/15/public_files/NIGMS%20T32%20Pilot%20for%20EB%2004032018%20final.pdf

