JOURNAL OF DIVERSITY AND EQUITY IN EDUCATIONAL DEVELOPMENT

Ackerman, J. R., Soto-Arzat, A., Stanley, C. A., & May, R. B. (2026). Faculty Development for Diversity, Equity, and Inclusion (DEI) in STEM: Mentoring Relationships of Historically Excluded Students and Faculty in an LSAMP Program. *Journal of Diversity and Equity in Educational Development*, *1*(1), 1–16. https://doi.org/10.5070/N5.47247

Research Article

Faculty Development for Diversity, Equity, and Inclusion (DEI) in STEM: Mentoring Relationships of Historically Excluded Students and Faculty in an LSAMP Program

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Abstract

The Louis Stokes Alliances for Minority Participation (LSAMP) program located within a university system in the Southern United States is designed to increase the number of historically excluded groups in STEM fields through intentional undergraduate research mentoring experiences. This qualitative study involving interviews of 13 mentors and 29 mentees in LSAMP revealed findings that illustrate how faculty development for Diversity, Equity, and Inclusion (DEI) can impact the mentoring experience and cultivate mutually beneficial mentoring relationships in undergraduate student research. Self-determination theory, White racial frame, and the intersectionality framework were used to interpret findings and draw implications for faculty development associated with mentoring impact, confidence and appreciation, time commitment, and intersectionality perspectives and opportunities in STEM.

Keywords: Faculty development, historically excluded groups, intersectionality framework, self-determination theory, White racial frame

Faculty development for Diversity, Equity, and Inclusion (DEI) in an era of anti-DEI state laws and executive orders against support of DEI initiatives strengthened our resolve to share this research study. In January 2025, the President of the United States issued executive orders restricting federal agencies such as the National Science Foundation (NSF) from implementing DEI initiatives, leaving programs like the Louis Stokes Alliances for Minority Participation (LSAMP) program with an uncertain future. The LSAMP institutional site, where data were gathered for this study, has been in existence and funded by NSF since 1990. When the program began in 1990, historically excluded groups earned 3914 of the STEM bachelor's degrees awarded in the United States. By 1998, the number of degrees awarded to these groups of students increased to 20,538 because of LSAMP alliance-based programs in the United States. In 2004, there were more than 30 LSAMP programs in the United States (TAMUS LSAMP, n.d.). In 2021, there were 61 LSAMP alliances, 55 of which were led by four-year institutions (U.S. NSF, 2024). Many graduates of LSAMP are accomplished STEM scholars and professionals.

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There is clear evidence that STEM drives innovation (English, 2018), addresses complex societal challenges (Morrissey et. al., 2022), and fosters economic growth (Croak, 2018). Colleges and universities help to drive innovation, and the STEM pathway to the doctorate must be globally inclusive and responsive to achieve equitable outcomes for the future of our society and world. Undergraduate research helps to accomplish career and academic learning outcomes (Kinkel & Henke, 2006), yet the social and cultural demographics of students in STEM remain largely White and male (Cheryan et al., 2017). Mentoring undergraduate students in STEM research presents challenges and opportunities for faculty and professional development (Atkins et al., 2020). For undergraduate students who have been historically excluded in the United States, opportunities to engage in undergraduate research experiences provided by LSAMP often involve showing up in spaces such as the classroom, research laboratories, and offices where they encounter mentors and peers who may or may not understand who they are, why they are there, and what they need for success.

Undergraduate research experiences are an effective pathway for LSAMP programs in the United States to increase the number of historically excluded groups to complete STEM degrees and pursue graduate studies. The LSAMP program at the institutional sites in this study provides undergraduate students with opportunities to engage in research with faculty mentors. There are several benefits and learning goals, including having the opportunity to engage in professional development such as presenting at conferences, building research skills, and engaging in writing for publication.

The criteria for participation in LSAMP across the institutional sites include: mentees must have at least a 2.5 GPA, be enrolled in a STEM major, demonstrate intentions for graduate school, have a strong interest in pursuing research, be a legal citizen, and face social, economic or educational barriers (TAMUS LSAMP, n.d.). Mentees work weekly with a faculty-led mentor, attend periodic workshops, and present at conferences to showcase their research work. Additionally, several mentees and mentors develop strong relationships over time, actualize goals and research interests, and engage in the creation of new knowledge (TAMUS LSAMP, n.d.). These activities also come with opportunity costs for both mentee and mentor, which will be addressed later.

Faculty mentors in LSAMP do more than just teach classes; they are expected to engage in service and research, including mentoring students in research. For historically excluded (Bensimon, 2017; Bhatti, 2021; McNair et al., 2020) students and faculty, there are often additional needs and challenges in STEM, especially since they comprise a small demographic sample of the STEM population. For example, the National Action Council for Minorities in Engineering (2014) reported that of all engineering faculty, only 6.3% identified as underrepresented minorities (URM) and the rest identified as White males. Another example of disparities persisting in STEM fields is that the majority of students (68%) in STEM are learning through a White Western lens (National Center for Education Statistics, 2010). Therefore, in STEM fields, similar to many social science fields, as noted by Patricia Hill Collins (1986), White males remain the dominant group; consequently, the needs of the normative group are often centered, including access to opportunities such as undergraduate research. For example, theories that are based on the experiences of women of color are often discredited as not being theoretical "enough" for academia (hooks, 1991). hooks (1991) further pointed out that the often-referenced standards and theories in academia are based on White supremacy. Throughout the United States' history, Black women have been theoretically erased, marginalized, excluded from academia, and are still not considered academic subjects (Alexander-Floyd, 2012; Crenshaw, 1989). Similarly, many Native women scholars' experiences have not been recognized. In some instances, scholarship continues to be segregated as a "feminine" experience, as polemic, or at worst

as not knowledge at all (Million, 2009). We need to examine and continue to monitor the micro and macro attitudes and behaviors that can impact the undergraduate research mentoring relationship.

Faculty developers can play a pivotal leadership role in creating DEI-focused faculty development programs that support faculty in their mentoring efforts. Faculty development efforts that "center the needs of minoritized faculty" (Castillo-Montoya et al., 2023, p. 1), as well as the needs of historically excluded students, are particularly critical given the state of current demographics in STEM fields. This paper therefore explores the following questions: (1) What motivates mentors and mentees from historically underrepresented backgrounds to participate in LSAMP and the undergraduate research mentorship experience? (2) How do these mentors and mentees experience the mentoring relationship in this undergraduate research program? (3) What, if any, lessons about the mentoring relationship and sustainable faculty development for DEI in STEM programs may be gleaned?

An Overview of Selected Literature

Undergraduate research experiences are often critical for the pursuit of graduate studies in STEM, but can also consume both students' and mentors' time. Undergraduate students in STEM take required and elective course credit hours and usually partake in some sort of internship experience or professional group; however, research adds another layer to what students perceive as a heavy workload. Similarly, most STEM faculty are expected to perform research, service, and teaching duties every academic year.

Effective mentoring can be challenging for many, as the activities require extensive time and resources for the mentor (Dolan & Johnson, 2009; Williams et al., 2020). Mentors often find their own research efforts hindered due to the amount of time invested in supervising the completion of research and related tasks with undergraduate mentees. In addition, faculty have competing priorities, and expectations to be thoughtful, energetic, and engaged might be a challenge when they are working to balance teaching, research, and service. If faculty members are untenured, mentoring students in research can be an additional stressor. Moreales et al. (2016) explored factors that motivate faculty to persist with mentoring students, even if the faculty do not receive direct benefits for their work. The authors solicited mid-level and later-career faculty about their experiences and concluded that (a) when faculty assumed supervising undergraduates would be time-consuming, they were significantly less interested in mentoring students via undergraduate research experiences and vice versa; and (b) faculty at the later career stages tend to have more responsibilities in their organizations, therefore do not have the time or energy to mentor students and are less interested in doing so. Faculty mentors also benefit from personal connections with undergraduate students; therefore, when faculty mentors have little to no contact with their undergraduate students because of competing responsibilities, they are less interested in serving as mentors (Moreales et al., 2016).

While mentoring can come with costs, many faculty nevertheless want to mentor students. Schwartz (2012) explored costs and opportunities around mentoring and noted that although faculty in their study described strains on personal life, research, and time, they also received satisfaction from motivating students to succeed. Faculty believe that students receive significant professional benefits from the research experience, and they achieve personal satisfaction when playing an active role in students' personal and professional growth (Chopin, 2002). Montgomery and Page (2018) argued that effective mentoring entails personalization, guidance, correction, affirmation, and agency for mentees. Mentors also need to thrive in spaces of growth, where there is openness for active participation, value, and correction to be successful with mentees. When these needs are met for both mentee and mentor, the experience leads to increased confidence and ultimately benefits the mentoring relationship (Montgomery & Page, 2018).

Since faculty's work and home responsibilities can be overly demanding, many universities offer mentor training programs; however, these can be time-consuming and costly for both faculty and administrators in terms of individual work–life balance and institutional resources (Felder, 2012). Johnson et al. (2015) argued that it is important to prepare faculty for their multiple roles as faculty members, researchers, and mentors. Felder (2012) suggested programs that are led by facilitators with expertise in STEM disciplines and general pedagogies, target workshops to the needs of the participants, and showcase a variety of choices for teaching methods.

Many studies also offer potential programmatic recommendations to better support faculty mentors. Schwartz (2012) suggested that there should be ways to decrease teaching loads for faculty who also participate in UREs, free faculty from departmental work that provides direct service to students, and work with other research universities to encourage graduate students to hold assistantships, assisting faculty in their research. Whittaker and Montgomery (2014) also noted that it is important to recognize and reward faculty and staff innovations in diversity-based student initiatives, including using diversity to improve learning, enhance research, and engage in service.

Academic leaders play a critical leadership role in creating infrastructure to reward excellence in mentoring while acknowledging rewards and costs to faculty (Johnson et al., 2015). This can include faculty development opportunities such as formal orientations and workshops, as well as the supervision of mentoring programs to ensure program efficiency (Allen et al., 2009; Braxton et al., 2011). For example, sometimes there are more students who want to engage in undergraduate research than there are available faculty mentors, which often serves as an obstacle to high-quality mentoring (Johnson et al., 2015). Therefore, department chairs and directors need to anticipate demand and ensure the availability of faculty mentors.

Despite the many challenges to creating effective and sustainable mentoring programs, mentoring relationships may have positive effects for both faculty and student mentees. Most STEM students and faculty partake in some sort of research mentoring, but may have differing experiences based on identity; it is therefore imperative to design programs with mentor and student identity in mind. Students and faculty from historically excluded and marginalized groups often face additional challenges as mentors and mentees. Matching mentors and mentees with similar identities and common experiences may help them form and maintain critical relationships, but mutual matching is not always possible (Robinson et al., 2019). Moreales et al. (2016) asserted that diversity in recruiting and retaining faculty in mentoring programs is therefore critical. When there is a lack of diversity with regard to race, ethnicity, gender, and sexual orientation, for example, it can limit the potential for students to find a beneficial mentor match (Johnson, 2015). In LSAMP, matching for mentors and mentees relies on mutual research interests, but some relationships are formed based on other commonalities, such as backgrounds and lived experiences. In general, faculty who place greater value on diversity efforts in academia are often more interested in serving as mentors. Faculty from historically underrepresented groups often place greater emphasis on the research and mentoring process, including helping students who are like themselves to reach their career goals (Moreales et al., 2016).

Theoretical Frameworks

We used three theoretical frameworks to guide the study: self-determination theory (SDT), White racial frame (WRF), and the intersectionality framework (IF). Deci and Ryan (1985), who developed the SDT framework, emphasized that when three basic needs of competence, autonomy, and relatedness are met, a person's sense of intrinsic motivation increases. People will engage out of self-interest without the external

need for validation, promises, or threats. Extrinsic motivation can lower a sense of self-determination because, as behavior is controlled by external rewards, people begin to feel less in control of their actions and wants (Deci & Ryan, 2000). When an individual wants to learn and prosper, whether mentor or mentee, they will engage in activities that foster growth for personal rewards (Deci & Ryan, 2000).

When they are intrinsically motivated, faculty members and mentees are more likely to engage fully in their research efforts because they find research interesting and enjoyable (Stupinsky et al., 2019). There are times when autonomous motivators are not met, especially for faculty, or when there is increased tension or a lack of perseverance or competence. Demands on curricula, pressure from administrators, and an increase in instructor needs may all negatively impact autonomous or controlled motivation (Pelletier et al., 2002).

In SDT, the three core factors work together to foster intrinsic motivation. According to Stupinsky et al. (2019), faculty autonomy can be increased when they are able to choose research questions that are most aligned with their values and not feel pressured to pursue research based only on funding potential. When autonomy is supported with ample opportunities for faculty development, like workshops and conferences, faculty are more likely to feel competent, more excited to engage in research, and achieve a better work–life balance. Not only will faculty feel more competent and engaged in their work, but also their mentees; thus, increasing feelings of relatedness.

However, SDT does not explore identities such as race, gender, and class as factors that can impact motivation. SDT states that people are motivated when their needs are met, but what about historically excluded groups whose needs are consistently unmet? For members of historically excluded groups, their needs and motivations may be different from researchers in dominant identity groups. For example, gender stereotypes may influence academic and career interests, while race can affect motivation due to experiences with discrimination (Gadassi & Gati, 2009). And these factors are even more challenging while mentors or mentees are striving for autonomy in STEM fields that were not created for them.

To explore the role of identity in the experiences of mentors and mentees from historically excluded backgrounds, we incorporated the WRF. Defined as a pervasive worldview developed and perpetuated by White people that includes stereotypes, ideologies, values, emotions, and a belief in racial superiority, the WRF influences interpretations of race and society (Feagin, 2020). According to Feagin (2020), racist framings and racist practices in the United States are tied to the history of slavery. Feagan (2020) argued that the WRF is pervasive, shaping how we think and act daily, both consciously and unconsciously. When the ideology of the WRF is enacted through practices such as racial segregation and unequal educational opportunities based on race, white students, faculty, and administrators in higher education institutions acquire distorted views of Black, Indigenous, and People of Color (BIPOC) colleagues. For example, half of the 779 White participants in a national survey incorrectly believed that Black Americans received similar, or higher, levels of education as Whites (Feagin, 2013). Because these respondents incorrectly view the educational playing field as even, these participants create false “profiles” of Black, African American, and Latine students and further perpetuate ideologies—such as lack of effort, inherent intelligence, etc.—to legitimatize and reproduce discrimination and racism.

In STEM, where the majority of students and professors remain disproportionately White-abled males, the WRF is particularly potent. In higher education, racial segregation influences educational attainment, interactions in general, and even dropout rates (Feagin, 2013). However, for STEM students in particular, racism also affects academic potential because students from historically marginalized backgrounds might not always think they are good enough or cut out for success in their chosen field (McGee, 2020).

While the WRF can be a powerful tool in understanding how systemic racism is normalized from a dominant White worldview, it has the potential for oversimplification. Specifically, the framework can be misconstrued in ways that obscure the specific, lived experiences of different racialized groups, and it may also fail to account for different forms of oppression.

We therefore used the IF to better understand mentors' and mentees' experiences and interconnections. Kimberlé Crenshaw (1991) defined intersectionality as a framework for understanding how multiple social categorizations such as race, gender, and other identities connect to create unique experiences of discrimination and privilege. Individual identity categories, such as race and gender, are neither mutually exclusive nor parallel but intersect and overlap to shape an individual's experience. IF has been taken up by several Black women scholars (e.g., Collins, 2017; Nash, 2019), to illustrate the experiences of women of color, including those in STEM, to explain how race, gender, and class overlap and intersect to impact the discrimination and invisibility experienced by Black women.

Methodology

We conducted 42 interviews with 13 mentors and 29 mentees during the Spring 2021 to Summer 2022 semesters. The demographics of each group can be found in **Table 1** and **Table 2**.

Table 1: Mentee Demographics

Mentee Pseudonym	Racial Identity	Sex*	Institutional Classification
Amanda	Black	Female	HBCU
Tay	Black/African American	Female	HBCU
Carol	Black/African American	Female	HBCU
Lion	Black	Male	HBCU
Alysa	Black/African American	Female	HBCU
Oralia	Hispanic	Female	HBCU
Emmber	Hispanic/White	Female	HWI/HSI/LI
Amber	Hispanic/White	Female	HWI/HSI/LI
Hugo	Hispanic/Mexican American	Male	HWI/HSI/LI
Noemi	Hispanic	Female	HWI/HSI/LI
Jeremy	Hispanic	Male	HWI/HSI/LI
Joel	Asian/Hispanic	Male	HWI/HSI/LI
Jairo	Hispanic	Male	HWI/HSI/LI
Joe	Hispanic/Scottish	Male	HWI/HSI/LI
Levy	Cuban/White	Male	HWI/HSI/LI
Raul	Latino/White	Male	HWI/HSI/LI
Crystal	Hispanic	Female	HWI/HSI/LI
Jorge	Hispanic	Male	HWI/HSI/LI
Lina	Hispanic/White	Female	HWI/HSI/LI
Mario	Hispanic	Male	HWI

(Contd.)

Mentee Pseudonym	Racial Identity	Sex*	Institutional Classification
Lorena	Hispanic	Female	HWI
Danilo	Southeast Asian	Male	HSI
Stephanie	South Asian/White	Female	HSI
Felipe	Hispanic	Male	HWI
Jocelyn	Hispanic/East Asian/White	Female	HWI
Nayeli	Hispanic/White	Female	HWI
Pablo	Hispanic	Male	HWI
Selena	Hispanic/White	Female	HWI
Barbara	Cuban/White	Female	HWI

HBCU = historically Black college & university; HWI = historically White university; HSI = Hispanic serving institution; LI = lead institution.

*During the interview, the interviewer shared their names and gender pronouns on the Zoom screen to encourage mentees and mentors to do the same. We recognize that female or male descriptions in Table 1 and Table 2 are not gender identities and are not interchangeable with genders such as "woman" and "man." However, the words "female" and "male" are used to describe participants who referred to themselves as women or men who or did not define their gender but were female- or male-presenting to the interviewers. We acknowledge the use of binary categories and their limitations, and how we discussed them in the study.

Table 2: Mentor Demographics.

Mentor Pseudonym	Racial Identity	Sex*	Institutional Classification
Ren	East Asian	Female	HBCU
Anya	African/Caribbean	Female	HBCU
Roy	Black/African American	Female	HWI/HSI/LI
Arthur	Black	Male	HWI/HSI/LI
Pakal	Latino	Female	HWI/HSI/LI
Thais	Latina	Female	HWI/HSI/LI
Jesus	Latino	Male	HWI
Bakarat	Middle Eastern	Male	HWI
Baladeva	Indian	Male	HWI
Qing	East Asian	Male	HSI
Cesar	Latino	Male	HSI
Leslie	White	Female	HSI
Gal	White	Female	HSI

Participants represented four institutional sites and types within a multi-campus state university system. The lead institution (LI) is a public; land-grant research and Historically White (HWI) university recently designated a Hispanic-serving institution (HSI). The other institutions are a Historically Black College and University (HBCU) and a Historically White Institution. The research team contacted LSAMP program coordinators from the institutional sites to obtain a list of faculty who had volunteered to serve as mentors.

Mentors were invited to via email participate in an interview via Zoom due to the COVID-19 pandemic. The use of this virtual platform had some advantages for our project, similar to Archibald et al. (2019), which included cost-effectiveness, enhanced security, and options that helped to capture perceptions and experiences of the participants in nuanced ways.

Participants signed consent forms and the researchers assigned pseudonyms to all. We encountered resistance from two mentors primarily due to confidentiality and use of research information, and they opted not to participate in the study. We used reasonable efforts, such as removing all personally identifiable information from the data before storage, to keep participants' personal information confidential as required by law and the Institutional Review Board, which approved our study. Recruitment procedures for participants included a description of the project, an informed consent document, and a Zoom link for each interview. The interviewer addressed any questions or concerns of participants before the interview.

We created guidelines and protocols for interviews. We used InqScribe software to transcribe the audio recordings of the semi-structured Zoom interviews. Two researchers independently coded the data. We used inductive coding to analyze data collected from 42 interviews and organized them into broad themes. Inductive coding is a bottom-up approach in qualitative research where codes are developed directly from the data, rather than using a pre-existing framework. Researchers read through the interview transcript data to identify patterns and develop codes organically during the analysis. This method is particularly useful for exploratory research, as it avoids imposing preconceived notions on the data and allows unexpected themes to emerge (Fereday & Muir-Cochrane, 2006).

To establish interrater reliability, we identified, compared, and agreed upon the common themes (Armstrong et al., 1997) that emerged from the data. Interrater reliability allowed us to assess the consistency of results among different coders, ensuring objectivity by measuring the extent to which agreement was reached on the same codes. This is accomplished through a collaborative process of developing a coding scheme, code training, and qualitative discussions to assess and improve agreement. The SDT, WRF, and IF theoretical frameworks helped guide interpretation of the data as we listened to the interviews, developed themes, and coded using the InqScribe software, while analyzing for patterns, connections, and relationships within and across themes.

Limitations

This study was limited with regard to the types of institutions and the nature of the undergraduate research mentoring relationship. The mentoring relationships examined in this study occurred individually and between faculty and students; however, there are other types of mentoring that could occur virtually or with peers. The sample size was drawn from multiple institutional sites during the COVID-19 pandemic; thus, mentoring relationships may have changed since then. As a qualitative study, the data cannot be generalized to broader populations.

Findings

The themes that emerged from the findings in answer to the overarching research questions pointed to the need for: (1) purposeful mentor/mentee relationships, (2) confidence and appreciation for STEM, and (3) intersectionality perspectives and opportunities that lead to a successful mentoring relationship in undergraduate research.

1. Purposeful Mentor/Mentee Relationships

When exploring what motivates mentors and mentees from historically underrepresented backgrounds to participate in LSAMP and the undergraduate research mentorship experience, we found that mentors expressed wanting purposeful and productive mentor/mentee relationships. Specifically, they seek students who enter the mentor–mentee relationship already knowing their interests, work styles, and preferred learning styles. For example, Anya, an African-Caribbean female-presenting mentor, explained what she looks for in a mentee. She said, "You want someone who wants guidance; you don't have to be forcing them [to participate in the process] or anything like that, especially because I didn't come here with the intention to do research." Anya wants a student mentee who desires guidance and who is already invested in the research process before being matched. In other words, she wants a worthwhile and purposeful mentorship. César, who identifies as Latino, as well as Gal, a White female, also agreed that their goal is to guide students, not tell them what to do. César stated, "I am not trying to give them pressure. I have had some disappointments in the past as a mentor because I was expecting more from students, but the plan is to guide them. You are more of a guide than a teacher. You are sharing your knowledge and guiding them through the process." Gal added, "I want students who are sophomores when they start in my lab, so that there is time to invest in them, time to train them, and I hope to get two years of help with bigger things before they transition to their own individual project." Both mentors expressed wanting a relationship that is beneficial to both parties and in which their students demonstrate agency and preparation. Mentors want to guide mentees in their research efforts, which they view as the more important aspect of mentorship, rather than teach them the basics. Mentors also voiced wanting to guide students professionally, like supporting with conference preparation and graduate school applications.

Despite the pull of other obligations, such as research, mentoring provides a unique and valuable personal relationship for mentors. Pakal, a Latino mentor, noted, "I might be changing a lot of life with research, right, but I like to see the face of the individual whose life I'm changing."

The mentees appreciated when their mentors provided them with opportunities beyond research, such as graduate school preparation and classroom assistance. Pablo, a White and Hispanic male-presenting student, and Alysa, a Black and African American female student both described how their mentors prepared them for life beyond their undergraduate career. Alysa stated, "Of course, [my mentor] guided me through how to go about research and professionalism; and then jobs, if I wanted to go to grad school. Pablo added:

> [My mentor] always suggests classes that she thinks are useful, and she also guides me in the amount *[sic]* of courses [to take]. She has helped by providing resources and materials for my research project. She helped me formulate [my research] and keeps me in scope. She was the one that presented LSAMP to me. I haven't *[sic]* heard of LSAMP before. She has a lot of resources and continuously presents new opportunities and experiences.

2. Confidence in and Appreciation for STEM

When exploring how mentors and mentees from historically excluded groups experience the mentoring relationship in this undergraduate research program, we found an emphasis on how confidence and appreciation for STEM affect the *quality* of the mentoring relationship. Mentors and students both believed they would gain confidence in the mentoring relationship if there is a deep relationship of trust and respect

formed that continues over a student's academic journey, instead of surface-level interactions. Thaís, a Latina mentor, said, "I like to see the impact on the students… so that's a part that I like, to see them develop their own confidence when we start working with them." There is mutual growth, a sense of pride, and a bond that forms when students and mentors are more confident because of their experiences.

The impact mentors have affects students' academic work and also extend beyond the classroom. Several students expressed that their confidence in STEM increased as a result of their mentors. Pakal, a Latino mentor, noted that his students not only flourished in their classes and research because of his mentorship, but also in their personal lives. Jorge, a Hispanic male, described learning about lab techniques and other classwork from his mentor. He said:

> When I first came into the lab, I had no idea what to do because it's definitely a steep learning curve, so [my mentor] guided me through the process. He helped me out a lot, he taught me everything, well mostly everything, I'm still learning of course. He showed me the different lab techniques. He showed me how to better read other papers, and how to get more acquainted with the research that I'm conducting. Whenever I have a question about what he is teaching in class, he helps and explains things to me.

On the other hand, Pakal, a Latino mentor, shared that being a mentor is much more than showing up for the mentoring relationship; it requires other skills that one is not necessarily trained for. He said:

> There was no official training to be a mentor. Most of my peers had a lot of teaching experience, so I already knew what worked and what didn't. But we need to learn to work with students on time management, motivation, disagreements, and communication. Things you can say. Things you cannot say. You feel responsible when you see a student struggling. Their expectations are not your expectations.

Lastly, both students and mentors addressed that constructive feedback is crucial to their professional development. Mentees sought affirmation and positive reinforcement for their work, but interestingly, mentors also expressed wanting positive feedback from their mentoring relationship. For example, Barbara, a White and Cuban female mentee, noted, "A good job, thank you for all your hard work is very comforting because I know what I'm doing is right." Roy, a Black male mentor, added, "Just knowing that people care, and that's the thing that I think has been instrumental in my own life, and when you get students who come back and say, 'Thank you, we can just see that you care'… that is so satisfying for me." Receiving affirmations from mentees helps both mentor and mentee feel affirmed and purposeful.

3. Intersectionality Perspectives and Opportunities

Participants in this study hold more than one marginalized identity, and they described how their identities, particularly race and gender, combined to strengthen their experiences in the mentoring relationship. Surprisingly, though participants valued mentorship matching with someone who shares their marginalized identities, as such matches help both mentors and mentees through affirmation, shared values, and a shared understanding of inequalities, participants showed a greater appreciation for mentoring across differences. Jairo, a Hispanic mentee, advocated for mentor–mentee matching. He said, "As a man, working with two women as my mentors, a White woman, a mixed Asian woman, I feel like I gained a lot of valuable

insights. [However,] it might be better to have a mentor that is also Hispanic and male because I couldn't relate to all the struggles women go through." However, when Gal, a white-identified mentor, described her previous experiences with mentors while a student, she emphasized the importance of having mentors who varied in identity. She said:

> One mentor I'm very close with is a South American female. She is wonderful and she's Hispanic of course. My PhD advisor is a White male and also wonderful, so they have very different perspectives. Different cultures and sexes offer new insight. Their outlook on quality and diversity and inclusivity are really embraced and they are leaders in their field.

Notably, Gal prioritized mentors for their insights, advocacy of diversity and inclusivity, and prominence in the field—not for identities that matched her own. In Gal's case, both mentors were role models who were successful and ones she could emulate and rely on as advocates in the field.

Similarly, Leslie described how diversity among her mentors and past mentees has influenced her own mentoring style. She argued that having multiple perspectives can improve faculty mentoring practice. She said:

> Having different genders [among mentors] has influenced my mentoring approach, and having different ethnicities has influenced me in a positive way. Having diversity in the people I have mentored has been extremely helpful because it has allowed me to broaden the scope of how I work with my students and how to have a more diverse skill set of resources.

These participants gained valuable perspectives by working with a range of individuals from different backgrounds. Mentors and mentees used phrases such as "we are all the same," and "race and gender doesn't *[sic]* matter to be a good mentor," prioritizing a shared humanity and personality and researching similarities over shared identities. Baladeva, an Indian male-presenting mentor added, "We all have the same fair opportunities" with regard to opportunities in STEM. New perspectives also led to opportunities for learning in mentorship and teaching by presenting multiple points of view. Specifically, engaging with others who hold multiple intersecting identities may spur new learning and help foster crucial critical thinking and problem-solving skills for what is often required in STEM fields (Metcalf et.al., 2018).

Discussion and Implications for Faculty Development

Findings from our study indicate implications and opportunities for faculty development in the mentoring relationship. Specifically, with innovative partnerships, appropriation of resources, and effective bridge building, faculty development efforts can go a long way toward enhancing DEI in STEM. Both mentors and mentees had similar views on what it takes to have a successful, beneficial mentoring relationship: quality time and impact beyond the lab. Given the investment of time and resources required in mentorship, faculty mentors also want to be acknowledged for their efforts, which suggests that academic departments and colleges can play a critical role in ensuring that policies, practices, and processes for building in rewards for effective undergraduate mentoring. Our findings also suggest that several mentors, such as Leslie, Pakal, and Anya, want to be appreciated by their peers and academia. Leslie, for example, noted, "I don't like that mentoring is not appreciated more in science." They appreciate when their work is recognized and rewarded. These rewards might include formal institutional recognitions like awards and

tenure considerations, informal acknowledgments, and tangible benefits such as reduced service obligations, course releases, or stipends. Other incentives might include increased faculty development opportunities where faculty can work with, support, and learn from one another.

In addition to extrinsic factors, the mentors were also motivated by intrinsic factors, including wanting to do research with others and seeing them succeed, a passion for learning from others, and supporting students, as well as their own growth. Faculty developers might therefore consider highlighting both intrinsic and extrinsic rewards when promoting, supporting, or developing mentoring programs.

Mentoring through LSAMP helps mentors develop skills such as effective teaching, conflict management, and providing constructive feedback, as noted from Pakal, one of the participants. In addition to these skills, there are multiple entry points for faculty developers to assist faculty and administrators in the design and development of effective faculty development initiatives and efforts to incorporate DEI efforts in the research, teaching, and learning culture. Pakal further described that "all these racial issues, discrimination issues, gender issues, unconscious bias, they are not positive at all. These are environments that are created by the culture of the organization where you are."

Our findings also suggest that mentors expect their mentees to enter the mentoring relationship with ideas about what they want to accomplish, including interests, career, and academic goals. Therefore, not only should mentors and mentees have a mutual understanding of the time commitment associated with mentoring, but also shared expectations of the work itself. Faculty developers might play a role in supporting mentors and mentees in defining roles and functions early on to eliminate any confusion throughout the mentoring process.

Many of the mentors and mentees in this study hold multiple marginalized identities and participants overwhelmingly valued having mentors of different backgrounds. This suggests an opportunity for faculty developers to support mentors in inclusive teaching and learning practices, including, but not limited to, strategies for perspective taking, advocacy and sponsorship, and creating quality time and mutual respect. In addition, faculty developers might consider learning about and guiding faculty mentors in frameworks such as intersectionality and the WRF to support mentor–mentee relationships across identity differences. Mentors can have a positive effect on relationships across intersecting identities by learning more about systemic racism in academia and STEM fields. Increasing the number of BIPOC in positions that have power and influence, for example, can broaden insights away from White racial framing, to enrich the global diversity and critical thinking that are often required in STEM fields and the workforce. It is important for the majority of White individuals in STEM fields, including faculty developers, to recognize research historicity and acknowledge how pervasive and harmful exclusionary practices have been to the field and continuously marginalized people, to make present and future research more socially just and inclusive. Such understandings of how intersecting social and cultural disparities persist in STEM could foster conversations between mentees and mentors and contribute to productive mentorship relationships.

LSAMP students who are members of historically excluded groups recognized the intersectionality of gender, race, and ethnicity, but also acknowledged other non-identity-based aspects of successful mentor–mentees relationships, such as quality mentoring, care given by mentors, and mutual respect and understanding in the relationships with their mentors, as important for undergraduate research success. Notably, however, by downplaying the salience of identity in the mentor–mentee relationship, to what extent are mentors and mentees reinforcing systemic racism and meritocracy, even as their own experience

in STEM contradicts ideas of meritocracy, equality of opportunity, and fairness? For example, mentees often described their experiences with being the historically excluded student in the classroom, laboratories, and other STEM fields and spaces, acknowledging that inequities exist in those spaces as well in undergraduate research. We therefore encourage faculty developers to support mentors and mentees in engaging in critical thinking and reframing for diversity, equity, and inclusion. Faculty developers can facilitate mentoring spaces provided by programs such as LSAMP and lead more nuanced discussions about equity and inclusion in STEM.

Key goals around educational development change efforts might include developing and promoting evidence-based and inclusive teaching methods, deepening content expertise, fostering professional growth, and supporting faculty wellness. Some of these initiatives might be long-term, with practice and reflection, sustained communities of practice, while addressing the institutional context to achieve lasting change.

Conclusion

Anti-DEI state laws agitate current ways of thinking about and doing research, increasingly excluding the narratives and voices of students, faculty, and administrators who maintain efforts to expand DEI. However, a diverse STEM field benefits from the participation of mentors and mentees of different backgrounds and experiences. This leads to more innovation, creative problem-solving, and solutions that serve an increasingly global society and workforce. The stories and contributions of historically excluded groups in STEM matter. They lift us all to do better and deliver on equitable educational outcome goals. This article, we hope, is a call for those of us engaged in faculty development to stay in the fight with historically excluded groups, to support and re-imagine the teaching, research, and professional growth of faculty and students for a more inclusive and equitable STEM environment. Furthermore, we cannot erase the fact that our world benefits from the pioneering contributions of notable scholars of color, a status to which many LSAMP students in this study aspire. These figures include, for example, Ellen Ochoa, the first Hispanic woman in space; Mario Molina, chemist and Nobel laureate who discovered the environmental threat posed by chlorofluorocarbons to the Earth's ozone layer; Katherine Johnson, a Black NASA mathematician whose calculations were critical to the success of the first and subsequent spaceflights; and George Washington Carver, an agricultural scientist who promoted environmentalism and devised uses for peanuts. As Mae C. Jemison, engineer, physician, and NASA astronaut, stated, we must "never be limited by other people's imaginations."

Acknowledgments

The authors greatly acknowledge the support provided by the National Science Foundation (HRD-1911375), and faculty, staff, and campus coordinators at institutional sites for their assistance with this research. Any opinions and recommendations expressed are those of the authors and do not necessarily reflect those of the National Science Foundation (NSF). Correspondence concerning this article should be addressed to the research co-principal investigators: Dr. Christine Stanley, Texas A&M University, email: cstanley@tamu.edu and Dr. Reuben May, University of Illinois, Urbana-Champaign, email: rabm@illinois.edu.

Funding Information

This research was supported by the National Science Foundation Award No. HRD-1911375.

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