Board 306: IM STEM: LSAMP- In Situ Inclusive Mentoring

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Abstract

Funded through the National Science Foundation Division for Equity for Excellence in STEM, the Louis Stokes Regional Center of Excellence: Inclusive Mentoring in STEM (IM STEM) program, brings together experts dedicated to investigating successful and promising practices for inclusive STEM mentoring along several STEM pathways in various learning environments. The Center represents a collaboration between academic institutions, Department of Energy (DoE) national laboratories, professional societies, and regional industrial partners in researching and augmenting inclusive mentoring activities for historically underrepresented minority students and students from other underserved populations.

Five institutions serve as co-principal investigators in The Center: The University of Texas at Austin, The University of Texas at El Paso, The University of Texas at San Antonio, El Paso Community College, and Colorado State University. Within The Center, three working groups established a definition for inclusive mentoring: Inclusive Mentoring is a multifaceted and reciprocal relationship in which a mentor engages a protégé(s) from diverse backgrounds to advance their goals and learn from their professional development experiences.

In addition to establishing a definition for inclusive mentoring, the Experiential Learning working group spent the summer and fall of 2022 interviewing Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM) recipients to gather an understanding of the current state of inclusive mentoring. Through these interviews the research team identified no only supports, but barriers for inclusive mentoring outside of the academic space. As a result, and in conjunction with seminal research from the National Academies, the IM STEM program identified spaces for institutions to serve as the hub of inclusive mentoring, not only for academic spaces on campus, but spaces away from campus where students and recent graduates enter the engineering profession.

Rationale

As the student population enrolled higher education institutions continues to diversify, a deep understanding and widespread adoption of inclusive mentoring practices that promote student success is needed. The purpose of the IM STEM is to expand, elevate, and influence conversations about effective mentoring among communities of STEM faculty, graduate students, and government and industry professionals committed to developing a strong, diversified STEM workforce. The potential impact of this work can occur at IM STEM universities, DoE national laboratories, and industrial sites that recruit students minority serving institutions. The results of this work in tandem the support professional organizations practices may bring additional organizations with a mentoring mission.

Findings and results

Definition of Inclusive Mentoring

During the first year of the grant, each working group met to identify a definition of inclusive mentoring. As a result, the IM STEM team developed the following definition of inclusive mentoring:

"Inclusive mentoring is a multifaceted, reciprocal and conscious relationship in which a mentor engages a protégé or group of protégés from diverse backgrounds to advance their goals and to learn from their professional development experiences. In addition to guiding the discovery of intellectual passions, providing advice and access to resources, and advocating for their protégés, inclusive mentors readily acknowledge their protégés identity, validate their backgrounds and accomplishments, and provide supportive environments to prevent isolation by promoting cultural awareness and sensitivity. Mentors and protégés work together toward a better future by engaging in a virtuous cycle of learning and growth of the individual as a whole through effective practices."
Keywords that allow this definition to be operationalized include: **reciprocal relationship, intellectual passion, advocating, validation, identity, supportive environment, cultural sensitivity, learning, whole individual, and learning and growth.**

Undergraduate/Graduate Research

The undergraduate and graduate research working group conducted a review of existing literature as it relates to inclusive mentoring. The review focused on existing literature focusing on best practices as well as consideration of gaps in the literature related to assisting individuals in developing a truly inclusive mentoring paradigm. Thus far, the literature suggests that positive and trusting relationships with mentors foster students' excitement, persistence, and achievement in STEM fields. Although expounding on this knowledge is perhaps most critical to the support and retention of students belonging to traditionally underrepresented ethnic groups/BIPOC in STEM fields, detailed literature on the mentorship experiences of these students is severely lacking. Moreover, while the literature indicates that some factors contribute positively to STEM field advancement (e.g., helping students develop a sense of STEM identity, a sense of belonging in the field, and utilizing culturally responsive STEM pedagogy, and subsequent favorable STEM student and professional outcomes), the literature is lacking on details regarding students' perceptions of mentor successes and failures. This lack of understanding limits mentorship based STEM programs from adequately training mentors to support students belonging to traditionally underrepresented ethnic groups. Understanding factors salient to successful/positive mentorship experiences could further inform known factors or reveal new ones that impact BIPOC student engagement in STEM fields.

Community College Students in Transition

This working group identified programs that center inclusivity in supporting students in transition from community colleges to four-year institutions. Current qualitative results indicate that inclusivity is important from the perspective of both the mentor and the community college student mentee.

For instance, Bridges to the Baccalaureate (B2B) - in collaboration with Front Range Community College (FRCC) - has been very successful. This program is now in its third round of funding from NIGMS and has resulted in an almost 87% FRCC B2B student graduation rate as well as significant research publications and activity. From the original cohort of B2B, six participants have gone on to graduate school in various STEM disciplines. As of the end of 2020, in the summer research program, 28 students from FRCC participated in summer research projects on the Colorado State University(CSU) campus. Of those 28, 26 enrolled at CSU; two enrolled but later dropped out, leaving their programs at CSU; and the last is enrolled at UCLA. Of the original eight students in the cohort of 2016, five have completed their bachelor's degrees, three are in graduate programs, two are continuing their undergraduate degrees, and one dropped out. In the 2017 cohort, six have completed their degrees and two of these are in graduate programs, and four others are continuing in their studies. For cohorts in 2018 and 2019, all but one student is continuing their undergraduate degree at Colorado State University.

During the last funding period for CO-WY LSAMP, we developed Community College Transfer Days in collaboration with the Metro Denver STEM Alliance, a Louis-Stokes Alliance for Minority Participation grantee, which included five community colleges in the Denver area. Students from the Metro Alliance were given the opportunity to visit four-year colleges at partner schools in the Alliance in order to build connections with those involved in the transfer process and meet with other students who have successfully transferred. Transfer Days were designed with the goal of engaging students in research opportunities available to them and the resources available upon transferring to schools in the Alliance.

Something unique to the CO-WY Alliance is that its three community colleges are located in very remote rural locations (the three geographically furthest in the Alliance). Central Wyoming College is a Native American-Serving Nontribal Institution; and Otero College and Trinidad College are both Hispanic Serving Institutions. With research evidence suggesting that racial and ethnic minority students are more likely to experience problems of alienation, marginalization, and loneliness than white students; and with minority-serving institutions often at remote (and with low enrollment) locations, there is a more difficult task of enticing minority students to leave a small campus community and enter "the unknown." That said, all three of the above-mentioned community colleges offer intensive academic support programs based on models of academic excellence, academic counseling, peer tutoring, and reciprocal learning techniques. These three community college partners have also developed strong research projects and programs (i.e., research of microbial ecology and glaciology expedition to East Africa Tanzania at Central Wyoming College; Balloon Satellite Research and Space Grant Consortium's Robotics Challenge at Trinidad State College; and Creatine Supplementation Using Cell Culture research at Otero College), which has done a great deal to encourage and assist minority students to present at meetings/conferences and see themselves as scientists. The CO-WY LSAMP has made strides in integrating math assistance and curricula between 2-year and 4-year institutions with the work of our Math Study, which included the development of three sets of self-paced math materials (supplemental materials developed to provide informative feedback to instructors about what students understand and what they have difficulty understanding). These materials were designed in the previous funding period and reviewed by five community college math instructors from the Alliance and have been finalized by a mathematics education specialist and a cognitive psychologist (an expert in the area of learning and metacognition). A pilot project, as an initial implementation to prove viability of the materials, is currently being established. Two publications have resulted from the Math Study over the last five years

Experiential Learning

After verifying that the amount of peer-reviewed literature on mentoring of experiential learners is extremely limited, the experiential learning working group recognized the importance of talking to inclusive mentors in STEM fields. This work began with the identification of five recipients of the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM) who were then interviewed in the summer and fall of 2022. These interviews ranged from 35 to 55 minutes in length and were conducted by two members of the research team. Findings from these interviews identified numerous themes including the importance of intrinsic and extrinsic factors of mentoring.

Intrinsic Factors

The research team described intrinsic factors as motivations by values or a need for self-actualization. This is understood as part of reaching one's full potential both personally and professionally.

Examples include intrinsic motivations from the early childhood that result in what mentoring looks like in practice. One mentor shared, "In undergrad…I needed to knock on doors because not everyone would be knocking on my door…You have to ask as so that's what I tell students now you know we're here to help, I'm here to help you know how to land." (CV) Two mentors shared that their intrinsic motivation

for mentoring stemmed from their childhood. One shared, “You know, I think my parents always stress that you know you have always, you need to share your talents because God gave you talents and if you don’t share them – it’s not good..if you have the well-being of others as your goal, you will never fail.” (KL) Another shared, that they “had two younger siblings that needed support in school” as their first foray into academic mentoring.

Another mentor described her path to mentorship beginning with their “love of research…my mentoring began in a lab.” They continued in describing the lab as a place of deep intrinsic reward in regards to mentoring, “My mentoring began in a lab, the students will just blossom and you can see their face, you can see how important it is for them to be connected and engaged.” (KL)

One mentor, when recounting her path to mentoring, identified a key moment in her academic experience, the transition from undergraduate school to graduate school as a “key moment” in her mentoring because they recognized they “needed a mentor- someone who looked like me to help me navigate the world of graduate school.” It was their experience with a professor in undergraduate that she described understanding who and what a mentor was sharing, “One of my professors, who I considered to have been my first official mentor, she is the one that encouraged me to come to the US, she said I needed to get a PhD, her words were so powerful, the fact that someone noticed me and encouraged me to do this.” (M)

Another mentor, who is an administrator at a community college because of his “personal experience” recognized the importance of knowing and understanding a student’s family and community. He shared an example of describing geologic field work to student’s family members.

“The perception of field work is totally different than what a perception of field work is to someone you know who did field work, I’m not talking about working out in the farm or in the crop, that’s not [geology] field work. These are the things that I had to change the perception on and get the students hands dirty into research. I help the students explain to their parents, what they are doing, why they don’t have to become doctors and lawyers and things that they’re parents saw as being successful.” (JV)
All participants interviewed described compassion as a key intrinsic component of their mentoring. One mentor summarized it well saying, “Compassion is important. Students are not going to find it everywhere, but if you are the first person to show it, and take that into consideration for their project or their time or whatever they’re doing with you for mentoring, it builds a kind of resilience in them that they may not have further down the line.” (JV)

Extrinsic Factors

The research team described extrinsic factors as motivations such as cognitive, esteem and social needs, which can be influenced externally. The pursuit of knowledge and understanding, self-esteem, status, and prestige, being part of a culture, as well as job security and advancement can also be motivators.

A resounding theme across all participants interviewed was the importance of creating programs or structures to support inclusive mentoring- one mentor described this “approaching mentoring in a programmatic way.” When describing a professional development workshop for students, one mentor shared they reach out to faculty and informed the them that these would be occurring to invite students and provide them an opportunity to grow their skillset. Another mentor described a program they created sharing, “We met every month and students had the opportunity mentor each other, understanding the power of that relationship with their peers, I created the environment in which they were able to do that…I fostered that community, that’s very valuable because on their own, they might not have come together, but I help make sure that it’s happening” (M)

This theme of creating and providing opportunities was the most prevalent extrinsic factor in each of the mentor interviews. It was clear from all interviews that funding opportunities were essential to supporting these programmatic supports for students to experience inclusive mentoring. One mentor shared, "I give credit to that forward thinking directed at NSF to really demonstrate the potential that community college students have for research when given the right environment." (JV) Another mentor took this sentiment a step further and realized they needed to "leverage [their] accomplishments to enhance programmatic activities." Once these mentors shared they were established in their career and could pursue funding for mentoring it became a focus, "I think for this funding opportunity- how can we purposefully create these situations in space for the actions and the feeling of mentoring to happen so students do feel seen and ultimately included." (M)

These activities extend beyond opportunities and into communication and advocacy as a component of inclusive mentoring. One mentor shared, "What I've gathered in terms of being a good teacher, a good mentor is that I need to disseminate to two other disciplines throughout the institution, because at the end of the day I need to help a student get to a math class and ensure the professor sees the potential that I see in that student." (JV)

Finally, one mentor summarized the extrinsic factor the best synthesizing the notion of creating opportunities and advocating for students stating, "Talent is universal, but opportunities are not. The talent is there, but the opportunities are not and that's where we need to reach out to those that are underrepresented to those that are underserved. You have to develop these infrastructures that are equitable that allow the talent to emerge because it is out there, yes, it's incredibly insightful." (M)

Conclusion

While the IM STEM research team is still in the process of gathering and analyzing data, the team has identified the importance of inclusive mentoring in STEM. In addition to a definition of inclusive mentoring, the group looks to increase knowledge building and dissemination about inclusive mentoring in STEM. We hope to support better quality mentoring, more inclusive mentoring of STEM students in transition, undergraduate and graduate researchers, and experiential learning students. In addition to the initial aims of the study, this research has uncovered the importance of a mentor's path towards inclusive mentoring in action- identifying the intrinsic and extrinsic factors that are inherent in this journey. Moving forward, we hope to shine a light on the outcomes and impacts of inclusive mentoring on students and supporting those mentors in the field.