Board 256: Encouraging Low-Income, High Achieving Undergraduate Students to Pursue Faculty Positions: Developing Socially Conscious Approaches to Pedagogy

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Encouraging Low-Income, High Achieving Undergraduate Students to Pursue Faculty Positions: Developing Socially Conscious Approaches to Pedagogy

Women, First-Generation College Students (FGCS), and students who identify as Black or African American, Hispanic or Latino, and American Indian or Alaskan Native (Underrepresented Minority [URM] students) are all underrepresented in the field of engineering, across undergraduate, graduate, and professional contexts [1], [2]. For example, though women comprise 50% of the overall population, they received only 24% of engineering bachelor's degrees, 29% of master's degrees, and 25.5% of doctoral degrees conferred in 2021 [3]. In addition, despite making up 33.7% of the US population [4], only 16.5% of bachelors' degrees were awarded to URM students [3]. These trends are mirrored in engineering academia and professions. Women make up 19.2% of tenure track faculty in engineering [3], and 13% of the total US engineering workforce [5]. Only 6.8% of tenure track faculty identify as URM [3] and make up only 12.5% of the US engineering workforce [5]. Undergraduate and graduate attrition rates are also disproportionate across these subpopulations.

These inequities harm the underrepresented subpopulations as they limit their access to high-paying, stable jobs, and this lack of diversity impacts the efficacy of engineering work product and research [1]. Engineering problems are complex, ever evolving, and tied to real-world consequences. The innovation required to solve these problems necessitates diversity of perspective and experience. To help all students develop the skills necessary to attract, retain, and consider the needs of diverse populations, engineering students need to consider social responsibility in the context of their engineering careers and scope of practice [6].

To help promote engineering students' ability to develop their social responsibility capacity, the University of Massachusetts Lowell S-STEM program began with an initial plan to recruit three cohorts of 8 low-income, high-achieving students (24 students total) who wish to pursue a career in higher education (e.g., faculty at community colleges or universities) and engage them in ongoing social responsibility and identity formation curriculum. Supporting scholars from junior year in undergrad through the completion of a master's degree or through the completion of their qualifying exam within a Ph.D. program, the program provides opportunities throughout to deeply engage students in reflecting on social issues. The goal of the program is to foster the professional development of S-STEM scholars to develop socially conscious engineers and engineering faculty who support students and come up with innovative solutions that meet the diverse needs of different populations.

Socially Conscious Programming

UML's S-STEM Program is halfway through the second cohort's first year. The programming described was offered in the first year for the first cohort and is being offered to the second cohort during their first year in the program this school year. Developing personal (self-awareness) and social awareness have been key components of programming.

Developing Self-Awareness

Before students can understand the needs and experiences of others, it is important for them to put their own in perspective. To do this, a key focus of the program has been to build student's self-awareness. We begin this process by initially having students identify their own goals and what processes are necessary to achieve them through **developing an Individual Development Plan (IDP)**. The IDP that has them inventory their skills, values, interests, as well as the progression of steps necessary to achieve their goals. Overall, participants agreed this activity was helpful and it was a valuable use of their time in their post survey, and different students specifically stated that the most useful component of the activity was building their sense of self-awareness and providing a mechanism for self-reflection.

Further self-reflection was achieved through a more intimate exploration of the path that led these students to their current career pursuit. One of the mentors of the program is trained in Community-Based Participatory Research (CBPR) under the guidance of Dr. Nina Wallerstein who uses **the River of Life activity** in her approach to CBPR [7]. This activity builds on the work of Engage for Equity [8], a partnership of the University of New Mexico Center for Participatory Research; the University of Washington, Community-Campus Partnerships for Health; the National Indian Child Welfare Association, University of Waikato NZ; Rand Corporation, and a Think Tank of Community and Academic Community Based Participatory Research (CBPR) Practitioners. The River of Life Activity modified to an engineering context asked the participants to draw a river explaining their engineering journeys, including but not limited to what attracted them to engineering, obstacles along the way, and their future path regarding engineering graduate school. Participants agreed the activity was a useful and meaningful way to spend their time, and appreciated, "the ability to reflect on how I got past obstacles."

Developing Social Awareness

To develop participants' social awareness, we wanted them to reflect on their awareness and attitudes towards those who belong to different cultural or ethnic backgrounds. To do this, one of our mentors is a certified assessor of the **Intercultural Development Inventory (IDI).** The IDI assesses intercultural competence, an individual's ability to understand and adapt their behavior to different cultural perspectives. Assumptions and stereotypes that scholars have experienced were discussed. The facilitator asked everyone to provide one word to sum up how they felt at the end of the session. Responses were: "Enlightened", "Curious", "Pretty Good", "Interested in Seeing the Survey Results", "Curious about Tool", "Feels Good", "Excited", and "Grateful." Participants reported the following as the most useful aspects of the meeting: "Asking us to consider the aspects of culture and where we meet them," and "Cultural awareness."

In a follow-up meeting, the program leader walked the group through the Intercultural Development Inventory (IDI) results using a PowerPoint presentation. Attendees discussed what it was like to take the IDI. The program leader scheduled one-on-one follow-up sessions with each participant to help them develop an Intercultural Development Plan. Participants reported the following as the most useful aspects of the meeting: "The charts given of our results" and "I like how people were encouraged to be open and share their thoughts about complicated subjects

like inclusion and diversity. I also like the evaluation and follow up interview for the results." As a follow-up event, S-STEM mentors in the program shared how their engineering careers have been influenced by how they are culturally situated, and participants shared in response to the event, "It was amazing to hear our mentors experiences, and their journey thru academia (undergraduate, graduate, and PHD), I could really identify with them, humanize them, and feel that I may be able to do it as well." The table below summarizes the programming offered so far and what skill it developed.

Developing Self-Awareness	
Activity Name	**Activity Description**
Individual Development Plan (IDP)	Identify goals and inventory skills, values, interests, and steps necessary to achieve goals
River of Life Activity	Method of Community-Based Participatory Research (CBPR) where participants to draw a river explaining their engineering journeys, including but not limited to what attracted them to engineering, obstacles along the way, and their future path regarding engineering graduate school
Developing Social Awareness	
Activity Name	**Activity Description**
Intercultural Development Inventory (IDI)	Assesses intercultural competence – the capability to shift cultural perspective and appropriately adapt behavior to cultural difference and commonalities.
IDI Follow-up Activities	• The program leader scheduled one-on-one follow-up sessions with each participant to help them develop an Intercultural Development Plan. • S-STEM mentors in the program shared how their engineering careers have been influenced by how they are culturally situated

Table 1. Overview of Socially Conscious Programming Activities.

Conclusion

Preliminary results demonstrate developing students' self-awareness and social awareness both broadly and specific to the engineering context is helping students to reflect and become more socially conscious. Data collection is currently limited to feedback after individual events as well as program evaluation collection mechanisms. As the program continues, the data collected will be of greater depth and detail. Preliminary findings support what other research indicates, that reflection in safe spaces, within cohorts and with familiar mentors, helps individuals reflect more deeply and develop greater awareness and compassion.

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