Board 258: Diversifying the Graduate Student Pipeline to Academia: Challenges in Recruitment of Low-Income, High Achieving Students to Graduate School—Award # 2130403

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Dr. Janna Jobel received her PhD in Educational Leadership researching the ways in which social emotional competencies are taught in STEM high schools. She is now a postdoctoral research associate in the Biomedical Engineering department of UMass Lowell conducting interdisciplinary research to better understand what factors most influence the K-20 STEM pipeline.

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Dr. Yanfen Li is an Assistant Professor in Biomedical Engineering at the University of Massachusetts Lowell. She received her Ph.D. in Bioengineering from the University of Illinois at Urbana Champaign in 2018. Dr. Li has extensive experience in engineering education focusing on recruitment and retention of underrepresented and under resourced students and engineering pedagogy. Her work spans the areas of curriculum instruction and design, program design and evaluation, and the first-year college experience.

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Dr. Hsien-Yuan Hsu is an Associate Professor in Research and Evaluation in the College of Education at the University of Massachusetts Lowell. Dr. Hsu received his PhD in Educational Psychology from Texas A&M University and has a background of statistics education. He works closely with researchers in STEM to pursue high quality of STEM education for future researchers. He is currently participating in an NSF-funded grant (#1923452) to spearhead research into middle school students' digital literacies and assessment. Recently, Dr. Hsu has received a seed grant at UML to investigate how undergraduate engineering students' digital inequalities and self-directed learning characteristics (e.g., self-efficacy) affect their learning outcomes in a virtual laboratory environment during the COVID-19 pandemic. Dr. Hsu's research interests include advanced quantitative design and analysis and their applications in STEM education, large-scale assessment data (e.g., PISA), and engineering students' perception of faculty encouragement and mentoring.

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Abstract

In higher education, faculty diversity is critical for a variety of important outcomes, including supporting students in pursuing and persisting in STEM fields by providing in-group role models. However, current engineering faculty do not equitably represent the general population. In order to address this lack of representation in higher education engineering programs, the University of Lowell S-STEM program, funded by the NSF Scholarships in Science, Technology, Engineering, and Mathematics Program (S-STEM), has the goal to recruit three cohorts of low-income, high-achieving students who wish to pursue a career in higher education. The UML S-STEM program supports engineering scholars for four years, their last two years of undergraduate school and their first two years of graduate school. The goal of the program is to attract and retain diverse engineering S-STEM scholars and prepare them to enter the competitive pool of future faculty candidates.

We present our successes and challenges in recruiting the first two cohorts of low-income, high-achieving students. In the first year, we focused on email blasts, a social media campaign, partnering with student groups, and general outreach via career panels. 55 eligible students were identified by the financial aid office, 12 applications received, and 4 students fit the timeline and eligibility requirements (all were accepted). Three of the four are first generation students, and three of the four identify as students from underrepresented minority backgrounds in engineering. Recruitment lessons learned were that because the scholarship opportunity is so unique, emails alone from a faculty member the students are not familiar with do not work well. Additionally, sophomores are often not proactively seeking more information and scholarship opportunities for graduate school. As a result of these findings, we increased our outreach opportunities to allow students to discuss and explore the benefits of graduate school to build the interest and self-efficacy of our target population. Further, we asked faculty members that work with the students to reach out to students individually and encourage them to apply. Using this approach, after identifying 79 eligible students, 38 applications were received, 84% from our list of eligible students, and 63% from populations underrepresented in engineering.

Problem

One of NSF's strategic objectives is fostering the growth of a more capable and diverse research workforce [1]. According to the recent National Academies of Sciences, Engineering, and Medicine (NASEM) report [2], the lack of diversity in STEM workforce (especially underrepresentation of women) results in immediate negative consequences, including a national labor shortage in many STEM fields and losing opportunities for economic gain. In higher education, faculty diversity is critical for a variety of important outcomes, such as innovation in research, graduation rates for underrepresented minority students, as well as awareness of sexual harassment and unconscious bias [3][4]. To date, whereas undergraduate student enrollment in higher education has become increasingly diverse, the sociodemographic

faculty diversity remains low [5]. It is imperative to create a diverse and competitive pool of future faculty candidates in order to increase faculty diversity. Faculty diversity can be expanded only if we can effectively support women and historically underrepresented minorities to pursue master's or doctoral degrees after receiving their bachelor's degrees [2]. However, strong evidence has shown that both Black or African American and Hispanic/Latino groups continuously underrepresent the students earning master's (4.8% and 9.2%, respectively, in 2019) and doctoral degrees (3.5% and 6.2%, respectively, in 2019), even though the number of master's and doctoral degrees in engineering earned by all racial and ethnic groups grew in the past two decades [5]. Furthermore, longitudinal data has also indicated that women earn fewer master's and doctoral degrees in engineering than men across most racial and ethnic groups.

The total number of women earning engineering graduate degrees represent roughly a third or less of the total students across all racial and ethnic groups between 2000 and 2019 [5]. This low diversity in doctoral degree holders impacts faculty diversity [2]. Nationally, only 17.6% of tenured/tenure track faculty in engineering were female, 2% were black or African American, and 3.7% were Hispanic in 2019 [5].

Project Description

In order to address this lack of representation in higher education engineering programs, 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). The UML S-STEM program will support scholars for four years, from their 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 ambitious goal of the program is to foster the professional development of S-STEM scholars for creating a diverse and competitive pool of future faculty candidates in engineering.

Year One (2021-2022) Recruitment Process

In our first year, our recruitment activities began with working with the financial aid office to obtain a list of eligible students. The financial aid office was tasked with identifying Sophomores in engineering with at least a 3.3 GPA and is low income; 55 eligible students were identified. We then sent out a targeted email to all eligible students. We also worked with the River Hawk Scholars Program who advertised our program to first generation students at UML. The UML S-STEM program hosted an Academic Career Path Panel for all engineering undergraduate students, which was poorly attended. In addition, we hosted an Academic Career Path follow up discussion with the Society of Women Engineers which had better attendance. Furthermore, we made a program website and set up social media platforms for the program. Through these efforts, 12 applications were received, and 4 students fit the timeline and eligibility requirements. These 4 students were accepted. Three of the four are first generation students, and three of the four identify as students from underrepresented minority backgrounds in engineering.

Lessons Learned

Recruitment lessons learned were that a mass-marketed email sent from an unfamiliar faculty member does not encourage students to question whether they want to attend graduate school. We discovered that low-income students were intimidated by and/or unfamiliar with the requirements of graduate school and may not consider it as a viable option for their career. This can stem from several factors including lack of self-confidence, lack of family support, lack of knowledge regarding graduate school funding, and lack of opportunities to discuss graduate school. Additionally, we found that talking about academic jobs too early is intimidating, and that we need to focus on graduate school first. As a result of these findings, we decided to increase our opportunities to allow students to discuss and explore the benefits of graduate school to build the self-efficacy of our target population and increase our cohort population. Further, as most of our students reported being encouraged to sign up from their affiliation with the River Hawk Scholars Program, we decided to actively partner with other faculty to recruit students.

Recruitment Process Year Two (2023-2024)

We decided to change our approach and focus on teaching students about graduate school and why they should consider graduate school. To begin, we reached out to all the different engineering departments at UML and arranged to present in front of all the sophomore classes, pitching the advantages of going to graduate school in engineering and explaining the S-STEM scholarship. Further, we again worked with the River Hawk Scholars Program as well as a Society of Women Engineers Career Panel. We offered the Academic Career Path Panel again, but it was rebranded to a Graduate School Panel, and attendance increased significantly, though it was still low. We offered a second workshop on Applying to REU programs which was overwhelmingly popular since REU programs are a more approachable topic and is a more recent decision students can make. It was also the only workshop on this topic offered within the college, as compared to a graduate school panel which may be offered by various departments and professional societies. We also added a career panel at UML's Asian American Center for Excellence & Engagement which was formed when UML was designated an Asian American and Native American Pacific Islander-Serving Institutions (AANAPISI).

We again worked with the Financial Aid office for a list of eligible students. From previous years, we learned that the students' categorization in Sophomore, Junior, etc. was based on credit hours – which is not an accurate way to measure student progress as many students may have transfer credits which do not count toward completion of their degree. Therefore, we asked for all eligible sophomores and juniors, and attempted to verify eligibility based on class standing across departments. In addition, we lowered the required GPA to 3.0 with the intent to develop additional programming to academically support scholars. We then notified all 79 eligible applicants. A week later, via email, we invited them to sit down individually for lunch with faculty or program representatives to ask any questions they might have. 4 students from UR backgrounds met with us. Next, for every eligible student who identified as a woman or from an underrepresented population, we reached out to their

professors and/or advisors to personally encourage them to apply. We then sent out a reminder email to apply two days before the due date and called each participant who had not applied yet. Through this approach, we were able to attract 38 applicants, 32 of which are from our list of eligible students. 32% of our applicants identify as women. 55% identify as URM students.

Conclusion

Recruitment of low-income students from underrepresented communities into STEM graduate coursework presents several challenges [6]–[9]. These students are less likely to have in-group role models, which often results in being unaware of and intimidated by both graduate coursework and the potential of working in academia. These students need to feel they have access to mentors to guide them as well as access to supports to help them be academically and socially successful. Within the parameters of this project, it takes several approaches over multiple years, with both peer and faculty mentors encouraging students to bolster their sense of self-efficacy. This program was successful in recruiting the desired amount of students in the second year, and after we successfully support these students by helping them apply to and persists in graduate school, those findings will address the gap in the research and the chasm in practice preventing an equitable STEM pipeline.

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