

Contributing to Diversity and Inclusion in STEM Graduate Education: An Interdisciplinary Approach

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Women and minority groups, Black or African American, Latinos, and American Indian and Alaska Native, are underrepresented in STEM graduate education and the workforce.

Broadening participation in STEM higher education can increase diversity in the workforce and help not only women and underrepresented minorities (URM) students to fulfill STEM careers, but also enable the United States to thrive in the 21st century. Moreover, research labs that are more diverse are more productive than those that are homogenous [1]. Thus, broadening participation can help sustain and grow research communities. Our National Science Foundation Research Traineeship Program (NRT), the Rural Resource Resiliency, at K-State University attracts students from diverse backgrounds and cultivates a culture of inclusiveness. Our NRT is an interdisciplinary graduate traineeship that trains diverse STEM graduate students to solve the grand challenges of creating sustainable food, energy and water systems in rural communities in semi-arid regions. Incorporating interdisciplinary research, faculty mentoring, developing students' career pathways, and periodic assessment and continued refinement of these three modalities, which has been designed as part of our NRT, may have a positive impact on diversity and inclusion and might be a model for other graduate STEM programs. To recruit students to the NRT with diverse backgrounds, we used multiple strategies. The most successful recruitment strategy has been connecting NRT faculty and trainees to prospective students. Program documents show that the NRT first and second cohorts comprised 50% women and 50% men. Our first NRT cohort comprised one URM students while our second cohort comprised half (50%) URM students, and the third cohort comprises of 53.84% URM students. The NRT composition of women and men aligns with the national population, while the NRT composition of URM students in the second and third cohorts is higher than the national population [2]. Evaluation feedback shows that our students rate the NRT program as very inclusive. We looked at why students applied to our program, if trainee's experiences differ based on gender or ethnicity, and why they rated our program as very inclusive.

The sample size is small (11 out of 16 trainees and 15 out of 20 trainees completed the survey in 2019-2020 and 2020-2021 academic years, respectively). Still, the data suggest some possible patterns. The strongest pattern is that more trainees from three groups: women, men, and Whites (and also many Asians/ Hispanics), chose 'To grow as an interdisciplinary researcher' and 'To address real-world Food/Energy/Water problems' more often than any other reasons for applying to the NRT program. The top reasons that Asian/ Hispanic trainees selected for applying to the NRT program were 'To advance my academic career' and 'To address real-world FEW system problems'.

In addition, survey findings show that trainees rate the program as very inclusive, which they attributed to how their NRT program experience provides them opportunities to interact with

people with diverse backgrounds. Responses from men focused more on how NRT program leadership team designed the program so that it can offer these interaction opportunities, while women and trainees who identified as Asian and/or Hispanic focused more on the diversity of the cohort participants. Most responses from women emphasized the small size of the NRT cohort group and opportunities to connect with others. Finally, survey findings provide evidence that cognitive diversity is among trainees' favorite aspects of the program. One trainee wrote: “{My favorite part of NRT so far has been} the connection and interaction with students from various backgrounds, expertise, and ways of thinking.” Another trainee wrote “My favorite part has been getting to learn the perspective of economists, sociologists, and policy makers as opposed to only looking at it from {my discipline's} perspective. “ Moreover, survey findings show that trainees rated faculty mentorship as useful for their career development and that they valued the opportunity to work with professors, and also peers, from different disciplines.

The small size of the NRT program cohorts and smaller size of the survey participant group limit our ability to generalize our conclusions to other graduate STEM programs. However, we did see interesting patterns that suggest small, interdisciplinary programs like the NRT contribute to diversity and inclusiveness at universities where they are situated. Trainees' reasons for why they apply to the NRT differ based on gender and ethnicity in a way that suggests that women might be more interested in interdisciplinary research than men, and that men might be more interested in advancing their careers than women. It also suggests that white trainees might be more interested in interdisciplinary research than Asian/Hispanic trainees, and that Asia/Hispanic trainees might be more interested in advancing their academic career, and addressing real world food, energy, water problems. Trainees rated the NRT program as very inclusive. In their responses, men tended to emphasize the role that NRT program team leadership played in offering these experiences, while women tended to emphasize the small size of the cohort group and opportunities to connect with a diverse group of peers and professionals. We will continue to collect data from subsequent cohort groups. This will help us develop a larger database, allowing us to explore and test these conclusions, and create a model that can be used by other graduate STEM programs to increase diversity and inclusiveness.

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[1] B. K. AlShebli, T. Rahwan, and W. L. Woon, “The preeminence of ethnic diversity in scientific collaboration,” *Nature Communications*, vol. 9, no. 1, Dec. 2018, doi: 10.1038/s41467-018-07634-8.

[2] Census Bureau, Annual Estimates of the Resident Population, 2019; Bureau of Labor Statistics, Current Population Survey, 2019. Available:
<https://www.census.gov/newsroom/press-kits/2019/national-state-estimates.html> [Accessed July 21, 2021].

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