

How Seattle University Plans to REvolutionize Engineering Education through Industry Immersion

The National Science Foundation (NSF) IUSE/PFE: REvolutionizing Engineering and Computer Science Departments (RED) program is an initiative that aims to enact groundbreaking, scalable and sustainable changes in undergraduate education. The RED program focuses on departmental level reform with the goal “to provide students with education that leads to both deep disciplinary knowledge and a broad set of professional skills” [1]. The RED program requires that the department chair or the dean be the principal investigator, and that each RED project have a social scientist and an engineering education researcher with knowledge of best practices. Nineteen programs have been awarded the RED grants from 2015 to 2017. Seattle University was awarded the RED grant in July 2017. It is one of the only two private universities and one of the only two mechanical engineering programs being awarded.

The goal of the project at Seattle University is to develop a mechanical engineering program where students and faculty are immersed in a culture of doing engineering with industry engineers [2, 3]. This culture of “engineering with engineers” is expected to help students connect and identify with the engineering profession. Research suggests that students who have a strong connection with engineering are more likely to engage in and persist in that profession [4, 5]. This appears especially true for underrepresented minorities and females [6, 7, 8].

A culture of “Engineering with Engineers” includes creating realistic and practical designs, solving open-ended, unstructured problems, and connecting information from different disciplines to address large-scale systems problems. “Engineering with engineers” also includes having ongoing relationships with practicing engineers, solving problems with them, presenting ideas and results to them, and being critiqued by them. At Seattle University, this culture of “Engineering with Engineers” will be created through changes in four areas proposed by Henderson, Beach, and Finkelstein [9]: shared vision, reflective faculty, relevant curriculum and pedagogy, and supportive policies. The theme unifying these changes is a significant connection to industry.

This connection to industry will be facilitated through strong alliances with professional organizations. The department will strengthen existing relationships with key professional societies and forge relationships with new ones. These relationships will help the department develop additional ties with local industries. Example involvements of professional organizations include: (1) Help identify opportunities for faculty immersion experiences in industry. (2) Be committed to building connections between academia and industry to improve engineering education. (3) Provide venues for dissemination. (4) Provide training for faculty and/or students both during the grant period and beyond.

To develop a curriculum of engineering with engineers and a pedagogy centered on industry, faculty themselves need to engineer with engineers. Faculty need to understand current industry practices so that they can reflect those in their teaching and in their curriculum. One way that faculty will engineer with engineers is through summer industry immersion experiences. Each faculty member will spend at least one month during summer months to work with practicing engineers and learn about current industry practices. The immersion experiences are expected to

help faculty develop their own engineering identities and interact with students as practicing engineers.

Currently, the mechanical engineering curriculum connects to industry in limited ways. As part of engineering with engineers, the program will implement a new vertically integrated course that emphasizes experiential learning with strong industrial components. Teams of freshmen, sophomores and juniors will work together on engineering projects advised by practicing engineers and a faculty member. This series of course will begin in 2019-2020 academic year. We will be seeking support from industry in areas like identify projects and advising student teams. Also, faculty will use pedagogic methods that engage students in activities in other courses that reflect what a practicing engineer might do. Those activities require support from industry as well. In addition, the department will encourage connection to industry by sponsoring regular seminars, field trips, social events, and Makeathons. These changes will help students feel like engineers who are a part of the engineering profession. Their identification should help them to engage and persist in engineering.

During this project, interviews, surveys, portfolios, reflections, and audio and/or video documentaries will be used to document the changes to the program and to student and faculty identities. All students, faculty and industry partners will be invited to participate in these evaluation activities and responses will be tracked throughout the duration of the project. This study will help understand the effects of a new program culture on the identities of students and faculty, and how these enriched identities affect students' engagement in and commitment to engineering. It will also lead to a better understanding of the factors that influence faculty identity, and how these richer identities affect how they view their roles and their students. It is our hope that this project will enact changes in incentives and training that promote industry engagements and building strong and sustainable industry-education interactions.

References:

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