

S-STEM: Cultivating Success: Career Development and Student Retention through Scholarships and Academic-Industry Partnerships

Dr. Shelly Gulati, University of the Pacific

Dr. Shelly Gulati is Professor of Bioengineering and Associate Dean for Student Success in the School of Engineering and Computer Science at University of the Pacific. She has been at Pacific since 2010. She received a BS in Chemical Engineering from Johns Hopkins University and a PhD in Bioengineering from University of California, Berkeley. She also spent two years as a postdoctoral fellow in London at Imperial College. Her research interests are in biomicrofluidics as well as engineering education. Her recent projects have focused on creating engaging learning environments that promote students' sense of belonging, persistence, and success in engineering.

Dr. Sebastian Dziallas, University of the Pacific

Sebastian Dziallas is an Assistant Professor of Computer Science at the University of the Pacific. He previously served as a founding faculty member at Fulbright University in Vietnam. He received a Ph.D. in Computer Science from the University of Kent and a B.S. in Engineering from Olin College of Engineering. His research interests in computing education research include using narrative methodologies to understand student experiences and exploring novel work-based learning approaches.

Dr. Mehdi Khazaeli, University of the Pacific

Mehdi Khazaeli is an Associate Professor in School of Engineering and Computer Science at University of the Pacific. He also serves as Director of Pacific's Technological Innovation and Entrepreneurship (TIE) Program. He teaches courses in Building Info

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Introduction

The *Engineering Innovation Scholars* program, an NSF-funded S-STEM project at University of the Pacific, provides \$15,000 annual scholarships to 10 first-year students and aims to increase the number of low-income, academically talented students that graduate in civil engineering or engineering management. It builds on established relationships between the university, internal partners, statewide programs, and local employers. Scholarship recipients will be organized into cohorts with structured academic and student supports (orientation program, social and professional development) and activities in partnership with employers (national competitions, summer internships, and cooperative education). By connecting academic and industry experiences, students in the program will gain relevant work experience early in their degrees, increasing their future success and career readiness.

The program is currently in its first year, with recruitment underway for the first cohort of scholars. In the following, we report on the ongoing outreach and recruitment activities, as well as the overall structure of the program.

Context

University of the Pacific is a minority serving institution (MSI) with Asian American and Native American Pacific Islander-Serving Institution (AANAPISI) and Hispanic-Serving Institution (HSI) designations. Its School of Engineering and Computer Science offers a variety of undergraduate and graduate degrees in engineering and computing disciplines and already has a large number of low-income students relative to the overall student population. For this program, we specifically focus on attracting low-income, academically talented students in civil engineering and engineering management, as graduates from these programs are well-positioned to address a strategic national and regional need for enhancing and rebuilding infrastructure [1], [2].

Outreach

Studies have found that students receiving college advising services are significantly more likely to enroll in a 4-year institution after high school [3]. Building on these findings, outreach for this program includes high school visits, recruitment at on-campus events, as well as webinars with industry partners.

The outreach activities are taking place in collaboration with University of the Pacific's Mathematics, Engineering, Science Achievement (MESA) program, which provides services to 1200-1400 middle and high school students at 23 high-needs school sites (at least 30% of students come from families with incomes below the poverty line) across two local school

districts. University of the Pacific's MESA program has been inspiring underserved students in the local area to explore and embrace their interests in STEM for 30 years through project-based and experiential learning, events, field trips, and mentorship. Importantly, it also brings students onto campus to build interactions with university students and to promote a sense of belonging on a college campus.

As part of this year's admissions cycle, one of the co-PIs visited 5 local high schools together with MESA leadership. They were joined by current students in civil engineering and engineering management. We selected student presenters who were raised in the region, were past MESA students, and ideally were graduates of that high school. The aim was to include student presenters that high school students could relate to as mentors and role models, increasing their confidence that they too can pursue STEM studies and careers.

During the school visits, we discussed the benefits of the Engineering Innovation Scholars program, including financial support toward tuition, cohort activities, and guaranteed summer internships following their first and second years. At two schools where we held longer sessions, we also provided information on what to consider in preparing their application essay. All student participants received a waiver of their application fee if they applied by the early action deadline.

We also shared information about the Engineering Innovation Scholarship at other on-campus outreach activities for local high school students. One was a summer high school institute class on computer drawing and drafting taught by a civil engineering faculty member. Additionally, a co-PI introduced the scholarship to two Introduction to Engineering classes for high school students following activities focused on civil engineering and engineering management career pathways. We also held a webinar with a faculty member in civil engineering and an industry representative from one of the partner employers to share more about the program, the range of careers for these programs, what it is like to work as an engineer, and how their work positively impacts the local community.

Program Structure

This program builds on and adds several elements to existing programs and structures at the university. For instance, in terms of academic and student support strategies, the existing faculty advising program will be complemented with a structured cohort experience and dedicated industry mentors. Similarly, in terms of work-based learning experiences, the existing CO-OP program at University of the Pacific will be complemented with guaranteed internships, as well as opportunities for participation in student club activities, national competitions, and real-world projects. These activities are designed to promote students' sense of belonging, self-efficacy beliefs, professional identity, psychosocial factors known to contribute to academic and student success of STEM students [4], [5], and career readiness [6]. Figure 1 shows the activities for each year of the program, which we describe in more detail below.

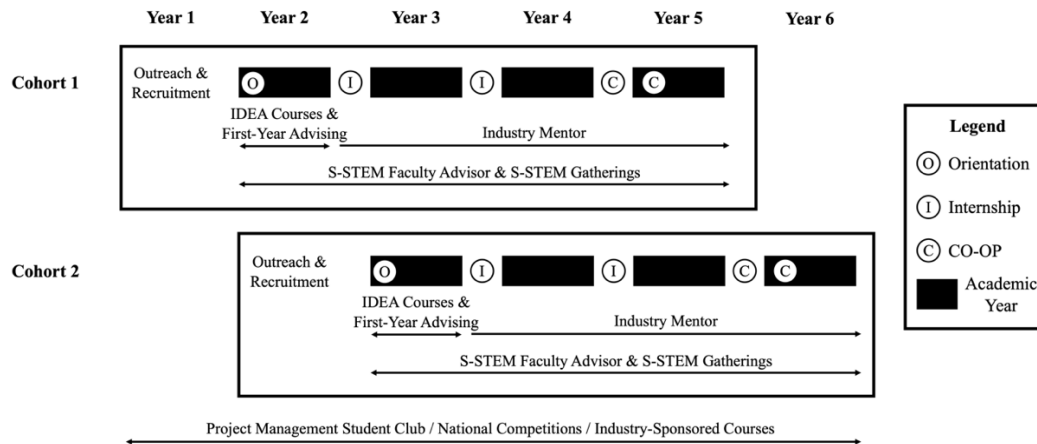


Figure 1: Timeline of Project Activities

Cohort Community Building

Studies have shown that activities that promote interactions with staff and peers and prompt personal reflection contribute to sense of belonging [7]. Faculty-student interactions outside the classroom also promote student success, persistence, and satisfaction with the college experience [8], [9].

To leverage these findings, each entry year of S-STEM students will be organized into a dedicated cohort. This experience begins with an overnight two-day retreat focused on relationship building and goal setting. To maintain this momentum, social activities for team building and end-of-semester celebrations will also occur throughout the first year. Additionally, students will be co-enrolled in the same section of the first-year introductory engineering design course (IDEA) and their respective math course to establish a consistent peer support network.

Throughout the duration of the grant, we will also organize regular gatherings with S-STEM students and their faculty advisors. The topics for these meetings are informed by a survey of current students in the MESA program (a population with similar demographics and needs to the S-STEM students) and will include topics such as academic and social support (study skills, adjusting to college life, time management, and financial management), mentoring needs (understanding college expectations and exploring academic opportunities and career path options), and career planning (completing the university's career-readiness milestone program).

Real-World Opportunities

Work-based learning has the potential to support students' self-efficacy and professional identity [10], [11], [12], while helping them to develop important skills necessary for a career in the workforce. As part of this program, we have partnered with 6 local employers that have committed to engaging with the S-STEM scholars via mentorship and work-based learning experiences. These industry partners have been engaged in the grant via an on-campus meeting to solidify their involvement, solicit ideas for the internship matching process, and identify ways to sustain the program after the grant has been completed. University of the Pacific's

Development Office has also been actively pursuing external funding opportunities and has already achieved early success in securing financial support to help sustain the program beyond the grant period.

S-STEM scholars will take part in two internships (in their first two summers in the program) and a CO-OP (beginning with their third summer in the program) with a designated industry partner. Students will also be assigned an industry mentor from their corresponding company.

This summer, we will be piloting the internship program with current first year students in order to refine the process for the first Engineering Innovation Scholars cohort in year 2 of the grant. We are also planning to incorporate additional real-world projects into students' academic experience. Many of the civil engineering and engineering management courses already include project-based learning and students also complete a Senior Design project. We will adopt projects generated from our industry partners in these courses, which will benefit not only the S-STEM scholars, but a broader group of students [13]. Furthermore, students will have the opportunity to participate in extracurricular activities, such as a new Project Management Student Club and national competitions.

Methodology

To study the effectiveness of the support strategies together with work-based learning, will use a mixed methods approach to gather data on students' sense of belonging, self-efficacy, professional identity, and career readiness, as well as retention and graduation rates. We are planning to use the following instruments to collect data annually:

- Sense of Belonging: Sense of Belonging in Science, Technology, Engineering, and Mathematics Domains Measure [14]
- Self-Efficacy: General Engineering Self-Efficacy Scale [15]
- Professional Identity: Identity as an Engineer [16]
- Career Readiness: measures for teamwork, communication, and leadership skills [17], [18]

Additionally, to gain a deeper understanding of scholars' professional identity and career readiness, we will conduct narrative interviews. Research in the field of narrative psychology has shown that we construct stories to make sense of our lives [19], making narratives a particularly appropriate way of exploring student identity [20]. We will collect stories from cohort students using an approach called *Participatory Narrative Inquiry (PNI)* [21]. In PNI, stories are collected through focus groups and participants themselves make sense of the data in a form of structured self-signification. This approach empowers participants by actively involving them in the research process and amplifying their voices.

Conclusions

This S-STEM program at University of the Pacific provides a framework for supporting low-income, academically talented students in civil engineering and engineering management. By

integrating \$15,000 annual scholarships with structured cohort activities and guaranteed work-based learning, the program directly addresses common barriers to student persistence.

In addition to supporting student success, this scholarship and work-based learning model has the potential to play an important role in regional economic and workforce development. By preparing students with industry-relevant skills and connecting them directly with local employers, the program helps to build a sustainable talent pipeline that meets current and future workforce needs.

Looking ahead, while student recruitment for the first cohort is ongoing, our research will provide additional evidence for the effectiveness of these academic-industry partnerships and offer insights into ways of fostering students' professional identity and career readiness in STEM.

Acknowledgements

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