

Impactful for whom? Exploring the diversity of learning pathways outside of the classroom for engineering students

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Abstract— Despite calls to increase diversity in engineering education and the professional workforce [1], there are persistent issues of underrepresentation for female and minority students [2]. This challenge warrants consideration of underrepresented students' experiences both inside and outside the classroom and how they can contribute to persistence. Engagement in out-of-class activities has been linked to positive academic and interpersonal outcomes. However, access to, and impact of, these activities can vary for different groups of students. This session leverages an ongoing National Science Foundation CAREER project to explore out-of-class participation disaggregated by student demographics to provide a more nuanced profile of engagement and offer strategies for advising undergraduate engineering students.

Keywords—diversity, co-curricular, extracurricular, learning pathway, undergraduate

I. INTRODUCTION

The undergraduate experience is a mosaic of opportunities that shape students' personal and professional development. Although most research in engineering education has focused on classroom experiences and outcomes, there is growing recognition of the importance and influence of involvement outside of the classroom. Undergraduate students spend less than 8% of their waking time in formal learning settings [3], which warrants consideration of how students engage in out-of-class activities (OOCA). These activities include co-curricular (those related to the field of study but not a particular course) and extracurricular (those not explicitly connected to academic learning). Previous research has explored the effect of out-of-class participation on academic outcomes [4] and academic engagement [5]. However, it can be difficult to generalize findings based on differences in student demographics, activity types, and institutional characteristics.

Access to OOCAs and experiences within these activities can vary across student demographics. For example, Black students, students from low-income families, and students whose parents did not attain a Bachelor's degree are less likely to participate in OOCAs [6]. There are also differences in the

types of activities, extent of involvement, and perceived outcomes based on student characteristics [7].

This session presents and builds on research from a National Science Foundation CAREER award that is investigating out-of-class participation of students underrepresented in engineering. The session explores the impact of OOCAs across different dimensions of diversity to expand the understanding of impactful activities and inform student advising accordingly.

II. SESSION GOALS

By the end of the special session, attendees should be able to:

- Define what is meant by high impact out-of-class activities in engineering education
- Describe outcomes associated with various out-of-class activities
- Identify impactful out-of-class activities disaggregated by student demographics including gender, race/ethnicity, disability status, and LGBTQ+
- Summarize findings on the frequency and level of involvement of out-of-class activities for engineering students
- Develop strategies for advising engineering students on the benefits of out-of-class activities and opportunities to pursue them

A. Anticipated Audience

This session is expected to be valuable for any FIE attendee. Educators who advise and mentor engineering students can benefit from understanding impactful out-of-class activities for different groups of students and how to mentor students accordingly. Individuals interested in co-curricular engagement, diversity, and broadening participation will also find this session relevant.

B. Novelty of the Session

Although involvement and impact regarding out-of-class engagement in college have been studied, past research has

primarily focused on the perspectives and experiences of White males. As a result, the findings might not be salient for non-majority students in engineering. This session leverages an ongoing National Science Foundation-funded CAREER project exploring out-of-class activities with a focus on the outcomes, incentives, and barriers for underrepresented students. This research adds to our understanding of impact and engagement for students disaggregated by gender and race/ethnicity. Out-of-class experience is not one size fits all. For educators to effectively advise their students and mentor co-curricular activities, it is important to understand the differential impact of activities and how to support students in learning outside of the classroom.

III. SESSION OVERVIEW

This session aims to go beyond exploring high impact out-of-class activities to challenge attendees to consider “high impact for whom?” Attendees will engage in hands-on activities and facilitated discussions.

A. Interaction During the Session

The session is designed to be interactive to generate dialogue around out-of-class engagement through the lens of diversity and broadening participation. The session will provide an opportunity for attendees to challenge their own perceptions of impactful activities. The session will prompt attendees to consider underrepresentation and out-of-class engagement in their local setting. The session will include individual reflection, small group conversation, and large group discussion to foster a comfortable environment for attendees from various backgrounds.

B. Session Agenda

Time (minutes)	Topic
5	Session agenda and goals
5	Facilitator and participant introductions
5	Brief overview of the NSF CAREER project to introduce our research and establish a common understanding of out-of-class activities
15	What are the most impactful out-of-class activities for engineering students? Activity: (think-pair-share) Using a handout, rate the impact of various activities on engineering students’ professional development.
10	Discussion: Share stories of “surprising” impactful activities from our research and invite attendees to share their own.
15	How does the impact of activities vary by student demographics? Activity: (think-pair-share) Using a handout, rate the impact of various out-of-class activities by demographic comparing male/female and race/ethnicity majority/minority. This activity is connected to our published research results on <u>disaggregating data by gender and race/ethnicity</u> .
10	Discussion: Explore stories of impactful activities for other underrepresented groups including students with disabilities and LGBTQ+ students.
10	How do we translate these findings into advising strategies? Activity: Brainstorm actionable strategies for advising engineering students.
5	Discussion: How do we integrate these findings into a framework for involvement of underrepresented students in engineering? Re-examining the Input-Environment-

Time (minutes)	Topic
	Output model through the lens of diversity.
5	Conclusions, questions, and acknowledgements

C. Notes on the Facilitators

All three of the facilitators have experience developing workshops and interactive sessions.

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Madeline Polmear is a postdoctoral researcher in the Department of Civil and Coastal Engineering. She has been involved in engineering education research for the past eight years with a focus on integrating professional competencies and supporting engineering faculty in teaching socio-technical skills. Dr. Polmear has developed and facilitated interactive workshops at local, regional, and national ASEE conferences.

Susan M. Lord is Professor and Chair of Integrated Engineering and Professor of Electrical Engineering at the University of San Diego. She is a Fellow of the IEEE and the ASEE. Dr. Lord has considerable experience facilitating workshops including the National Effective Teaching Institute (NETI) [8], the MIDFIELD Institute [9], and special sessions at FIE.

IV. EXPECTED OUTCOMES AND FUTURE WORK

The expected outcomes of the session are a nuanced understanding of out-of-class engagement and impactful activities for non-majority students and a contribution to the ongoing conversation of broadening participation in engineering through involvement. This session aims to be a starting point for discussion with the engineering education community including soliciting input on integrating our research findings into an expanded or revised Input-Environment-Output model as a framework for exploring out-of-class involvement for underrepresented engineering students. We will also provide a handout that distills our research findings including learning pathways and key results.

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