

Let's Talk about Leaving: A Special Session on Attrition and Departure from the Engineering Doctorate for Administrators, Advisors, Mentors, and Graduate Students

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Abstract—This special session is based on empirical findings from an ongoing NSF CAREER Grant specializing in characterizing the mechanisms of attrition for engineering doctoral students. While many researchers have characterized “what” issues can cause students to be dissatisfied, fewer are working to understand how factors layer for individual students under individual conditions. Further, many faculty hold myths of graduate engineering attrition that are incomplete or do not cover both psychological and sociological perspectives. Therefore, this special session introduces graduate engineering attrition through the lenses of both theory and composite narratives constructed from the interviews we have conducted as part of this study. The special session is aimed at multiple stakeholders, and after the interactive session, participants will leave with access to resources and materials that will be useful to talk about leaving in productive and healthful ways than is typically common with the goal of reducing stigma and promoting the education for graduate students.

Keywords—graduate engineering education; attrition; persistence; narratives

I. DESCRIPTION OF THE SESSION

This special session will lead participants in an engaging and interactive discussion on attrition from the engineering PhD, with the goal of reframing conversations around leaving graduate degree programs to be more student-centric and healthy. The content for this workshop stems from Dr. Catherine Berdanier’s ongoing NSF CAREER grant entitled “Characterizing Master’s-Level Departure from the Engineering Doctorate through Multiple Stakeholders’ Perspectives.”

National statistics compel attention to graduate attrition and persistence in engineering: The ten-year completion rates for U.S. domestic engineering PhDs are 65% for men and 56% for women, with estimates much lower for students from underrepresented groups [1], [2]. Each graduate student that leaves their program also represents a loss of talent and lost investment from funding agencies, departments, faculty, and the students themselves. While the lack of a PhD is not a barrier to career success, retention of the PhD workforce is important for innovation and national competitiveness [3] and is required to broaden participation in engineering and the professoriate [1].

Overall, analyses of graduate attrition point to advisor support [4-6], academic climate [7-9], personal traits (such as self-efficacy or self-regulation) [10-12], and funding [4, 37] as factors of persistence. The importance of mentorship is particularly well-documented [13-18]. Narratives related to the feeling of “stuckness” in graduate school are also documented [17] and may be related to Gardner’s [19] finding that graduate advisors often attribute attrition to different causes than non-completers.

By the end of this workshop, participants will be able to

1. Articulate, though theory, how myriad factors can layer to affect graduate student success, thriving, persistence, and attrition in graduate school.
2. Name the “boundary conditions” for different stakeholder groups and articulate how these constraints complicate “talking about leaving” for different stakeholder groups.
3. Diagnose underlying issues related to attrition in persistence from composite narratives of engineering graduate students.
4. Develop effective conversation prompts and questions to facilitate effective conversations on leaving (from any stakeholder perspective.)

II. ANTICIPATED AUDIENCE

This workshop will be shaped to be able to target all stakeholder groups that interact with graduate engineering, including faculty, administrators, and graduate students themselves. Out of this interactive workshop, participants will be provided with access to a digital “toolbox” of resources, including composite narratives, language for their own research groups, and talking points/question prompts for multiple stakeholders to help them talk about leaving with other stakeholders and to begin sharing this language with others in their departments or colleague groups. In addition, participants will also gain strategies from their interactions with others participating in the workshop.

III. JUSTIFICATION FOR THE SPECIAL SESSION

A. Background and Motivation

Attrition is largely stigmatized as a topic of discussion. Students considering attrition often feel isolated as a contributing factor for the decision, but feel isolated in their decisions, even though our research shows that nearly 75% of graduate students sometimes or often consider departing from the engineering PhD with a Master's degree (or more rarely, with no degree) [20]. Some advisors avoid the conversation with their graduate students, worried that it may "plant ideas" into students' minds. Indeed, as graduate students are an expensive investment and persistence is tightly wound around traditional systems of merit, tenure, and promotion, advisors are wary of students who may leave before finishing the PhD. Unfortunately, without clear communication about these issues, students feel alone in their decisions and advisors may be blindsided by student decisions to depart. Recent literature on STEM faculty perceptions [19] show different narratives of attrition than PI Berdanier's most recent findings based on engineering student-centric data [20]. Incongruity between the perspectives of faculty and graduate students is a persistent barrier to reducing unnecessary graduate attrition. Best practices in mentorship strategies, such as the use of an Individual Development Plan (IDP) or similar personalized plans (e.g., [22]) are sometimes encouraged and enforced by universities to enhance communication between graduate students and advisors; however, graduate students are often wary to discuss these issues with their advisors or with each other.

B. Dominant Theoretical Conversations

This work draws on theoretical orientations that span both the sociological and psychological perspectives for graduate students. Primarily, we rely on the Graduate Attrition Decisions (GrAD) model [20] while was developed for an engineering graduate student context and has been recently updated [23]. We also align ourselves with modern incarnations of Expectancy-Value Theory (EVT) [24-26], particularly in the incorporation of "cost" within a graduate students' decision making processes. We also subscribe to role identity theory [27, 28] to understand the oscillating roles required by graduate students as they move between being a consumer of knowledge and a producer of knowledge. We also understand that there are dominant narratives of what it means to succeed in academia: Theories like Ideal Worker Theory [29-34] are useful in understanding harmful and exclusionary visions for what it means to be "rigorous" or successful, with the expectation that to be a scholar one needs to abandon all other interests and values; and that any degree of 'otherness' (e.g., gender or racial/ethnic identity) is a penalty. These theories combine to help stakeholders understand why engineering graduate students struggle, even the ones who are "smart" and are meeting academic milestones.

C. Findings on Which Special Session is Based

The findings from the first stages of the CAREER grant have recently been published in literature. As a summary paper, [35] includes a comprehensive list of publications resulting

from this work. The first journal-level article out of the qualitative methods was published in 2022, in a piece entitled "Engineering graduate students' critical events as catalysts of attrition," [36] which showed how even contexts and events that advisors would consider typical or mundane can be the initiating "critical events" by which graduate students begin to consider attrition from the PhD. In 2023, two journal articles have been published, one entitled "Persistence at what Cost? How Graduate engineering students consider the costs of persistence within attrition considerations" [23] and the other "Investigating the tension between persistence and well-being in engineering doctoral programs" [37]. These two papers begin to explore the issues with over-glorifying persistence and 'grit' at the expense of well-being. In particular, the latter article presents a narrative analysis of four graduate students who by all predictions will likely complete their PhD, presenting their stories as crafted narratives that demonstrate uniquely the tensions between persistence and well-being that have not been discussed to date. It is based off these findings, and our research team's expertise in highlighting the 'missing pieces' to translate between graduate students and advisors that are leveraged in this special session.

D. Novelty and Merit of the Session and Topic

In our work, we have dispelled several common myths held by faculty members about graduate attrition, and it is the goal of this workshop for multiple stakeholder groups to be able to apply findings to their own situations. One example of one of these assumptions or myths is that graduate students are smart (which is true), so they don't need as much structure since independence is part of a PhD (which is partially true— independence must be developed through the PhD so that *at the end*, the student can be an independent researcher.). Another is that "only students who fail their qualifying exams leave their PhDs." This special session will transform our impactful research into practice, giving advisors, administrators, and graduate students an empirically complete view of doctoral attrition in engineering education research.

E. Purpose of the Special Session and Expected Outcomes

The purpose of this workshop is to destigmatize conversations on leaving and to develop shared language among stakeholder groups surrounding decisions to depart, based in empirical data. The first phase of the CAREER grant employed interview methods to collect data from $n = 42$ questioning and departed engineering graduate students. This is a large sample size for qualitative research perspective, especially from such a stigmatized, silenced, and often hidden population.

From the participants, we constructed composite narratives [38-39]. These composite narratives, along with the other findings from our ongoing research, will be the starting point to engage with stakeholders in this workshop.

Out of this interactive workshop, participants will be provided with access to a digital "toolbox" of resources, including composite narratives and talking points/question prompts for multiple stakeholders to help them talk about leaving with other stakeholders and to begin sharing this language with others in their departments or colleague groups.

IV. SCHEDULE OF SPECIAL SESSION ACTIVITIES

Table 1. Anticipated Special Session Schedule

Time Period	Topic	Notes on Activity and Rationale
0:00 – 0:10	Introduction, Ground Rules & Bookkeeping, and Introductions	Re-seat participants based on stakeholder group (e.g., students with other students, etc.) Overview of ground rules and expectations for the session Rationale: facilitators understand potential issues with group dynamics, reduce power dynamic as much as possible
0:10-:20	Introduction to the use of Composite Narratives to Investigate Graduate Attrition	Each participant has a different composite narrative representing a complex situation that has led to a graduate student considering whether to depart from the engineering PhD Goal: Participants to engage with composite narratives from their own positionalities: Narratives invoke strong feelings, and participants will be prompted to engage with these feelings and what their gut reactions are
:20-:35	Tackling the Sneaky Problem of Graduate Attrition in Engineering: Discussion on Graduate Theory, the ongoing CAREER study, and methods for collecting the data that is used in this workshop	
:35-:45	Acknowledging Positionality in the System of Graduate Education	Participants, with their groups, reflect on their own experiences with and impact on graduate student persistence and attrition Participants work with their groups to articulate links between participants' experiences and reactions to the narratives and theory Participants re-envision their reaction the composite narrative from other stakeholders' perspectives, and what different systemic constraints and pressures may be at play
:45-1:00	Identifying and Diagnosing	Participants are presented with a new composite

	Underlying Issues in Graduate Student Experiences	narrative, and work in small groups to actively identify and table their gut reactions, and instead work to develop a series of exploratory questions that could be asked of the hypothetical student (Note: This activity is equally useful to students because it encourages reflective practice)
1:00-1:10	Mapping Underlying Issues to Potential Solutions	Participants map the potential answers to their exploratory questions to productive and reasonable solutions
1:10-1:20	Report Out, Conclusion, Orientation to Digital “Toolbox” and Questions	

V. PRESENTERS AND FACILITATORS

This workshop will be designed by Dr. Catherine Berdanier, the PI of the NSF CAREER grant on which this material is based. She and her team have deep expertise in graduate-level engineering education. The co-facilitator, Ms. Gaby Sallai, is a member of Dr. Berdanier's research team and were involved with the data collection and analysis to date. Her involvement will also ensure that the graduate student perspective is appropriately represented in these sensitive conversations.

Dr. Catherine Berdanier is an Associate Professor of Mechanical Engineering at the Pennsylvania State University, where she is the Director of the Engineering Cognitive Research Laboratory (ECRL). Catherine earned her B.S. in Chemistry from The University of South Dakota, her M.S. in Aeronautical and Astronautical Engineering and Ph.D. in Engineering Education from Purdue University. Her research interests include graduate-level engineering education including doctoral student attrition and persistence; engineering writing; and engineering communication.

Gabriella Sallai is a fifth-year PhD Candidate in Mechanical Engineering with an expertise in qualitative methods and graduate engineering student well-being, thriving, and goal-setting. She has led many of the qualitative aspects of the CAREER grant on which this workshop is based, and is an NSF Graduate Research Fellowship Program Awardee and a Sloane Scholar.

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