



Engineering Industry Perspectives and Policies Related to Employees' Pursuit of Engineering Doctoral Training

Ms. Erika Mosyjowski, University of Michigan

Erika Mosyjowski is a PhD student in the Center for the Study of Higher and Postsecondary Education at the University of Michigan. She also earned a Master's in Higher Education at Michigan and a Bachelor's in Psychology and Sociology from Case Western Reserve University. Before pursuing a PhD, Erika had a dual appointment in UM's College of Engineering working in student affairs and as a research associate. While grounded in the field of higher education, her research interests include engineering education, particularly as related to systems thinking, organizational cultures, professional identity development, and supporting the success and ideas of underrepresented students within engineering.

Dr. Shanna R. Daly, University of Michigan

Shanna Daly is an Assistant Professor in Mechanical Engineering at the University of Michigan. She has a B.E. in Chemical Engineering from the University of Dayton (2003) and a Ph.D. in Engineering Education from Purdue University (2008). Her research focuses on strategies for design innovations through divergent and convergent thinking as well as through deep needs and community assessments using design ethnography, and translating those strategies to design tools and education. She teaches design and entrepreneurship courses at the undergraduate and graduate levels, focusing on front-end design processes.

Dr. Diane L. Peters, Kettering University

Dr. Peters is an Assistant Professor of Mechanical Engineering at Kettering University.

Engineering Industry Perspectives and Policies Related to Employees' Pursuit of Engineering Doctoral Training

I. Introduction

Supporting multiple pathways through engineering education, including at the graduate level, is a commonly cited priority in conversations about the future of engineering [1], [2]. Similarly, increasing the diversity of experiences and perspectives represented in the engineering population is critical for successfully and thoughtfully addressing the complex problems typical of contemporary engineering work. Engineering returners, who we define as students who work for five or more years after completing their undergraduate engineering degree before pursuing a PhD, represent an often-overlooked group of students who have a distinct educational trajectory and rich past experiences they bring to their PhD work [3]. Returners' substantial engineering work experiences help direct their exploration of critical engineering research questions, inform their research process, and may position them well to help find innovative solutions to present and future engineering problems. However, while returners may be particularly well-positioned to contribute to the field of engineering in important ways, little research has attended to their experiences and the factors that might shape their decisions to pursue a PhD [4], [5].

Our work aims to contribute to our collective understanding of engineering PhD returners' perspectives and their experiences in the professional and academic contexts in which they are situated. In our team's prior work examining the factors that may shape returners' decisions to pursue and persist in engineering doctoral study, returners reported substantial financial, academic, and work/life balance challenges associated with their transition from an engineering career back to a student role [6], [7]. While these findings provided insight into the experiences of PhD returners once enrolled in graduate study, they raised questions about the work contexts would-be returners might be coming from and the workplace-level attitudes and policies that might contribute to individuals' perceptions of the cost of returning and ultimately inform decision making. While many engineers return to pursue a Master's degree (and data suggests many companies have programs in place to support their employees doing so), the experience of deciding to return for PhD is likely a distinct experience. Thus, we explore what barriers and supports exist within organizations employing engineers that might shape interested employees' thinking about whether or not they should pursue a PhD. Are there particular policies or programs that encourage employees to pursue doctoral study? In what instances is employee earning a PhD perceived to be a benefit to the company? How might such policies and attitudes affect would-be returners' decision making? Through interviews with participants at a number of government and industry organizations employing engineers, this study provides some preliminary insight into these questions.

II. Background

Data suggest returning students are a minority of engineering PhD students. The average age of engineering doctoral students upon degree completion is 30, suggesting many students enroll in doctoral study shortly after completing their baccalaureate, and perhaps a master's, degree. While the PhD graduation age is comparable to that of other STEM fields, it is in stark contrast to average graduation ages in fields such as education (38.3) and humanities (34.2), where it is more common for students to return for a degree after working in the field for several years [8].

Though there is limited research on returners at the doctoral level in engineering, research on returners generally in a number of fields suggests returning students may have distinct strengths and challenges. In addition to the rich applied work experiences they can bring to their doctoral work [3], returners may be more mature, goal-oriented, and motivated, and possess strong teamwork skills and a high work ethic [9] - [11]. However, returners can also face challenges transitioning into academia from the workforce. They often have less recent experience with advanced mathematics curriculum [11], have different work style preferences than their younger peers [12], and may be more likely to have significant family responsibilities like care for children or aging parents that make balancing their academic and personal commitments more challenging [13], [14].

Our team's earlier research used Eccles' Expectancy Value Theory (EVT) to explore the factors that might influence returning and direct-pathway students' decisions to enroll and persist in engineering doctoral programs [7]. Expectancy-value theory suggests that individuals' achievement related choices are motivated by their expectations of success (or competence beliefs) given a particular task and their beliefs about the relative cost and value of that task [15] - [17]. Individuals' competence beliefs and the costs and values they associate with a particular choice are informed by their past experiences, personal identity beliefs, the societal/cultural context, and individuals' interactions with these cultural norms or expectations [16], [17]. Our findings suggested that returners perceived higher levels of costs in a number of areas compared to their direct-pathway peers. These costs included academic costs, which relate to individuals' feelings about their academic performance, relationships with peers, and adjusting to a new type of work and environment; balance costs, which include challenges with family and friend relationships, self-care, and other activities and responsibilities; and financial costs, which relate to the cost of tuition and related expenses, challenges finding funding, and having reduced income and financial security. These concerns were also mirrored in interviews with returners [6]. These findings provide insight into the individual-level experiences of students who successfully returned for a PhD. Expectancy Value Theory would suggest that, for these students, higher perceived costs may result in a reduced likelihood that students choose to persist in their program of study. However, this research provides little insight into the organization-level policies and attitudes that could affect would-be returners' decision making prior to actually enrolling (should they ultimately decide to do so).

The success of returning students has implications beyond academia. Though it is often assumed that PhD programs serve as preparation for academic careers, in reality a majority of engineering

doctoral recipients do not pursue academic careers. Approximately 14% of newly-minted engineering PhDs work in academia after graduation, 72% find work in industry or business, while others work in government (10%), nonprofit (3%), or other (1%) organizations [18]. Thus, the support and training of engineering doctoral students is an issue relevant to many employers in these areas.

There is limited research that provides insight into workplace policies and attitudes and how these might affect employees seeking to pursue doctoral study, particularly within the field of engineering. Several studies suggest that, broadly, factors related to employment do have implications for workers pursuing a PhD. Malfoy and Yates [19] and Martinsuo [20] found that, for industry students, and particularly for those industry students enrolled in doctoral programs part-time, employer support is linked to students' degree progress [21].

A national survey of U.S. employers across a range of industries (not just those employing engineers) suggests that many employers do, in fact, provide some form of financial support to employees pursuing further study. In a 2015 survey [22] including 338 public and private sector employers found that approximately 83% offered some sort of educational assistance or tuition benefit to their employees. Employers most commonly reported providing assistance to fund undergraduate- and master's-level courses, but nearly 47% of those employers surveyed reported providing some degree of doctoral level tuition assistance. Over two-thirds of employers reported a fixed dollar amount cap on tuition benefits, which the majority of those employers reported was \$7,000 or less annually. These benefits typically come with requirements – most employers required individuals pass courses to be eligible for reimbursement, while approximately half required the employee pay back tuition benefits if leaving the organization within a given number of years after receiving those benefits. Slightly more than half required courses to be job-related in order to qualify for reimbursement. Such data provides valuable insight into national policies across a variety of sectors, but further work is needed to understand the range of policies within engineering employers and those specific to individuals at the doctoral level, and, perhaps most importantly, the informal practices and attitudes that may also play a role in workers' access to and decision-making around pursuing advanced doctoral study.

III. Methods

In this preliminary study, we aimed to advance an understanding of the potential employer-level barriers and supports that may affect perspective returners' decisions to pursue a PhD after extensive work experience. Specifically, we asked:

- What types of workplace practices, policies, and attitudes related to employees pursuing advanced graduate study exist at different companies that employ engineers?
- How might these shape employees' decisions to return to school for a PhD?

To address these questions, we interviewed six individuals with work experience at a number of organizations, in both industry and government, which employ large numbers of engineers. An interview study enabled us to gain an initial understanding of both formal policies and informal attitudes related to employees' pursuit of doctoral study.

Participants and Data Collection

Because it was our goal to understand policies and attitudes that exist within engineering organizations, we recruited participants with substantial experience working for one or more employers of engineers. While most of the participants had advanced degrees (three with a PhD, two with a Master's), we did not specifically recruit individuals who had themselves returned to pursue a PhD after extensive work experience (we interviewed these individuals in an earlier phase of our study), but rather recruited participants who could provide insight into the beliefs and practices at a range of engineering employers. It was not our goal to compare participants' experiences, but rather begin to understand the range of both formal policies and informal practices and beliefs at various organization that could be relevant to returners' decision processes. An interview design best enabled us to collect data about practices and attitudes that might not be otherwise documented in company records.

As this was an exploratory study, our recruitment practices reflect a sample of convenience. We relied on contacts of our team members. An initial introduction email was sent to contacts at several government and industry employers via email, who then further shared our recruitment email with others at their workplaces.

Individuals who agreed to participate were interviewed via videoconferencing or in person at a time and location convenient to them. One researcher conducted all six interviews. Interviews all lasted approximately 30 minutes each. Participants were compensated \$50 for their time. The interviews were audio recorded and later transcribed. To protect their identities, participants were assigned pseudonyms used in all reporting of the data.

Interview Protocol

We drafted a semi-structured interview protocol designed to capture the perspectives and policies of participants' workplaces, consistent with the goals of this study. We asked several individuals with extensive industry experience to review to protocol to ensure it was clear and asked questions that would target the types of information we hoped to learn about. The interviews asked participants to provide an overview of their organization, including the culture, size, and mission, their own responsibilities, their knowledge of the experiences of individuals from their organization who returned for PhD, perceptions of individuals within their organization about the value of a PhD, and policies or practices at their organizations that might influence an employee's decision to pursue additional education. The full interview protocol is provided in Appendix A.

Analysis

One researcher conducted the initial analyses described in this paper. She first read all of the transcripts to familiarize herself with the data and make notes on initial impressions of the data. Then, given the relatively small scale of the data set, she inductively coded the entirety of each transcript. Emergent codes included one to three word descriptors of the general type of

information included in a passage. Example codes include “organizational context,” “value of PhD,” and “policy: degree funding.” At this same time, the researcher took brief notes summarizing passages that fell under each of these codes. Next, the researcher reviewed the notes and codes and, in conversation with one of the other authors, discussed the emergent themes related to organization policies and attitudes associated with doctoral study. The researcher compiled all coded passages relating to these two topics and began to group the codes into categories and sub-categories. For example, passages relating to organizations’ policies related to funding doctoral study (coded as “policy: degree funding”) fell under “organizational factors” and, under that, “formal policies.” The researcher also examined coded passages for indications about the relationships between various codes and categories, such as how company and university policies might intersect to influence a students’ options for doctoral study. Collectively, these descriptive and relational analyses were used to develop the tentative descriptive model outlined in our findings.

IV. Findings

Our interviews provided insight into both the formal policies and informal practices and attitudes within engineering employers. Though characterizing these employer-level policies, practices, and attitudes was the focus of these interviews, participants also named several university-level policies that may interact with those at the employer level. In our findings, we discuss these employer and related university influences that may partially influence employee decision making. Figure 1 provides a summary of our preliminary findings. It is important to note that we do not argue that the factors explored in the present paper are the only, or even primary, ones influencing the decision making of individuals considering pursuing a PhD. Instead, they are intended as a primary exploration that expands on our team’s previous work on the cost, value, and expectancy of success reported by successful returners by providing insight into organization-level factors that inform this decision making context. We discuss each component of the figure in the following sections.

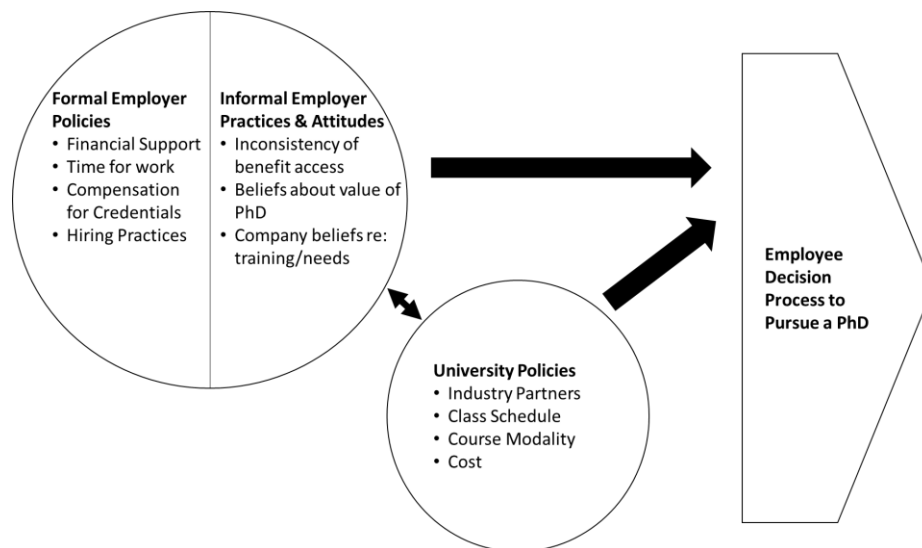


Figure 1: Summary of preliminary findings of employer and university policies, practices, and attitudes that may shape employee decision to pursue a PhD

Formal Employer Policies

Formal policies identified by participants as having potential implications for employees' decisions to pursue a PhD included financial support, flexible hours or time off to accommodate coursework, procedures and resources related to the approval of company support for the degree, compensation tied to educational attainment, and hiring practices based on educational attainment.

Financial Support. Participants described various programs designed to provide financial support to employees pursuing their doctoral degrees, though the structure and requirements of such benefits varied. There were a number of models for this support. Though one participant reported that his former employer did not provide any financial support toward the cost of doctoral degrees, multiple participants explained that their organizations provided full funding for all degree-related costs. Garrett, for instance, contrasted others' experiences with the level of financial support offered by his current company:

You know, some places, "Ah, we'll pay half." Or, "We'll pay 80 percent." Well in the government, even still, they pay everything except textbooks and graduation fees, but I mean, that's a huge incentive. [The total cost of a degree], I mean that's a lot of money. Most people that are I should say non-traditional students, don't pay that on their own. If the company ain't paying, they ain't doing it.

He emphasized that this full financial support was a major factor in returning students' decisions to pursue advanced study. Matt similarly reported that at his company, a large manufacturing firm, "every class you took was going to be paid for, 100%," a benefit which he described as an "incentive" for pursuing further study.

Consistent with national data on employers [22], participants also described various types of requirements for PhD tuition benefit eligibility. These requirements included maintaining grades of "at least a 'C' or better" and taking courses only as part of a "formal degree program." One requirement discussed by several participants was the expectation that employees would stay at the company for a given number of years after completing their degree based on the duration of their degree. One participant, Arlene, who worked to connect employees with educational opportunities, described how such a policy played a role in an older student's decision to pursue a PhD:

In any case, we now have a three to one pay back system in where they want the pay back to start when you're completely finished with your degree. I had a conversation with a gentleman who is 40. He is embarking on a PhD program, he also is going to be doing it in a remote type status, but what happens is even though you're doing it that way, we're looking at about six years to finish. He had to think long and hard because he realized that say he did this, he starts at 40, he finishes at 46, and then he can't retire because of this pay back situation. We actually have had conversations with some of the universities that are offering

these online courses that they're saying, "We had a drop in folks that are interested. We think it may be due to this particular policy."

While Arlene explained that such policies were newly implemented in response to employees taking advantage of tuition benefits and then leaving immediately upon completing their degree, such policies do have implications for more experienced employees hoping to pursue a doctorate. The degree may take many years to complete, particularly part-time, and the requirement of working even twice as many years as the degree took may put some employees well into retirement age. This years-long commitment, or the financial risk associated with not being able to fulfill the terms of the agreement, may prove to be a major deterrent for would-be returners.

Time to complete academic work. In addition to financial support, several participants described various organizational policies related to providing employees time to complete their academic work. In some instances, the participants described their organizations being supportive of a degree only to the extent it did not interfere with their work commitments. Matt described that at his organization, they provided some financial support for him to finish his doctoral degree, but did not offer any flexibility or time off during work hours to complete coursework.

Financially, what they supported was about \$6,000 a year in tuition. So that covered a good chunk of tuition and reimbursements. But they did not support any time during the work hours. So they said, "As long as you're not working on your homework during work hours, you're fine." The other part was they said, "If you work at lunch on it, that's okay, or lunch break or after work. That's fine, but no work hours," 'cause they were like, "Well, we hired you. We've got a lot of work for you to do."

Other employers offered flexible work times to allow employees to attend classes or sit for exams, with the expectation they complete their work at another time. Several participants described policies that allowed employees paid time during the work week to complete their doctoral work. One participant explained that he was able to negotiate for time to do academic work during the week, in addition to financial support for his degree:

They said, "Hey, look. We're paying for what we want you to complete. It's really important that you complete. So if you need some time during the week" ... I kind of bargained it, too, an eight-hour chunk or something, eight-hour chunk in the week that you could go do homework.

In several instances, organizations provided paid leave for employees to return to school full-time, with the expectation that they return to work at the company upon completion of their degree.

Here's a program to apply to where we'll send you to any college you want to get your PhD and pay you a stipend while you're there and then you have to come back and work x number of years. There were tons of programs specifically designed to enable people to get their PhD. The way [Organization] tries to do it

is you work for [Organization]. Then after a couple years, they'd want you to go back and get your advanced degree but you wouldn't technically quit because they'd be the one funding it.

Participants also mentioned similar programs, including a year-long sabbatical program in which employees are given a paid year off to use as they would like, which some individuals used to complete doctoral degree coursework. This time to complete work can have major implications for prospective returners' ability to complete a doctorate. Flexible hours or time during the week to work may allow employees to pursue courses that are only offered during the day or simply make the academic workload easier to balance with their other responsibilities. Extended paid time away from work likely incentivizes and enables individuals to complete any required coursework much more quickly than they might otherwise be able to do part-time.

Credential-Based Compensation. Participants discussed compensation models and if and how they were tied to degree attainment as another factor that might affect employees' decisions to pursue a doctorate. Companies seemed to vary widely on this issue. Josh described his experience working at a large research-oriented organization, and explained that they had a very clearly-defined policy for setting pay rates based on experience and education.

When I came on, they're like, a couple years ago, they're like, "You have 15 plus years experience and a PhD, so that put you in the list of candidates." So [Company] had like an equation for everything ... it's like, "Oh, these people are in that category and you would be considered in ... we put you in the 50th percentile here, or we'll ..." they have it all kind of laid out.

Such a policy provides clarity for workers and Josh described this policy as an attraction, contrasting it to his past employer. He explained that at his previous organization, there was little financial incentive to pursue a PhD, saying "if you had your PhD, it might go towards a paper or two [in terms of compensation equivalents]. It was kinda, to me almost disrespectful, the fact that they thought a PhD could be equivalent to like a paper or two."

Hiring Practices. Finally, several participants described how a company's hiring practices had implications for the extent to which current employees received company support to pursue a PhD. At one organization in particular, several participants described that, while PhDs were highly valued at the organization, they were typically hired right after completing their education, with little to no industry experience. As one employee explained:

In general, [Organization] hires people ... they kind of expect you to have the advanced degree and so there's not a lot of push for them to pay for people to get advanced degrees because they assume most people already have them which can be problematic for the people who don't have the advanced degrees.

Another employee similarly described the organization as wanting "their people to come educated already. They're pushing for that educational aspect to already have occurred." While employees felt the organization also valued employees with extensive industry experience, it was rare for more seasoned veterans of the industry to have their PhD already, or be supported by the

company should they hope to pursue one. None of the participants with familiarity of that organization were aware of any employees who had pursued a PhD while working at that organization, aside from an intern or two finishing up their degree during their internship program.

Informal Employer Practices and Attitudes

Beyond the formal policies related to doctoral education, participants also cited a number of informal practices or widespread attitudes within their organizations that similarly have potential implications for employees' access to and interest in doctoral study in engineering. These included a lack of clarity around company policies, inconsistencies in which employees had access to various forms of employer support for their degrees, and widely held beliefs within those organizations, often negative, about the value of a PhD, both generally and in relation to organization needs.

Clarity and Consistency of Policies. Though many organizations did have particular policies related to supporting employees' pursuit of advanced study, our participants explained that companies varied widely in the extent to which those policies were understood by and available to all employees. In some instances, participants, who had been at their organizations for years, were not aware of some of their organizations' policies, or if they existed. For example, Jonah, who had earned a Master's degree supported by his organization, was uncertain about the compensation policies for earning a doctoral degree. Several other participants contrasted how different employers communicated about their education benefits. Julian spoke of his time at one employer that he explained was "very intentional about publicly pushing and making sure everyone knew their opportunities for getting advanced degrees. [Organization...] also had a policy for wanting to develop its employees and maintain them for a long time." Josh, who had spent time at three major companies explained that one organization employed a "person who would tell you about the programs, what we will pay for, what we didn't, who you could talk to, if you were gonna talk, you did talk to HR about something, they were that person." He explained that, at the other organizations he had worked with had no such resource.

The individuals interviewed also described inconsistencies in who some educational support resources were made available to. For example, company support for an employee's PhD often varied by manager. Arlene explained this inconsistency at her own organization: "What happens is it's spotty. A lot has to do with who you're particularly working for, your particular manager, and whether or not they value the PhD or not." She explained this supervisor support was likely the biggest factor determining if an employee of her organization was able to pursue a doctorate. Participants also described support varying by division based on the perceived relevance of a PhD for the work of that division. Several other individuals interviewed described companies making choices to provide financial support for a doctorate to those working in particular positions or enrolled in a particular program within the organization. Garret explained that the educational resources made available to employees were at times status-dependent:

So I mean there's all kinds of interesting ways to spin things. It's depending on who you are. There's benefits too. Like they might send you away. I think our chief scientist, he went to like a satellite program where he went over to a different state and finished his degree. I believe he still had his own salary the whole time. So it depends on who you are and what program it is and what do they want you ... How bad they want you. And if you're on the golden pass, you know?

He felt it was this way at several organizations that he worked for and felt that some of these benefits were “legit” and “some of them aren’t.”

Company Beliefs about Needs, Training. The support of individuals’ pursuit of doctoral study reflected company or division-level beliefs about the needs of the organization and the extent to which a PhD can help provide employees with the necessary skills and knowledge. One individual explained that, given the type of work at his organization, and the company’s relationship with customers in academia, a PhD was generally perceived as more valuable than it was at his other engineering-related employers:

They try to sell all their products to academic institutions. That's a place where they experience a lot of success in how they grow their customer base. Because they're so tightly involved in academia, there's this natural, oh, these degrees are good. The nature of the product supports that because it's a software tool. We do a lot of stuff that's very theoretical where people who are book smart are useful because the reality is, in the software world, you can get away with that more than if you're building hardware.

Julian similarly described the organization-specific ideas about the usefulness of doctorate training. He suggested that most engineering firms felt that applied experience was typically more useful, with limited exceptions:

Basically, in engineering when people actually have to get their job done, they really don't care what your degree is because they want somebody who has experience and can get it to work. The difference is if there's really hard theoretical problems where lots of math is involved, then all of a sudden they're like, "Where's the person with the PhD."

Julian had earned a PhD himself and explained that, at his last employer, he made a point of not sharing his credentials with his colleagues. He felt that the degree would be seen as irrelevant at best and, at worst, have negative implications about his work as an engineer. However, he described being more open about his degree in his current company, as he felt the skills associated with his PhD training were more oriented in a research and theory-oriented context. Julian connected employer support of employees returning for PhD to the perceived needs of an organization. Speaking of his former employer, he explained management would likely allow an employee to pursue a PhD “to keep you happy as an employee” but “would not necessarily want to encourage it” because they “don’t do a lot of research” as an organization.

General Beliefs about the Value of a PhD. Even beyond questions of workplace attitudes about the relevance for a PhD given a particular task or organizational focus, multiple participants described perceptions about the value of a PhD in general, held by those in their organizations, that had affected their own and others' decision making about whether to pursue a doctorate in engineering. Garrett described the PhD as a "kiss of death" in the industry he worked in prior, explaining "and that's the reason why I didn't pursue it when I was there." He elaborated, saying:

And in every place I worked, you know, you'll be working and all of a sudden someone comes in the meeting or is introduced as PhD, everybody is thinking this: "Get this guy out of here. We got work to do." And I know that's a bad connotation, but that's absolutely, a hundred percent true.

He contrasted this perspective to that held within his current organization, where he felt the degree was more respected. Though he had considered it for years, it was once he found himself in an environment where a PhD was not frowned upon that he felt it was again an option for him and ultimately did go back to earn his degree. Jonah similarly reported widespread negative perceptions of PhD-holders in his industry. He explained there was a belief that "PhDs produced less" and that "they want to do their own thing, what interests them," rather than what needed to be done. He suggested that this perception was likely to deter individuals at his organization from going back for a doctorate in engineering.

Intersection of Employer and University Policies

Though workplace-level policies and attitudes were the focus of our interviews, participants also named several ways that employer policies and practices intersected with university policies. One participant described a partnership between a local university and his company to jointly offer a (primarily distance learning-based) master's degree in which a cohort of employees at his organization were able to take courses and study together. He struggled to finish the degree after switching employers and feeling isolated from his classmates at his former employer. Though it was a master's program, he suggested that returning doctoral students might benefit from a similar model in which there are company-based cohorts of distance learners:

So from a distance learning program, it was ... I think the support team at GM was much easier to get through classes, and on my own or having student-centered distance learning on their own, it'd be nicer if there was something that was set up for them to help them get through. I've ran across this with many people that have said about the same. They really got stuck when they didn't have help, and the courses they were having trouble in, they had to get help with several other people that were also distance learning.

Another participant described another partnership model, in which his organization helped coordinate and fund enrollment in several PhD programs at local universities.

Several students described conflicts between work schedules and the PhD course times and modalities offered by some universities, particularly at major research institutions. They cited options like evening and weekend courses, or online courses as university offerings that made it more feasible for part-time returning students to complete their doctorate while working. Josh explained:

When you get to the PhD you have labs and everything else, they're harder to find, so if you can find something at night, that's flexible ... I've heard of something people actually doing during the day, but that takes a real understanding from your management because now, you're gonna be out of work during the day. I was working my 10 hour day and then I would go to school. So I might be gone from my house from six in the morning until eight o'clock at night.

For some students, such a schedule would be prohibitive, even if they were able to take evening courses at a local university. Arlene described one returning student at her workplace who decided it was both cheaper and easier to attend a university out of state that offered many online courses, than to either enroll in daytime courses at the local research university or take evening courses at another regional university.

He actually did a spreadsheet calculation of course, and determined that it made sense for him to get his PhD [out of state...] but he looked at the cost for commuting to [Local Research University], local, as well as the cost of commuting to [Out of State University], because this particular PhD program could be done remotely. He needs to fly there a couple of times and it turned out that it was cheaper for him to do this commuting type of relationship and to fly there as opposed to do an evening where you're commuting to [Regional University] or ... Unfortunately we don't have a lot of folks that are going say to [Local Research University] because it's not conducive to folks that are working. We have a few, but again there are special arrangements and there is more of a burden on the organization for them.

While some returning students are able to take advantage of programs that allow them to work on their PhD full-time before returning to their organization, for students working while pursuing their degree part-time, university course offerings and schedules can be a critical factor. Many engineering PhD programs have an expectation of full-time enrollment, which is often in conflict with the policies of employers or the goals of those returning students who want to maintain their employment while pursuing their degree. Some returners may ultimately decide that, for them, pursuing a PhD means leaving their organization, or even changing fields altogether.

V. Discussion

Findings from this preliminary study contribute to our understanding of the workplace context, including the policies and cultural beliefs about the value of a PhD, that may inform returners' (or potential returners) decisions about pursuing a PhD. Though this study does not specifically focus on if and how these pre-PhD contextual factors shape decision making, it complements our

team's earlier work that drew on Expectancy Value Theory [4], [6], [7] to explore the elements that inform an individual's decision making, including the costs and values returners associate with earning a PhD, as well as their expectations about their likelihood of succeeding. EVT suggests that the costs, values, and expectancy of success an individual associates with a particular choice are informed by a number of factors, including their past experiences and the societal and cultural contexts in which they are embedded [15] – [17]. Thus, experiences in the workplace and perceptions of workplace cultural norms may in part contribute to the costs and values potential returners associate with earning their degree, as well as their expectation that they will succeed. So, the extent to which a PhD is respected or stigmatized in a workplace may shape an individual's perceptions of the value of earning the degree. Similarly, workplace policies may compound or reduce the level of different costs an individual associates with earning a PhD. Policies like financial assistance, time off, or flexible hours may help reduce an employee's experiences of the financial or work/life balance-related costs they associate with earning a degree while working and ultimately could make pursuing a PhD a more appealing choice. Conversely, when employer and university policies and practices are in conflict with one another, as would be the case when most local universities only offer courses during the workday and the employer does not provide flexible time for course taking during this time, employees may either be less inclined to pursue a PhD or, decide the costs of doing both are too high, and choose to leave the company to pursue full-time study.

The typical trajectory for returning students – whether they work or attend school full-time, or the timing of the degrees they pursue – is not fully known, though our team's non-generalizable survey of returning students suggest these trajectories vary. However, we do know a majority of engineering PhD recipients ultimately work in non-academic positions [18]. While some employers, like one organization described in interviews with participants in the present study, may choose to hire newly-minted PhD recipients with little work experience, there may be a benefit for some organizations to promote the development of current employees interested in such an opportunity. Engineers who return to school to earn their PhDs after substantial work experience are already familiar with the work and culture of the organization and have had an opportunity to develop the professional skills necessary to succeed in such a role. They likely do not require the same training as new hires, even if switching roles.

Supporting employees' pursuit of engineering PhDs may not always be in an organization's best interests. However, we suggest that employers carefully consider and specify, as many have, the range of skills it would be most beneficial for employees in different roles within the organization to possess and the types of training and experience that would facilitate the development of those skills. Then, they may want to consider how they might effectively support employees in getting access to these types of training. In addition to making the resources available, it is equally important that organizations clearly communicate with employees about any educational programs and policies, as our findings suggested this was not always done consistently within organizations. In some cases, organizations may find that supporting experienced employees interested in pursuing a PhD to be beneficial not only in helping the employee achieve his or her goals and be happy working for the organization, but for the organization as well. These suggestions are aligned with the recommendations found in a report

sponsored by the Council of Graduate Schools and Educational Testing Service emphasizing the growing need for employees with graduate training in industry and calling for employers to closely consider how to best address employment and training needs. The report includes specific recommendations for employers to better support graduate study, including establishing endowed chairs for graduate students which include covering tuition and fees and an internship opportunity, offering employer-matched education savings accounts for employees, providing tuition reimbursement, and creating industry-sponsored fellowship programs [23]. However, we would not expect all, or in some cases any, models of supporting employees' doctorate work, to meet the needs of all engineering organizations.

Within engineering, there are often calls to support additional pathways through graduate education. Recruiting and supporting returning students may be a pathway that some universities want to explore further. Our findings suggest that many employers are willing to offer some financial support, but often anticipate employees will continue working full-time, or only take a limited number of years away from the organization to complete their doctorate degree. Changes to doctoral curricula should be context dependent, thus we are not proposing specific changes in any university's engineering doctorate curriculum, but rather hope our initial findings may provide some useful information to more informed administrators and faculty making these decisions. Our findings suggest that working returning students might be drawn to programs that accommodate their work demands. Possible ways to attract these students might include offering evening courses, condensed courses that could be completed in a several-week vacation period, or different forms of online courses. In addition to flexible and online courses, Gardner and Gopaul suggested that ensuring online access to other vital resources, like library materials, financial aid and graduate services, were key for supporting part-time doctoral students. They also suggested extended evening and weekend hours for on-campus services like writing, counseling, and childcare centers could better meet the needs of doctoral students working full time [24]. There may also be opportunities for university-employer partnership programs or ways to help returning students select research topics that compliment both scholarly and company interests. Of course, such policies would warrant a great deal of consideration; this paper only intends to spark that conversation.

Limitations and Directions for Future Research

As exploratory research, this study is limited in scope and application. The participants interviewed reflect a sample of convenience and their descriptions of their workplace experiences and policies are not generalizable to engineering employers as a whole, nor are they intended to be. Rather, we hope our initial findings provide information that can inform future work.

While several of the participants had worked for different companies and lived in different regions, at the time of the interview, they were all working at companies based in the same geographic region, which has a distinct industrial history. Thus, while the workplaces described in this study differed in terms of size and engineering field and were both government and private organizations, some attitudes and policies may reflect regional trends. In this instance, we

also risk overlooking policies and beliefs more common in other regions or engineering industries. Additionally, participants may not have been fully aware of all policies and beliefs, particularly for those working for large multinational organizations. Finally, while we ultimately hope to understand how workplace policies may influence returners' decision making, exploring any such causal relationships is outside the scope of this study. Findings from this study should be interpreted as an initial exploration of some of the policies and beliefs that might pertain to individuals interested in pursuing a doctorate.

Our preliminary findings suggest several directions for future research. Given this study's limited size and geographic scope, a larger study, capturing greater company diversity, would be an important next step for understanding the full range of employer policies, practices, and attitudes that might have implications for returners' decisions to return. Additionally, while our interviews included several examples of how employer-level factors related to (prospective) returners' decision making, and we explore the potential theoretical implications of these factors, we cannot make any definitive causal claims about how individuals actually account for employer-level factors in deciding whether or not to pursue a PhD. Finally, while our team's work suggests that returners' experience may be an asset to their research work (Forthcoming) and that returners may be particularly well-situated to apply their academic research to address real-world needs [3], more research is needed about skills that returners who pursue careers in government or industry bring to that work.

VI. Conclusion

This study provided a preliminary understanding into the various formal and informal engineering employer policies and attitudes that might be relevant for employees wishing to return to school to pursue a doctorate. These prospective returning students represent an often-overlooked pathway through engineering doctoral training that may be worth more fully supporting, as returners bring a unique set of experiences to both their PhD and post-PhD work. Interviews with experienced employees at a number of local companies provided insight into the types of policies (or lack thereof) that might provide support to or incentivize employees interested in pursuing a doctorate, which include financial support, flexible time or time off for course taking, and credential-based compensation policies. In addition to these, we learned of a number of informal practices and policies that have potential implications for returners, including inconsistent information about and access to some education benefits and deeply held cultural beliefs within some organizations about the negative connotations of a doctorate degree in engineering. Participants also described how university policies, such as partnership degree programs or inconvenient course times and modalities might compliment or conflict with employer policies and further shape an employee's decision to earn a PhD. These findings offer some initial insight into the employer-level factors that could inform returners' thinking that returners, employers, and universities may want to consider in future decision making.

References

- [1] Baker, S., Tancred, P., & Whitesides, S. (2002). Gender and Graduate School: Engineering Students Confront Life after the B. Eng. *Journal of Engineering Education*, 91(1), 41–47. <http://doi.org/10.1002/j.2168-9830.2002.tb00671.x>
- [2] National Science Board. (2012). *Science and Engineering Indicators 2012*. Arlington VA: National Science Foundation
- [3] Peters, D. L., & Daly, S. R. (2012). Why do professionals return to school for graduate degrees? American Society of Engineering Education Annual Conference & Exposition, San Antonio, TX. <https://peer.asee.org/22234>
- [4] Peters, D. L., & Daly, S. R. (2013). Returning to graduate school: Expectations of success, values of the degree, and managing the costs. *Journal of Engineering Education*, 102(2), 244–268. <http://doi.org/10.1002/jee.20012>
- [5] Strutz, M. L., Cawthorne Jr., J. E., Ferguson, D. M., Carnes, M. T., & Ohland, M. W. (2011). Returning students in engineering education: Making a case for “experience capital.” Presented at the American Society of Engineering Education Annual Conference & Exposition, Vancouver, BC. <https://peer.asee.org/18735>
- [6] Mosyjowski, E.A., Daly, S.R., & Peters D.L. (2017). Challenges and Benefits of Applied Experience as an Engineering Returner in a PhD Program. American Society of Engineering Education Annual Conference & Exposition, 2017. Columbus, OH.
- [7] Mosyjowski, E. A., Daly, S. R., Peters, D. L., Skerlos, S. J., & Baker, A. B. (2017). Engineering PhD Returners and Direct-Pathway Students: Comparing Expectancy, Value, and Cost. *Journal of Engineering Education*, 106(4), 639-676
- [8] National Science Foundation, National Center for Science and Engineering Statistics (2014). *Doctorate Recipients from U.S. Universities: 2014*. Arlington, VA. Retrieved from <https://www.nsf.gov/statistics/2016/nsf16300/digest/nsf16300.pdf>
- [9] Hofinger, R. J., & Feldmann, L. J. (2001). The role of the adult student in the classroom. Paper presented at American Society for Engineering Education Annual Conference and Exposition, Albuquerque, NM.
- [10] MacFadgen, S. L. (2007). Mature students in the persistence puzzle: An exploration of the factors that contribute to adult learners’ quality of life and retention in post-secondary education (Thesis). Faculty of Education–Simon Fraser University. Retrieved from <http://summit.sfu.ca.proxy.lib.umich.edu/item/8453>
- [11] Prusak, Z. (1999). Learning environment in engineering technology with a high percentage of non-traditional students. Presented at the American Society of Engineering Education Annual Conference & Exposition, Charlotte, NC.
- [12] Schilling, W. (2008). Issues affecting doctoral students returning to engineering education following extensive industrial experience. Presented at the American Society for Engineering Education Annual Conference & Exposition, Pittsburgh, PA. Retrieved from <https://peer-asee-org.proxy.lib.umich.edu/3847>

- [13] Gardner, S. K. (2008). Fitting the Mold of Graduate School: A Qualitative Study of Socialization in Doctoral Education. *Innovative Higher Education*, 33(2), 125–138. <http://doi.org.proxy.lib.umich.edu/10.1007/s10755-008-9068-x>
- [14] Nettles, M., & Millet, C. (2006). *Three magic letters: Getting to Ph.D.* Baltimore, MD: Johns Hopkins University Press.
- [15] Eccles, J. S. (2005). Subjective task value and the Eccles et al. model of achievement-related choices. In A. J. Elliot & C. S. Dweck (Eds.), *Handbook of Competence and Motivation*. New York, NY: Guilford Press.
- [16] Eccles, J. S. (2009). Who Am I and What Am I Going to Do With My Life? Personal and Collective Identities as Motivators of Action. *Educational Psychologist*, 44(2), 78–89. <http://doi.org/10.1080/00461520902832368>
- [17] Wigfield, A., & Eccles, J. S. (2000). Expectancy-Value Theory of Achievement Motivation. *Contemporary Educational Psychology*. <http://doi.org/10.1006/ceps.1999.1015>
- [18] National Science Foundation, National Center for Science and Engineering Statistics. (2015). *Doctorate Recipients from U.S. Universities: 2015*. Arlington, VA. Retrieved from <http://www.nsf.gov/statistics/sed/2015/>
- [19] Malfroy, J., & Yates, L. (2003). Knowledge in action: Doctoral programmes forging new identities. *Journal of Higher Education Policy and Management*, 25(2), 119-129.
- [20] Martinsuo, M. (2007, August). Part time doctoral studies—opportunity or myth? Resources and study progress of part-time doctoral students. In 19th Nordic Academy of Management Conference (NFF) (pp. 9-11).
- [21] Martinsuo, M., & Turkulainen, V. (2011). Personal commitment, support and progress in doctoral studies. *Studies in Higher Education*, 36(1), 103–120. <http://doi.org/10.1080/03075070903469598>
- [22] International Foundation of Employee Benefit Plans. (2015). *Education assistance benefits: 2015 Survey results*. Brookfield, WI.
- [23] Wendler, C., Bridgeman, B., Cline, F., Millett, C., Rock, J., Bell, N., & McAllister, P. (2010). *The Path Forward: The Future of Graduate Education in the United States*. Educational Testing Service.
- [24] Gardner, S. K., & Gopaul, B. (2012). The part-time doctoral student experience. *International Journal of Doctoral Studies*, 7, 63–78.

Appendix A: Interview Protocol

Thank you for taking the time to talk to me. I'm going to give you some background on how this will work. Our conversation will be recorded and later transcribed. Everything you tell me will be confidential. And identifying information will be removed on the transcript and the audio will be kept in a secured location.

The purpose of the interview is for me to learn about the attitudes, norms, and policies within your organization that might influence employee's decision-making about whether or not to pursue a PhD. There are no right or wrong answers to any of the questions I ask you.

I'll ask follow-up questions so that we can arrive at a deeper understanding of your experiences or perceptions. I'm going to leave some open time after I ask a question. I won't just jump in to clarify a question if there is a pause. I want to give you time to think. If you need clarification of a question, please ask me. Do you have any questions for me before we get started?

1) First, could you provide me with a brief overview of the nature of your position within your organization?

Could you broadly describe its size and organization?

Do you personally have any supervisory responsibilities?

2) Generally speaking, how would you characterize your workplace culture and climate?

3) Do you know of anyone, either yourself or a colleague, who has returned to school to pursue a PhD or other advanced study after starting work for your organization? What were their experiences? Do you think the organization was supportive?

Do you know of anyone who expressed interest in returning but ultimately decided not to pursue a PhD? What do you think influenced their decision?

What opinions or perceptions do you think your coworkers have about getting a PhD?

4) Generally speaking, do you think your organization is supportive of employees who wish to return for a PhD?

Do you think having a PhD would be seen as a benefit to the organization? If so, what would that benefit be?

What advice do you think managers would give to an employee considering returning?

IF THEY ARE A MANAGER: What type of conversation would you have with one of the employees they supervise if they were considering returning?

Do you think all employees would be equally encouraged to pursue a PhD? Why or why not?

5) Are you aware of particular policies or practices at your organization that may affect employees who are interested in pursuing a PhD? (Either positively or negatively?)

6) Is there anything else you would like to share about your organization your perceptions of attitudes and policies that might shape employee's decisions to return for a PhD?