

How ‘Returner’ and ‘Direct-Pathway’ Graduate Students’ Experiences May Lead to Attrition from Doctoral Programs

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Abstract—This research full paper addresses how different pathways into graduate school may correspond with students’ attributions of the factors that impact their attrition decisions. Studying attrition in graduate engineering programs is important to understand and benefit graduate engineering students in their programs. Pathway into to graduate study and its effect on themes in questioning departure from programs has not been widely studied. Returners, defined as students who had a gap of at least 6 months between undergraduate degree completion and graduate program entry, are often an understudied group in graduate engineering attrition. In this study, narrative analysis methods were employed to investigate potential differences between returners and direct-pathway students experiences as they questioned departure from their graduate engineering programs. In this work, we found that returners commonly face challenges in finding a support network and direct-pathway students commonly struggle with unclear goals in their studies. Providing returners with better support and helping direct-pathway students understand their goals can help students persist in their graduate engineering program.

Keywords—Narrative Analysis, Non-Traditional Graduate Student, Attrition, Graduate Education

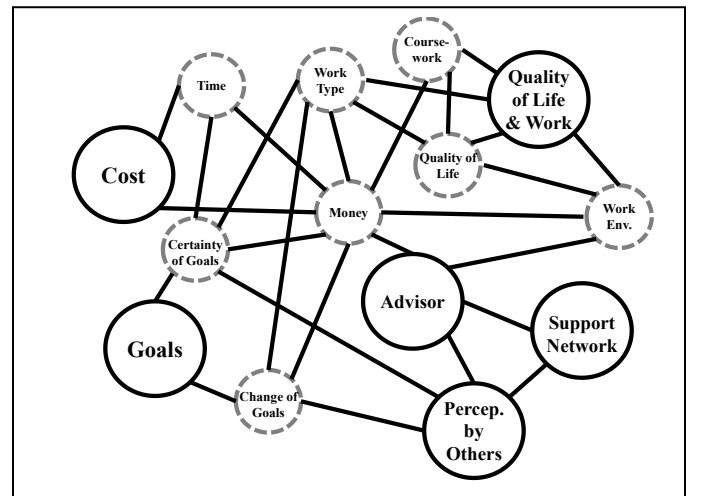
I. INTRODUCTION, REVIEW OF RELEVANT LITERATURE, AND THEORY

Attrition, specifically in doctoral engineering programs, is an understudied field. This research can be used to understand the experiences of students and improve these programs. The Council of Graduate Schools’ most recent reports identify that attrition for doctoral engineering programs is around 34% for men, 44% for women, and even higher for minoritized groups [1]. Reasons why students consider departure from their program are often interconnected and include difficulty achieving work-life balance, problems with socialization, roles of their advisor, student perception of cost, support network, goals, perceptions of others, and quality of life and work [2]–[5]. Further, students who are not provided with adequate support may question departure from their doctoral programs [3] compounding the effects of false expectations going into graduate school [4].

Berdanier et al. [3] identify common themes in how students question departure from their graduate programs, depicting how

these themes are interconnected in their GrAD model, as shown in Figure 1. The themes of cost, quality of life and work, advisor, support network, perception by others and goals and various subthemes are all interconnected [3]. The use of an interconnected model is beneficial here as a conceptual framework for this study, as reasons for questioning departure from a graduate engineering program are often complex and include more than one consideration [3]. Engineering graduate students who are questioning departure often have many reasons for questioning and the GrAD model brings clarity to how these reasons are connected. In Fig. 1, dominant facets of attrition are in the circles with solid lines, and the sub-facets are in the dashed circles. It is evident that the subthemes from one theme are often linked with other themes and sub-themes, showing how interconnected these decisions are. This model for attrition decisions has not to date been investigated from the point of view of how the students came to be in graduate school, and whether they were direct-pathway students enrolling in their graduate degrees immediately after undergraduate, or whether they had returned to graduate school after some time in industry.

FIG. 1: GRADUATE ATTRITION DECISIONS (GRAD) MODEL, ADAPTED FROM [3]



Most literature that investigates graduate engineering students focuses on direct-pathway students, while it is

documented that returners, or those who have spent at least six months in the workforce, face unique challenges. Peters [6] studied the types of “costs” that returners experience, classifying them into the categories intellectual, balance, cultural and environmental, and financial. Changes to financial security, decreased personal time, difficulty connecting with peers, challenges during group projects, and struggles to adapt to the university environment are all challenges that returners experience [7]–[9] differently than direct-pathway counterparts. Not only are the types of costs that returners perceive different, but returners perceive higher costs than direct-pathway students and may be less confident in returning to graduate school and [7], [10]. Conversely, returning students bring with them several important attributes: Work experience provides returners with maturity and specialized technical skill sets [7], which allow them to approach problems differently. These unique skills can positively influence their research abilities [11] and can be a significant source of confidence [12]. Literature has also documented that students with military backgrounds who return to engineering graduate school have strengths in teamwork, leadership, and their ability to rely upon others [13]. Peters and Daly [8] have noted that these attributes often cause returners to be more selective in advisor matching and see graduate school as a professional goal, which are typical traits of returners.

The identities that graduate engineering students hold also affect experiences in graduate school. For example, it is documented that the “chilly climate” of engineering can discourage female engineering students from continuing with their studies [14], and younger female students are more likely to leave their doctoral program [2]. Interestingly, literature has shown that holding a science-related job for a year or more prior to entering their program makes women over five times less likely to graduate from a doctoral program [15], which may indicate that this group of students are not as well-supported. Women of color are particularly underrepresented in graduate engineering programs, despite efforts to reduce barriers to entry into academic research [16]. These trends indicate that continued attention to the support of graduate engineering students from non-normative groups is important in facilitating success for in graduate programs.

As a complement to the GrAD model [3] as a conceptual framework, this research also relies on socialization theory as a lens. Socialization, or the implicit processes by which students come to learn the expectations and norms of their academic discipline and support networks are important facets of the graduate engineering experience, and in engineering are often facilitated through the advisor. The positive effects of healthy advisor support have been studied at length and are shown to have significant influence on persistence in graduate engineering education [17]–[21]. However, women, students of color, people with families, and older students all experience challenges with socialization in their graduate program [22], but not all graduate programs or research advisors may be prepared to mentor students from different backgrounds. It is essential to build support structures for graduate students, especially for women [23], students of color [22], and nontraditional students

[24]. Providing non-traditional students with the support they need can make them less likely to leave their doctoral programs.

In contributing to the effort to understand attrition and persistence of engineering students, it is essential to understand how the pathways of attrition differ between returner graduate students and direct-pathway graduate students, a comparison that has not been investigated in literature to date. Without fully understanding the mechanisms of attrition, engineering doctoral programs will struggle to provide students with the support they need to succeed. In an effort to continue to diversify the graduate engineering student population, the purpose of this research is to investigate the experiences of graduate students in relation to their pathway to graduate study. This paper seeks to answer the following overarching question: **How do pathways into graduate study correspond with the experiences and considerations of departure?**

II. METHODS

A. Data Collection

Graduate coordinator and department heads were contacted at the top fifty U.S. engineering Ph.D. awarding universities in the American Society of Engineering Education’s 2018 annual report [25] asking them to distribute a recruitment survey to their graduate engineering students. In the fall semester of 2019, a Qualtrics survey was created with the intent to understand wellbeing, attrition, and persistence of graduate engineering students as funded through the NSF CAREER Grant. Students were selected to participate in the study based upon how often they thought about leaving and their willingness to participate in a follow-up interview. Of the 620 students who completed the survey, 38 of these students were selected to participate in interviews through maximum variation sampling [26]. In this sampling, we selected participants from racially diverse backgrounds and genders and who had spent differing amounts of time in graduate school. We also purposefully excluded international students because they are known to have unique and differing experiences compared to domestic students [27], [28]. Because this was part of a larger study trying to capture the experiences of students who had departed from their PhD programs, participants were asked whether they knew people who fit this criteria and were willing to share their experiences. Four more participants were obtained through this snowball sampling, bringing the total number of participants to 42. Using maximum variation sampling created a participant pool that was not representative of the engineering community itself, but allowed for a more diverse narrative of experiences. There were a larger percentage of female participants, 57%, than the percentage of female engineering doctorate recipients in the U.S., 23.6% in 2018 [25].

Semi-structured interviews were conducted by two researchers via Zoom. Participants were asked to describe their experiences into engineering and graduate school, their advisor relationship, and their thoughts on leaving their program among other things. The semi-structured nature of the interview protocol allowed for researchers to ask follow-up questions, and for participants to reveal as much information as comfortable. As a

part of the interview protocol, participants were asked if there were any additional questions that should be added to the interview. This allowed for the interviews to reflect issues on students' minds. Participants were compensated with a \$10 Amazon gift card and audio recordings of the interviews were professionally transcribed by a secure transcription service. The participants were assigned pseudonyms and any identifying information was removed during the cleaning process.

B. Data Analysis

Narrative analysis [29] was used to understand themes of attrition for graduate engineering students. Labov and Waletzky's structural model of narrative form was followed which can be useful in analyzing a set of narratives to find common themes amongst them [30]. Narratives were created for each participant, focusing on their pathway to graduate school and reasons that they considered departure. The narratives created are made up of direct quotes from the participants and some clarifying language. Some instances of expletive language do exist within the narratives. The thematic analysis of factors related to attrition was conducted using a framework for graduate engineering attrition proposed by Berdanier et. al. [3].

To capture patterns in the data, these narratives were separated into two initial groups: returners and direct-pathway students. Peters et. al. [6], [8], [12], [13] define returners as students who had a gap of at least 5 years between completion of their undergraduate program and entry into a graduate program. For the purposes of this study, however, we define returners as those who had a gap of at least six months in between undergraduate degree completion and entry into a graduate program. This choice is justified to capture the influence of the decision to return to graduate school on the ways in which participants' experiences led them to consider attrition.

Through analysis and narrative configuration, it was noted that some participants had a deliberate and defined desire to continue into graduate studies from early on in their undergraduate career or earlier. We classified these participants as "Planned" pathways. Conversely, other participants seemed to pursue graduate school in less planned ways, whose pathways we characterized as "Serendipitous." Most of the participants whose pathways were characterized as serendipitous had some outside influence in their decision to attend graduate school or made the decision at the last moment. These serendipitous students either received guidance from a mentor, were not yet ready or did not have a job offer to enter engineering industry, or saw graduate school as their best option. The term "serendipitous" is being used loosely here and is not intended to imply that these students did not want to attend graduate school. Grouping the participants into direct-pathway and returners, and further into planned and serendipitous, allowed for common themes to be found between these groups.

C. Limitations

As with any study, there are limitations of the research. Qualitative data is not intended to be generalizable, and although our participants represent a diverse pool of engineering graduate students with a relatively large sample size for qualitative work, there may be additional narratives and themes that were not captured for participants from other marginalized or intersecting identities. Further, the interview participant selection strategy focused on diversity in race, gender identity, and years in graduate school but did not necessarily focus on diversity in age or experience. As such, returners were not a targeted sample, though they did represent about a quarter of our participants such that the experiences of returners can still be investigated. The semi-structured nature of the interviews asked all participants the same core questions but allowed participants to expand in areas that they felt were important or held memorable challenges, it also meant that all participants had a slightly different interview. In a future study, focusing on diversity within recruitment based upon age and experience would allow for more returners to be evaluated.

III. RESULTS

Interviews with all 42 participants were analyzed to determine common themes in their questioning whether to remain in their graduate program based on their pathway to engineering graduate school. Narratives were created from each interview and were separated into two groups: returners and direct-pathway students. Within these groups, participants were further divided into students who had a planned entry into their program and students who had more of a serendipitous path. Table 1 shows the number of planned and serendipitous students within the categories of returner and direct-pathway.

TABLE I. NUMBER OF PARTICIPANTS BY PATHWAY TO DOCTORAL PROGRAM

	<i>Planned Decision to go to Graduate School</i>	<i>Serendipitous Decision to go to Graduate School</i>
Number of Returners	5	6
Number of Direct-Pathway	14	17

From Table 1, we see that there are more direct-pathway participants compared to returning participants, which corresponds to the fact that there are less returners within graduate engineering programs. The number of students who had a planned entry is about equal to the number of students who had a serendipitous entry to their doctoral program for both returners and direct-pathway students, which is interesting considering that neither of these aspects were related to our sampling criteria.

The common themes are defined as follows for consistency when analyzing the narratives. A "Lack of Support Network" refers to students not feeling well supported in their program by their department, their advisor, or their peers. Issues involving work-life balance and overall well-being are represented by "Quality of Life". "Cost" implies both financial and opportunity

costs that can occur throughout a program. Having poor communication with, disagreements, and any similar negative interactions with their advisor is captured by “Advisor Relationship”. “Unclear Goals” indicates that students might be questioning if being in a PhD program is the right decision for them at this point in time. Table 2 identifies these common themes in questioning for each grouping.

TABLE II. COMMON THEMES IN QUESTIONING BASED UPON PATHWAY TO DOCTORAL PROGRAM

	<i>Planned Decision</i>	<i>Serendipitous Decision</i>
Returners	<ul style="list-style-type: none"> • Lack of Support Network • Quality of Life • Cost 	<ul style="list-style-type: none"> • Lack of Support Network • Advisor Relationship • Unclear Goals
Direct-Pathway	<ul style="list-style-type: none"> • Unclear Goals • Advisor Relationship • Lack of Support Network 	<ul style="list-style-type: none"> • Unclear Goals • Quality of Life

Table 2 shows that returners most commonly discussed concerns related to support networks and direct-pathway participants are most commonly concerned with unclear goals. For planned pathway participants, lack of support network was a common theme and for serendipitous pathway participants, unclear goals was a common theme. Themes within each grouping and example narratives that demonstrate how these themes interact within participants’ attrition decisions are discussed in the sections below. For each category—returners and direct-pathway student—first, one demonstrative narrative is presented, as an exemplar and introducing what themes were in common and how they interacted. Then, a specific narrative depicting a planned and a serendipitous path are presented.

A. Returners

Returners unique experiences within their programs cause them to have different reasons for questioning than direct-pathway students. Most returners, regardless of whether they had a planned or serendipitous path to graduate study, mentioned difficulty in developing a support network within their program. This is not surprising as returners tend to be older students and may have issues in connecting with their younger peers. One of the returners who had mentioned a lack of social support was Daisy, who always wanted to be a professor but spent some time working in industry between her undergraduate and graduate study.

I really liked teaching in high school, and in college I did some tutoring. So, I think I started to think about grad school as a path probably back in high school, but I think I started more seriously considering it in college. And then, I spent some time working for a couple of years before coming back to school. I knew that I wanted a PhD just as like a job prerequisite to become a professor, more than actually wanting the degree or wanting to do the research process. Coming back to classes was hard, because I had done an online master’s program while I was working, which was less rigorous, definitely. I think it’s probably the

first time that I felt like I might fail a class or might not be like good enough. So, I think I’m glad that I did the master’s, but it definitely felt like I was behind when I got here. It’s pretty tough socially too, ‘cause I’d kind of gotten used to being a working person. And then I kind of uproot my life so now I’m hanging out with all these people who just graduated college and are in totally different places in their lives than I was at the time. It was pretty tough. I just remember that it’s my path and it doesn’t have to look like other people’s.

-Daisy

Daisy mentioned how she had issues socializing because the other students were in different stages of their lives. Additionally, Daisy mentioned how diving back into classes was a challenge for her. Returners are more likely to struggle with their coursework as they have been away from regular studying for a while. Many other returners also shared these same feelings related to support in their interviews. All but one returner mentioned having issues building a support network. This highlights how important it is to provide resources for support for returning students to help them feel welcomed and included.

1) Returners—Planned

Quality of life and costs associated with obtaining a degree were common themes that increased questioning among returners who had a planned entry to graduate school. Since returners have already had a job away from their studies, they have a better idea of what options they have outside of graduate study. This gives returners something to compare their program to and, in some cases, makes it challenging for them to motivate their persistence. Cailin went back to school after the recession to become a nurse, then worked as a nurse for a number of years before returning to graduate school for engineering.

I had majored in Math and Russian in undergrad and I graduated in 2008 and it was the start of the recession so there were not a lot of jobs involving math and Russian and so I went back to school. I went to nursing school and then I actually worked as a nurse for several years, before going to grad school for engineering. I was missing the math and missing the computational stuff that I had done previously so I decided to study biomedical engineering. Coming from a nursing background, I feel isolated in the program, both socially and then also just research-wise. It was me starting from nothing and I think that’s really frustrating and then there is also financial concerns. I feel like I can’t save anything and recognizing that it’s temporary but I can’t save anything and it affects where I live and what I can do and if I can travel and stuff like that. Learning how to communicate in a male dominated field is challenging. I think if my co-workers were more aware of how the gender dynamics play a role in our communication, that would help a lot. If I stay and I’m successful, I’ll have a PhD, which will make it easier for me to get jobs. Also, the skills that I’m developing right now, I think, is very valuable in terms of what I’ll get in a career later. But I also wanna be

closer to my friends from undergrad and I miss the mountains, things like that, silly little things. Personally, it's not where I wanna be, geographically.

-Cailin

Cailin mentions how she wishes she could travel whenever she'd like and how she feels as though she is not able to save any money. She also mentions how she felt isolated and had trouble communicating with her peers, especially coming from a field outside of engineering. This isolation and communication challenge may be further exacerbated because Cailin is a woman in engineering and therefore, a minority. Even something as minor as not enjoying where she is geographically located caused Cailin to struggle with quality of life. Issues involving quality of life and costs were common amongst planned returners, likely because returners have had different life experiences than direct-pathway students.

2) Returners—Serendipitous

Returners who had more of a serendipitous path to graduate study decided to pursue graduate study for many reasons, including being unsatisfied in their industry job, wanting to regain skills after being outside of the workforce for a while, or following their dreams of teaching. These returners are serendipitous in that they had not necessarily planned on pursuing graduate study but decided upon it in some other unplanned way. Support network is the most common theme for these returners, but they also mention issues with their advisor relationship and with goals. Jonathan was a returner who mentioned negative interactions with his advisor. He got his Master's degree directly after his undergraduate degree, then decided to work in industry for a few years, and then went into a PhD program after he decided that a career in industry was not for him.

So after undergrad, I immediately went to get my Master's degree. Well, it was supposed to be a doctorate. And then I decided that wasn't the place for me, and I got my Master's degree. So, I decided that I was gonna work a couple of years. If I wanted to go back to a graduate degree, I could. And I worked for three years, decided that wasn't for me, so then I went back for a PhD. My advisor has a very passionate personality in a different facet of science and I think at that point, we do clash a lot. I know one meeting we had, we just probably argued for three hours over science. I think it's just we don't see eye-to-eye what's important, I think, in research. And I think that has definitely created some rifts in my feelings towards my research productivity and my importance in graduate school. I'm like, "Man, did I really choose the right path and can I ensure that I'm involved in this field at least after my PhD?" And so, it's like, the skills I'm developing now, are they really... Are they so far removed from what I wanna do? And so that's when those thoughts come up, that's when I'm like, shit, am I in the right direction?

-Jonathan

Jonathan mentioned clashing with his advisor which caused concerns when it came to productivity and his importance in his program. He was also uncertain in his goals, questioning if a PhD is the right choice for him after having negative interactions with his advisor. Since serendipitous returners had more of an unplanned entry to their program, this caused several of them to question their goals. These participants were unsure if they should stay in their program, if they should depart with a Master's degree, or if a different program would be better suited for them. Additionally, many of these students had negative experiences with their advisors. This might be because these students had less of a premeditated plan to study and therefore, might not have been as selective in choosing an advisor.

B. Direct-Pathway

A common theme in questioning amongst direct-pathway students was unclear goals. Direct-pathway students' only post-undergraduate experience has been their graduate program, which can make them question whether they chose the correct path. Angie, a direct-pathway participant who mentioned uncertainty in her goals, initially did not want to attend graduate school but decided she should after winning the NSF GRFP grant.

The summer before my senior year, the actual PI of the lab was like, "You should apply for the NSF Graduate Research Fellowship." Then, I was like, "F this. I don't wanna go to grad school. I don't wanna have to reach out to all these advisors. I don't wanna have to pay for every single application." So, I had a job in Chicago all lined up. And then, in April, I found out I had won the NSF, and so I was like, "Oh, shizz." I talked to my PI; I talked to other faculty advisors, and they were essentially like, "You'd be dumb if you turn down the NSF. You're not gonna get this opportunity again; you should go to grad school." The main problem was that I was not excited about the research or the school at all. I knew in my mind the worst-case scenario I'd master out with a free master's and that's not a bad thing, in my mind. The best-case scenario, I get a PhD. One of the main reasons I wanna leave is because I want this work-life balance that I cannot get here. I wanna go to work. I wanna work from 9:00 to 5:00, I'm going to clock out, and I'm not going to think about work for the rest of the day. The problem is that I have a job I've signed for a company that I would start June 1, so I would have to leave my program. And the problem is what if I wanna stay? My mind changes with the weather.

-Angie

While Angie was in her program, she was questioning leaving because she had a poor work-life balance and was wondering if she had chosen the correct path. Her uncertainty drove her to search for jobs and even sign a job offer letter which would require her to leave her program. This uncertainty was common amongst direct-pathway students. Many of these participants wondered if there were better options out there besides graduate school. By not having a gap in between undergraduate and

graduate study, direct-pathway participants can feel uncertain in their goals.

1) Direct-Pathway—Planned

Direct-pathway participants who had a planned entry to graduate school commonly questioned departure due to issues with advisor relationship and support network. Spike had spent his entire academic career at the same university and chose his advisor because he was one of his favorite professors from undergrad, but found that he did not enjoy his advisor's personality once in his program.

I've been at my university for all of my academic career. I ended up working with one professor, basically, from the summer after my freshman year all the way into my first year in grad school. During the first year, I was starting to feel like I've been at my university for too long. I came in as a PhD, but after my first year I realized that I wasn't sure enough of what I wanted to do a PhD in, or who I wanted to work with, the university people I thought I would wanna work with just weren't people I saw myself working with for three, four years, whatever it would be for a PhD. And so, it was around the end of last year that I decided that what would be best for me at this time would be to just get a Master's and see what happens, if maybe a PhD is in my future. I started TAing for my professor from undergrad. I learned a lot being a teacher and teaching students in a class that I had taken myself but the dynamics of the relationship between him and his TAs was something that I really didn't appreciate, I didn't jive with the way he would always show up to meetings late, so late that we would have to change up our whole plans and schedules to accommodate his time. The way that I see it, I don't wanna be a part of his lab.

-Spike

Spike departed with a Master's degree after facing challenges with his advisor and other people that he worked with. Once Spike became a TA for his advisor, he realized that his advisor was not as supportive as he had hoped. Several of the direct-pathway students with a planned entry to graduate study mentioned lacking advisor support and negative interactions with their advisor. While an advisor can be an important part of a student's support network, students often rely upon support from other sources such as peers and others in their department. Planned entry direct-pathway participants frequently mentioned that they had struggled when it came to finding a good support network within their program.

2) Direct-Pathway—Serendipitous

Serendipitous direct-pathway participants had struggles defining their goals but also mentioned struggles with quality of life. Entering graduate school can be a big change for students and may cause issues with work-life balance and finding purpose through their study. Lizard, for example, had planned to go into industry but decided to go to graduate school to continue learning.

I didn't think about grad school until halfway through my junior year. I thought I was ready to go into industry but I think I just felt like I hadn't finished learning. First off, I didn't really know what I was passionate about, wanted to do and I feel like that's pretty common. But I felt like undergrad did not give me some of the skills I wanted and I like the idea of grad school because it forces you one way or another. I think I know deep down this is the right place for me to be, even if it's hard. It's hard. It's uncomfortable. Yeah, moving on with life I guess would be cool to a certain extent. I was having a really good time and suddenly I thought about it one day and I was like, "I'm really unhappy. This sucks." And so, I did something about it but in that time, I had definitely thought about leaving. I always feel like I should be working more. I feel really bad about that but then even when I'm probably working enough, I still feel like I'm not working enough. There are certain times where I feel like you're called to do things above and beyond like a normal... But you don't have a choice. You get congratulated for it but it's still like, "This isn't really normal."

-Lizard

While in graduate school, Lizard found herself unhappy. One thing Lizard mentioned was a constant feeling that she should be working more, regardless of how hard she was already working, making it difficult to maintain a healthy work-life balance. Lizard also mentions that "moving on with life" would be nice. This idea that one is "stuck" or isn't able to move on in life was a common theme amongst serendipitous direct-pathway students in particular. Providing these students with support so they can feel as though their study has purpose would be one way to encourage them to persist within their program.

IV. DISCUSSION

Our results show that pathways into graduate school including returning, direct-pathway, planned and serendipitous do correspond with students' experiences and considerations for departure. Berdanier et. al.'s GrAD model connects many different themes and subthemes based upon narratives of graduate engineering attrition including quality of life and work, support network, advisor, perception by others, goals, and cost [3]. All of these themes were represented within our participants' narratives, in particular lack of support network, advisor relationships, and unclear goals. Mosyjowski et. al. [7] found that returners had struggles in finding peers to work with and struggled to adapt to the university environment. Both of these findings are related to feeling insecure in their support network, which was a common theme for returners in our work. The research presented here provides some new additions to the existing returners research which includes concerns with advisor relationships for serendipitous students and concerns related with quality of life and cost for planned students.

Almost all returners interviewed mentioned concerns when it came to support network. It is not surprising that these non-traditional students often have a harder time feeling supported

and don't feel as though they fit in with their peers within their programs. These students are typically older than direct-pathway students, have held jobs outside of academia, and may have familial obligations outside of their program. Other non-traditional students often feel disconnected and experience distress from their college experience; however, increased familial support can decrease this distress [31], [32]. This disconnection from their program is common amongst these non-traditional students. Returners struggle to find a support network within their program, but may be benefiting from a well-established support network at home that is not as common amongst direct-pathway students. Either way, resources for returners to feel supported within their program could benefit students to connect more with their peers and ultimately encourage them to persist.

Unclear goals was a common theme for direct-pathway students which means they may need more guidance within their programs. Many direct-pathway students mentioned that they felt unsure about their decision to pursue graduate study and wondered if they were "wasting their time." These direct-pathway students are typically in their 20s and several participants felt as though they were wasting valuable years of their life. Working towards an engineering PhD is a valuable cause and providing these students with the support to feel secure in that could be beneficial.

An interesting finding was that regardless of whether the participant was a returner or a direct-pathway student, common themes were found amongst all serendipitous and all planned participants. Unclear goals was a common theme amongst students with a serendipitous path to graduate study and support network was a common theme amongst students with a planned entry to graduate study. Serendipitous students may be more unclear of their goals just based upon their less-planned entry into their programs. These students may be more likely to wonder what else is out there and potentially begin to explore these other options. Support network being a common theme for planned students could mean that these students are only being supported by their own will to obtain the degree and are not receiving enough support from their institution. These common themes amongst all planned and all serendipitous students, regardless of direct-pathway or returners, indicates that pathway to graduate study does have an influence on themes in questioning.

It should be acknowledged that there are many implications for students based upon pathway to graduate study. Zerbe et al. [4] discussed how undergraduate experiences may not accurately prepare students for their graduate programs. Direct-pathway students should discuss their career goals with their advisor or a trusted mentor regularly to give them confidence that graduate school is the right choice for them. Direct pathway students can also observe from their returner peers that a gap between undergraduate and graduate study may allow for some reflection that can lead to clarity when it comes to goals and pathways. Returners should acknowledge that they may not feel well supported in their program and seek out support early on through clubs, social events, and finding peers with similar

interests. Additionally, engineering industry and engineering academia have two different climates which may cause returners to need some time to adjust to academia when returning from industry.

Knowing that returners struggle in finding support and direct-pathway students can have unclear goals can help advisors tailor their relationships with these students. Advisors should provide extra support and encourage building a social network to returners. Advisors should also discuss goals early on in a direct-pathway students' program not only to give them confidence that grad school is a good choice for them, but also to ensure that they are interested in the research at that lab.

It is clear that the more a graduate program understands their students, the more they can improve their programs and these can help graduate engineering programs improve. Administrators and graduate programs can provide resources for returners to encourage them to feel better supported in the form of social events and clubs. Graduate programs should also encourage advisors to discuss goals with direct pathway students to provide some clarity for these students.

V. CONCLUSION

A total of 42 engineering graduate students who considered departure from their program were interviewed. Narrative analysis was used to determine the effect of pathway to engineering graduate study on themes in questioning departure. From this narrative analysis, common themes were found based upon pathway to graduate study for direct-pathway and returning students. Returners identified challenges with support networks which made them question departure from their graduate program. Unclear goals was a common theme amongst direct-pathway students which made it difficult to persist. Common themes were also identified amongst all planned and all serendipitous students, regardless of direct-pathway or returners, which indicates that pathway to graduate study does have an influence on themes in questioning. Engineering graduate students can recognize these common themes as areas in which they may struggle, advisors should work to provide support to their students and engage in honest conversations with them, and engineering graduate programs should provide resources related to support to encourage students to persist in their programs.

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