AC 2012-3832: THE PATHWAYS TAKEN BY EARLY CAREER PROFESSIONALS AND THE FACTORS THAT CONTRIBUTE TO PATHWAY CHOICES

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The Pathways Taken by Early Career Professionals and the Factors that Contribute to Pathway Choices

Abstract

Understanding undergraduates' preparation for their future careers remains a research focus in engineering education. To advance the growing body of literature, we take the perspective of early career professionals (ECPs) and examine their career path decisions after obtaining a bachelor's degree in engineering. We use Social Cognitive Career Theory (SCCT) to guide our research because this framework provides broad categories of factors that create an appropriate backdrop for understanding how career choices happen.

Because we were interested in acquiring a deep and contextually rich understanding of the ECPs' perspective, we took a qualitative research approach using semi-structured interviews as our primary data source. Our sample includes 36 participants who graduated three to five years ago with engineering degrees from one of three schools. Interviews allowed us to capture the career choices ECPs are making immediately after graduation and then throughout the first years of their careers. Interviews were conducted by phone, audio recorded, transcribed verbatim, and then coded.

Through our analysis, we identified the initial paths chosen by ECPs simply as 1) entering the workforce or 2) continuing in education. We then examined the robustness of initial choices by determining if participants stayed in their initial work/school pathway and if, at the time of the interviews, they are doing what they thought they would be doing prior to graduating. Offering insight into the initial career decision process of ECPs allows academia and industry a better opportunity to prepare undergraduate students for the decision process of graduate school versus entering the workforce directly from undergraduate studies.

Introduction

Engineering as a profession struggles to retain a robust and diverse workforce. Research in engineering education has shown that students who enter engineering programs do not always persist in earning engineering degrees and even in their senior year are unsure of pathways forward [1, 2]. Furthermore, even those students that complete their engineering degrees do not always remain in engineering fields. Developing an understanding of how graduates make early career choices can lead to strategies for supporting choices to remain in engineering professions including both workforce and graduate school choices.

Much of the existing research on engineering career choices has focused on undergraduates' intended career plans as they are graduating. For example, according to Atman et al [2] projected career plans of engineering students indicate that 40 percent consider engineering graduate school as a first step. Of the engineering students considering entering the workforce, nearly 80 percent plan to pursue engineering work. In addition, more than 60 percent of engineering seniors consider a combination of engineering and non-engineering work and graduate school [2]. In a similar study, survey results yielded 42 percent of engineering seniors reported they "definitely" intended to pursue engineering. Fourteen percent planned not to pursue engineering

careers, and 44 percent were unsure. Follow-up interviews were conducted by the researchers, which provided added detail of the students' intentions. The interview data highlighted vacillation of decision making by the students and the intentions of students definitely planning on engineering careers dropped to 21 percent and the percentage definitely not planning to pursue engineering increased to 25 percent[1]. Institutional differences may be a factor in students' decisions as well as student gender [1-4]. Based on these numbers reported in current literature, it is important to research ECPs' actual pathway choice as well as the potential for ECPs to exit the engineering profession. With regard to studying career choices post graduation, researchers have examined women's choices to stay in or leave engineering fields through a broad, national, multi-generational sample [5]. However, little research has focused specifically on the pathways of engineering students after they graduate and become early career professionals (ECPs). This is an important area of study as it can help graduate school and workplace recruiters understand how to attract, retain, and develop ECPs. Hiring recent graduates or accepting graduate students is an investment in the future and understanding how they make career choices can facilitate employers and faculty in making the best investments.

To identify and describe the career pathways of ECPs, we build on the Academic Pathways Study (APS) conducted by the NSF-supported Center for Advancement in Engineering Education (CAEE) [2] by examining actual experiences of the same early career professionals (ECPs) who were studied as undergraduate students. Understanding the actual career paths of the ECPs, rather than their intended career paths, provides information to support research on persistence in both engineering education and engineering careers. The purpose of this analysis is to use qualitative data to characterize ECPs' initial career path choices. The primary research questions addressed in this study are:

- What are the initial pathway choices upon completion of ECPs' undergraduate degrees?
- To what extent do ECPs believe they remained on their initial pathway choice?

We adopted Social Cognitive Career Theory (SCCT) [6] as our framework. SCCT asserts that career choice is a function of many interacting factors. For the early career choice, the SCCT model indicates learning outcomes, self-efficacy, outcome expectations, and interests are key factors in determining initial goals [6]. Figure 1 (used with permission) shows the SCCT model [6, 7]. The choice of an engineering career is related to the individual's belief that he or she has 1) the skills, knowledge, and support to be an engineer, 2) belief and confidence to be an engineer, 3) expectations of the rewards of an engineering career, and 4) an interest to do the kinds of things that engineers do.

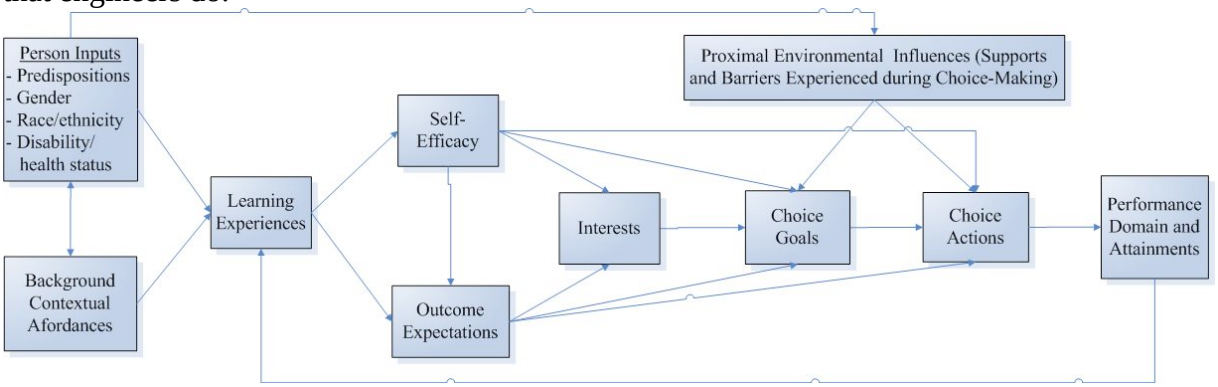

Figure 1: Lent, Brown, and Hackett's SCCT model (1994).

SCCT has shown promising results for understanding the career choices of engineering students and particularly underrepresented populations [8, 9]. Prior work includes studying engineering students to test the relationship of outcome expectations, self-efficacy, and interest toward goals [10]. Therefore, extending application of the model of SCCT to early career professionals in engineering is appropriate. This work is also unique in that it uses qualitative interviews. Studies that explore SCCT using qualitative methods are limited, but include Lent et al.'s[22] analysis of college students' perceived influences and persistence in career choices and Fouad, Fitzpatrick, and Liu[5] research on female persistence in engineering. In addition, qualitative data collected as part of larger mixed methods research includes work such as Trenor et al.[9] and Lichtenstein et al.[1]. Though the quantitative results allow pathway analysis of the SCCT to be statistically mapped [11], the qualitative research methods provide insight on why chosen pathways are important. To this end, further qualitative research is needed.

Method

In the overall study, EPS uses an exploratory sequential mixed methods [12] approach to examine transitions from being an undergraduate to being an ECP. Findings from in-depth interviews were used to develop a survey designed for a broader sampling of ECPs. The exploratory strategy of using interviews to inform survey instrument development is a preferred method when existing surveys are inadequate for the research questions [12]. The focus of this manuscript is on the qualitative interviews, as the findings are meaningful in themselves in addition to informing the survey.

To answer our first research question, we conducted a content analysis of the transcribed interviews to determine ECPs' initial career choices and the prevalence of each [13]. This content analysis relied on a priori codes of "graduate school" and "workforce". To answer the second research question, we coded the data for ECPs' reflection about remaining on their planned path ("doing what they thought they would be doing") using emergent themes. Using tables and counts of codes, we then quantitized the qualitative data with regard to career pathways. Content analysis and quantitizing data allows for the systematic and objective inferences through coding, theme identification, and pattern recognition to quantify a phenomenon [11, 13, 14].

Data Collection

Data collection included an online pre-questionnaire survey instrument and, where consent was provided, semi-structured interviews. The pre-questionnaire was developed as the first follow-up to interviews and surveys administered to APS participants in their junior and/or senior year of college. The pre-questionnaire was used to identify volunteers for the interviews and contained feeder questions for the interview protocol. Access to the survey opened in February 2011 and closed in May 2011.The follow-on interviews were conducted March to May of 2011 via phone calls; the calls were recorded and transcribed verbatim. Four members of the interview team conducted the interviews, which lasted no more than an hour. The interview protocol was semi-structured [15] and contained 13 questions followed by a broad final question allowing the interviewees to provide any additional information they thought important. To ensure consistency across interviews, we created an interview protocol that included the interview

questions, a purpose for asking each question, and anticipated prompts to help ensure interviewee's ideas were explained and elaborated.

Trustworthiness [16]of the pre-questionnaire and interview protocols was enhanced using the extended EPS research team as resources with expertise. The extended team includes the interview team and the external project evaluator, as well as other researchers working on EPS. In addition to reviewing the questions with the extended research team, the interview team piloted questions with graduate students and working ECPs of similar age as the sample population (between 25-26 years old). The questions were revised and improved during multiple rounds of pilot testing. The final interview protocol probed the ECPs' past and present experiences and future plans. For example, the ECPs were asked if they are currently doing what they thought they would be doing as an undergraduate.

Participants

As previously mentioned, the participants in this study are a subset of the participants studied in APS. A pre-questionnaire survey was sent to former APS participants who graduated from Technical Public Institution (TPub), Large Public University (LPub), and Suburban Private University (SPri) [2] and for whom a current email address was available. There were 53 responses to the pre-questionnaire survey with 40 consenting to interviews and 36 interviewed. Fifteen of the respondents interviewed were from SPri, 13 from TPub, and 8 from LPub. The APS oversampled for women and minorities [17], the EPS sample likewise oversampled these groups resulting in 39% women, 59 % White/Caucasian, 18 % Asian American/Asian, 10 % African American/Black, 5 % Hispanic/Latino, 5 % Mexican American, and 3% Native Hawaiian. A few respondents checked multiple ethnicity categories so the percentages were normalized to 100. Six of the 36 ECPs are considered "non-persisters" as they changed majors and graduated with degrees outside of engineering. Five of the six non-persisters were from SPri and the remaining one was from TPub. All six non-persisters are male. The six non-persister ECPs are part of the APS data set and are included for thoroughness of our interview data set. Inclusion of the non-persisters helps us to understand if initial pathways are unique to engineering or not.

Qualitative Coding

The authors used MAXQDA software to code the interviews. We coded the interviews for current employment status, as well as first employed position after graduation and any intermediate positions (if different from their current position) to provide insight into job mobility. We also coded the interviews for perceptions about whether the interviewee was doing what they thought they would be doing as undergraduates. These codes emerged from the data inductively.

We established trustworthiness of the data analysis and reporting primarily through researcher triangulation[16]. Triangulation of our data was obtained through each researcher's independent analysis of interviews, discussion of differences during regular phone calls, and development of definitions allowing for agreement of interviewee placement. Each interview was coded in its entirety. The codebook used for this paper is shown in Table 1.

Table 1 Codes for initial pathway content analysis

Code	Description
Intermediate Job(s)	• Change in company(i.e., not merely a change in location or position within a company) • Does not include internships
Doing more than what I thought	• Comments that they were doing more than they expected; may include the phrase more than they hoped for
Doing exactly what I thought	• Only a yes or positive response provided • Does not include doing more than expected (see previous code)
Somewhat doing what I thought	• Response included both a yes and a no component • May be different expectations realized for job title, location, or specific field (e.g. energy versus biotech)
Not doing what I thought	• Only a no or negative component to the response • May relate to being in school versus at work, field of work, or job description

Quantitizing Data

The codes developed allowed the authors to categorize and then numerically translate (i.e., quantitize through counts and tables) our qualitative data to investigate potential patterns and meaning [11]. Quantitizing is particularly important at this stage to illustrate varied pathways. Future work can then build on this to qualitatively understand critical factors influencing pathways. The categories we quantitized include initial career path (entering the workforce or graduate school), current career path at the time of interview, and intermediate jobs (if any). We combined the quantitized data with information on gender and school for each participant. In addition to quantitized data, we provide some quotes to illustrate the choice processes. Note: The numerical data presented in this paper are not intended as generalizable percentages, but rather to help describe our sample population.

Results

Initial Career Path

The research questions we addressed were: 1) What are the initial pathway choices upon completion of ECPs' undergraduate degrees? and 2) To what extent do ECPs believe they adhered to their initial pathway choice? The data for each of these questions is presented in total, by school, and by gender. Figure 2 shows the descriptive data for the initial choices and current employment status of the 36 ECPs. The workforce option represents ECPs who are working full time and graduate school represents full time students. As no ECP is both working full time and going to school full time, all ECPs are represented only once within each column (at graduation and Spring 2011) in Figure 2.

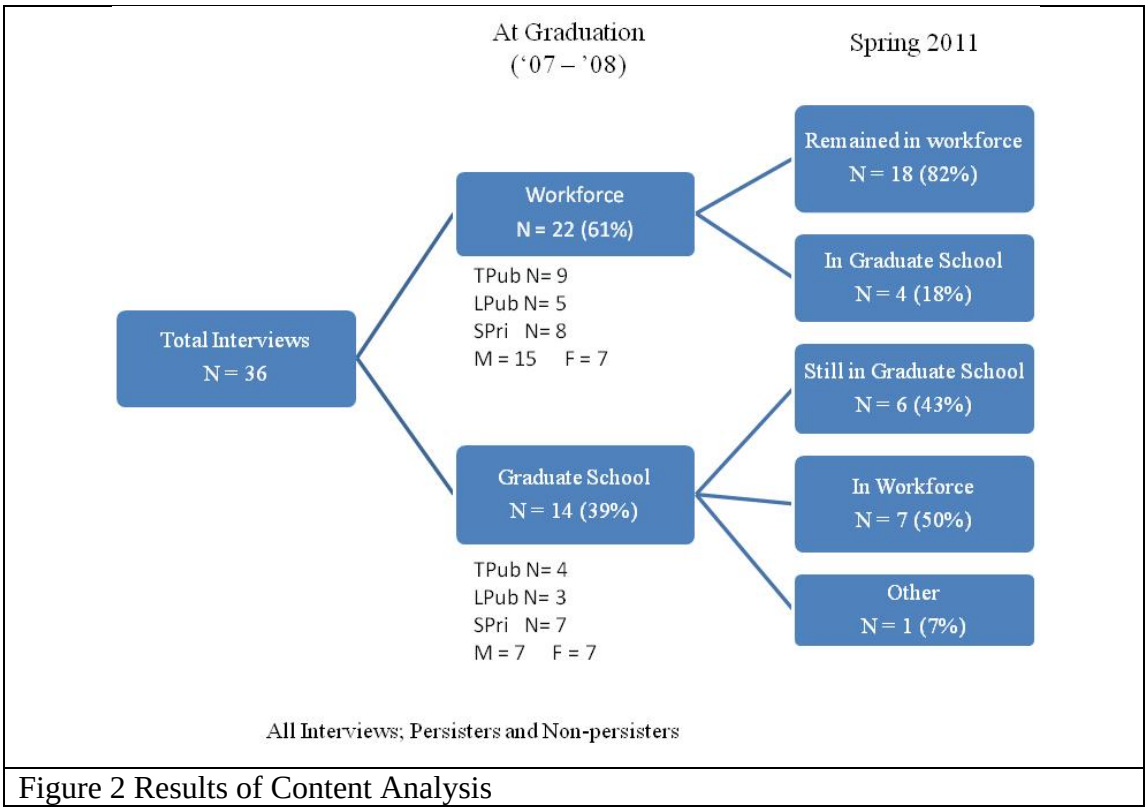

Figure 2 Results of Content Analysis

Sixty-one percent of the ECPs entered the workforce after earning their undergraduate degrees compared to 39% who chose graduate school. The six non-persisters were evenly split between attending graduate school and entering the workforce.

Workforce first. In total, 22 ECPs chose work first; 15 males and 7 females. By institution, the breakdown of ECPs choosing work first was TPub 9 out of 13, LPub 5 out of 8, and SPri 8 out of 15. These ECPs offered several reasons for choosing work directly after graduating including financial concerns, significant others, and internships. As an example, Justin talked about the influence of his internship on choosing a career.

> *"One of the reasons that I returned to this company was because of a really strong development manager that I really liked, and did that impact my career decision, … yes, you know, definitely." (Justin, LPub)*

Several ECPs indicated that they planned to work first to gain a few years of experience prior to returning for a graduate degree. It is important to note that not being accepted to graduate school was generally not given as a reason for entering the workforce. This implies that workforce is not an alternative to academics. However, one ECP indicated not being accepted by his first choice of school caused him to enter the workforce first (he is now in the graduate program that he initially wanted to be).

At the time of our follow-up interview, 82 percent of the ECPs who chose work as their initial path remained in the workforce while the other 18 percent are now in graduate school. One of the workforce participants indicated he is enrolled in a part-time evening graduate school program.

Three of the four participants who returned to graduate school after working for some time are currently pursuing technical degrees, including one PhD student, while the other one is pursuing an MBA, and all four are male. Several reasons were given for going to graduate school, including having always planned to return after working for a few years.

> *"I did have [a] plan to eventually go back to school and maybe two or three years seemed like a good time frame to have experience and not be quitting on that right away." (Austin, LPub)*

Not all ECPs went directly to work; some chose to continue their education with an advanced degree.

Graduate school first. In total, 14 ECPs chose to pursue graduate school directly after completing undergraduate degrees (seven males and seven females). The breakdown of ECPs choosing graduate school first by institution was TPub 4 out of 13, LPub 3 out of 8, and SPri 7 out of 15. Reasons for going directly to graduate school included wanting to become a professor, improving their research skills, better job opportunities with a graduate degree, and/or an opportunity to work with an undergraduate mentor.

Several of these participants made their choice due to a lack of job offers. For example, Joe went on job interviews but after not receiving any offers decided to attend graduate school.

> *"Basically I went on several interviews, most of them ended up being for… production positions and things, and I kinda realized that that wasn't quite what I wanted to do, and I had an opportunity with one of my professors to go into grad school and I jumped at it." (Joe, TPub)*

Though internships were commonly cited among ECPs as a reason to choose a specific job, one person chose graduate school over work after realizing through her internship experiences that work was not as exciting as she thought it would be.

> *"I didn't think I would stay in school this long. As an undergrad, I did a lot of internships because I assumed that I'd be out in industry fairly quickly. But the more internships that I did, the more I realized it just wasn't as exciting as I thought it might be. They were all good jobs, I worked with nice people, and they were well paying, but school was exciting to me and the jobs really weren't."(Kara, LPub)*

Of the 14 ECPs who chose graduate school first, six are currently pursuing doctorates (four persisters and two non-persisters; four females and two males). Two graduate students indicated they would pursue a master's degree, but are remaining for a doctorate. All ECPs who chose graduate school first, and are now working, completed a master's degree.

Non-Persisters. Three of the six non-persisters entered the workforce immediately after college while the other three entered graduate school. In the spring of 2011, two of the three graduate students were continuing their graduate studies to pursue a doctoral degree. The other four non-

persisters were working. The non-persisters' reasons for pursuing a graduate degree were in line with those of the persisters, i.e., wanting to develop better research skills and/or be a professor.

Intermediate positions. Of the ECPs working in the spring of 2011, two-thirds have not changed jobs, though a few have changed position within their company. No pattern emerged between changing jobs and being a persister or non-persister.

Decisions by school and gender. Of the three schools involved, the graduates from SPri and LPub were nearly equally split between workforce and graduate school (slightly higher for workforce) while graduates from the technical public university were more likely to enter the workforce than to go to graduate school. Females across all three schools were split 50/50 between workforce and graduate school; two-thirds of males, however, chose to enter the workforce immediately after undergraduate schooling.

All of the ECPs from LPub who initially chose graduate school over work are still in graduate school and enrolled in PhD programs. All four of the TPub ECPs who choose graduate school as their initial career path completed masters' degrees and then entered the workforce. The ECPs from SPri have pursued both masters' and doctorate degrees; some are still in graduate school while others have since graduated.

Doing what they thought

After describing the patterns in ECPs initial career choices, we analyzed whether or not ECPs stayed with these original choices. Specifically, we examined if participants thought they were doing what they had planned to do as seniors. Table 2 contains the quantitized data for ECPs' perceptions about doing what they expected. The results are shown according to the spectrum we developed and further refined by school and gender. Insights by category are presented through some exemplar quotes following the table.

Table 2 "Doing what they thought" (N = 35)*

Response	TPub		LPub		SPri		Total	
	Male	Female	Male	Female	Male	Female	Male	Female
More than expected	1	0	1	0	0	0	2	0
Exactly as expected	3	1	2	1	6	2	11	4
Somewhat as expected	2	0	0	0	2	0	4	0
Not as expected	2	4	0	3	2	3	4	10
Total	8	5	3	4	10	5	21	14

*No information for one ECP

Doing more than expected. Two ECPs commented that they were doing more than they had expected to. Austin went to work after completing his undergraduate degree and is now in graduate school. Joe went straight to graduate school, obtained an engineering master's degree, and is now working.

> *"I don't know if it's what I thought I'd be doing, I don't know what I thought I'd be doing, but it's what I was hoping to do so that's good." (Austin, LPub)*

> *"I'm doing what I hoped I would be doing. I was expecting more of a general plant metallurgist position or something more in a production environment, not a science R&D position." (Joe, TPub)*

Doing exactly as expected. Fifteen ECPs reported that they were doing exactly what they expected to do when they graduated from college. Their explanations as to why they felt this way range in scope. Some indicated that they have the type of job expected they expected to have, such as John, while others spoke more generally about a category of jobs, such as Kevin.

> *"There's basically three different disciplines when you get out of school for being a [discipline] engineer, and I wanted to be a [type] engineer that's what I've done so far, so, this is, this is definitely where I want to be and I'm enjoying it." (John, TPub).*

> *"Yes, when I was an undergraduate I didn't have a totally specific idea of where I'd be in a few years but, I knew that I was interested in technology and in particular the kind of business side of things in technology." (Josh, TPub).*

This category includes participants who were uncertain about exactly what they would be doing but knew they had interests. Several ECPs indicated they were unsure about what they expected during their first few years of undergraduate and a few we still even during their senior year. Reflecting back, however, they believe that what they are doing now is in line with their interests as undergraduates.

> *"So am I doing what I thought I'd be doing freshman year? No, but am I doing something I thought I'd be doing when I was graduating? Yeah." (Beth, TPub)*

Doing somewhat as expected. Four ECPs indicated that they were somewhat doing what they expected, just not completely. Some ECPs were doing the type of work that they expected to but in a different field. Oscar, for example, was doing hands-on work, as he expected, but related to electric vehicles rather than space systems Paul also commented on doing the same kinds of activities that he expected to but in a different field.

> *"It was some expected and I was planning on going into something in the spectrum between R and D and designing equipment. I didn't expect to go into the [specific field] as it is, but other than that, it's pretty close to what I expected." (Paul, TPub)*

Not doing as expected. In total, 14 ECPs were not doing what they had expected to do. Some of the ECPs report accepting a job but upon reflection regretted the decision. In the case of Lisa, she was not pleased with her first job and is now pursuing a different career field.

> *"I should have just never done that [accepted first job] and just searched for a company that I actually would have liked and enjoyed working with." (Lisa, TPub)*

Other ECPs are not doing what they expected, but like what they are doing. Reasons given include learning early that their original plan was not something they liked or that something they thought they would not like turned out to be interesting. Internships and summer projects helped two ECPs to make this realization. In the case of Kara, as discussed above, she chose to pursue graduate school in lieu of entering the workforce. Kyle is content with his current position, though he stated during college,

> "I actually wanted to be as far away from the [type work] as possible, I didn't think it was going to be as interesting as it has become to me." (Kyle, TPub)

Several ECPs indicated they are not using their degrees to the extent that they expected. Leah and Will both indicated that they are not doing what they are expected because they are not using their specific degree in their work.

> *"I thought it would be much more technical, I don't really use my degree as much with this particular job; it's more project management. In college I always thought it would just be so much more engineering work and more about applying what I've learned in my classes to my job." (Leah, TPub)*

> *"I don't really need to have, um, formal engineering education to do what I do. I mean, I got a degree in electrical engineering and I'm not really using it at all." (Will, TPub)*

Gender differences. Although approximately 50 percent of the ECPs are doing exactly, or more than, they expected as seniors, there is a difference between males and females (as shown in Table 2). Sixty-two percent of all males are doing exactly or more than they expected, while only 29 percent of all females are doing exactly what they expected (none are doing more). Though several males are categorized as doing "somewhat" as they expected, no females were placed in this category. Ten (of 14) females are not doing what they expected.

Two salient reasons cited by the females for not meeting expectations are 1) a lack of understanding about engineering as an undergraduate and 2) geographical restrictions at graduation. The majority of people in the "not doing what they expected" category are females; seventy-one percent of all females responded they are not doing what they expected, compared to 19 percent of males. Though a gender trend was seen for those not doing what they expected, the initial career path ratio (work versus graduate school) held. For example, one-half of the ECPs who entered the workforce first, and are still in the workforce, are "not doing what they expected" or "somewhat" doing as expected. Overall, four male ECPs are not doing what they

thought; three of the four are non-persisters. All of the ECPs who remained in the workforce (N = 9) who are doing what they expected (N=8) or somewhat doing what they expected (N=1) are males. Within the females, the four who are doing somewhat as expected all chose graduate school for their initial career path.

Discussion

Entering the workforce after receiving an undergraduate degree was the common choice by ECPs. At the time of our interviews, of the 22 ECPs who persisted in an engineering degree and entered the workforce, 16 indicated their job was engineering or had aspects of both engineering and non-engineering work. The number of ECPs reporting they are not doing engineering work aligns with results reported by Lichtenstein et al.[1]. A wide range of explanations was given concerning what aspects of an ECPs' job are engineering (or not). If ECPs and employers have different expectations of what an "engineering job" is, then the gap between employers' expectations and ECPs' expectations will be difficult to close.

Changing jobs at least once between graduation and the interview was not an indicator of ECPs meeting their expectations. However, all of the ECPs who started in the workforce, but subsequently returned to school full time, indicated they are doing what they expected at least somewhat. ECPs may be pursuing advanced degrees as part of an initial plan to achieve their goals or because they realized additional education could help them achieve their goals. Regardless of the reason, ECPs who left the workforce within 3 – 5 years reflect that their actions are justified as part of their original expectations. Some of these ECPs may return to the workforce after completing their advanced degree, but returning to the original place of employment is not apparent.

The number of ECPs who went directly to graduate school is in agreement with professed expectations for attending graduate school reported by Atman et al.[2] in their analysis of the full APS sample; 39 percent of the total and 50 percent of the females. In addition, after a few years in the workforce, an additional 11percent (total of 18, or 50 percent) of ECPs are attending graduate school. Though these numbers are in agreement with the APS report, it is important to note that the national average for engineering graduates getting advanced engineering degrees is 15 percent[19]. Furthermore, only four percent of ECPs one to three years after graduation have earned an advanced engineering degree while another 14 percent are working on one[20]. The subsequent EPS survey will help us better understand if the alignment between APS and EPS is statistically significant across the three schools. Further research would then be needed to understand why the APS/EPS sample differs from national averages.

The non-persisters (began in engineering and changed to a non-engineering degree) were included in the analysis to allow emergence of any "differences" between them and students who graduated with an engineering degree. The six non-persisters interviewed are all male. The non-persister results are in-line with the total data set with respect to work versus graduate school, changing jobs, and changing jobs not being an indicator of meeting expectations. Switching away from engineering did not result in an increased likelihood of meeting expectations. In fact, when isolated to the male participants, male persisters are almost twice as likely to be doing at least somewhat as they expected.

Our research shows that ECPs are still in flux about their proximal career path through their senior year and outcomes vary by gender and educational institute, which aligns with other work conducted[1,2]. Now that we have mapped the pathways of ECPs, we are well positioned to tie these mappings back to the SCCT framework to understand the factors that contribute to these early career choices. For example, we know that the economic decline played a role in ECPs early career choices [18]. Moreover, by connecting this information with that from the APS interviews, a fuller longitudinal assessment of the ECPs and the development of their career choices and goals is possible. Such mapping has already begun[21].

Our research also showed variety with regard to ECPs meeting their initial career expectations. The variety was due in part to the criteria used to measure matching expectations. ECPs' perceptions about doing what they expected encompassed a range of criteria. Some of the ECPs indicated they are doing what they expected based on their job description alone. Others consider a combination of geographical location, type of job, and use of their education in deciding if they are doing what they anticipated that they would be doing. Of particular interest is the disparity between males and females with respect to their reflection on whether or not they are doing what they thought they would be doing. In combination with Fouad's work [5] that shows women leave engineering careers at higher rates than men, our finding suggests a need for further examination of women's career expectations and how they are met or not met.

The extent to which institutional differences influence ECPs is unclear, but our analysis suggests additional research in this area is warranted. One potential research question, for example, is whether there are cultural differences by school or type of school with respect to entering the workforce with a bachelor's degree versus an advanced degree.

As discussed, one limitation of our study is having only a small subset of ECPs from each of the three schools. It is possible that ECPs' tendencies to pursue graduate study or enter the workforce were over or understated based on this small sample. Results from the follow-up survey to this work will help determine the broader impact of our findings.

Conclusions

Through our content analysis, we analyzed the number of students that transitioned to graduate school or industry and after a few years how many have stayed on that path. In addition, we analyzed the extent to which ECPs are meeting the expectations that they set for themselves as seniors. The transition of engineering students from undergraduates to industry or graduate school may seem, upon first glance, to be a simple "either or" decision. However, as our analysis of the ECP interviews reveals, even after being out of college for 3-4 years, ECPs' plans are still in flux. Changes in job and between work and school may be one way of figuring out what they want to do or getting to where they want to go. Unfortunately, such changes may be frustrating to the employers that have invested in ECPs development through rotational and other training programs. In addition to illuminating ECPs' choices regarding work and graduate school, the procedures developed for this study can be leveraged for further analysis into aspects of ECPs' career decision-making and deeper analysis to better understand factors contributing to changes in job/work status for ECPs. Additionally, we can better understand the decisions of ECPs to

pursue engineering versus non-engineering careers after earning their undergraduate degree, as well as the permanence of that decision over time.

Describing how ECPs make their initial career choice allows educational institutions and industry to tailor opportunities to attract people who best match their needs. To help students make informed career decisions and to help future employers (including graduate school programs) make informed hiring or acceptance choices, we need to promote clarity around job expectations and requirements. Both academic institutions and industry should be involved in promoting realistic expectations of what is involved for different opportunities and identifying the consequences of such choices.

Our recommendations include exposing students and ECPs to a wide variety of work and graduate school-like situations so that they can develop expectations for each and figure out where the best fit is. Such exposure could include required undergraduate research experiences, internships, or for ECPs rotations in work assignments or graduate school laboratories before settling on a career path. We also suggest developing practices around mentoring. Mentors, whether in the form of undergraduate advisors and research professors or bosses and coworkers at a first job, can have substantial impacts on career choices. Knowing why some mentors have such a tangible impact can help develop a set of best practices.

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