Helping Engineering Students Get Jobs: Views from Career Services Professionals

Dr. Cheryl Carrico P.E., Virginia Tech

Cheryl Carrico is a Postdoctoral Research faculty member for Virginia Tech. Her current research focus relates to STEM career pathways (K-12 through early career) and conceptual understanding of core engineering principles. Dr. Carrico owns a research and consulting company specializing in research evaluations and industry consulting. Dr. Carrico received her B.S. in chemical engineering from Virginia Tech, Masters of Engineering from North Carolina State University, MBA from King University, and PhD in Engineering Education from Virginia Tech. Dr. Carrico is a certified project management professional (PMP) and licensed professional engineer (P.E.).

Angela Harris, Stanford University

Angela is currently a Fellow with the Thinking Matters program at Stanford University. Angela received her PhD in Stanford's Environmental Engineering and Science Program (Spring 2015). Angela completed her B.S. in Chemical Engineering at the Georgia Institute of Technology prior to coming to Stanford for her M.S. in Civil and Environmental Engineering.

Angela conducts research related to water, sanitation, and child health in developing countries. Angela has extensive experience in developing survey questionnaires and conducting structured observations at the household level as a part of research studies in Tanzania, Kenya, and Bangladesh. Alongside her work in environmental engineering, Angela also conducts research related to engineering education as part of DEL group. Currently her work related to education seeks to better understand student career choices and institutional support for students in career development and career preparation. She also works on better understanding undergraduate engineering student interests, behaviors, development, and career choices related to innovation and entrepreneurship.

Dr. Holly M. Matusovich, Virginia Tech

Dr. Matusovich is an Assistant Professor and Assistant Department Head for Graduate Programs in Virginia Tech's Department of Engineering Education. She has her doctorate in Engineering Education and her strengths include qualitative and mixed methods research study design and implementation. She is/was PI/Co-PI on 8 funded research projects including a CAREER grant. She has won several Virginia Tech awards including a Dean's Award for Outstanding New Faculty. Her research expertise includes using motivation and related frameworks to study student engagement in learning, recruitment and retention in engineering programs and careers, faculty teaching practices and intersections of motivation and learning strategies. Matusovich has authored a book chapter, 10 journal manuscripts and more than 50 conference papers.

Dr. Samantha Ruth Brunhaver, Arizona State University, Polytechnic campus

Samantha Brunhaver is an Assistant Professor of Engineering in the Fulton Schools of Engineering Polytechnic School. Dr. Brunhaver recently joined Arizona State after completing her M.S. and Ph.D. in Mechanical Engineering at Stanford University. She also has a B.S. in Mechanical Engineering from Northeastern University. Dr. Brunhaver's research examines the career decision-making and professional identity formation of engineering students, alumni, and practicing engineers. She also conducts studies of new engineering pedagogy that help to improve student engagement and understanding.

Dr. Ruth A. Streveler, Purdue University, West Lafayette

Ruth A. Streveler is an Associate Professor in the School of Engineering Education at Purdue University. Dr. Streveler has been the Principal Investigator or co-Principal Investigator of ten grants funded by the US National Science Foundation. She has published articles in the Journal of Engineering Education and the International Journal of Engineering Education and has contributed to the Cambridge Handbook of

Engineering Education Research. She has presented workshops to over 500 engineering faculty on four continents. Dr. Streveler's primary research interests are investigating students' understanding of difficult concepts in engineering science and helping engineering faculty conduct rigorous research in engineering education.

Dr. Sheri Sheppard, Stanford University

Sheri D. Sheppard, Ph.D., P.E., is professor of Mechanical Engineering at Stanford University. Besides teaching both undergraduate and graduate design and education related classes at Stanford University, she conducts research on engineering education and work-practices, and applied finite element analysis. From 1999-2008 she served as a Senior Scholar at the Carnegie Foundation for the Advancement of Teaching, leading the Foundation's engineering study (as reported in Educating Engineers: Designing for the Future of the Field). In addition, in 2011 Dr. Sheppard was named as co-PI of a national NSF innovation center (Epicenter), and leads an NSF program at Stanford on summer research experiences for high school teachers. Her industry experiences includes engineering positions at Detroit's "Big Three:" Ford Motor Company, General Motors Corporation, and Chrysler Corporation.

At Stanford she has served a chair of the faculty senate, and recently served as Associate Vice Provost for Graduate Education.

Helping Engineering Students Get Jobs: Views from Career Services Professionals

Abstract

A diverse and highly skilled engineering workforce is needed to address today's grand challenges involving sustainability, medicine, information technology, and learning. To grow such a workforce, research is needed to better grasp the decision-making of early career engineers as they seek their first post-undergraduate job. To aide in understanding this process, we first sought to understand the knowledge, skills, and abilities (KSAs) that career service professionals believe are critical for students to develop. Accordingly, we analyzed semi-structured qualitative interviews with career service professionals at two universities to answer the research questions: What knowledge, skills, and abilities (KSAs) do career service professionals perceive as important for undergraduate engineering students during the process of applying to, being considered for, and obtaining a job offer? How do career services professionals help students gain these KSAs? Our findings suggest that both universities believe their school's reputation insures employers that their engineering students will have sound engineering skills. In addition, they believe that acquiring a job offer requires a dynamic set of interactive abilities, such as marketing themselves and networking, which may not be addressed within the engineering curriculum or fully understood by students. Differences included approaches of optional versus required exposure to career services and philosophies of providing one-on-one assistance to proactively support students versus optional support designed to develop a student's self-awareness. Our findings suggest that career service professionals use their beliefs about students as a basis for decisions on how to support students. Implications of our study include considerations for how we inform students regarding knowledge and skills associated with successfully obtaining a first job post-undergraduate degree and how those knowledge and skills may be different from ones necessary to obtain an engineering degree.

Introduction

A diverse and highly skilled engineering workforce is needed to address today's grand challenges involving sustainability, medicine, information technology, and learning.[1] Yet many smart, capable engineering graduates leave the engineering field.[2, 3] To grow the needed workforce, we need to understand the processes by which engineering undergraduates seek and attain their first post-undergraduate job. The process of obtaining a job, e.g., knowing where to look, how to look, and how to get hired, is an increasingly complex process, yet, there is limited granularity into how new engineers navigate this path.

To begin developing information about the career choice process of early career engineering graduates, we have undertaken a multi-method, multi-institution study to better understand how engineering undergraduates explore and prepare for their first employed position after college. Our overall study, the Professional Engineering Pathways Study (PEPS), will combine longitudinal surveys and interviews of engineering students with interviews of university stakeholders at six U.S. institutions. Specific for this research paper, we analyzed semi-structured qualitative interviews with career service professionals at two of our six participating

universities to answer the research questions: *What knowledge, skills, and abilities (KSAs) do career services professionals perceive as important for undergraduate engineering students during the process of applying to, being considered for, and obtaining a job offer?* and *How do career services professionals help students gain these KSAs?* Notably, this paper focuses on the KSAs necessary for students to acquire a job offer, which may differ from the KSAs needed to successfully graduate with an engineering degree. We chose this focus because considerable literature already addresses the development of technical and professional skills among engineering students and recent graduates.[4-6]

Framework

This research is a subset of a larger research project situated in our model, Professional Pathways Model, which combines Sampson et al.'s model of Cognitive Information Processing[7] and Eccles et al.'s Expectancy X Value Theory of Achievement Motivation (EVT).[8, 9] Combined, these models represent a series of factors that influence career choices. For this particular analysis, we focused on elements of the EVT model that are most salient to the role of socializers in shaping career pathways. EVT focuses on the perspective of an individual making choices about activity engagement, and recognizes the importance of valued others that socialize the individual through interactions. Socializers are the valued people in the individual's life. In the context of career choice engagement, these socializers are commonly parents, teachers, school staff, or administrators with whom students interact regarding career choice options. In this analysis, we focused on university influencers (UIs) as socializers of students' career pathways and specifically on career service professionals.

Figure 1 is a reconfigured conceptualization of Eccles' EVT model to emphasize the role of socializers. This adaptation is based on Eccles' prior reframing to show the role of parents in academic choices.[8] As shown in the figure, student outcomes (including task engagement) are informed and influenced by background characteristics, and the beliefs and behaviors of socializers. For our context, the model suggests that UIs will have beliefs about engineering degrees, students, and how the students match with possible careers (general beliefs). They will also have specific beliefs relative to the student with whom they are interacting (student-specific beliefs). As a result of these beliefs, the UI will engage in behaviors when interacting with the students that contribute to career choices.

Methods

For this case study analysis,[10] we analyzed semi-structured qualitative interviews with career service professionals at two universities (cases) to answer our research questions. Our study was conducted in accordance with approved human subject's research practices. Accordingly, we assigned all sites and participants pseudonyms.

Research Sites (cases)
We selected Midwestern Private University (MPri) and Western Private University (WPri) as the two case sites for this analysis. These two case sites allow for a rich comparison based on their student body characteristics, Carnegie classifications[11] and approaches to career service models and philosophies.
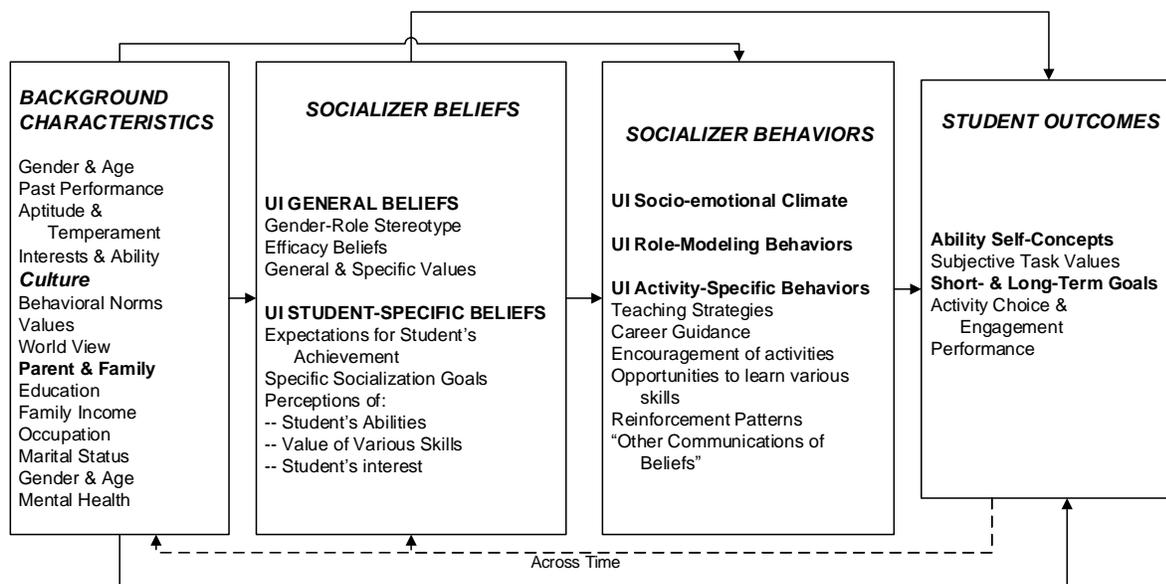
Figure 1. Modified Eccles' EVT representing University Influencer (UI) Beliefs and Behaviors

MPRI is a small private school located in the Midwest region of the United States. MPRI is listed as more selective and primarily residential according to its Carnegie classifications. MPRI focuses on undergraduate degrees and, of those, the majority are engineering degrees. The student demographics for undergraduate engineering degrees mimic those of current United States engineering graduates in that approximately 15 percent are non-white and approximately 20 percent are females. The career services program is centrally located and does not have college of engineering specific employees.

WPRI is a large private university in the West Coast region of the United States. WPRI's Carnegie classifications are of a more selective, residential school with a primary focus on arts and sciences. The student demographics for undergraduate engineering degrees do not mimic the national average, as nearly two-thirds are non-white and approximately one-third are female. Roughly 20 percent of undergraduate degrees are awarded in engineering. WPRI's enrollment includes a nearly equal number of students pursuing advanced degrees as undergraduate degrees. The career services group is centrally located and has a liaison employee for the college of engineering. During our interviews at WPRI, the career service center was transitioning from a transactional model (e.g., task oriented, such as helping with a resume) to a transformational model with an intent of providing a more holistic service to students.

Participants
Participants worked in career service centers at a university level or within the college of engineering. The difference in level creates differences in the size and organizational structure of the centers, though in practice the levels are comparable. We invited participants to be interviewed based on job title (e.g., Director of Career Services), through recommendations from our partner school liaisons, or from a recommendation from a previous interviewee. In total, four people from MPRI and two from WPRI participated. We omitted further details on the participants as they could make participants identifiable.

Data Collection
Our primary data for this analysis were semi-structured interviews.[12] We conducted in-person, one-on-one, or focus group interviews (depending on the participant's preference) during the spring of 2015. The interviews were audio-recorded and transcribed verbatim for analysis.

We developed the interview protocols using the modified EVT model shown in Figure 1 as our basis for question development. We tailored our questions for different socializers, e.g., career service director or career service professionals. All interviews began with an introductory preamble and each interview included eight to nine questions. The preamble provided a brief overview of the project to remind the participant of the research focus including undergraduate engineering students and the research involving multiple institutions. Interview questions generally asked about the participant's perceptions of students and student experiences with regard to pursuing a post-graduate job (or graduate school).

Interview questions most related to the research objectives of this paper included those focused specifically on the KSAs needed for obtaining a job offer, including, for example, the following questions:

> *Let's talk more specifically about the students who are applying for jobs or graduate school and the process of learning about opportunities, applying, and being interviewed. I would like to talk first about job search skills and knowledge helpful to students in finding a particular career pathway and employer "match" and ability to obtain the job/graduate school acceptance. What job search skills and knowledge do students in your school have and how do they acquire them?*

> *Thinking about these job search skills and knowledge, do you receive feedback from Alumni or potential employers regarding these job search skills and their applicability to the job, not just obtaining a job? That is, what overlap, if any, is there related to job search skills and knowledge and skills needed for the jobs (or graduate school)*

For all questions, we had follow-up probes to elicit richer information.

Data Analysis
We analyzed all interviews in their entirety though we focused on the types of questions cited above as particularly relevant to our research questions. We analyzed the transcripts using Dedoose coding software, developing case synopses[10] and using comparative matrices to compare and contrast sites.[13] We used both a priori and emergent codes.[13] A priori codes drew on EVT and specifically our adaptation of Eccles' (2007) model to study university influences on students' career choices (Figure 1). We added emergent codes to operationalize the relevant constructs of beliefs and behaviors and of career services employees. We coded for Socializer Beliefs and Socializer Behaviors separately and then specifically analyzed the behaviors in relation to the primary beliefs noted for each site.

Socializer Belief Codes. Socializer Belief codes captured the UI General Beliefs (Figure 1) participants held about students with regard to KSAs needed to acquire jobs. Items included the participant's beliefs about his or her roles in helping students acquire job offers, beliefs about job

acquisition KSAs, and general beliefs about students. These codes were then further refined with sub-codes as shown in Table 1.

Next, we reviewed all coded segments for each code in Table 1. We returned to the transcribed interviews, as necessary, to help ensure accuracy of context and meaning of words and phrases. For example, the context of when and why students should "communicate" and "network" were verified and if the participant defined what was meant by "communicate" and "network". In addition, we considered the extent to which these phrases were represented and their importance relative to other factors discussed during the interview as part of our analysis.

Table 1. Key UI General Belief Codes (from participant's perspective)

Primary Code	Sub Code	Belief Definition
Beliefs about the self (i.e., interview participant)	Primary Function - Personal	Participants' self-reported primary work function and what a "typical week looked like".
	Primary Function – Career Center	The primary function of their Career Center from the participants' perspectives.
Beliefs about job acquisition KSAs	Traits to get hired	Characteristics needed by students to aid in getting a job offer; these may have extended beyond KSAs.
	Degree skills	Students' degree skills needed; may be technical or professional skills. Included participants' perception of the quality of these skills.
	KSAs to get hired	KSAs for knowing about and getting interviews for a job. These could be different from KSAs students needed to get their degree.
Beliefs about Students	Perception of students	Participants' perspective on what students believe are necessary KSAs to obtain a job.

Socializer Behavior Codes. Whereas the coding for Socializer Beliefs started with primary codes that were then divided into sub-codes, the coding for Socializer Behaviors started by identifying the behaviors and then grouping them based on the type of career development support provided to the student. First, we assigned a code to describe what the behavior was, for instance, an event or program or one-on-one counseling service. A second code was assigned to the behavior to classify how that behavior supported student career development and was assigned as career discovery, career skills, or job acquisition skills (or a combination of the three). Career discovery involves supporting students through the process of determining their career interests, which helps students better understand themselves but also the career opportunities that exist. Career skills involve supporting student development in skills that will be useful in their career, including both technical and professional skills (such as communication and teamwork). Job acquisition skills involve supporting the students in gaining the skills necessary for them to obtain a job offer, including job search skills, resume building skills, and interviewing skills. The student career development classification codes emerged after an initial review of the behaviors identified.

Cross Case Analysis. After analyzing each case site's data set for belief and behavior themes, we compared the themes present in one case for inclusion in the other case. Though the beliefs and behaviors reported by participants are not as simple as "exist or do not exist," we illustrated

our cross case analysis as a matrix mapping behaviors to each case site's belief themes. The results in Tables 2 and 3 show the case ordered descriptive[13] display of key belief and behaviors for MPRI and WPRI. Our case ordered matrix ensured we purposely looked for "what was not in the data" for each case.

Quality of Research

To ensure trustworthiness, we focused on accuracy of data collection and validity of interpretation.[14] In data collection, we used multiple interviews per research site and conducted the interviews using a protocol with sufficient probes to elicit participant meaning rather than relying on assumed knowledge. During interpretation, we used *Analyst triangulation*[15] and held regular research team meetings to review emerging findings and code definitions. Researchers at these meetings included those who conducted interviews and those who did not. We used an intercoder reliability[14] process such that multiple researchers reviewed coded segments and negotiated final code definitions to consensus. To improve validity, we drew on member checking[14] by presenting each case site synopsis to those stakeholders during case-site specific stakeholder meetings. The stakeholders were asked to review and comment on the synopsis and in all cases agreement with the content occurred during each meeting. In addition, the stakeholders did not add information to fill any gaps in the information they provided during the interviews.

Limitations

Our primary limitation was the small number of people interviewed at each site and, therefore, we may not have saturated the data set. However, our participants did include the key personnel, by title, at each location (e.g., director of career services and engineering liaison). In addition, a review of our findings with stakeholders at each site demonstrated that the themes developed accurately reflect our two case sites. Finally, our participants were subject matter experts regarding student career services for their respective universities.

Results

We organized our results by case site and then compared the sites. The results for each case site identified a predominant belief, written as a perception, regarding students' development of KSAs needed to acquire a post-graduation job. Next, we provide the "how" or the primary overarching actions (behaviors), described by participants, taken by career services and associated with those beliefs. Notably, the actions are also associated with a set of beliefs about how participants can best help students achieve the KSAs. Consequently, each section intertwines beliefs and behaviors in order to answer our questions about perceptions of the KSAs needed and how development of these KSAs is supported. Finally, we compare the two sites.

Case Site: MPRI

Perceptions of KSAs Needed: Students should develop their professional skills because these skills are as important as technical skills in acquiring a job.

According to the career service center at MPRI, companies know, and are satisfied with, the technical skill set of MPRI graduates. Thus, the participants from the career service center believe their mission involves working directly with students to round out the students'

"secondary skill set" and to assist them in obtaining a job with a company that matches the students' preference and personality. In summary, as stated by an MPRI participant, career services' job is to help students "gain all of the other secondary skill sets companies are looking for in a good hire." An example of a professional skill cited as important for students to receive a job offer included students' ability to communicate with others:

> *"It's taking that ego and knocking it down a notch or two and understanding that there also is a personal relationship side, that you can be as brilliant as you want to be, but if you can't communicate with others, whether it's other engineers or just other salesforce or just even a secretary, then you're going to have a problem in the workforce."*

MPRI career service professionals believe that some students "have a resistance to their technical engineering knowledge not being the primary focus" for obtaining a job; that is, the participants indicated that some of their students thought the only characteristic necessary to obtain a desired job should be their technical skills. The career service professionals at MPRI recognize, however, that professional skills are considered in hiring processes, "[t]he organization, the teamwork, the communication skill sets that companies come in here and that's how they [companies] rank out their hires because to a certain degree they [hires] know the technical skills."

MPRI provides support for students to develop their professional skills in several different forms, including individual counseling, group workshops, and sessions within a required first-year course. For individual counseling, the career service professionals try to identify which professional skills the student struggles predominately with and assists them in developing that skill further. The group workshops occur intermittently throughout the year and offer formal training on a specific career development topic. The MPRI career service professionals also have a role in a required freshmen course regarding both college and life skills. The course met once a week for a term and the career service professionals led sessions for two weeks utilizing small groups (10 – 12 people) and also two large group sessions. One large group session was on resume building and the other was on career fair expectations and performance. In general, the career service professionals try to impress upon the students that professional skills are very influential in getting hired for a position, and should be valued just as much as the technical skills they are working to acquire during their academic career.

How: Meeting students' career service needs requires targeted and personal support to students as they search for jobs.

The participants all believe that their university focuses on providing a personal touch to the students and are able to better align students with employers because of their one-on-one involvement. They connect this belief with the belief that the "relationship between employer and student is vital."   The one-on-one involvement of the career services center allows the participants to consider important traits and individually assist students. An example given involved a student who had difficulty in making eye contact which may be detrimental during an interview. Yet, as the participant stated, low eye contact does not mean the student does not have the skills to be employed:

> *"If you got that student that can't make the eye contact, that doesn't have the personal communication skills, it doesn't mean they can't be employed. It's 'What's going to be the best employer match for them?', and reaching out to the appropriate employer and saying, 'Hey, I've got this student that does not have these skills. However, they're the best programmer that you'll ever run across.'….Once you make that connection, the things take off."*

The career service professionals at MPRI recognized that some "students aren't going to participate in full fledge workshop[s], but they will respond to one-on-ones." In order to meet those students' needs, they make an effort to reach out to the students, often through email, to engage the students in career development related learning; in their words, they ensure they are "touching base with every single one of them on an individual level." In addition, they were assigned to different majors and contacted each student in the major prior to graduation to ensure they have the support they need to be employed by the time they graduate. The career service center hosts a company-sponsored, outdoor advertising event that attracts many students as well, the participants believe this event is important because it occurs in a casual setting that may benefit some of their students who are less skilled in formal interviews and to allow students and companies to network in a social setting that is "fun and stressless." Reportedly, students recognize the personal support by sharing receipt of job offers because, "They know that coming here to tell us that they got a job is almost as valuable as telling their parents because we are that invested in it."

How: Students need career development throughout their academic careers, and connections to career services need to start in the first year.

The career service professionals believed the school has a culture of students and career services working together throughout the student's time at MPRI but they believed students need direct intervention early. Reportedly, there were "only" two times students must meet with career service personnel, but they are the second and third weeks of their first year during a required course that includes "life skills." According to MPRI participants,

> *"We talk about expectations. We talk about the culture. We talk about what industry expects. We throw out an initial resume assignment. We'll show them what system we utilize and how to get on the system. Then, it's all cultural that takes over."*

This approach was seen by some as their mission and believed it is the culture of more than just the career service center,

> *"What my office and what our mission is really and it evolves or involves the entire campus, as far as taking this entering freshman and then basically over the next four years, exposing that freshman student into sophomore into Junior to become and to gain all of the other secondary skill sets companies are looking for in a good hire."*

The required first-year course established a relationship between the students and career service professionals early, and the staff worked to foster that relationship throughout the students'

academic career. This early relationship with the career center gives students an opportunity to understand the services offered and to begin developing their career thinking. The career service professionals at MPRI believed there was a culture of using and engaging with the career center at their institution, and they start fostering this culture from the very beginning of students' academic trajectories. This culture shows by the students' senior year as illustrated by a participant indicating it "is a part of the campus culture" for students to visit the career center in March before graduation to partake in an "exit interview" with the career service professionals.

Case Site: WPRI

Perception of KSAs Needed: Students need self-awareness and empowerment to acquire a job.

Similar to MPRI, technical skills do not seem to be a concern from the career services perspective at WPRI.

> *"I'd say engineering-wise, they're trained. This is[a] top-notch engineering school. There's no way you could survive and make it through if you didn't have great skills and abilities and just really the smarts to make it through here."*

When asked what skills and knowledge benefit students who are looking for a job, WPri indicated, "First and foremost, what is most important is for students to have awareness of themselves and of the world of work that's around them." They explained,

> *"Without it [self-awareness] I can't do anything else. I mean, you can be a great negotiator, a great interviewer. You can start a resume. You can have all these set of criteria in order to land a job, but if you really don't know who you are and what you want; you really struggle in this career development piece."*

Thus, the participants of WPRI indicated,

> *"We're in the business of helping students understand who they are and understand the opportunities that are available to them, and then empower them to make those decisions for themselves."*

To support students gaining awareness of themselves, WPRI offered services and advice during counseling visits. WPRI career service professionals offered assessments during individual counseling sessions "in order [for the students] to learn about what they are interested in." In addition, WPRI career service professionals believed that, "experience improves that awareness." Thus, they encouraged students to gain experience throughout college to help with their self-awareness, and WPRI career service professionals highlighted that experiences can be volunteer or employed roles. WPRI career service professionals highly encouraged students to participate in an internship, and they incorporated this sentiment into group presentations related to finding employment. The career service professionals also communicated the importance of internships to the parents of students during "parents' weekends," stating that parents are "huge influencers for the undergrads." WPRI believed internships not only assist students in gaining awareness about themselves but also exposes them to the different job opportunities that exist (i.e., awareness of the world). In addition to promoting internships, WPRI career service

professionals offered "career treks" that allow students to visit companies and hear from employees in different careers. WPRI also has a mentorship program that engages industry partners in presenting students with "a diverse range of opportunities."

WPRI believed that through the process of gaining awareness of themselves and the world around them, students should feel empowered to make career related decisions. WPRI participants indicated students are "working with career coaches on reflecting about their journey and what they're interested in."

How: Career services provides an optional service to support and empower students.

Though participants noted that some people, including some parents, believe the career services offered should be a required part of the undergraduate curriculum, the participants believed it should be optional to emulate real-world experiences students will encounter after leaving college.

> *"We force you to meet with your academic adviser, we force you to go to class in order to get a credit, and we force you to do homework. We get that, it's all part of the learning. This is the one thing that's going to be your experience for the rest of your life. It's time to grow up."*

The career service center participants from WPRI indicated they were, "committed to helping students through the lens of their communities" and to becoming more of a lifelong model for achieving career success. These recent changes to the career service center were intended to improve the number of students who want to engage in using the career service center. In an effort to engage students early in thinking about their careers, WPRI career service professionals were also putting significant effort into advertising. As an example, one participant described actions of their career coaches,

> *"[O]ur career coaches are getting out there. They're meeting with students in dining halls, in residence halls, in student clubs. They're sending them emails, they're doing meet-ups all over the place."*

Cross Case Comparison of MPRI and WPRI

Our findings for MPRI and WPRI revealed different philosophies for assisting students. Thus, we focused our cross case analysis on comparing the results of each case site via a side-by-side comparison. Considering findings from each case site and purposely looking for the same information in the other case site aided in a thorough comparison by insuring we had not neglected beliefs and behaviors that may be secondary to a case site's primary focus. Specifically, we looked for each case site's results in the other case. First, both MPRI and WPRI indicated supporting students in ways other than helping them obtain the technical skills necessary to earn an engineering degree. In comparison, MPRI focused their support through a formal process that requires students to participate in at least some career service meetings, and the career service personnel take a personal approach with students, getting to know them as individuals. Conversely, WPRI's approach was one of developing a service where students can choose to participate and that is intended to help students grow as individuals, presumably leading them to a job choice they will value. As noted in the methods section, after identifying

emergent key beliefs and actions for each school, we looked at the other university's data, and specifically for the beliefs and actions noted at the opposite university as a form of negative case-checking.[15] Our findings are summarized in two tables; Table 2 presents the results from examining WPRI for the themes in MPRI data and Table 3 presents the results when comparing MPRI to the themes present in the WPRI data.

Table 2. Cross Case Analysis Results Comparing WPRI to MPRI

Belief Theme (MPRI)	Behavior Theme Associated with Belief (MPRI)	Cross Case Finding Behavior (WPRI)
Importance of Professional Skills	-Individual counseling sessions to identify gaps in professional skills and advise for further development -Group workshops to help students develop professionally -Sessions in a required first-year course on life skills where they communicate the importance of professional skills	-Mentioned as a focus -Specific behaviors not articulated
Targeted Personal Support	-Career service professionals reach out to individual students to make sure they are getting the support they need -Personalized support for job search, including matching students with specific job opportunities -Required freshmen course establishes contact early and they continue to foster a relationship with student throughout their academic career -Tradition of student exit interview to discuss future career	-Offer opportunities for individual counseling -Long-term and personal relationships with students were not discussed or emphasized -Extensive effort is put into advertising services to students in an effort to get them to engage with the center
Required Support, Beginning in First-Year	-Two visits required during beginning of first year -Follow-up personal emails to encourage additional contact -Culture of providing support throughout entire undergraduate program	-Support is optional. -Intensifying advertisement in an effort to increase the amount of students, and their frequency of, using career services support

Table 3. Cross Case Analysis Results Comparing MPRI to WPRI

Belief Theme (WPRI)	Behavior Theme Associated with Belief (WPRI)	Cross Case Finding Behavior (MPRI)
Student Self-Awareness and Student Awareness of the World	-Student assessments to identify interests and strengths -Encourage students to experiment and engage in a variety of experiences, including volunteer and employed positions - Offer career treks (i.e., company site visits) -Job database and career fairs including opportunities from a variety of job sectors -Mentorship program with alumni and industry partners	-Encourage students to do internships Individual counseling sessions to identify gaps in professional skills and advise for further development -Have a school-funded internship program - Job database and career fairs including opportunities from a variety of job sectors -Support job recruitment talks from employers -Site visit to a single company mentioned
Optional Support Aimed at Developing a Lifelong Model for Career Success	-Students are not required to engage with the career center or to use their services -Invest in extensive advertising and outreach to engage students early -Researching methods to determine how best to engage students early and best meet their needs	-Required first-year course that exposes students to career services and gets them thinking about their career from the beginning of their academic trajectory -Personalized follow-up with students to ensure student career service needs are being met

Beliefs about KSAs Needed. WPRI career services emphasized wanting to help students gain an understanding of themselves and the world around them, whereas MPRI career services emphasized helping students improve their professional skill sets. MPRI career service professionals did not emphasize opportunities for students to gain awareness of themselves and did not mention offering assessment tools for students to use to determine their interests. MPRI does offer some experiential learning opportunities and encourages internships, but these are often encouraged as a way for students to build their resume and not as an opportunity for student self-discovery.

How KSA Development is Supported. Both MPRI and WPRI mentioned wanting early and continued student engagement in career thinking and the services offered by their career center. MPRI has achieved this goal through required interaction with students from the start of their undergraduate careers and continuous personal outreach. MPRI indicated being able to maintain their relationship with students from entrance to exit of their engineering program and credit a school "culture" of having a one-on-one relationship with students. WPRI was working to develop empowered engagement; career services personnel have started collecting feedback and information from students in an effort to learn more about student thinking at different stages in their academic careers. WPRI career service professionals have also worked to improve their advertising approach by visiting dining and residence halls to reach out to and engage with students.

Discussion

We set out to explore what KSAs career service personnel perceive as important to assist undergraduate engineering students during their process of obtaining their first post-graduation job and how they attempt to provide assistance to support students. Our findings demonstrate similarities and differences across the sites with regard to perceptions of essential KSAs to get hired, actions taken by our participants to help students develop those KSAs, and the culture associated with each case site regarding the role of career services. Importantly, it is not our intent to suggest that one school's way of supporting students is better than another school's way. Rather, our hope is that making different possibilities visible can help career services, students, and faculty to all better engage in the process of helping students develop the skills needed to acquire jobs.

Our findings suggest that the career services professionals at each case site believe that the school's reputation provides confidence to employers that the engineering students who graduate from their school will have sound technical skills. This is consistent with a general emphasis on technical skills within engineering programs.[16, 17] However, both career service centers believe that additional KSAs are needed; MPRI focuses on professional skills while WPRI focuses on self-awareness and empowerment. In addition, participants at both case sites believe a key distinction between what career services provides and what faculty provide is with regard to developing KSAs beyond the technical skills required for obtaining an engineering degree.

Participants from both career service centers believe that students must value the services being provided in order for the services to be effective. This could prove challenging as research

regarding engineering students and early career engineering professionals suggests that engineering students lack awareness of the importance of the KSAs beyond technical skills to becoming an engineer; it is not until engineering graduates engage in the workforce that they begin to value professional skills.[18]

Consistent with the depiction EVT shown in Figure 1, socializer's beliefs and behaviors are connected.[8, 9] In the context of our study, each center offers services consistent with beliefs about the best ways to help students gain the skills they think are most needed. To illustrate this point, consider the interpretations of the need for experiences such as co-op, internship, or volunteer work. Of interest is the implied purpose for these experiences. MPRI suggested the value of the experiences was to support resume building and provide examples to use during job interviews. WPRI suggested the importance was to help students gain an understanding of the world around them. Similarly, the career services personnel at both case sites desire to engage students early in their academic career to help students think about how they can prepare for their future careers. Yet, their philosophies and approaches to student engagement vary. MPRI uses a personalized approach that includes a required course, personalized follow-up, and individual exit interviews. WPRI uses a more voluntary approach believing students should make the decisions on their own as it will better prepare them in the long term. WPRI also uses extensive advertising and conducts research to better understand students' needs and how to engage them.

Our framework of EVT proved beneficial for our analysis, and we note that the apparent role of university and career service culture appears intertwined with their beliefs and behaviors. Due to our research being exploratory, we do not fully know how this triad interacts. However, our results suggest that much of what career services base their decisions on emerged from their beliefs about students. Thus, it is important to ensure their beliefs are accurate and up-to-date. Future work of PEPS will benefit career service personnel, faculty, and students by addressing student beliefs and behaviors via surveys and interviews.

Conclusions, Implications, and Future Work

In conclusion, there are multiple approaches used with the common goal of assisting college engineering students in obtaining a career and being successful in their chosen career field. In both of our cases, behaviors aligned with beliefs within each case and culture emerged as a key characteristic.

Our findings have implications for career service center personnel, faculty, and students. In both of our cases, career service center personnel were able to articulate their beliefs about students and how students could best be supported. The programs were then structured consistently with these beliefs. However, in practice, this may not be as easy as it seems. As demonstrated by WPRI, communicating the purpose of and services offered by career service centers could be important in helping to engage students in their services. Additionally, students may not appreciate the importance of career service's benefits until it is in hindsight. Faculty could contribute by taking note of two aspects of this study. First, our study provides a reminder that KSAs other than technical skills are needed to acquire a job. Thus, faculty may want to consider how they can support development of professional and job acquisition skills within the teaching of technical skills. Second, faculty could become more aware of the services offered by career service centers on their campus. Such awareness would enable faculty to refer students to

appropriate resources. Similar to faculty, students could take note of the importance of non-technical skills in acquiring a job and they could actively engage with the career service centers on their campus.

Our research points to several avenues of future work that would support developing and understanding how students navigate pathways to first post-graduation jobs. EVT posits that socializers' beliefs and behaviors impact the choices students make.[8, 9] To validate this theoretical claim for our context, we need to examine student outcomes and how they relate to the approaches taken by career service centers. Within the larger PEPS project, longitudinal student surveys are planned which will capture information on student's first jobs out of college and the extent to which the career services centers played a role in assisting the student seek and obtain their first job. In addition, the larger PEPS project may be able to provide feedback to the career service centers on the short term versus longer term (3 – 5 years out) impact of the support they provide.

Another important area of future work is to expand our analysis to include all six partner schools within the PEPS research project. We intentionally chose the six sites to represent diversity in cases. Determining if and how current findings manifest within the data from the remaining partner sites will enhance the transferability of our findings.

Acknowledgements

References

1. National Academy of Engineering *Grand challenges in engineering*. 2008.
2. Frehill, L.M., *The Society of Women Engineers National Survey about Engineering: Are women more or less likely than men to be retained in engineering after college*, in *SWE Magazine*2007. p. 22-25.
3. Lowell, B.L.a.S., H., *Into the eye of the storm: Assessing the evidence on science and engineering education, quality, and workforce demand.*, 2007, Urban Institute: Washington, D.C.
4. Jamieson, L. and J. Lohmann, *Creating a Culture for Scholarly and Systematic Innovation in Engineering Education: Ensuring US engineering has the right people with the right talent for a global society*2009, Washington, D.C.: American Society of Engineering Educators (ASEE).
5. Sheppard, S.D., K. Macatangay, A. Colby, and W.M. Sullivan, *Educating Engineers: Designing for the Future of the Field*2008, San Francisco, CA: Jossey-Bass.
6. Shuman, L.J., M. Besterfield-Sacre, and J. McGourty, *The ABET "Professional Skills" — Can They Be Taught? Can They Be Assessed?* Journal of Engineering Education, 2005. **94**(1): p. 41-55.

7.   Sampson, J.P., J.G. Lenz, R.C. Reardon, and G.W. Peterson, *A Cognitive Information Processing Approach to Employment Problem Solving and Decision Making.* The Career Development Quarterly, 1999. **48**(1): p. 3-18.

8.   Eccles, J.S., *Families, schools, and developing achievement-related motivations and engagement*, in *Handbook of socialization: Theory and research*, J.E. Grusec and P.D. Hastings, Editors. 2007, Guilford Press: New York, NY. p. 665-691.

9.   Eccles, J.S., T.F. Adler, R. Futterman, S.B. Goff, C.M. Kaczala, J.L. Meece, and C. Midgley, *Expectancies, values, and academic behaviors*, in *Achievement and Achievement Motivation*, J.T. Spence, Editor 1983, W. H. Freeman: San Francisco, CA. p. 75–146.

10.   Yin, R.K., *Case study research: Design and methods*2009, Los Angeles, Calif.: Sage Publications.

11.   The Carnegie Foundation for the Advancement of Teaching. *The Carnegie Classification of Institutions of Higher Education*. 2010 [cited 2010 October 1, 2010]; Available from: http://classifications.carnegiefoundation.org/.

12.   Patton, M.Q., *Qualitative Research & Evaluation Methods*. 3rd ed2002, Thousand Oaks: SAGE Publications.

13.   Miles, M.B. and A.M. Huberman, *Qualitative data analysis: An expanded sourcebook (2nd Edition)*1994, Thousand Oaks, CA: Sage Publications, Inc.

14.   Creswell, J.W., *Research design: Qualitative, quantitative, and mixed methods approaches*. 3rd ed2009, Thousand Oaks, CA: Sage Publications, Inc.

15.   Patton, M.Q., *Qualitative research and evaluation methods*2002, Thousand Oaks, CA: Sage Publications.

16.   Shuman, L., M. Besterfield-Sacre, and J. McGourty, *The ABET "Professional Skills" - Can they be taught? Can they be assessed?* Journal of Engineering Education, 2005: p. 41-55.

17.   Matusovich, H.M., M.C. Paretti, A.m. Motto, and K.C. Cross. *Understanding Faculty and Student Beliefs about Teamwork & Communication Skills*. in *Proceedings - American Society for Engineering Education Annual Conference and Exposition*. 2012. San Antonio, TX.

18.   Winters, K.E., H.M. Matusovich, S. Brunhaver, H.L. Chen, K. Yasuhara, and S. Sheppard. *From Freshman Engineering Students to Practicing Professionals: Changes in Beliefs about Important Skills over Time*. in *American Society for Engineering Education Annual Conference and Exposition*. 2013. Atlanta, GA.