Engineering Education Ph.D. Students: Where Are They Now And What Was The Job Search Process Like?

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I was accepted into the Mechanical Engineering major during fall semester 2012 of my sophomore year. As a junior Mechanical Engineering student I continue to work towards my major along with a minor in Business Entrepreneurship to help me pursue a leadership role in the engineering field. Coinciding with my academic career I enjoy being a member and leader of multiple organizations. I have been a member of Green Engineering Scholars since my freshman year. Within the program I worked on my teamwork skills by participating in many volunteering and engineering events with fellow members. I also help plan events and projects for the program as a member of both the social and mentorship committees. As the Ohio State University Pistol Club Vice President I have gained valuable experience as a leader; teaching members how to properly and safely handle a pistol. Besides being involved with these activities I enjoy volunteering for my high school Science Olympiad team. I help coach and run events for the team when they attend invitationals in Ohio, Pennsylvania, and Michigan. I enjoy going back to help the students learn more about science and engineering and my career at Ohio State University enables me to teach them.

As an Engineering student I have been an intern for multiple companies. When I interned at Case Western Reserve University I helped collect research data for a study the school of nursing was conducting. Part of my role as a research assistant was to document the research process with interactive adobe software. Later, the school published the interactive article I created. At Rockwell Automation I helped program and design updates to air handler units for General Mills. I gained hands on experience while working directly with the customer through the design and installation processes. Last summer I interned at General Electric Healthcare within the MRI coils division. My internship role gave me extensive experience with designing mechanical components and testing fixtures for MRI Coil assemblies. Then, I completed numerous verification and validation tests for the components to make sure they complied with strict medical classification standards. I am currently an Undergraduate Teaching Assistant for the First Year Engineering Series. My role entails helping the students understand the material by answering their questions, grading their papers, and tutoring them on difficult subjects. I greatly enjoy teaching the students because they are extremely fascinated with engineering and love to learn.

Being a top engineering student is a key component to my goals which will carry into my career. I would like to pursue a Masters in Engineering and work at a prestigious Engineering company once I graduate where I can apply my knowledge of business entrepreneurship to the field of engineering. I also hope to work for a university as an engineering professor and counselor after gaining experience in industry so I can use my education and experience to help new engineering students on their path to graduation. Receiving a scholarship would enable me to spend more time focusing on my academics, community service, and student organizations without the burden of how to pay for my education. The schooling that I would gain from receiving a scholarship will greatly enhance my future and set me up for success.

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Abstract

Engineering education as a research field is ever growing with more programs being developed that offer a Ph.D. specifically in the discipline. With this evolution, it is important for prospective and current students to understand what jobs are available for individuals who obtain such degrees after they graduate and what experiences in the job search process are like. We hypothesize that as the field has evolved so has the job search process and market for individuals with these types of degrees. This "Tricks of the Trade" paper provides information related to the hypothesis through a mixed methods research project grounded in Q methodology that targeted those who have recently received a Ph.D. specifically in engineering education.

Introduction

Although engineering education has been studied for many years, it has only recently become a recognized field of formal research, with the first Ph.D. in Engineering Education granted by Purdue University in 2006.[1] Before this time, there were many researchers in engineering education who joined the field through different pathways, but now the number of institutions offering a Ph.D. in engineering education has increased. Likewise, the number of professionals entering the field through a Ph.D. program has risen dramatically. As with any emerging professional field, the job market for engineering education professionals can be unstable and unpredictable as the new professionals of this field make careers for themselves.

It is important for both prospective and current engineering education graduate students, as well as those advising engineering education graduate students, to have an accurate view of the current job market and how to go about the search for a job in the field. For example, what positions can these new professionals hope to fill, and what will their careers look like? Is the field receptive to the expertise that these individuals can offer, or must they work hard to find a place for themselves? This paper provides a glimpse at the current job market to answer these questions, as well as suggests tips for finding a desired job in the field of engineering education. We hypothesize that as the field has evolved over the last 10 years, so has the job search process and job market in the discipline. This "Tricks of the Trade" paper provides data on the engineering education job search process through a mixed methods Q methodology based research project targeting those who have recently received a Ph.D. specifically in engineering education to answer the research question: *What are recent graduates' views of the engineering education job search process, and what types of positions are they obtaining?*

Background

Around 2005-2006, the field of engineering education expanded with two major events. First, the *Journal of Engineering Education* officially moved to a research focused journal[5, 6] and Purdue University granted its first Ph.D. in engineering education.[1] Before that time, researchers entered engineering education through a variety of pathways[2], which directly contributed to the ever expanding and interdisciplinary nature of engineering education. (For additional

information on the history of engineering education please review the article by Jesiek, Newswander, and Borrego.[7]) As the field began to change, more programs were developed aimed at producing graduates with Ph.D.s specifically in engineering education. According to the Engineering Education Community Resource Wiki which was created by the ASEE Student Division (SD) in collaboration with the Center for Engineering Learning & Technology (CELT), just over 15 programs currently offer a graduate degree in engineering education or a closely related field (for a up-to-date listing of these programs, visit engineeringeducationlist.pbworks.com).[8] Paralleling this growth, is an increasing number of engineering education positions. The Engineering Education Community Resource Wiki also contains a list of engineering education job postings, which currently lists over 120 jobs related to engineering education. [8] As the field of engineering education continues to grow and expand, it is important to understand where engineering education graduates are working, what their job search processes were like, and how the job search process has evolved over time.

Past researchers have explored this topic, most notably Adams and Cummings-Bond[3] and Borrego.[4] While the scope and focus of our study is different than past research, their findings help build an understanding of the development of the job market in engineering education and aid in understanding if progress has occurred. In 2004, Adams and Cummings-Bond[3] wrote a manuscript detailing the career trajectories of three groups of researchers involved in engineering education. They focused their work on those who received an ASEE Educational Research Methods Apprentice Faculty Grant, those who received an NSF CAREER award, and those who received a Ph.D. for a thesis centered on an engineering education topic. Their work revealed that for individuals in these three groups, careers in engineering education were possible and that which of the three categories the research participants were in had an impact on the career trajectories available to them. It was found that additional work was needed to truly understand long term career pathways such as earning tenure because the volume of professionals that have been in the field long enough to reach tenure was low.

Expanding the timeframe for understanding trajectories, Borrego[4] studied the careers of engineering education researchers by focusing on reviewing job postings and conducting a survey of engineering deans. Borrego summarizes her findings in her 2006 manuscript:

> The results suggest that engineering education program graduates will be competitive for a variety of staff and faculty positions in colleges and schools of engineering. However, availability of tenure track positions will be limited, as a Ph.D. in the discipline is generally required and very few Engineering Education departments currently exist.[(4, p. 1)]

Borrego's results can be considered a prediction of the today's engineering education job market: jobs will be available, but tenure track positions will be limited.

Borrego's predictions were published in the year that the first engineering education doctoral student graduated. Today, eight years later, we can examine the current job market to validate and expand on her findings and to provide information to current and prospective engineering education students. Based on a high level examination of the Engineering Education Community Research Wiki, we see that 25 of the postings are for entry-level, tenure track positions with 15 of those positions in departments that do not grant graduate engineering education degrees. [8]

This indicates that there may be more tenure track positions available than initially predicted. However, engineering education graduates are competing with discipline-specific engineering graduates, so it is not clear how many engineering education graduates are placed in these positions. There are nearly 100 total entry-level positions, which indicates there is a variety of available positions (e.g., postdoctoral scholar, and instructional designer). Finally, with 20 postings for advanced positions (e.g., assistant dean, department chair, tenure track at the associate/full level), we see that there is recognition of the need for advanced engineering education experts. While this examination of job postings does provide an indication of the current job market, there is a need to examine engineering education career paths in more detail to determine which positions engineering education graduates are actually obtaining. Our work fills this gap and builds on Borrego's[4] predictions by examining the current market through the experiences of recent graduates. Specifically, we survey recent graduates to better understand their job search processes and to build a landscape of engineering education career opportunities today.

Methods

To explore the current positions and job search process of those with a Ph.D. in engineering education, we employed Q methodology and gathered data from a Q sort and set of demographic questions administered as an online survey through www.qsortware.com. As stated on the Q Methodology: A Method for Modern Research website "Q Methodology is a research method used to study people's 'subjectivity' -- that is, their viewpoint."[9] We chose this methodology and method of administration to allow for the perspectives of the participants to be the focus and to allow us to better understand similarities and differences across job search experiences in engineering education. For both the development and analysis of our survey we followed the recommendations of Steven R. Brown, which can be publically accessed at http://qmethod.org/howto.[10] It should be noted that while Q Methodology has not be applied to study our particular topic in the past, it has been used in other areas of educational research.[(e.g., 11, 12)]

Instrument

Our instrument was a survey consisting of a Q sort and demographic questions all related to current positions held by participants and the engineering education job search process. Using the Q sort as a method for gathering data allowed us to look for correlations between statements across participants. The method assisted in rating the importance of each statement compared to all the statements provided. This differs from traditional Likert scale questions that require the user to evaluate each statement independently. We chose a Q sort so that participants would critically evaluate their opinions on the statements as a whole to provide a more holistic view of their experience evaluating each statement in reference to the other. In total, participants evaluated 30 statements. Each statement was rated and placed into one of seven categories (strongly agree, agree, somewhat agree, neutral, somewhat disagree, disagree, and strongly disagree). The layout used by participants for their sort can be seen below in Figure 1 where one statement was placed into each of the 30 blocks. It should be noted that vertical placement was not a factor in the analysis (i.e., only the columns factor in the analysis, not the rows). In typical Q sort methodology, the headings for the sort would be number rankings (e.g., -3 to 3 where 0 is

the middle column), but due to the independent and online nature of our survey, we believe providing typical Likert-type headings provided guidance for the participants (e.g., the middle column corresponds to neutral while would typically be represented by 0 in a Q sort).

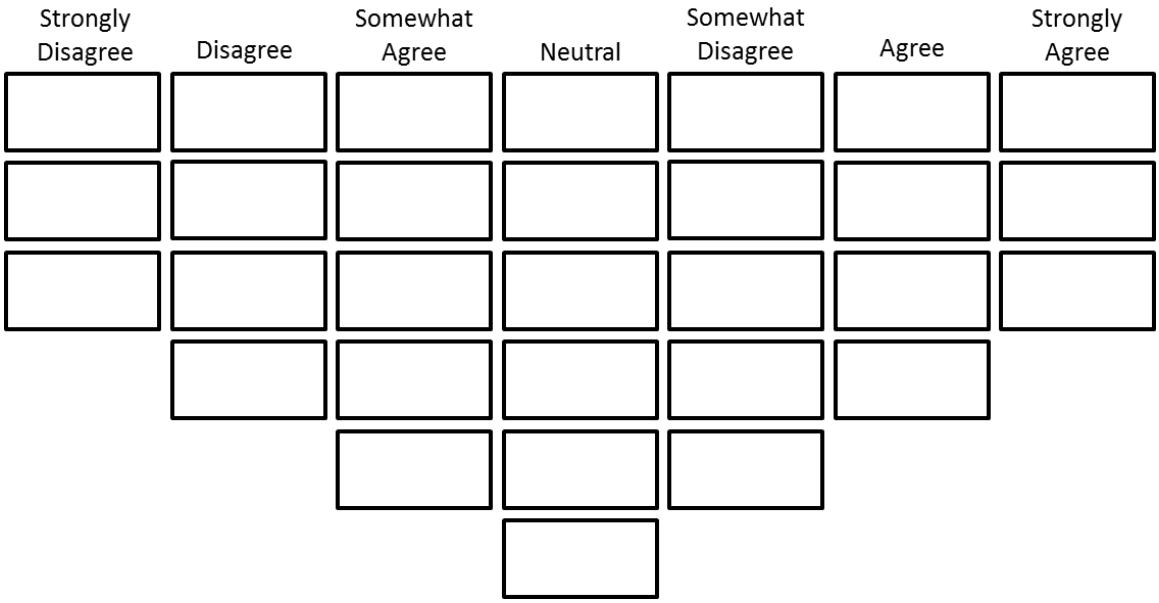

Figure 1: Q Sort Arrangement

The 30 statements ranged from questioning the ease of the job search process to their opinion of their current position and the work their position entails. The statements were developed through an iterative process that involved creating, revising, removing, and adding statements. All the authors of the paper participated in the statement development phase. The final list of statements can be found in Appendix A.

Following the Q sort, participants were asked to answer 12 demographic questions related to their job search. These questions were limited to their current position and job search and did not ask typical questions regarding race, gender, age, etc. We purposefully chose not to gather this information to help ensure confidentiality and anonymity in our study as the potential sample was small. Future work will look to include this information as the sample is broadened. These demographic questions can also be found in Appendix A.

To ensure trustworthiness in our findings, we had two individuals outside of the research team and intended participant pool review the statements for wording and clarity before the survey was administered. These individuals will graduate with a Ph.D. in engineering education in the next few years so we believed they could provide a unique perspective regarding this topic as they are the immediate audience for this work. During their review, we also had them consider if any statements were missing that would be beneficial for understanding the job search process in engineering education. Additionally, the final instrument was pilot tested with two members of the research team who did not assist in creating the final survey to determine timing and to adjust the directions for the Q sort as needed. This process helped to establish a well-crafted

instrument. The survey took approximately twenty minutes to complete and all research activities were conducted in accordance with approved human subject research protocols.

Participants

For our study, we contacted recent graduates of two programs at two different universities that offer a Ph.D. specifically in engineering education. This yielded a potential participant pool of 42. We purposefully limited our potential participants to those who have graduated in the last five years as we believe the job market has changed remarkably since the initial emergence of these programs as discussed above. Additionally, we recognize that programs other than the two we focused on offer the same degree or very similar degrees. However, we believe this approach provides us with a strong baseline for answering our research question because all students graduating from these programs have common qualifications providing stability across our sample.

In the end, we collected 13 responses, a 31% response rate. While this is a small sample size, we believe the survey responses collected provide us with a strong representation of the experiences of engineering education Ph.D. students. It should be noted that two of the responses came from two authors on this paper that were part of the potential participant population. While including these individuals is not typical educational research practice, we chose to include them in our analysis because of the small population of interest.

Analysis

Our analysis consisted of two parts. The first dealt with the Q sort data and used Q methodology principles to determine participant groups or clusters based on responses, which are referred to as factors. The second part included simple quantitative statistics using data from both the Q sort and the demographic sections of the survey.

The Q methodology analysis techniques followed recommendations of Brown[10] and used the PQMethod analysis software. For this part of the analysis, a principal component factory analysis was first conducted to determine the correlation between the various Q sorts gathered from the participants. Following that initial analysis, a varimax rotation was conducted to determine the number of factors (or groupings of participants) present in the data. This analysis revealed two distinct factors in the sample, which are discussed further in the results and discussion section.

Demographic questions were analyzed with respect to the two factors identified to determine possible trends within the factors. Due to the small sample, and even smaller subsamples for each factor, analysis was limited to counts and averages.

Results and Discussion

We begin our results and discussion with an overview of the demographic information collected from our participants.

Table 1: Participant Demographics

Questions		Responses	Number	Percentage
Current Position		Tenure Track	5	38%
		Non-Tenure Track	8	62%
Number of Different Positions Since Graduation		0	1	8%
		1	8	62%
		2	4	31%
Ever Held a Post Doc		Yes	4	31%
		No	9	69%
Job Search Occurred…		After Degree	1	8%
		Before Degree	12	92%
Initially Apply To X Jobs		2-5	5	38%
		6-10	2	15%
		More than 10	6	46%
Search Method	Email Listserves	Yes	13	100%
		No	0	0%
	Institutional Websites	Yes	13	100%
		No	0	0%
Limitations	Geographic Restriction	Yes	7	54%
		No	6	46%
	Tenure Track Only	Yes	2	15%
		No	11	85%
Interviews	Phone	1-2	3	23%
		3-4	7	54%
		5 or more	3	23%
	On-Campus	0	1	8%
		1-2	5	38%
		3-4	7	54%
Job Offers		1	4	31%
		2	6	46%
		3	3	23%

The majority of our participants held non-tenure track positions (62%), held only one position since graduation (62%), and did not participate in the post-doctoral pathway (69%). Nearly all participants searched for their initial job before obtaining their degree (92%). With respect to the number of jobs participants applied to, participants either restricted their job search to a minimal number of positions (38% applied to 2-5 jobs) or applied to a large number of open positions (46% applied to more than 10 jobs). During the job search process, all participants utilized email listserves and institutional websites, and half the participants restricted their search to a specific geographical region (54%). Only two participants (15%) limited their job search to tenure track positions. As a result of the job search process, nine of 13 participants (69%) received multiple job offers.

Continuing our presentation of results and discussion as mentioned in the analysis section, there were two distinct factors or groupings for the participants' responses to the Q sort. Six participants loaded to Factor 1 and three participants loaded to Factor 2. The remaining four participants did not load to a factor indicating their responses were not highly correlated to the other participants' responses which is common for a small sample. If we were to expand the sample or rotate the data in a different way, we may be able to load the remaining four participants on a new factor, but this is beyond the scope of this project.

Below in Table 2 are the most salient statements for each factor including which category the statement would have fallen under. All of these statements had a p-value < 0.05 indicating the z-score for these items was significantly different than the z-score for the other factor regarding these statements.

Table 2: Salient Statements by Factor

Factor 1	
Strongly Agree	I believe my current position is a good fit for someone with a Ph.D. in engineering education.
Agree	My current position involves service.
Agree	Finding positions I wanted was time intensive.
Neutral	During my job search, my engineering education Ph.D. made me a more desirable candidate than someone with a traditional engineering Ph.D.
Disagree	Finding positions I wanted was easy.
Strongly Disagree	There are many industry jobs available to engineering education Ph.Ds.
Factor 2	
Strongly Agree	Personal networking with someone already employed at an institution played a strong role in obtaining my first position after obtaining my Ph.D.
Strongly Agree	In my current position, those with discipline-specific engineering degrees view an engineering education Ph.D. as less rigorous.
Agree	During the job search process, I typically found engineering education oriented jobs to be teaching focused and non-tenure track positions.
Neutral	Finding positions I wanted was time intensive.
Neutral	Finding positions I wanted was easy.
Somewhat Disagree	My current position involves research.
Disagree	By graduation, I had secured my number one job choice.
Strongly Disagree	In general, people understand that a Ph.D. in engineering education equates to research capability rather than simply "teacher training".
Strongly Disagree	During my job search, my engineering education Ph.D. made me a more desirable candidate than someone with a traditional engineering Ph.D.

Focusing on the statements on the extreme ends of the spectrum, Factor 1 reveals that some engineering education graduates are obtaining positions that are a good fit for them. Additionally we see that current graduates fitting into Factor 1 believe there are not many jobs in industry for those with an engineering education Ph.D. Factor 2 reveals that personal networking can be a strong influence in obtaining a job. However, those with discipline specific engineering degrees view engineering education degrees as less rigorous. Factor 2 revealed the perception that having a Ph.D. in engineering education did not make you a more desirable candidate than someone with a traditional engineering Ph.D. and that many "outsiders" perceive the engineering education Ph.D. as "teacher training" rather than associating it with research. With all of these statements additional research is needed to parse out why recent graduates hold these beliefs, but this research has taken the first step in understanding the current job market.

Our results are somewhat consistent with Borrego's[4] survey of Engineering Deans. Her survey results indicated that engineering education graduates would encounter negative perceptions of their degree's rigor. This negative perception is strongly reflected in Factor 2 where participants agreed with the statement that those with discipline-specific degrees view engineering education degrees as less rigorous and more in line with "teacher training." Our survey of engineering education degree holders finds that negative perceptions of rigor still exist seven years after Borrego surveyed engineering deans. This view may also be reflected in the low number of participants holding tenure track positions. If recent graduates of established programs in the field are not holding tenure track positions, questions regarding the validity of the profession surface including higher education's commitment to the discipline.

Interestingly, neither Factor 1 nor 2 indicated that an engineering education Ph.D. equated to a more desirable candidate status when applying for jobs as a salient statement. This result should be further explored since it was reported in both factors. For instance, did participants apply to mostly discipline-specific positions? If so, it may be natural that engineering education applicants were not more desirable. However, it also indicates that in a competitive job market, those type positions may be closed to engineering education degree holders. If participants applied primarily to teaching-centered or advising positions that, from an engineering dean's perspective, are more closely aligned with engineering education degrees[4], then this common result between both factors is troubling. Noteworthy, while these negative perception factors exist, they are mitigated by the fact that all 13 participants indicated that they were currently employed.

Lastly, our final analysis involved investigating differences between the two groups. Table 3 lists demographic counts for the two factors. No significant patterns or differences emerged from our analysis. We believe this is primarily due to the small number of participants, and even smaller number of sub-participants for each factor. Small differences between the two factors were identified in the Notes column of Table 3. These differences (e.g., no participant in Factor 2 participated in a post doctoral position) could be used to aid the design of future studies investigating the engineering education job search process and job market.

Table 3: Participant Demographics by Factor

Questions		Responses	Factor 1	Factor 2	Notes
Current Position		Tenure Track	2	0	No TT for Factor 2
		Non-tenure Track	4	3	
Number of different positions since graduation		0	0	0	None
		1	3	2	
		2	3	1	
Ever Held a Post Doc		Yes	4	3	No postdoc for Factor 2
		No	2	0	
Job Search Occurred		After degree	0	1	One Factor 2 after degree
		Before degree	6	2	
Initially Applied to X Jobs		2-5	3	0	Factor 1 tended to apply for fewer jobs
		6-10	1	1	
		More than 10	2	2	
Search Method	Email Listserves	Yes	6	3	None
		No	0	0	
	Institutional Websites	Yes	6	3	None
		No	0	0	
Limitations	Restricted Geographic	Yes	2	3	Majority (67%) of Factor 1 did NOT restrict
		No	4	0	
	Tenure Track Only	Yes	2	0	Two Factor 1 limited to tenure-track
		No	4	3	
Interviews	Phone	1-2	1	0	None
		3-4	3	3	
		5 or more	2	0	
	On-Campus	0	0	0	Factor 1 had slightly more interviews
		1-2	2	2	
		3-4	4	1	
Job Offers		1	2	0	None
		2	1	3	
		3	3	0	

Despite the small number of responses, which was expected due to the recent nature of graduates with a Ph.D. in engineering education, we were still able to see trends in the data that help in understanding the engineering education job search process. Most notably, our results parallel the work of Borrego[4] in that there are still barriers and challenges for engineering education Ph.D. graduates.

Limitations

First and foremost, we recognize the limited scope of our sample and believe our work is only generalizable within the bounds of our target population. Additionally, there may be some response bias with our findings. Due to the limited sample and the limited number of responses, it is possible that the information documented here only relates to this subset of the population. For example, it is possible that recent graduates without jobs did not respond to the survey which

would possibly skew the results in the positive direction. We acknowledge this possible limitation and hope to address it with future work. Also we have reason to believe that some of the survey responses submitted by participants were not being captured, and we are unsure as to how many responses we may have missed. Despite this shortcoming, we believe we still collected a range of responses over time related to the job search process in engineering education as shown by the two factors. A thorough analysis of the responses was conducted through a targeted internal member checking process that revealed that the responses that were collected were accurate.

Future Work

The first piece of future work for this study would be to expand the potential participant population to those who are receiving engineering education degrees or closely related degrees beyond the two universities we recruited from. As programs that specifically offer a degree in engineering education continue to grow and develop, we suspect that graduates of these types of programs will provide information about the typical job search experience in the field. Future work may explore others who participated in different types of programs to provide a wider view of those who are entering engineering education as professionals and how their job search may be uniquely different or the same based on their education and experiences. This expansion of the potential participant pool would provide more information about the job market in terms of what types of individuals are applying for engineering education jobs. Future analysis of this type of data could examine trends in recent graduates' applications and job acceptances helping us to better understand what engineering education positions look like. Additionally as an area of future work, we would like to continue our investigation into Q methodology implementing this study using other software and more likely conducting the Q sorts in a one-on-one interview session. This would allow more flexibility in the sorts which may reveal new findings regarding this topic.

Recommendations

In keeping with the "Tricks of the Trade" nature of this paper, we would like to offer recommendations to future researchers based on our experiences conducting this work. For this project, we employed a methodology new to us, which included a recently available software package. Using a new software package proved to be challenging in that it was still being developed and did not work entirely as intended. For future researchers, we recommend not combining a new methodology with a new software package on a project or building in enough time in your research project to fully vet both. While we took several steps to ensure our work is sound (e.g., testing the software to ensure it stored answers appropriately), the process of completing this study would have been easier with foresight into this area. Additionally, we recommend that future researchers try new methodologies and approaches to their work. We began this study based on personal interests but hope to pursue it in the future as it seems to be a promising line of work with great potential. If we did not venture out of our comfort zones for this project, we may not have uncovered our interesting results.

Additionally, we would like to offer recommendations to recent graduates of Ph.D. programs in engineering education. First, when applying to jobs be opened minded and never give up. Based

on the results of our work, many individuals outside of the engineering education community still do not understand what engineering education is or the value that engineering education degree holders bring to the academic setting. With that, recent graduates need to be willing to apply for a variety of jobs. Second while there may be some misunderstanding about engineering education Ph.D.s, recent graduates are being employed, which is a strong positive for the field. The career paths of these individuals may not be what they expected when they began their journey in the field, but they are making a place for themselves. Finally, based on our findings and on our own personal experiences, we recommend that recent graduates network and communicate with those both in engineering education and outside of the field. You never know when a job opportunity will arise, so staying well connected will help you in your job search process.

Conclusions

Engineering education as a career field is still developing and changing. While our results parallel those of past researchers, we also observed developmental changes in the job search process that demonstrate progress. For example, 40% of respondents indicated that they held tenure track positions. Additional research is needed to better understand the nuances of the engineering education job market, but this work has taken steps towards that understanding.

Finally, it should be noted that this work provides a snapshot in time of the career paths for those with a Ph.D. in engineering. As the field continues to evolve, additional studies will be needed to keep a true pulse on the job market and the ever changing landscape. One recent change that will likely affect the job market is the future graduation of students involved in bachelor programs in engineering education.[(e.g., 11)] Currently these programs are new and their graduates will have their own job markets to explore, but as they continue to develop and graduate students, we suspect they will directly affect the job market of those with a Ph.D. in engineering education. Future work is needed to better understand these new developments in the field as well and how they impact the career pathways and the job market for all recent graduates.

References:

1. Purdue University, School of Engineering Education. (2014). *History*. Retrieved from https://engineering.purdue.edu/ENE/AboutUs/History
2. Adams, R., Fleming, L., & Smith, K. (2007). *Becoming an engineering education researcher: Intersections, extensions, and lessons learned among three researchers' stories.* In Proceedings of the International Conference on Research in Engineering Education (ICREE), Honolulu, HI.
3. Adams, R., & Cummings-Bond, R. (2004). *Career trajectories in engineering education—Where are they now?* Paper presented at the 111th American Society for Engineering Education Annual Conference and Exposition, Salt Lake City, UT.
4. Borrego, M. (2006). *The higher education job market for M.S. and Ph.D. engineering education program graduates.* Paper presented at the 113th American Society for Engineering Education Annual Conference and Exposition, Chicago, IL.
5. Felder, R. M., Sheppard, S. D., & Smith K. A. (2005). A new journal for a field in transition. *Journal of Engineering Education, 94*(1), 7-10.
6. Lohmann, J. R. (2005). The editor's page – Building a community of scholars: The role of the *Journal of Engineering Education* as a research journal. *Journal of Engineering Education, 94*(1), 1-6.

7. Jesiek, B. K., Newswander, L. K., & Borrego, M. (2009). Engineering education research: Discipline, community, or field? *Journal of Engineering Education, 98*(1), 39-52.
8. Carberry, A. & Yasuhara, K. (2014). *Engineering education community resource.* Retrieved from http://engineeringeducationlist.pbworks.com
9. Q Methodology: A Method for Modern Research. (2011). *About Q methodology.* Retrieved from http://qmethod.org/about
10. Brown, S. R. (n. d.) *Q methodology workshop given by Steven R. Brown*. Retrieved from http://qmethod.org/howto
11. Ray, C. M., & Montgomery, D. M. (2006). Views in higher education toward methods and approaches for character development of college students. *Journal of College & Character, 7*(5), 1-15.
12. Stephenson, W. (1980). Newton's Fifth Rule and Q methodology: Application to educational psychology. *American Psychologist, 35*, 882-889.
13. Reid, K., Hertenstein, T.J., Fennell, G.T., Spingola, E.M., & Reeping, D. (2013). *Development of a first-year engineering course classification scheme.* Paper presented at the 120th American Society for Engineering Education Annual Conference, Atlanta, GA.

Appendix A: Survey Questions

Q Statements: Participants sort 30 statements into 7 categories shown in Figure 1.

1. The job search process was easy.
2. The job search process was stressful.
3. The job search process was time intensive.
4. The job search process was what I expected.
5. During my job search, my engineering education Ph.D. made me a more desirable candidate than someone with a traditional engineering Ph.D.
6. In general, there were more jobs available for engineering education Ph.Ds. than I expected.
7. There are many tenure track jobs available to engineering education Ph.Ds.
8. There are many industry jobs available to engineering education Ph.Ds.
9. There are many non-tenure track academic jobs (e.g., advising, Dean's staff) available to engineering education Ph.Ds.
10. Finding positions for which I was qualified was easy.
11. Finding positions for which I was qualified was time intensive.
12. Finding positions I wanted was easy.
13. Finding positions I wanted was time intensive.
14. By graduation, I had secured my number one job choice.
15. My current position involves research.
16. My current position involves teaching.
17. My current position involves service.
18. I believe my current position is a good fit for someone with a Ph.D. in engineering education.
19. Before my job search, I believed my engineering education Ph.D. qualified me for discipline-specific, tenure track positions.
20. After my job search experience, I still believe my engineering education Ph.D. qualified me for discipline-specific, tenure track positions.
21. Personal networking with someone already employed at an institution played a strong role in obtaining my first position after obtaining my Ph.D.
22. Networking through my advisor or other mentor played a strong role in obtaining my first position after obtaining my Ph.D.
23. In my current position, those with discipline-specific engineering degrees view an engineering education Ph.D. as less rigorous.
24. Most people with discipline-specific engineering degrees I encountered know what a Ph.D. in engineering education entails.
25. In general, people understand that a Ph.D. in engineering education equates to research capability rather than simply "teacher training".
26. My colleagues view me as an asset due to my engineering education training.
27. My superiors (e.g., department heads, deans, supervisors) view me as an asset due to my engineering education training.
28. During my job search process, I knew exactly what type of job I was looking for.
29. Before my job search process, I knew what options or types of jobs were available to me with my degree background.
30. During the job search process, I typically found engineering education oriented jobs to be teaching focused and non-tenure track positions.

Demographic Questions:

1. I would classify my current position as…
    a. Academic – tenure track
    b. Academic – non-tenure track
    c. Industry based
    d. Government based
    e. Other_____
2. Since I graduated, I have held __ different positions.
    0, 1, 2, 3, 4 or more
3. I have had or currently have a post doc position.
    Yes or no
4. How many jobs did you initially apply to?
    1, 2-5, 6-10, 10 or more
5. How many phone interview requests did you receive?
    0, 1, 2, 3, 4, 5 or more
6. How many on-campus interview requests did you receive?
    0, 1, 2, 3, 4, 5 or more
7. How many job offers did you have?
    0, 1, 2, 3, 4 or more
8. I looked for jobs sent out through e-mail listservs.
    Yes or no
9. I searched for jobs on institutional websites.
    Yes or no
10. I bounded my search to a specific geographic region.
    Yes or no
11. I bounded my search to tenure track positions only.
    Yes or no
12. I completed my job search…
    a. after finishing my degree.
    b. while I was finishing my degree.