
EMPIRICAL RESEARCH

The Purpose of a PhD in Engineering: Where Does Teaching Fit In?

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Background: Institutions in the United States are classified by the Carnegie Classification of Institutions of Higher Education. These classifications are largely delineated by the institutions' focus on research versus teaching. Almost all professors in the US earn their doctorate degrees at doctoral universities with the highest research activity (R1), given that those institutions are the ones that confer PhD degrees; however, there exists a misalignment between earning a PhD at an R1 institution and preparing for a faculty career at a more teaching-focused institution (non-R1). Some professors pursue a PhD entirely for the teaching credential with the goal of teaching at an institution of higher education. With R1 institutions focusing primarily on research, the purpose of graduate education and its effectiveness in preparing the next generation of engineering faculty is put into question.

Purpose: The purpose of this paper is to explore the following question: How do engineering assistant professors at US institutions experience the transition from graduate school at R1 institutions to their current faculty position at non-R1 institutions?

Methods: Audio-recorded semi-structured ethnographic interviews were conducted with twelve participants, three representing each of four institution types (R2, R3, master's, and baccalaureate). One participant at each institution type identified as female, and the other two identified as male. An inductive-deductive thematic analysis was conducted and resulted in three major themes.

Results: The participants described feelings of misalignment between their graduate program and preparation for a faculty career, especially in terms of preparation for teaching, which was attributed to the research mission of the universities they attended (R1 institutions). In addition to feeling underprepared to teach, many participants described feeling unprepared for the emotional challenge of pursuing a position that is perceived to be less prestigious than a position at an R1 institution.

Discussion and Conclusions: The results of the thematic analysis point to the need to reimagine the training graduate students receive to better align with future employment opportunities, especially preparation for teaching-focused positions and including preparation for non-academic positions. Additionally, the results indicate the need for a cultural shift toward doctoral training that is more inclusive of the diverse career interests of graduate students.

Keywords: future faculty preparation; graduate education; developing teaching skills

Teaching quality at colleges and universities in the United States has been increasingly criticized in recent years (Matchett et al., 2016). Specifically, there have been calls to improve the quality of teaching in engineering, including calls to examine and adjust the reward structure for teaching in faculty positions (Jamison & Lohmann, 2012; Olson & Riordan, 2012). Some studies have described that students leave engineering and other STEM majors in large part due to poor teaching (Hewitt & Seymour, 2016; Marra et al., 2012).

In response to these concerns about teaching quality, many researchers are examining preparation for faculty positions and graduate student training. For example, the Chronicle of Higher Education published a special report called "Teaching PhDs How to Teach." Likewise, there are many programs, often referred to as Preparing Future Faculty (PFF) programs, available to graduate students who are interested in pursuing academic careers and specifically for preparing teaching

skills (Golde & Dore, 2001). These programs, however, are not utilized by all engineering doctoral students; only about half of doctoral students in engineering participate in teaching development programs of any kind (Crede et al., 2010). One explanation for why engineering students have not been heavily involved in PFF programs is the fact that over 73% of engineering PhD graduates pursue post-graduate work in industry (Cox et al., 2011) and teaching skills may not be viewed as necessary for positions in industry. Nevertheless, this downplaying of the need for teaching skills is affecting those who do end up pursuing positions that require teaching, with graduate students describing a misalignment between their current roles as graduate students and their future roles as faculty members (Svyantek et al., 2015). Thus, studying engineering faculty pathways and reflections on graduate training is important to understand how to best prepare engineering graduate students for future faculty careers.

A more thorough understanding of the pathways of new engineering faculty is necessary to understand how graduate education could be expanded and redesigned. Most graduate students earn their PhDs at institutions classified as Doctoral Universities with Highest Research Activity (referred to as R1). Non-R1 institutions often have higher teaching expectations than their R1-counterpart institutions (VanDeGrift & Davis, 2006). For this reason, non-R1 faculty members that graduated from R1 institutions are the ideal sample population to understand how graduate school training at an R1 institution is falling short in preparing future faculty members for teaching responsibilities in general, and for teaching focused positions in particular. In this paper, I explore how to prepare graduate students for teaching expectations associated with non-R1 career pathways by answering the following question: How do assistant professors at non-R1 US institutions experience the transition from graduate school to their current faculty position?

Preparing graduate students for teaching positions has implications for career success and job satisfaction of faculty members, as well as for student learning and teaching quality.

Literature Review

Faculty responsibilities in the United States typically consist of three main components: teaching, research, and service (Adams, 2002). Nevertheless, several researchers have demonstrated that very little attention is paid to the teaching aspect of faculty positions in graduate programs (Adams, 2002; Austin et al., 2009; Baiduc et al., 2016; Svyantek et al., 2015). Most graduate students earn their PhDs at R1 institutions (defined as Doctoral Universities with Highest Research Activity by the Carnegie Classifications of Institutions of Higher Education), which focus primarily on research. Graduate engineering programs at R1 universities largely aim to prepare students to function as independent researchers, in alignment with the expectations of faculty at these institutions (Austin & McDaniels, 2006; VanDeGrift & Davis, 2006).

This study examines the experiences of non-R1 faculty; however, since most research about faculty focuses on R1 institutions, a brief overview of the landscape of higher education is helpful. The Carnegie Classification of Institutions of Higher Education classifies institutions by research activity as well as the number and type of degrees conferred (Carnegie Classification of Institutions of Higher Education, 2016). Over 70% of universities with engineering programs are doctoral universities (VanDeGrift & Davis, 2006). Of the 281 US institutions with engineering programs, 102 (36.3%) are doctoral universities with the highest research activity classification, R1 (American Society for Engineering Education, 2015). Another 95 (33.8%) institutions are doctoral universities with higher (R2) or moderate (R3) research activity. Only 84 of the 281 (29.9%) institutions with engineering programs are not doctoral institutions but, rather, are baccalaureate and master's institutions. All of these institutions have teaching requirements for their faculty, with non-R1 institutions typically having higher teaching expectations.

A number of scholars have examined processes associated with acquiring sufficient knowledge (Austin & McDaniels, 2006; Connolly et al., 2016) and motivations (Kajfez & Matusovich, 2017) to teach at the college level. Under-preparation for teaching is not unique to engineering and has been observed in studies concerning nursing students and STEM students more generally (Baiduc et al., 2016; Bullin, 2018; Svyantek et al., 2015). One main repercussion of the omission of teaching training in the PhD curriculum is that new STEM faculty are often unprepared for their teaching demands (Golde & Dore, 2001). New faculty in particular may spend proportionally more time teaching during their first years because they have not learned how to prepare efficiently or effectively (Rockquemore & Laszloffy, 2008). Given that teaching loads are often higher at non-R1 institutions, the impact of this under-preparedness for teaching could be even more pronounced for new faculty at non-R1 institutions.

Indeed, there are many programs in place and much research has been conducted about how to help new faculty succeed (Boice, 1991; Solem, M., Foote, K., & Monk, 2008; Sorcinelli, 1994). Many guidebooks also exist for helping faculty succeed in the three tenets of tenure-track careers: research, teaching, and service (Buller, 2010; Seldin, 2011). There are numerous opportunities for new faculty to participate in professional development activities at their institutions, through conferences, and through formal programs (Felder et al., 2011). Some examples of programs include the Center for the Integration of Research, Teaching, and Learning (CIRTL) (CIRTL Network, 2020) and the National Effective Teaching Institute (American Society for Engineering Education [ASEE], 2020; Felder & Brent, 2008), which is aimed at engineering educators

in particular. In the context of training future faculty members, socialization is the process of making sense of graduate school and academic communities and learning about career pathways after graduation (Austin, 2002). Future career choices can largely be influenced by the socialization received during graduate training. A graduate student's socialization is driven by the mentoring and advising received. In particular, it has been found that a graduate student's primary advisor plays a major role in how graduate students conceive of what it means to be a faculty member (Bieber & Worley, 2006; Rogers & Goktas, 2010; Svyantek et al., 2015). Being socialized into academia by an advisor within the R1 environment can socialize a student to believe that they should pursue an academic career at an R1 institution.

While engineering graduate school is intended to prepare future faculty members, scholars have found that curriculums do not involve mentoring in regards to teaching (Stice et al., 2000, p. 7). Furthermore, the differences between institution types in the US are not adequately explained to graduate students, and STEM doctoral students are especially unaware of the differences (Connolly et al., 2016). Naturally, graduate students at R1 institutions develop conceptions about faculty members in the context of R1 institutions. Austin and McDaniels (2006) argue that future faculty members' understanding of teaching and learning processes is potentially equally as important as their understanding of research processes, engagement, and service, and gaining an appreciation of institutional citizenship (p. 418). This can especially be the case for faculty that pursue positions at institutions that focus more on teaching, such as master's institutions and baccalaureate colleges (Baker et al., 2016). Research must seek to understand the perspectives of faculty at non-R1 institutions and how they were socialized at R1 institutions to inform how graduate school experiences could be adjusted to better prepare students for teaching and be more inclusive of students who want to pursue non-R1 careers.

Although there has not been much exploration of various pathways to faculty positions in academia specifically concerning engineering faculty, there has been some attention in other fields. Preparing Future Faculty (PFF) programs began in the early 1990s as a national movement to change the way graduate students were prepared for faculty positions and careers, even specifying preparation for various types of institutions (Faculty, 2016b). While no official PFF programs exist for engineering, many initiatives have been built upon the PFF model (Faculty, 2016a). And while programs do exist to help graduate students and faculty succeed as teachers, there is limited support in preparing future and current faculty at non-R1 institutions. This study focuses on educators during transition: it examines early-career faculty and their transition from graduate student to faculty member and from an R1 to a non-R1 institution. Four institutional types were considered, all of which are commonly understudied.

Methods

In light of the existing literature on teaching quality at US higher institutions, and with an understanding of the under-preparation and under-examination of faculty at non-R1 institutions, this paper seeks to answer the following research question: How do assistant professors at non-R1 US institutions experience the transition from R1 graduate schools to their current faculty position?

For this study, it should be noted that this transition includes socialization experiences in graduate school at R1 institutions, applying for faculty positions, and the socialization experiences in the first few years in their positions at non-R1 institutions.

Positionality of the Researcher

This research has been approached from a social constructivist research paradigm (Guba & Lincoln, 1994), meaning that the participants were believed to build knowledge and opinions about their experiences based on their particular context and culture. As the researcher, I recognize my personal bias that I hold, including the desire to elevate the status of teaching. However, I have subjected my research design and approaches to critique by expert colleagues and through publishing two papers at conferences (Trellinger & Jesiek, 2016, 2017). These audiences helped check that my approaches to collecting and analyzing the data were sound.

Participants

Table 1 provides an overview of the twelve participants included in this study. As this is an exploratory qualitative study, three participants were purposefully selected from each of the four institution types, including one female at each type. This sample selection is in line with qualitative research practices that describe the selection of a small sample to acquire a thick cultural description (Clifford Geertz, 1973; Marshall & Rossman, 2011). **Table 1** provides each participant's pseudonym, gender, current institution type, and amount of time in current position at the time of the interview.

Data Collection Procedures

The primary source of data for this study was semi-structured ethnographic interviews (as described in Frank, 2011) with twelve engineering assistant professors at four institution types. The interviews, which lasted between 60 and 120 minutes,

Table 1: Overview of Participations and Defining Characteristics.

Participant Name	Gender	Current Institution	Time in Position
Steven Bradley	Male	Baccalaureate	2 Years
Valerie Michaels	Female	Baccalaureate	0.5 Years
Opie Hampton	Male	Baccalaureate	2 Years
Christopher Davis	Male	Master's	1 Year
Samantha Reed	Female	Master's	1 Year
Jason Talbert	Male	Master's	1 Year
Matthew Land	Male	R3	3 Years
Emma Edgerton	Female	R3	1.5 Years
Richard Vine	Male	R3	0.5 Years
Brandon Oakley	Male	R2	2 Years
Molly Sanders	Female	R2	3.5 Years
Tyler Colton	Male	R2	2.5 Years

were conducted via Skype. While the Skype conversations did utilize the video feature, only audio was recorded. All data collection activities were completed under Purdue University IRB Protocol #: 1606017812.

The ethnographic-style interview protocol was designed to elicit descriptions of the participants' pathways to their current position. The ethnographic interview approach prioritizes participants' voices and characterizes each participant as the informant on their life and experiences (Frank, 2011). In this approach, the participant is encouraged describe the experiences that were meaningful to them and elaborate on instances that impacted their journeys.

Table 2 includes sample questions from the interview protocol and highlights the purpose of each example question.

Data Analysis Procedures

A thematic analysis was conducted that considered the twelve assistant professors' full transcribed interviews. A deductive-inductive coding approach (Fereday & Muir-Cochrane, 2017) was utilized, relying on both expected themes from the literature and allowing for themes to emerge from the data. The deductive codes were based on the findings from a literature review, and included codes related to the participants' university experiences and socialization (e.g., advisor and peer relationships) and typical faculty roles such as teaching, research, and service. The inductive codes were developed as part of the initial analysis procedures. Starting with three interview transcripts, emergent themes were identified. An initial codebook based on the first three interviews was used to code the remaining interviews, with the ability to continually update the codebook with newly identified emergent themes. Through the process of corroborating and legitimizing the themes, first-order and second-order themes were developed, which are presented in **Table 3** in the results section.

Trustworthiness

Qualitative research that relies on interviews requires trust both with the research participants as well as with those who ultimately read about the work. Herein, I describe measures I took to build trustworthiness as a researcher and author.

As I did not know most of the interview participants before my interviews with them, I made efforts to build trust and rapport with my participants. I did this by making sure I withheld all judgment in interviews and through genuine curiosity about their stories. As Caroline Frank (1999) emphasized, "in an ethnographic interview, the ethnographer conducts the interview in order to learn something, not in order to explain something" (p. 28).

In order to address the concern of building rapport, I began my relationship with my participants through email correspondence, which Seidman (2013) acknowledged as a crucial time to build rapport. I gave my interviewees the option of a phone interview, Skype audio only, or Skype with video interview in order to make sure my participants were comfortable. I began every interview with my own background and story and kept the conversation informal so my participants could get to know me. This demonstrated the sincerity of my intentions (Tracy, 2010) and helped build rapport before doing the actual interview.

Another measure I used in order to increase the trustworthiness of the data and build rapport with the participants was to require each participant to review and approve their individual narratives I constructed. This is an essential practice in narrative inquiry which allows for participants to know their contributions were accurately portrayed as well as provide credibility to readers and the community of the quality of the work (Creswell & Miller, 2000; Kellam et al., 2015).

Table 2: Selected Questions from Interview Protocol.

Purpose of Question	Interview Question
Transition to non-R1	Why did you select your current position and what factors came into play?
Transition to non-R1, socialization in graduate school and current position	How have you experienced the transition between institutional cultures of your undergraduate, graduate, and faculty institutions?
Socialization in graduate school	How did you learn what faculty members do?
Socialization in graduate school and current position	If you could redesign your graduate program, what are the key things you would include?
Socialization in current position	Are you encouraged to spend time on teaching?
Socialization in current position	How does your department/institution support or deter you from teaching?

In order to be aware of my biases as a researcher, I kept a journal that serves as an audit trail. I reflected on elements of the interviews that were a surprise to me and elements that were in line with my expectations. These reflections helped me remember to be judgement free during the interview process and allowed me to check my assumptions with broader literature. However, it should be noted that Webster and Mertova (2007) emphasize verisimilitude, the appearance of being true or real, and expect that the researcher resonates with the critical events described by participants (p. 99). While I checked in regarding my biases, it is also important to note that the critical incidents that resonated with me were often justified for inclusion for that reason.

Limitations

Qualitative research quality procedures were implemented to increase the trustworthiness of the research and results. Walther, Sochacka, and Kellam’s (2013) approaches were followed, including frequent comparisons of research design and results with the literature. Nevertheless, some limitations to this study exist.

First, consultations with research advisors and comparisons with the literature were critical since the research was led and conducted by one researcher. Further, this study only considered tenure-track faculty at R2, R3, master’s, and baccalaureate institutions in the United States, although it is noted that non-tenure track positions often focus more heavily on teaching. The balance between research and teaching may also be different in contexts outside of the United States. Future research should expand upon this work to include perspectives from other position types and different international contexts. R1 faculty were also excluded from this study, even though it is likely that many new faculty members at R1 institutions feel similarly underprepared for teaching. The experiences of non-tenure-track faculty, faculty members at two-year institutions, faculty at institutions outside of the United States are, likewise, worthy of study and should be explored in future work. Each of these limitations are areas that would benefit from further research but were out of the scope of this project.

Results

The findings are presented in three sections following the three first-order themes developed from the data, as outlined in **Table 3**. Given that the constructivist paradigm used relies on interpreting the descriptions of the experiences of each participant, many direct quotations from the participants are included.

Table 3: Themes Resulting from Thematic Analysis.

First-Order Themes	Second-Order Themes
Preparation for Job Market and Teaching	Swimming Upstream
	Desired Graduate Programming Focused on Teaching
	Map Needed for Non-R1 Job Search Approaches
	The Role of Luck
Decision-Making Factors	A Focus on Teaching was Desired
	Overcoming Perceived Failure
	Family Matters
Comparisons Between Institution Types	Misalignment of Teaching and Research Expectations
	The Institutional Environment in Comparison to R1

Preparation for Job Market and Teaching

Swimming Upstream – encountering resistance to pursuing a non-R1 position

Almost all participants realized that their choice to pursue teaching-focused positions would cause resistance from some members of their community, including advisors and peers, even if the participant was confident in their decision to pursue a non-R1 position. In a sense, they needed to *swim upstream* and figure out the pathway to a teaching-focused institution themselves. In choosing this pathway, they were going against the goal they perceived to be socialized as most desirable: an R1 faculty position.

For example, Stephen asked his advisor for help navigating the non-R1 job market and how to prepare, and he was not given much support. As he explained:

As great as my advisor was, he didn't really have any advice for me in terms of that career path. And he told me straight up, you know, "I admire, I'm very supportive, I'll do whatever I can, but I don't have that experience, I don't know very many people who have done that." So, I was on my own.

Fortunately for Steven, his advisor suggested that he take a course on teaching. Christopher had a similar experience with an advisor who was not able to provide much advice for teaching-focused jobs, but he was glad that his advisor and committee members were able to provide him with many opportunities to teach throughout his graduate program.

In contrast, Molly had a negative experience with her advisor regarding learning about and getting experience teaching. Molly recalled that her advisor told her not to get a teaching certificate during graduate school. She described:

I think partway when I was there in graduate school, they started offering a certification in teaching for engineering, and I had wanted to do that, and my advisor, who knew that I was interested in going into teaching down the road, said, "It's probably not the best use of your time. So, you really need to focus on the research and do a good job there because that's what people are looking for when they interview you." It was frustrating. He meant well and coming from where I am now, I understand. I was angry because I'm like, "Well, shouldn't you get training to teach?"

Molly saw value in teaching experience and training as a graduate student, yet her advisor believed focusing her efforts on research was more important.

Desired Graduate Programming Focused on Teaching – Descriptions of how graduate school could include opportunities for those interested in teaching careers

Roughly half the participants had formal training in teaching, that is, a class or a program aimed at future faculty. For instance, Opie participated in a teaching fellowship program that allowed him to teach a section of a course, and Matthew attended a multiweek workshop on teaching. Nevertheless, when asked what they would have changed about their graduate school experience, most participants described wanting even more formal opportunities to integrate teaching into their program.

In almost every participant's graduate school experience, the participant needed to go beyond the curriculum and standard expectations to get a teaching opportunity. In Jason's case, he was required to be a teaching assistant for one semester, but still described that experience negatively: "All a TA (teaching assistantship) did in the [PhD University] graduate program was grade papers, they were a grader and that was it. It was horrible."

Jason also described wishing there were opportunities for graduate students to help co-design courses, while Christopher thought it would be useful for graduate students to be able to get a master's degree in engineering education along the way to their technical PhD. Opie went as far as to suggest there should be a separate track for PhD students who want to focus on teaching. As he described:

If I could change something, maybe it would be to kind of split it up, and have – it's the same degree, but do you have a research focus or a teaching focus... I had a lot of great opportunities, but it's because, in a lot of cases, I lucked into them, or I went out and found them, and it wasn't really baked into any program in a meaningful way.

From Jason's and Opie's comments, it is clear that some participants felt that the graduate school experience could have better prepared them for careers with teaching expectations.

In multiple cases, the participants reported that they were not able to participate in formal teaching programs; a program was started at Jason's institution as he was graduating, and Molly was advised by her advisor not to participate in the program started at her institution. Despite not being able to participate in such a program, Molly did have opportunities to be a teaching assistant. She thought, however, that the experience of being a teaching assistant could have been improved by getting more feedback from the instructor on how to improve as a teacher.

Map Needed for Non-R1 Job Search Approaches – Recognition that the pathway to non-R1 positions was not clear

In many cases, the participants mentioned that they did not have a clear *map* as they were pursuing non-R1 positions. For a few participants, it was crucial to have a mentor guide them through the process of applying to faculty positions. These mentors were especially important because, as noted previously, many of the participants' advisors and universities did not have extensive resources for graduate students interested in positions at non-R1 institutions. For example, Jason had a mentor who accepted a position at a master's institution two years before Jason entered the job market. This mentor helped Jason make sense of the non-R1 landscape and ultimately helped him decide to accept the offer at his current institution (a master's institution). Similarly, Christopher had a mentor, his sister, who helped him navigate the job search. Christopher stated that his sister emphasized how important it was to demonstrate during interviews "that you know you won't have PhD students, that your primary job function will be teaching, that you are okay with that."

While Jason and Christopher had people to mentor them through the job search process, Emma spent a lot of time researching her current institution before applying. She spoke about how useful it was for her to understand the specifics about the institutions to which she applied. For example, she described:

[needing to understand] the process at this university – we're not a single lab that's going to get a three-million-dollar grant. Funding at a place like this works by having three or four faculty members get together ... and we can team up and share our resources.

Valerie was also aware of specifics associated with the various institution types. She was certain that she wanted a position at either a baccalaureate or master's institution, so she made a spreadsheet of institutions that met her criteria. She used ABET and Carnegie Classifications to make a list of institutions to which she would consider applying. As she explained, "I knew I wanted to teach. So, I didn't want a university that had high research expectations."

Not all participants were as systematic or specific as Valerie. Rather than strictly applying to teaching-focused institutions, a few of the participants applied to all types of institutions. For example, Richard, who accepted a job at an R3 institution, described applying to any institution that had an opening. Tyler also applied to a wide variety of institutions and ended up with offers from a few baccalaureate colleges but ultimately accepted a position at an R2 institution. Reflecting on that decision, however, he described regret:

I interviewed at two schools that were heavily focused on teaching. And I don't know if it was arrogance or to think that I need to do research because that's what I do. But I got job offers from those schools, but I just turned them down, and didn't think twice about it. I would definitely go back and change that, or I would have taken a lot more time to think about – I guess what I'm really interested in and what I really want to do, and not put so much weight on the actual salary or the school or things like that.

In this statement, Tyler expresses being not fully aware of the benefits associated with non-R1 institutions. Tyler would have benefited from learning more about different institution types during graduate school, especially in terms of deciding where to accept a faculty position.

Indeed, mentors played a key role for some participants when they were on the job search. Additionally, entering the job search with a clear idea of the type of institution the participant wanted to join was an advantage. To that end, a better understanding of various institution types is necessary to understand the landscape and could be useful when applying for and considering different job offers.

The Role of Luck – Explanations of luck playing a role in the job search process

Several participants spoke about how they were lucky to get their job, or that they were lucky to have a good mentor during the transition from student to faculty member. When discussing his teaching opportunities, Opie mentioned that he lucked into many of them. Richard described how he felt lucky to have had a great advisor and a friend who mentored him through the job application and interview process. Emma also felt like she got lucky, however, immediately after describing her luck, she described her diligence with her application, and that she "was pretty careful with the application to make sure I was meeting all [the] criteria, doing my research and homework on what the university was about."

Feeling like luck was a critical factor in why they got offered a job was sometimes accompanied by feelings of vulnerability. Jason described the PhD and job market process as "as little bit of bait and switch – it just feels like there are so many PhD students and then so few jobs and it's just terrifying." He additionally explained that to get a job, "all the stars have to align."

Richard also acknowledged that the academic job market is very competitive, and that he felt lucky to have received two job offers. While the participants viewed the outcome as lucky, it seems that their hard work and attention to the specific needs of various institution types set them up for success while on the job market.

Decision-Making Factors

A Focus on Teaching was Desired – Explanations for looking for positions that put teaching at the center

The ability to focus on teaching, especially without negative comments for doing so, was very attractive for the majority of the participants. Jason, who is now at a master's institution, described being surprised that his colleagues loved working with undergraduate students. When he compared some of his new colleagues to his advisor at an R1 institution, the differences became clear. Jason found it “hilarious coming here [his current institution], where everyone is like, yes, teaching, I love interacting with undergrads.”

Four participants had previously attended non-R1 institutions that are similar to those at which they are currently employed, including one participant that is now a faculty member at their undergraduate institution. For participants who attended non-R1 institutions as undergraduates, those experiences influenced the participants as they were looking for jobs. In contrast, many of the participants who attended R1 institutions exclusively for their education were not aware of the differences between institution types when they decided to pursue a non-R1 institution for their education.

Family Matters – Descriptions of the role family members and peers played in the pathway to non-R1 positions

Talking with family members often helped clarify the participants' decisions to pursue non-R1 positions. In many cases, the participants needed to consider opportunities for their spouses in the area of their new institutions.

For example, Opie realized that his current institution was a good fit for him when his wife was welcomed into the community. He described how impressed he was by the effort his current institution made to welcome his wife to the area. Matthew also needed to consider his wife's ability to find a suitable job in the city to which they would move.

Some participants described other ways that their partners influenced their decision to pursue and accept their offers at their current institutions. In Brandon's case, his wife found the job posting and told him to apply. In Jason's case, his wife helped him realize his current institution was the right fit. He described her saying “[Jason] this is your dream, this is what you want. And I was like, you're totally right.” As will be described in the next section, Jason struggled with the perception of being a failure when he chose an undergraduate-focused institution, but his wife helped him remember what his goals were in relation to his ideal position.

Finally, a few participants mentioned that they felt their positions at their universities allowed them to focus more time on their families. For instance, Richard enjoys his lower teaching expectations because he can spend time with his three children, and Emma described how she loves the fact that she has a nine-month appointment because she has summers off with her son. Ultimately, it is clear that participants were influenced by their family during the decision-making process, and also in terms of their satisfaction with their current institution.

Overcoming Perceived Failure – Descriptions of feelings of failure associated with choosing a non-R1 pathway

Some of the most emotional components of the interviews came from discussions surrounding risk and vulnerability when deciding to pursue a teaching-focused position. Several participants described how it was challenging for them to finally decide to pursue a position that focused on teaching because people in their community told them it was a poor choice.

Jason, now a professor at a master's institution, struggled with a perceived sense of failure associated with choosing a position at a non-R1 institution. He described support from his wife and a mentor who was also at a non-R1 institution. Their support helped him realize that being a professor at a master's institution did not make him a failure. As he explained:

There's this really scary thing that once you leave the R1 realm, there's a huge bias there. You feel like you fail, the sense that you're a failure, that people are going to look down on you, and all sorts of other stuff. And that was the scariest part. Just because of the bias that you should go to an R1. That was just really hard to overcome.

Matthew also discussed dealing with a perceived sense of failure associated with accepting a position at an institution that focuses on teaching. He explained “I think the pushback was mostly cultural, in the sense that it was never something that we had talked about before, and if it's not in your stated goals, it kind of feels like failure.”

Making decisions that went against social expectations caused some participants to have emotional responses that were challenging to overcome. It was also apparent that once the participants accepted the decision to pursue a position at a non-R1 institution, there were many attractive aspects to those institutions. Most notably, non-R1 institutions allowed more focus on teaching and encouraged a focus on the student experience.

Comparisons Between Institution Types

Misalignment of Teaching and Research Expectations – Encounters with differences in expectations for tenure at various institution types

Tenure expectations regarding teaching and research were the major differences participants noted between their R1 PhD universities and their current non-R1 institutions. Higher tenure expectations surrounding teaching and, often lower expec-

tations surrounding research were attractive to most of the participants and were major factors when they decided to accept a position at a non-R1 institution. Interacting with others at the institution who advocated for spending time on teaching was also an important characteristic for some participants.

The transition from R1 to non-R1 institutions did not vary based on the non-R1 institution type. Furthermore, there did not appear to be a major relationship between the type of institution and the commitment to teaching. Rather, the teaching versus research emphases were largely based on the commitment of the individual departments and institutions. For example, in Richard's case at an R3 institution, he was encouraged by his dean to spend time on teaching, which helped motivate him to try new techniques in the classroom.

Matthew, who was also at an R3 institution, explained the influence of his dean as well. He described that the expectations for tenure at his institution depended heavily on teaching, even though high-quality research was also expected. As he explained:

Our department wants to be competitive on the world stage as a research department, but that doesn't mean we get to slough it in teaching. So, my dean is one of the founding members of the department, and our department probably has the highest participation in the center for teaching and learning workshops. So, the culture is very much supportive of improving as teachers.

Valerie observed a stark difference between her PhD university and her current institution; at her PhD university, if a professor had a large grant, poor teaching would not be a problem, whereas, at her current institution, a baccalaureate college, poor teaching would be cause for change.

Molly similarly discussed the idea that a great researcher could be a poor teacher at some universities and was disappointed to witness this phenomenon at her own current R3 institution. She described:

You can be an okay teacher and a great researcher and get tenure. You can be a great teacher and a terrible researcher, and you won't get tenure, so the idea - that statement in itself tells you where the university is placing its focus. [That makes me] feel sadness, because I feel that the university is designed to train people, to give students an education. And, I mean, research is important, but the view from the world is not that universities are places that churn out great research and advanced knowledge. I mean, maybe that is to a lot of people, but most people think, "A university is where you go to get an education." And somewhere there's this disconnect between the way the world views a university and the way it actually is from the inside.

From the perspectives of Richard, Matthew, Valerie, and Molly, it is clear that teaching and research are often held in tension, with one often valued more than the other. However, which is valued more is not always obvious based on institution type.

The Institutional Environment in Comparison to R1 – Descriptions of non-R1 environments compared to PhD institutions

Comparisons of the participants' current non-R1 institutions with the R1 institutions at which they previously studied also included comparisons of the environment and culture of the departments and institutions.

One way that participants described their perceptions of their current institution's environment was in terms of their experiences on search committees. Participating in the search process for new faculty members helped participants make sense of their own experience of applying to and interviewing for faculty positions. For example, Richard described his experience on a search committee, including how the committee looked for applicants who fit into his current institution's culture as an R3 institution. As he described:

I would say, we just try to identify the people who are going to be a good fit for our culture. And also, who are going to be – not only for [Current Institution's] culture, but for [Current State's] culture. And we definitely, for us, we try to look at candidates who are serious about coming here.

Steven described the difference in institution types relative to the university's focus. Steven, who is at a baccalaureate college, described how his institution placed great emphasis on graduating good engineers rather than advancing scientific research, the latter of which he viewed as the goal of R1 institutions. As Steven explained:

That's what I've observed a little bit, and I think that's just the difference in, if the primary goal of your institution is to advance scientific research versus to graduate good educated engineers, that's going to come out in the people that you hire, in the way that your program is structured. [Baccalaureate College] – it's very communal in its nature anyway, and the faculty here – if that's not what you're looking for, you'll probably not end up staying here. The faculty, they are here because they like that sort of environment.

Steven, like Richard, mentioned that the faculty at his institution sought out the culture and environment that his current institution provided. While the environment and focus of a non-R1 institution may be different from an R1, it provided culture and benefits that many faculty members found to be a good fit.

While all participants noted differences between their current non-R1 institution and the R1 institution at which they earned their PhDs, these differences were not unique to any particular institution type. Some of the participants noted cultural and environmental differences at their current institutions that were welcome, such as a higher focus on undergraduate education and a communally oriented institution.

Summary of Results

The present research aimed to understand individuals' experiences transitioning to the role of new engineering assistant professors at non-R1 institutions. The twelve participants described their experiences of transition from R1 institutions where they earned their PhDs, to their current institutions which were non-R1 institutions. In general, the participants felt underprepared for a job search that focused on teaching positions, in part due to not having much teaching training during graduate school and also because their advisors were unhelpful. In some cases, the participants' advisors were unsupportive of the participant's decision to pursue a non-R1 position, which led to feelings of failure. In instances of doubt and lack of direction, many of the participants relied on peer-mentors and family members to help them through the transition and decision. Once at their current institutions, participants noted differences in the institutional environment between their PhD and current institutions. In most cases, their current institutional environment was a welcome difference to their experiences at R1 institutions, mainly because they could focus on teaching and be proud of their interest and dedication to teaching and helping students.

Discussion

Given that graduate school is often viewed as the socialization into academia (Austin, 2002), and that this socialization takes place at R1 institutions almost exclusively, the vast majority of participants were socialized to think of successful academic careers at R1 institutions only. Socialization in graduate school focused heavily on research and, as such, it is unsurprising that the features that stood out to participants at their current non-R1 institutions included an emphasis on teaching. For example, many participants described feeling frustrated that they did not learn more about various institution types during graduate school. Some participants eventually learned about their current institution's institution type and were very content in their positions. However, Tyler serves as a counterexample given that he accepted a position at an R2 institution and is now starting to look for alternate positions at institutions that focus more on teaching. It is possible that new faculty members would prefer teaching-focused positions but simply do not know about other institution and position types.

Perhaps if the experiences of faculty members at various institution types were discussed more often during graduate school, more future faculty could make decisions about where to apply and ultimately accept positions that would better align with their goals. Even so, it would be important to emphasize that the focus on teaching varies from institution to institution; choosing a position based on institution type alone would not be advised. For example, some R2 institutions have a strong teaching focus while research is still required at baccalaureate colleges. These variations among departments have been described by Campbell and O'Meara (2014), who found that departmental context had a vast impact on the experiences of faculty members.

As described in the results, participants were largely underprepared for their teaching roles. Most participants, if given the chance to change their doctoral training programs, described wishing they had more training in teaching methods. The participants' desire for more teaching experience and training closely aligns with the stated goals of many PFF programs already in existence at some institutions. The misalignment between graduate school and future faculty roles found in this study is supported by previous research (Svyantek et al., 2015). As such, R1 institutions should dedicate resources to the expansion of existing centers that focus on teaching and preparing future faculty for teaching roles. Perhaps, the opportunities for professional growth that participants mentioned wanting during graduate school would reduce the apparent feeling of luck impacting the success on the job market. For example, more teaching opportunities and mentors that guide graduate students through the job market process could be instrumental in ensuring that job seekers are better positioned for success.

When considering how the participants developed their faculty schema in graduate school (as described in Bieber & Worley, 2006), many depended on their advisors and the context of the R1 institution as examples. Nearly half of participants described that their mentors and PhD advisors were able to help make sense of the experience of preparing for and applying to teaching-focused institutions. However, a few participants felt that they did not have much support from their advisors, and, in a handful of cases, advisors expressed active resistance against more teaching-oriented experiences and career pathways. Because numerous participants described their PhD advisors as inadequate in helping them navigate the

non-R1 job search, campus resources such as PFF programs could be vital in supporting graduate students on pathways to non-R1 positions. These resources would help increase awareness of non-R1 jobs and help students to navigate the process of applying to and accepting job offers for non-R1 positions.

Graduate education typically focuses on preparing independent researchers, not future teachers, and often not industry professionals. Even in the case of non-R1 institutions, where teaching is more of the focus of faculty positions, some participants were frustrated with the general trend that academia as a whole is taking toward higher research-related expectations. With the rise of research importance even at teaching-focused institutions (Véliz & Gardner, 2019), some participants questioned the purpose of universities, and expressed fears that their purpose to educate is getting lost against a backdrop of research pressures.

Whether participants consciously or serendipitously ended up at their current institutions, many of them expressed inadequate preparation for the teaching required in their current role, which might have been expected given the research focus of R1 institutions. However, some aspects of the participants' descriptions of their transition were surprising. First, the level of emotion associated with transitioning away from a research-intensive institutional culture was very poignant. Moreover, the negative reactions and perspectives offered by faculty at R1 institutions on the decision to pursue a teaching-focused position seriously impacted the wellbeing of some of the participants.

The emotional aspects of the journey to non-R1 institutions are worth exploring in more detail. While describing their graduate school experiences and desires for change, many of the participants described emotional hurdles they needed to overcome. The notion that graduate students are at risk for mental health concerns is starting to be researched in more depth, and the dominant narrative of research being more important than teaching is likely contributing to these mental health issues. For example, Levecque et al. (2017) and Evans et al. (2018) found that a supervisor's perception of a career outside of academia affected graduate students' mental health. According to participants in this study, many advisors were not supportive of their choice to pursue a teaching-focused career. While the participants pursued their personal goal of a teaching-focused career anyway, the impact of an advisor's opinions may not be as apparent to other graduate students. It is becoming increasingly important for faculty mentors to recognize the impact of their opinions about career choices on graduate students' decisions.

Conclusion

The participants in this study were all interested in seeing the perception and prestige of teaching increase and demonstrated that there is great potential to improve engineering teaching in the United States and even internationally. Imagine what kind of educators could be trained if there were more built-in opportunities for teaching in graduate school and if graduate students were encouraged to spend time thinking about teaching, rather than being socialized to believe research is always superior to teaching. Teaching quality in the US remains a serious issue, with some students pointing to poor teaching quality as reasons for leaving college (Hewitt & Seymour, 2016). New professors often do not know how to teach because it is not a part of graduate education in most programs. Furthermore, beyond supporting teaching interests in the name of teaching quality, engineering higher education would likely also have happier and healthier graduate students and future faculty if they were better supported to pursue their interest in teaching careers.

This paper offers perspectives of non-R1 professors, and the findings largely point to issues surrounding teaching preparation in graduate education. It is important to note that most of these professors still want the PhD degree to include research but believe that research was overemphasized in their PhD program and wanted more room for teaching. Most institutions have teaching resources to support graduate students and faculty who are interested in gaining teaching skills; however, the results of this research point to the need to go beyond these resources and make teaching and exploring the landscape of higher education institutions a fundamental component of the PhD process.

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Competing Interests

The author has a mentorship relationship with Shane Brown, an editor-in-chief of *Studies of Engineering Education*.

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