SWIMMING UPSTREAM: PATHWAYS OF NEW ENGINEERING FACULTY AT NON-R1 INSTITUTIONS

by

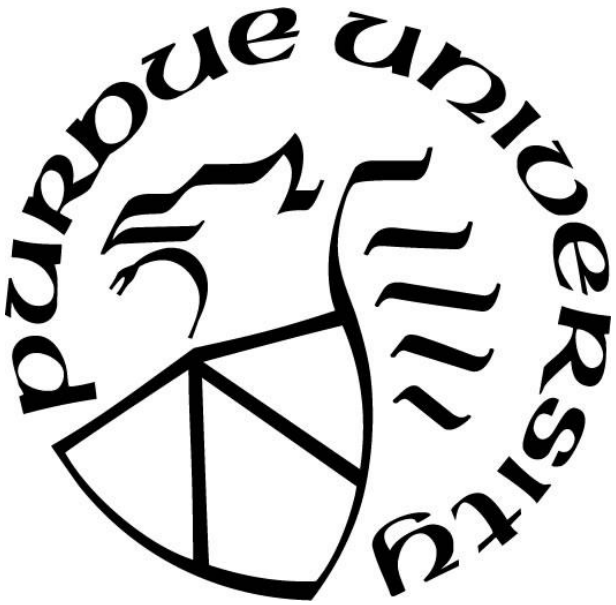
Natascha Trellinger Buswell

A Dissertation

Submitted to the Faculty of Purdue University

In Partial Fulfillment of the Requirements for the degree of

Doctor of Philosophy



School of Engineering Education

West Lafayette, Indiana

December 2017

For Jeff

ACKNOWLEDGMENTS

There are many people and groups I want to acknowledge who contributed to my success in graduate school and in life. I know that I would not be where I am without these people, and I know that I will rely on many of them to continue to guide me throughout my life.

First, to my advisor, Brent Jesiek, who has been an incredible mentor and source of support these last four and a half years. I look forward to continuing our friendship for many years to come. Thank you for all the opportunities you afforded me, and for being such an incredible role model, both personally and professionally.

To Michael Loui, thank you for your kindness, your detailed feedback, and for all your advice. I am grateful to have someone with so much knowledge and such a big network rooting for me.

To Ruth Streveler, thank you for always making time for me, and for telling me my prelim document was great before my defense. Your down-to-earth support, and reminders to nourish my soul have made a world of difference to me.

To Jim Borgford-Parnell, thank you for joining me on this journey and for being my local advisor and source of support when I worked from Seattle. Your work inspires me and has had a huge influence on me as a researcher.

To the women in my engineering education cohort: Emilie Siverling, Molly Goldstein, Catherine Berdanier, Monique Ross, Trina Fletcher, and Neha Choudhary, I could not have done it without you. I am grateful for our little first-year closet-office that brought us together and that we continue to be as close as we are today. Your support and laughter are very important to me. To my research group, thank you for your help and patience. Special thanks to Andrea Mazzurco and Qin Zhu. To the Women in Engineering Program and the Graduate Mentoring Program. Thank you for all the support and allowing me to gain leadership skills with a mission I am so passionate about. To my LT ladies and other members, thank you. To the many mentors who went before me and guided me, Brook Sattler, Alexandra Strong, Nathan Canney, and Jeremi London, thank you. To my many friends who supported me throughout this process,

thank you for believing in me and always being there for me throughout this journey, Claire McNellan, Jessica Peters, Anna Sigler, and Julia Pitkin.

I would not be where I am today without my family. Thank you to my parents, Odette and Karl, who have loved me unconditionally and provided me so much. My brother, Alex, thank you for being a built in best friend and for always being there for me. To my husband, Jeff, thank you for your unrelenting support and making sure that I laughed a lot during my graduate school experience. And lastly, thank you to Kona, the sweetest dog who kept me company throughout my whole dissertation process and made sure that I got up from my desk to go for a walk every day. It made all the difference.

Finally, thank you to the twelve participants of my study. Without you, this dissertation would not exist. Thank you for sharing your stories with me.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Author: Buswell, Natascha Trellinger. Ph.D.
Institution: Purdue University
Degree Received: December 2017
Title: Swimming Upstream: Pathways of New Engineering Faculty at Non-R1 Institutions
Major Professor: Brent Jesiek

The landscape of engineering academia is varied, yet many graduate students are socialized to aspire to a tenure-track faculty position at a research-intensive institution, and are told that teaching is a necessary activity in order to focus on research. However, some graduate students seek out a PhD so that they can primarily teach at the college level. There exists a misalignment for some graduate students between the way graduate programs in engineering prepare their graduates for academic positions and the way graduates desire to be prepared.

In this dissertation, I examined the experiences of twelve assistant professors in engineering who are at institutions with varying focus on teaching and research. The Carnegie Classification of Institutions of Higher Education classifies institutions in part based on research activity. Most engineering programs, and most tenure-track engineering professors, are at Doctoral Universities with the Highest Research Activity (R1). All twelve participants earned their PhDs at an R1 Institution and were assistant professors at the following four institution types at the time of the interviews: Baccalaureate, Master's, DU with Moderate Research Activity (R3), and DU with Higher Research Activity (R2). All four of these institution types likely have more focus on teaching than R1 Institutions and I was interested in understanding the transitions to these institutions from the R1 environment.

The findings are presented in two ways: First, a thematic analysis was conducted to understand how the participants' experiences were similar and different from each other. The thematic analysis findings are presented in response to the two main research questions: The pathways and experiences are discussed first, and then the teaching conceptions are discussed Second. Next, a co-constructed narrative was written for each participant to showcase the pathways from graduate school to their current institution. In

order to better make sense of the thematic analysis findings and the co-constructed narratives, I also present one narrative in greater detail through the use of narrative themes. I found that a majority of the participants felt underprepared for teaching and were socialized to believe teaching mattered less than research. Most participants specifically sought out non-R1 Institutions where they could focus on teaching in an environment where their dedication to teaching was supported. However, some participants still focus very much on research and scholarship, but enjoy the less intense expectations of their current institutions. In this dissertation, I introduce twelve stories about new engineering faculty at non-R1 Institutions so that current and future graduate students, as well as current and future faculty members, can learn more about the pathways to faculty positions at non-R1 Institutions.

CHAPTER 1. INTRODUCTION

1.1 Preface

I begin this dissertation by sharing my personal pathway and connection to the research purpose to demonstrate my sincerity and to increase the trustworthiness of my work (Tracy, 2010). The reader will find many of my concerns for and interest in this area are also supported by a larger body of scholarship which is explored in the literature review in Chapter 2. Additionally, my personal interest in storytelling and connecting with pathways in academia is evident in the choice of narrative inquiry for my methods, as described in Chapter 3.

My primary reason for conducting this work is to encourage graduate students to pursue a path that best fits them and their values. I know of many people that want to teach but only know of how teaching is practiced and perceived in R1 Institutions, which is almost always the academic setting they are being trained in. For example, if you are trained at an institution in which all faculty only lecture, that would be a major portion of your understanding of teaching methods. Furthermore, the culture of research universities can deter those interested in pursuing a teaching focused career. If people around you are talking about how much more important research is than teaching, or that anything other than a tenure-track faculty position at an R1 Institution is worthless or not prestigious, it is easy to question the worth of pursuing positions at non-R1 Institutions in academia.

Since the typical and well-respected pathway in engineering academia is to pursue a position at an institution with high research activity and prestige, it can be difficult to go against what people believe is the best pathway (i.e., a tenure-track position at an R1institution). In my case, I experienced frustration in hearing people's comments about my choice of study after my bachelor's degree. I studied aerospace engineering as an undergraduate, and I was very good at what was required of me in the aerospace engineering curriculum. I ranked at the top of my class and brushed off when people expressed how impressed they were with my success in aerospace engineering, saying "it's just so interesting to me." But when I mentioned to people that I was going to study engineering education in graduate school, I stopped getting impressed reactions. People

would even say, “why are you going to do *fake engineering*?” Since I could have continued studying aerospace engineering in graduate school or even practiced in industry, many of these people were shocked to find out I would “waste” my talents on something as mundane as engineering education. This was my first experience of doing something that other people thought was less prestigious than other options that were likely open to me.

When I was an undergraduate engineering student at Syracuse University, I remember the moment I was told that all professors were required to teach even if they did not want to. This shocked me. I thought the only reason someone would become a professor would be to teach and interact with students. Like many college students, I was having some amazing experiences in the classroom, but I was also subjected to some terrible teaching. I thought to myself, why is this professor teaching me when they have no interest in doing so? I later learned that there is a very complex institutional system that can explain why I was seeing what I was seeing.

Personally, I originally sought out a PhD mainly for the credential. I was aware that most teaching positions in colleges and universities required a doctoral degree, so I decided that I would need a PhD to pursue my career aspirations as a college teacher. I was studying aerospace engineering at Syracuse University, and since I had expressed my interest in graduate school early on, I was given opportunities to contribute to research projects. However, when my advisor asked me about my curiosity regarding the motion of a jellyfish and how results would change based on the shape of the jellyfish bell, I realized I was not naturally curious about technical engineering research. I was, however, curious about how and when students learned best, and how to teach engineering toward that outcome. When I found the engineering education PhD program at Purdue, I felt like it was a perfect fit. At Purdue, I would get the credential of a doctoral degree while studying what I was truly curious about – engineering teaching and learning.

When I started my PhD at Purdue University in engineering education, I was so excited to learn about teaching methods, how people learn, how to help people learn, and other research surrounding teaching. But I was quickly told that the focus here was not teaching, but research. I was surprised to find that there was no formal requirement for me to teach, and that it might be difficult to find opportunities to teach. I was on a

fellowship my first two years, and was often told that this was great because not only could I focus on research, but I could choose what research to pursue rather than just work on what my advisor wanted me to do. I struggled to make sense of the recommendations I was receiving and to find out what it was that I wanted from my whole experience in a doctoral degree program. I remembered that my original interests were teaching: *how* people teach and *why* people teach. I realized that I would be able to pursue this interest within the engineering education PhD curriculum by doing research on teaching.

The engineering education curriculum excited me beyond expectations. I was able to think about teaching and learning engineering all the time, and connections to teaching practice were a common implication for the research studies I was reading. While taking the engineering education course Content, Assessment, and Pedagogy: An Integrated Approach during my second semester in the program, I knew I had found my niche. The course project was to design a learning module based on research and through this work I fell in love with course design. I enjoyed the creativity of course design, reading the theory behind student motivation and how people learn, and thinking of myself as an engineering teacher. It was in this course that I knew I wanted to research some aspect about how professors teach engineering.

Even though I loved envisioning myself as a teacher, my first-hand experiences were limited to facilitating small engineering workshops and tutoring. I explained to my advisor that I wanted to have experience in the classroom and he arranged for me to help as a teaching assistant in Engineering in Global Context, an undergraduate elective course about the historical and cultural forces that have shaped and continue to shape engineering. Simultaneously, I was enrolled in a mentored teaching course in which I was guided to learn about and try new teaching methods, as well as carry out a small-scale study about the learning that was happening in our class. In this study, I explored the students' learning conceptions and how they mapped to Bloom's Taxonomy and Schommer's Epistemological Dimensions (Trellinger & Loui, 2015). This experience helped me recognize that while I am very interested in student perspectives on learning, I was even more interested in exploring the perspectives and points of view of instructors.

The following semester, I asked one of my committee members if I could help support her Content, Assessment, and Pedagogy class as a faculty apprentice. The faculty apprentice role allows senior graduate students to gain experience supporting and teaching a graduate level course in Purdue's engineering education PhD program. I was particularly interested in being a faculty apprentice in this course because of the instrumental role the content and experience had played in my own development as a teacher and researcher. Since the course project involved designing a learning experience based in research, I wanted to observe and help other graduate students unearth their own teaching philosophies and discover how research could be integrated into course design. Through this experience I recognized how a course syllabus can represent a large amount of conceptions about teaching a course and why and how it came to be. To this end, I found that these graduate students' course syllabi reflected much of their teaching philosophies, which in turn inspired me to think about how to use such documents as part of my data collection for my dissertation.

As I continued to recognize my passion and desire to spend a lot of time teaching, preparing to teach, and interacting with students, I also realized that pursuing a faculty position that focuses mostly on research, like at Purdue, would likely not be fulfilling for me. Purdue is an R1 Institution, and for many faculty, research often takes precedence over teaching. While this type of institution is important and necessary for advancing our world forward in terms of research, I struggled to envision myself focusing mostly on research in my future job. At the same time, I often heard about other types of institutions; institutions that are teaching-focused or teaching-oriented. Even though I knew these various institution types existed, I did not know much about them. I wanted to know: What would it be like to work there? How would it be different? Would it be what I was expecting? Is the teaching and learning environment different or better in significant ways?

As I was thinking about these questions, I was thrilled when I saw an announcement for a workshop in a series called *Be a Competitive Candidate: Faculty Positions at Institutions Primarily Focused on Undergraduate Teaching* offered by the Engineering Graduate Dean's Office. I immediately signed up and could not wait to hear from the panel of engineering professors at these other types of institutions. The

conversation naturally turned towards faculty application requirements. Each of the panelists carefully explained that we need not worry if we do not have any teaching experience: While it is preferred if we have some experience in the classroom, it is not required. I realized there was a huge gap here – I asked myself: how is it possible that you can be offered a job at a teaching oriented university, where you will likely be teaching at least three courses a semester, and not need to have prior teaching experience?

This research is one of personal exploration as well as a way to help address questions about non-R1 Institutions for other people that are curious, including graduate students, early career faculty, and even faculty advisors and mentors. One way that I imagine it possible for each of these groups to interact with and benefit from my research is through the sharing of the stories of individuals at varying types of institutions. Therefore, I collected stories from twelve engineering assistant professors at institutions that looked different than what I was familiar with, i.e., institutions that were not R1 Institutions, about their graduate school pathways and current teaching experiences. My purpose for this research study is to document and understand the experiences, perspectives, and teaching conceptions of engineering faculty as they prepared for, and transitioned into, academic careers at non-R1 Institutions.

1.2 Background[1]

Teaching quality at colleges and universities in the United States has been in the spotlight in recent years (National Academies, 2016). Additionally, there have been more specific calls to improve the quality of engineering teaching, potentially by changing the way faculty members are rewarded for their teaching efforts within the academy (Olson & Riordan, 2012, p. 11; Jamieson & Lohmann, 2012). Poor teaching has also been blamed by many students for the reason they leave engineering and other STEM fields (Seymour & Hewitt, 1997; Marra et al., 2012). More recently, studies have shown that students might choose to stay or leave engineering based on the experiences in the first

[1] ©IEEE, ©ASEE. Portions of this section have been reused with permission (see Appendix D)

and second year (Kober, 2015). Yet one obvious question to ask when considering teaching quality is how are faculty members trained to teach engineering?

Graduate school is most commonly viewed as the entryway and socialization into the academic career of faculty member (Austin, 2002). Socialization for doctoral students is best understood as the process of making sense of the academic career or other career pathways after graduation (Austin, 2002). This socialization includes a great deal of preparation in the forms of mentoring and advising, which largely shape a graduate student's perception of their future career. However, it has been noted that college teaching is a skilled profession unlike others in that it generally does not involve specific mentoring as part of the educational process (Stice, Felder, Woods, & Rugarcia, 2000, p. 7.). Furthermore, some college teaching positions at various institution types focus on the teaching aspect more than others, and STEM (science, technology, engineering, and math) doctoral students are often not aware of these differences (Connolly, Lee, & Hill, 2016).

Faculty positions traditionally consist of three main components: research, teaching, and service (Adams, 2002). Although some engineering graduate students will continue to faculty positions, the teaching component of faculty positions receives almost no attention in the typical engineering doctoral degree program (Adams, 2002; Austin, Campa III, Pfund, Gillian-Daniel, Mathieu, & Stoddart, 2009). One main repercussion of this omission is that new faculty, especially at doctoral universities with very high research activity, are often not prepared to handle and balance the demands of a position that includes teaching. This under-preparedness could be even more pronounced for new faculty at an institution that places even greater emphasis on teaching.

The emphasis on research for graduate students aligns well with the missions of the departments in which they are trained in. Most graduate students in engineering are trained at doctoral universities with very high research activity, and since these universities focus primarily on research, graduate engineering programs largely aim to prepare students to function as independent researchers in alignment with the identify and expectations of faculty at these same institutions (Austin & McDaniels, 2006a; VanDeGrift & Davis, 2006). Graduate training often takes the form of an apprenticeship model, where an advisor mentors a graduate student for an imagined faculty position and

career pathways similar to their own, i.e., one that focuses mainly on research (Rogers & Goktas, 2010).

However, there has been critique of the lack of mentorship and training of doctoral students in the teaching and service realms of academic responsibility (Austin & McDaniels, 2006b). Service activities often include advising students and serving on departmental and university committees, including faculty search and curriculum committees for example. If a graduate student is preparing for a position at a different type of institution, this lack of attention to teaching skills could be even more influential. For example, at an institution that has higher teaching expectations for their faculty, teaching might be the basis of tenure and promotion, and teaching more courses could potentially mean more impact on student learning. Another consequence of little attention to teaching during doctoral training is that engineering programs at all institution types continue to suffer from inappropriate and inadequate teaching approaches at both the undergraduate and graduate levels (Rugarcia, Felder, Woods, & Stice, 2000; Finelli, Daly, Richardson, 2014). For example, while more appropriate teaching methods for engineering have been identified to improve to improve student learning, engagement, interest, and other outcomes, engineering faculty have generally been slow to adopt these methods (Kober, 2015; Finelli, Daly, Richardson, 2014). Instead, many engineering faculty continue to rely on lecturing as a dominant approach (Rugarcia, Felder, Woods, & Stice, 2000; Finelli, Daly, Richardson, 2014).

Kober (2015) has addressed the concern of engineering and science faculty relying on lecturing by publishing a book to help faculty easily and appropriately integrate research based instructional strategies (RBIS), also called evidence-based, into their own classes. Other scholars have produced similar publications, and have noticed their use and positive impact (Borrego, Culter, Prince, Henderson, & Froyd, 2013). In line with understanding why and how faculty undergo the transition to using these evidence-based instructional strategies, Bird and Kellam (2013) conducted a narrative study examining the stories of three engineering faculty as they made the change to student-centered teaching. These studies offer tentatively positive indicators that the quality of engineering teaching is improving. However, these studies have primarily been concerned with faculty at doctoral universities with the highest research activity

classification, which is where most engineering tenured and tenure-track faculty are employed. There is a lack of understanding of the teaching approaches and use of RBIS at other institution types.

The Carnegie Classification of Institutions of Higher Education classifies institutions by research activity as well as the number and type of degrees conferred (see Table 1 and Appendix A) (Carnegie, n.d.). Of the 281 U.S. institutions that have engineering programs, 102 (36.3%) are Doctoral Universities with the highest research activity (R1) classification (ASEE, 2015). Another 95 (33.8%) institutions are doctoral universities with higher (R2) or moderate (R3) research activity, making doctoral universities the dominate institution type with over 70% of institutions with engineering programs. Finally, 84 of the 281 (29.9%) institutions are not doctoral institutions at all but rather are Baccalaureate and Master's institutions. Most Baccalaureate and Master's Institutions do not offer doctoral degrees. With just under 30% of institutions without doctoral university designations, it is natural to wonder how the faculty experience at those institutions is different. Given that research activity levels at non-doctoral universities are lower, it can be surmised that attention to teaching is different, likely more so than at doctoral universities. It should also be noted that faculty positions at all types of institutions almost always require a PhD. This means that all PhD-holding faculty are trained primarily in research-intensive programs which probably did not give much attention to the teaching and service dimensions of academic careers (Austin & McDaniels, 2006a).

Almost two-thirds (65.2%) of the total number of tenured and tenure-track engineering faculty in the U.S. are at institutions that are classified as the highest research activity doctoral university (ASEE, 2015). While faculty at these institutions are most prevalent, VanDeGrift and Davis (2006) have noticed that faculty at other types of institutions have not been given much attention in the engineering education literature. A concern that arises from the lack of attention towards faculty members at other types of institutions is that the faculty perspectives of educating approximately one-third of the bachelor's degrees in engineering are relatively unknown. For example, in 2015, of the 102,888 bachelor's degrees conferred in engineering, 39,743 (or 38.6%) of these were granted at institutions other than doctoral universities with highest research activity

(ASEE, 2015). It is also presumed that institutions with less emphasis on research activity would conversely focus more on teaching, but how that focus is realized is unknown. If more attention is paid to teaching engineering at these types of institutions, much might be learned about teaching engineering successfully. Since faculty at these various institution types likely spend more time on teaching (VanDeGrift & Davis, 2006), perhaps they have tried more evidence-based instructional strategies. Yet since while these faculty spend more time on teaching, it might also be the case that heavy teaching loads deter efforts to improve student learning and engagement. While there is likely a balance between effective and high-quality teaching and strain to manage more classes, the stories and experiences of faculty at various institution types have not been adequately explored.

The findings from research concerning faculty from non-highest research activity universities could inform and illuminate more effective teaching at all types of engineering programs, including those highest research activity doctoral universities. These faculty members represent an untapped resource to our understanding of how to best educate engineers in the United States. This research project aims to document the individual experiences of engineering faculty who pursued non-traditional pathways in the academy, i.e., those being pathways at non-highest research activity institutions. While this path is non-traditional in engineering, it should be noted that it is a common path in other fields, especially in the humanities and liberal arts. In understanding the pathways of engineering faculty, this study also examines the ways these faculty describe their teaching conceptions and how they are shaped by their institution type, including reasons why their conceptions are better aligned with the institution at which they are employed.

1.3 Research Objectives and Questions

Considering a community need and personal interest in studying faculty pathways, the purpose of my study is comprised of two primary research objectives, namely to:

1) document and describe narrative accounts of the academic pathways of engineering assistant professors at institutions with varying research and teaching activity, and

2) document and describe the teaching conceptions and methods of engineering assistant professors at institutions with varying research and teaching activity.

To address these objectives, two overarching research questions will guide my inquiry. These research questions, and how I will answer them, are stated here and further described in more detail in Chapter 3.

1) How do assistant professors experience the transition from graduate school and other previous educational and/or work experiences to their current faculty position?
2) How do assistant professors describe their current teaching conceptions and methods?

1.4 Significance of Study[2]

The findings in this study will contribute to the extant literature and engineering education community, and especially the graduate student education and mentoring community, in four main ways. First, graduate student preparation for faculty roles might consider more diverse career pathway preparation as a part of their training. With a broader understanding of faculty positions at various institution types, graduate programs can tailor their programming to various graduate students' goals. Second, by exploring the narratives and pathways of these current faculty, future faculty, among others, will be made aware of diverse career paths in the academy. This awareness can support decision making about perspective careers and/or support those on various career pathways. Third, findings from this study can inform development of criteria and practices for evaluating teaching for hiring and tenure requirements at various types of institutions. Fourth, this study will identify teaching methods and conceptions that might impact the effectiveness of engineering teaching across institution types. Since the faculty that will be examined in this study focus more heavily on teaching than the majority of engineering faculty, it is

[2] © IEEE. Portions of this section have been reused with permission (see Appendix D)

likely this specific population will have insights about highly effective approaches to teaching that all faculty will benefit knowing about.

This study may be of particular interest to graduate students and those who mentor graduate students who are interested in pursuing non-traditional pathways in the engineering academy, as well as current engineering faculty at all institution types. Additionally, faculty developers, graduate program chairs, and department heads will likely find value in this work.

For examples of how this work might be used, Figure 1 provides hypothetical sketches of possible ways various stakeholders might use and interact with the narratives that result from my study. I envision these narratives to act as inanimate "more competent others" (Chaiklin, 2003) that can facilitate learning and exploration about diverse institution teaching pathways. "More competent others" is a concept derived from Vygotsky's Zone of Proximal Development (ZPD). In the ZPD, a learner can greatly benefit when learning from someone who is slightly more advanced than they are (Chaiklin, 2003). In this case, various stakeholders, presented below, could learn from the narratives presented.

Brenda, a hypothetical assistant professor who was interviewed for this project: Brenda was excited to have the opportunity to share her story with a larger community. She often felt isolated and judged by faculty and peers as she was pursuing her PhD since she was interested in a faculty position that emphasized the teaching component more than research. During her interview, Brenda felt like she was sharing her tips with the next generation of future faculty who are looking for a pathway similar to her own. She also really enjoyed the experience of reflecting on her teaching philosophy and why she does things the way she does in the classroom.
Eduardo, a PhD student at an R1 Institution: Edwardo is starting to look for job opportunities after graduation and has realized he really wants to pursue his passion for teaching but not give up his love for research completely. He comes across a narrative that explains how an assistant professor manages the balance between teaching and research at an R3 Institution. Edwardo feels like he found a role model and an example for a pathway he is interested in pursuing.
Alexi, an associate professor at an R1 Institution: Alexi is interested in mentoring his graduate students to achieve their personal goals. He comes across some narratives that explain helpful activities and experiences that current assistant professors at other types of institutions pursued as graduate students and shares them with his PhD students. Additionally, Alexi was surprised to find that reading the narratives helped

him understand the experiences of faculty at non-R1 Institutions that had always seemed mysterious to him. He is also excited to have come across new teaching methods that he is interested in trying out in his own classroom.
Jenna, an engineering graduate dean at an R1 Institution: Jenna has been working to develop relevant programming for all the graduate students in her college of engineering. She reads the narratives from this project and finds specific strategies that will help the PhD students who are interested in focusing on their teaching after graduation, possibly at non-R1 Institutions. She also finds value in understanding why these faculty teach the way that they do and plans to ask the college to hold a workshop for faculty to explore their own teaching philosophies.

Figure 1: Various Stakeholder Hypothetical Interactions with the Results of this Work

With an understanding for why it is important to examine the stories of faculty at various types of institutions and how they got there, the next chapter will examine relevant literature. Through this examination, it will become clear that this research study is timely and relevant, and can potentially impact current and future generations of engineering teachers in the United States and beyond.

1.5 Overview of Dissertation Document

Chapter 2 is a narrative literature review that explores the context of the Carnegie Classification of Institutions of Higher Education and relevant literature regarding graduate education, graduate engineering education, teacher preparation, and faculty experiences. Additionally, I include an overview of studies that have explored similar research objectives regarding the preparation of doctoral students for academic teaching, new faculty experiences, and narrative research. This chapter is intended to provide further background and motivation for the study, making clear how and why the exploration of my research objectives is important and relevant. I will also demonstrate how my work will fill an important gap in the existing literature.

Chapter 3 describes my research methodology. I present my specific research questions, study design, and methods for how I approached this research project. More specifically, I provide a rationale for my use of a narrative research approach, including why it was appropriate for addressing the research questions at the heart of this study. I also explain my approach to the thematic analysis I conducted. To enhance the

trustworthiness of my work, I explain what specific measures I took to collect reliable data and present valid results. This includes a discussion of how I conducted and analyzed interviews with twelve assistant professors at various institutions, including through use of thematic and narrative analysis approaches.

My thematic analysis findings, presented in Chapter 4, naturally fall into two groupings based on the two research questions. First, I detail the thematic analysis findings for the research questions concerning the participants pathways to their current positions, including their preparation for the job market, decision making factors, and comparisons between institution types. Second, I describe the thematic analysis findings for the research questions that examined the participants' teaching conceptions and methods.

In Chapter 5, I continue the presentation of the findings, but focus this chapter on the presentation of the co-constructed narratives. To bridge the thematic analysis and the narrative analysis, I describe one narrative in detail. Though the use of Jason Talbert's narrative, I describe four narrative themes. These narrative themes make visible the descriptive themes from the thematic analysis in the context of Jason's story.

In Chapter 6, the discussion, I describe the main findings with references to specific participants. I highlight the common themes among the twelve participants as they pursued their current positions. To understand the experiences of the participants as they transitioned from graduate school into their assistant professor roles, it is important to both understand common themes among the twelve stories, but also to keep the stories of each individual intact, as was done in the co-constructed narratives. I additionally present implications of my dissertation for graduate education and teaching quality.

Chapter 7 provides an overview of the whole project. Then, I describe my final conclusions, planned future work, and dissemination plans. I conclude my dissertation with an epilogue that details the impact of my dissertation on me as a person.

Appendix A contains an explanation of the Carnegie Classification of Institutions of Higher Education; Appendix B includes my interview protocol; and Appendix C details the codebook I used for the thematic analysis. Appendix D includes documentation for my approved use of previously presented and published materials that

appear in some sections of this dissertation. A footnote indicates sections that include material that appeared in previous publications.

CHAPTER 2. LITERATURE REVIEW

This literature review examines the scholarship of graduate teacher preparation as well as the scholarship of engineering teaching and learning. It will set the stage to demonstrate the usefulness of the current study and the framing of the research questions and study goals. This literature review begins with a description of the context of institutions of higher education and the way they are classified (section 2.1). These differences in institution type motivate the understanding of the pathways faculty take that lead to positions at various institution types (section 2.2). Since the journey to becoming a faculty member begins in graduate school, studies concerning how graduate students are prepared for academic careers in engineering will be examined (section 2.3). Additionally, since the quality of teaching engineering is of national interest, literature on effective teaching will be reviewed (section 2.4). Next, literature on transitioning to new faculty position will be examined (section 2.5) To close the chapter and set the stage for the research questions that will be explored in this study, gaps in the literature will be described (section 2.6).

2.1 Carnegie Classifications of Institutions of Higher Education[3]

To begin to explore faculty pathways in the academy, it is important to understand the landscape of academia today. The Carnegie Classification of Institutions of Higher Education (n.d.) classifies institutions by several characteristics, including size and setting, enrollment, undergraduate and graduate programs, and research activity. The research activity classification is of particular interest in relation to engineering since most engineering programs exist at institutions that are classified as doctoral universities with the highest research activity. The Carnegie Classification of Institutions of Higher Education (n.d.) describes their classification system as summarized in Table 1, which also includes how the classifications are notated in the remainder of this document. The full descriptions of the classifications are given in Appendix A.

---

[3] © IEEE. Portions of this section have been reused with permission (see Appendix D)

Table 1: The Carnegie Classifications (Carnegie, n.d.).

Carnegie Classification	**Abbreviation**	**Summary of Classification**
Doctoral University, Highest Research Activity (R1)	R1	Awards at least 20 doctorates per year; research expenditures (aggregate and/or per capita) index very high.
Doctoral University, Higher Research Activity (R2)	R2	Awards at least 20 doctorates per year; research expenditures (aggregate and/or per capita) index high.
Doctoral University, Moderate Research Activity (R3)	R3	Awards at least 20 doctorates per year, limited research activity.
Master's College and University (Large, Medium & Small)	Master's	Awards at least 50 Master's degrees per year but fewer than 20 doctorates.
Baccalaureate Colleges	Baccalaureate	Bachelor's degrees account for at least 50% of all degrees awarded per year; fewer than 50 master's degrees awarded per year.
Special Focus Institutions	Special Focus	Based on concentration of degrees in a single field or set of related fields of at least 75% at both the undergraduate and graduate level.

When considering the breakdown of engineering institutions within the Carnegie Classification scheme, it can be seen in Table 2 that most engineering schools are of the R1 classification. However, while most engineers are indeed trained at this type of institution, there are still many institutions of different classification types, including 20.6% that are Master's institutions. Eighty-four institutions out of 281 (~30%) are not doctoral institutions at all. With almost 30% of institutions without doctoral university

designations, it is natural to ask how those institutions are different, especially in terms of faculty experiences, including approaches to teaching and research. Pifer, Baker, and Lunsford (2015) have noted these differences in faculty experiences at Baccalaureate colleges in particular. Also included in Table 2 are the total number of Doctoral, Master's, Baccalaureate, and Special Focus institutions across higher education at four-year institutions. From this comparison, it is evident that the very high percentage of programs at doctoral universities is unique to engineering with 35% of engineering schools being at R1 Institutions, but R1 Institutions only comprising 13% of institutions overall.

Table 2: Number and Percentage of Engineering Programs at Various Institutions (ASEE Profiles 2015; Carnegie, 2015) © IEEE

Carnegie Institution Type	Number of Institution Type (Engineering)	% out of 292	Number of Institution type (All)	% out of 2664
R1	103	35.3	(all DU) 335	12.6
R2	67	22.9	-	-
R3	29	9.9	-	-
Master's	39	13.4	741	27.8
Baccalaureate	23	7.9	583	21.9
Special Focus	4	1.4	1005	41.5

When considering the number and types of degrees being conferred at these various institutions, it is understandable that doctoral universities award the larger number of bachelor's, master's, and doctoral degrees, especially at highest research activity universities, as seen in Table 3. For example, over 11% of bachelor's degrees come from master's institutions.

Table 3: Number and Percentage of Engineering Bachelor's, Master's, and Doctoral Degrees Awarded at Various Four-Year Institution Types (ASEE, 2011; Carnegie, 2015)

Carnegie Institution Type	Bachelor's Degrees Awarded	% out of 79,639	Master's Degrees Awarded	% out of 46,696	Doctoral Degrees Awarded	% out of 9,518
R1	48,527	60.9	30,056	64.4	8,116	85.3
R2	16,428	20.6	9,060	19.4	1,104	11.6
R3	3,237	4.1	2,347	5.0	165	1.7
Master's	9,288	11.6	5,085	10.9	118	1.2
Baccalaureate	1,918	2.4	24	0.1	7	0.1
Special Focus	744	0.9	124	0.3	8	0.1

Finally, when further considering the breakdown of U.S. Engineering Programs by the number of tenured and tenure-track faculty, just over one-third of faculty are at institutions other than the R1. Table 4 summarizes the distribution of faculty members.

It is also important to note that there are faculty positions that are non-tenure track (NTT). NTT positions include roles that are frequently called "instructor" or "lecturer." However, especially in science and engineering, NTT roles can also refer to some positions that either focus solely on research or teaching, such as research and teaching professors. While the experiences and perspectives of NTT faculty are also unknown and understudied, they will not be the focus of this work, since this work examines the experience of tenure at various institution types, however, community colleges and other two-year institutions are not included. For the remainder of this document, the term *faculty* will refer to those that are tenured and tenure track at four-year institutions.

Table 4: Number and Percentage of Engineering Tenured and Tenure-Track Faculty at Various Institution Types (ASEE Profiles 2015; Carnegie, 2015)

Carnegie Institution Type	Tenured / Tenure-Track Faculty	% out of 25,227
R1	16,315	64.7
R2	4,637	18.4
R3	1,322	5.2
Master's	2,251	8.8
Baccalaureate	469	1.8
Special Focus	233	0.9

Now that we have an understanding of the number of tenured and tenure-track faculty at each institution type, we can begin to explore the pathways to faculty positions.

2.2 Pathways to faculty positions[4]

There has been significant interest in examining the preparation of graduate students for academic faculty jobs. For example, The Chronicle of Higher Education recently published a special report called "Teaching PhDs How to Teach" (Chronicle, 2017), yet most of this interest has not been specific to STEM fields (Austin, 2002). Many graduate students are interested in pursuing academic careers (Golde & Dore, 2001), although this is not necessarily the case in engineering. In fact, over 73% of engineering PhD graduates pursue post-graduate work in industry (Cox, 2011). Researchers are interested in understanding graduate student pathways in more depth, reflected by the existence of the Early Career Doctorates Survey (NSF, 2016a), which seeks to better understand the experiences of doctoral students after graduation.

[4] © IEEE, ©ASEE. Portions of this section have been reused with permission (see Appendix D)

Engineering is a unique field that often prepares graduates with a Bachelor's degree for industry practice, unlike other fields, such as law and medicine, which require professional school. Thus, studying engineering faculty pathways in particular is important.

The pathways towards academic positions in engineering at R1 Institutions are clear: a PhD is needed and research publications in top-tier journals are desired. However, specific pathways within the academy are not distinctly understood. Disciplinary differences in graduate training such as admission criteria, advising styles, and when a student is deemed worthy of conferral can also have a large impact on the graduate student experience (Turner, Miller, & Mitchel-Kernan, 2002). For example, there can be disciplinary differences regarding research methods, questions, and what outcomes are valued. The relationship between teaching and research may also vary by discipline in addition to by institution (Austin & McDaniels, 2006a). For example, while postdoctoral positions are almost always required before a faculty position in most science fields, they are not always required for engineering. Therefore, it is valuable to consider the graduate training and career pathways of engineering faculty members specifically.

A number of scholars have examined processes associated with acquiring sufficient knowledge to teach at the college level. For instance, Austin and McDaniels (2006a) proposed a three-step progression that examines graduate teaching assistants' (TA) dependence on their supervisors: "(1) highly dependent upon the faculty member for advice and support; (2) counterdependent or independent from teaching supervisors, trying to solve teaching dilemmas on one's own; or (3) interdependent with the faculty member, sharing ideas for pedagogical improvement" (Austin & McDaniels, 2006a, p. 410). These stages of teaching assistant socialization have a major implication, namely that proper socialization as a teacher takes practice and time. One recent study considered future STEM faculty and the role of teaching development during graduate school specifically, and this work points to the importance and positive long-lasting impact teaching development can have on faculty careers (Connolly, Savoy, Lee & Hill, 2016). Researchers agree that one single experience will not be sufficient for graduate students to develop into teachers. However, it seems that many new faculty only have one

teaching experience prior to starting a faculty position (Austin & McDaniels, 2006a; Adams, 2002).

Austin and McDaniels (2006b) also 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 at Baccalaureate Colleges (Baker, Pifer, & Lunsford, 2016). Even though the responsibilities of faculty are well-understood to encompass all that Austin and McDaniels specify, socialization of graduate students often does not achieve adequate preparation in the above aspects, except for research processes (Golde & Walker, 2006). This leaves future faculty underprepared for faculty positions, especially with regards to teaching and service roles, which often come as a surprise to new faculty members as very difficult and time-consuming (Adams, 2002).

To better understand what graduate students think about future faculty positions, the theory of faculty schema can help explain why graduate students pursue academic faculty positions (Bieber & Worley, 2006). Schema, as originally proposed by Piaget in 1926, are abstractions of an individual's lived experience that can help interpret life's events, including future events (Bieber & Worley, 2006). In relation to graduate school and faculty positions, graduate students develop schema based on their experience of graduate school and through consideration of future opportunities. Since most graduate students are trained in an apprenticeship model, they often develop faculty schema, or ideas and thoughts about the reality of faculty life, based on working with and observing their advisor and other faculty. This idea of a faculty schema is especially intriguing in the context of graduate students who pursue positions at non-R1 Institutions. These graduate students will be familiar with their advisor's faculty role which is most likely at an R1 Institution. Faculty members who are at non-R1 Institutions will likely have built schema as graduate students about what it would be like to be a faculty member at a different institution type, likely including conceptions about teaching.

Conceptions, while similar to schema, describe specific meanings attached to phenomena (Pratt, 1992). In addition to constructing schema about faculty life, graduate

students also construct conceptions specific to research and teaching. Teaching conceptions represent the lenses through which one teaches, including the beliefs and understandings about knowledge, students, and the content (Borgford-Parnell, 2006). Two notable studies examined conceptions about teaching. Torres-Alaya (2012) found that doctoral students in engineering develop the following conceptions about teaching: 1) delivering knowledge, 2) helping understand and apply concepts, 3) motivating students, 4) helping students learn how to approach problems, and 5) preparing students to make socially conscious decisions (Torres-Alaya, 2012). Similarly, Borgford-Parnell examined the conceptions of effective teachers in a variety of disciplines but not including engineering, and found that effective teachers in research universities have conceptions which he called a Pedagogy of Larger Concerns (Borgford-Parnell, 2006). These consist of: 1) teacher's power is leavened with responsibility, 2) students are synonymous with positive vision of future, 3) learning to learn takes precedence, 4) teachers are essential to student learning, and 5) new learning fits to the student's lifetime of learning (Borgford-Parnell, 2006). Borgford-Parnell et al. (2017) found that the Pedagogy of Larger Concerns that resulted from his study were also found to be very useful for engineering instructors reflecting on their teaching. This finding implies that the conceptions are relevant for engineering instructors. The conceptions of new faculty in engineering at varying non-R1 Institutions likely reflect aspects of both Torres-Alaya and Borgford-Parnell's findings, which capture how conceptions about teaching develop over time.

Along with developing schema about faculty life and conceptions about teaching, graduate students are exposed to an entire community that affects their development and preparation for future faculty positions. Community of practice theory suggests that individual activities are inherently influenced and interpreted by the practices of a larger community (Crede, Borrego, & McNair, 2010; Lave, 1991; Wenger, 2000). New members of the community are enculturated into the community and learn how certain activities are practiced and rewarded. This is particularly important in the case of understanding graduate students and faculty members. Departments or schools can easily be viewed as communities of practice, with specific norms and procedures. A new graduate student or faculty member in engineering will learn from the community what is

required of them with regards to teaching, research and service in their particular department at their particular institution type.

To better understand why communities of practice can be so influential, situated cognition theory suggests that learning is inherently linked to the situation where something is learned (Brown, Collins, & Duguid, 1989; Lave, 1991; Wenger, 2000). For example, learning about becoming an engineering faculty member at an R1 Institution influences the way graduate students learn about their prospective profession and life as a faculty member. Once a faculty member begins their position at a different institution type, however, they are exposed to a different community of practice and institutional culture, making what they learned about teaching at an R1 Institution potentially in conflict with the norms of their new context. This transition between institution types has been underexplored. However, while communities of practice at the institution level can be very influential and will be explored in this study, communities of practice can take many forms, including at departmental and disciplinary levels (Pifer, Baker, & Lunsford, 2015). Even small teaching groups can be viewed as a community of practice that can be extremely influential for someone as they are developing their teaching conceptions and preparing for future faculty positions (Crede, Borrego, & McNair, 2010).

Although there has not been much exploration of various pathways in academia specifically for 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 institutions with or varying types (PFF, 2016a). While there are no official PFF programs have been instituted for engineering, many initiatives have been built upon the PFF model (PFF, 2016b). For example, Lewandowski, Fried, Bishop, Kukreti, and Purdy (2003) report on a preparing future faculty program in engineering at the University of Cincinnati. These authors make an important distinction for why PFF programs can be so valuable for engineering in particular: Since so many engineering graduate students are international, there exists a large opportunity to discuss cultural differences and diversity with regards to pedagogy (Lewandowski, Fried, Bishop, Kukreti, &, Purdy, 2003).

Other examples of efforts to improve preparation of doctoral graduates for faculty careers include the National Science Foundation (NSF) Integrative Graduate Education and Research Traineeship (IGERT) program (NSF, 2016) and the Department of Education (DOE) Graduate Assistance in Areas of National Need (GAANN) Fellowships (DOE, 2016). Crede, Borrego, and McNair (2010) examined another college-level specific program that prepared engineering graduate students for faculty careers. One notable distinction about this program is that is provided funding to the fellowship recipients that was more than other graduate assistantships (Crede, Borrego, & McNair, 2010). Prevost, Vergara, Urban-Lurain and Campa (2017) report on Graduate Student Teaching Professional Development Programs at Michigan State University. One major motivation for focusing on STEM graduate students in this program is as a mechanism to transform undergraduate engineering education. The authors argue that graduate students might be more open to using evidence-based teaching practices in their own teaching than current faculty members, eventually transforming engineering teaching. Additionally, teaching assistants who are exposed to evidence-based teaching practices might impact the faculty with whom they are working to utilize such approaches. A number of researchers have found that faculty can be particularly resistant to integrating new pedagogies into their teaching practice (Fairweather, 2005, Henderson, Dancy, & Niewiadomska-Bugaj, 2012).

Crede, Borrego, and McNair (2010) additionally draw attention to the prestige factor when it comes to teaching versus research. Teaching assistantships in STEM are typically held in lower regard than research assistantships, and often students only TA as long as they have to, i.e., until they find a position as a research assistant (Austin, Campa III, Pfund, Gillian-Daniel, Mathieu, & Stoddart, 2009). This preference for research relates back to the idea of community of practice as discussed earlier. If the people in the community around you prefer research over teaching tasks, it can be uncomfortable or discouraging to pursue pathways that focus on teaching. This notion of research-first in a community also often challenges faculty members and will be discussed below.

2.3 Current Engineering Faculty

Faculty roles have been discussed from many disciplinary perspectives, and again, specific attention to the roles in engineering remain underexplored. Concerns about the quality of engineering education have gained attention nationally, with teaching often viewed as inadequate (Olson & Riordan, 2012). Most studies concerning engineering faculty, however, take place at institutions where the primary role of engineering faculty members is to conduct research.

Academic faculty positions primarily consist of three roles: research, teaching, and service (Adams, 2002), and the balance of these roles continues to be a challenge for faculty (Sorcinelli, Austin, Eddy, & Beach, 2005). Historically, there have been arguments both for and against the research-teaching nexus, or that research informs one's teaching positively and vice versa (Prince, Felder, & Brent, 2007). As with graduate students, faculty are largely influenced by the community of practice they are situated within and whether that community favors and rewards research over teaching (Fairweather, 2008). However, there has been considerable pushback on research, or the scholarship of discovery, being the only form of scholarship. In his groundbreaking work, *Scholarship Reconsidered*, Boyer (1990) developed the idea of the scholarships of application, integration, and teaching. The concept of the scholarship of teaching has encouraged faculty and others to see worth and value in spending time and energy on teaching and becoming an effective teacher (Boyer, 1991). However, efforts spent on teaching continue to receive much less attention, or reward, than research at most doctoral institutions. In fact, some researchers found that research is typically most rewarded even at institutions that have larger teaching requirements (Berube and Young, 2002).

Further, it has been shown that the reward structure of an institution can largely impact what an institution or community favors (Fairweather, 2008). When comparing various institution types that have engineering programs, it is very important to understand the reward structure at the various institutions, as these practices will likely influence how an assistant professor approaches and thinks about teaching.

In light of these potential differences in reward structure and communities, there has been a growing interest in diverse pathways in the academy. Some faculty in different

roles at institutions that focus more on undergraduate teaching have begun to share their stories at conferences. For instance, Finley (2001) shared his personal experience as a department head in computer science at Tri-State University, and VanDeGrift and Davis (2006) shared their experiences seeking tenure-track positions in computer science at non-R1 Institutions. Further, Boice (1991a) examined and compared the teaching experiences of faculty at both a comprehensive (or teaching focused) university and doctoral university and found that the experiences of faculty were indeed different. One example of a difference was that faculty at the research university were advised against participation in faculty development programs that would detract from research productivity, while faculty at the teaching focused university were not (Boice, 1991a). This study will be examined in more detail in section 2.5 below.

While we have seen that research is often favored over teaching in many faculty roles, teaching quality has been the focus of research studies for some scholars. The next section explores teaching methods as well as barriers faculty face in their teaching.

2.4 Teaching Methods

The quality of engineering teaching has been put into the national spotlight in recent years as a way to meet national goals such as graduating more engineers (Olson & Riordan, 2012). It has been shown many times over the years that student-centered approaches to teaching have more success for student learning and career preparation, however, engineering faculty are slow to adopt these practices (Felder, Woods, Stice, & Rugarcia, 2000; Finelli, Daly, & Richardson, 2014).

Teaching quality in engineering has been put into question for some time now (Connolly, Lee, & Hill, 2016). There have been many teaching approaches that have been verified as being more useful for student learning, yet engineering faculty do not quickly incorporate these practices into their teaching (Felder, Woods, Stice, & Rugarcia, 2000; Borrego, Froyd, & Hall, 2010; Finelli, Daly, Richardson, 2014). Jamieson and Lohmann (2012) also found that faculty desire more support and rewards regarding their incorporation of new educational innovations in their classrooms.

While we understand that many faculty find engineering teaching innovations difficult to adopt, there are a range of characterizations of engineering education inquiry.

Engineering teaching is often criticized as still being primarily comprised of talk-and-chalk lectures (where the instructor writes on a chalkboard and talks about what he/she is writing) and individual homework assignments with closed-ended problems (Adams & Felder, 2008; Sroka, 2015). At the opposite end of the spectrum, there are faculty members whose research is actually focused on the study of engineering education. The Engineering Education Inquiry Framework (Borrego & Streveler, 2015) presented in Figure 2 can help us understand the variations of teaching and research practiced in engineering education. One way to distinguish between effective teaching and scholarly teaching is that effective teaching produces student learning, while scholarly teaching is additionally based on best practices and grounded in literature. Some types of inquiry begin to include the scholarship of teaching and learning (Boyer, 1990) as well as educational research. Adams and Felder (2008) have a similar framework that goes one level further to describe educational philosophers and provocateurs. It should be noted that one type is not necessarily better than the other (Sroka, 2015), and it is hoped that teaching as taught in the future will actually involve a status quo where effective teaching methods are predominant.

Type of inquiry	**Attributes of level**
Teaching	• Status quo • Teach as taught
Effective Teaching	• High quality instructional content • Effective teaching methods
Scholarly Teaching	• Classroom assessment and evidence gathering • Uses evidence and best practices to improve • Invites evaluation and review

Scholarship of Teaching and Learning	• Is public and open to evaluation and critique • Is in a form others can readily build on • Involves question-asking, inquiry, investigation • Focused on student learning (what? how much?)
Engineering Education Research	• Involves research questions (why? how?) • Interprets research results in light of theory • Pays careful attention to study design, methods • Disseminates findings, such as via journal papers

Figure 2: Engineering Education Inquiry Framework, adapted from (Borrego & Streveler, 2015)

Much criticism of teachers is that they practice "Teaching," described by the Inquiry Framework "as taught." Teaching based on the status quo often leads to ineffective teaching (Felder, Woods, Stice, & Rugarcia, 2000). This is often very easy to do since graduate students have often succeeded with these methods, which can be attributed to the fact that they are still in the education system and succeeding by those standards. Furthermore, with the apprenticeship model still in place, many graduate students will teach similarly to how their advisors and other professors they had as students teach. As faculty move towards "Effective Teaching" and "Scholarly Teaching" in the Inquiry Framework, they begin to more effectively incorporate practices that help students learn. These practices include activities such as active learning, inquiry based learning, and culturally relevant pedagogy among others (Felder, Woods, Stice, & Rugarcia, 2000; Freeman et al., 2014). Using activities such as those described by Felder et al. (2000) can help improve teaching effectiveness and in turn, help students learn better (Sroka, 2015).

One way a faculty member's teaching approach and methods can be understood is through a statement of teaching philosophy. This statement of teaching philosophy likely reflects, implicitly and explicitly, various elements of an instructor's schema and conceptions about teaching. Statements of teaching philosophy are commonly required for faculty job applications and promotion documents and are generally in the form of a narrative (Chism, 1998). These narratives statements typically describe an instructor's teaching goals and how s/he achieve them, and the statements can also be used to stimulate reflection on teaching (Chism, 1998). Asking faculty to develop and maintain teaching philosophy statements has also been proposed as a crucial way to promote a campus culture that is supportive of teaching (Goodyear & Allchin, 1998). Goodyear and Allchin (1998) describe how individual teaching philosophy statements are useful to many stakeholders including students, faculty, and university administrators.

Similar to statements of teaching philosophy, course syllabi include instructors' goals and beliefs about teaching, and can be viewed as an "enacted" version of a teaching philosophy. Syllabi might vary from teaching philosophy statements in that they almost always include actionable items, such as specific information about how students are graded and evaluated (Johnson, 2006). They also often include course objectives and activities that indicate a given instructor's philosophy, at least to some extent. Formally, a course syllabus is a contract between an instructor and the students taking the course (Parkes, Fix, & Harris, 2003). Syllabi have also been proposed as a good mechanism for improving classroom communication (Smith & Razzouk, 1993).

2.5 Transitions and New Faculty

Many would agree that the transition to becoming a faculty member is a challenging process and experience. There are many programs in place and much research has been conducted about how to help new faculty succeed (Boice, 1991b; Sorcinelli, 1994; Solem, Foote, & Monk, 2008). There also exist many guidebooks for helping faculty succeed in the three tenets of tenure-track careers: research, teaching and service (Seldin, 2011; Buller, 2010). Many studies in engineering education have explored faculty transitions to being more effective educators (Finelli, Daly & Richardson, 2014; Felder, Brent, & Prince, 2011; Wankat, 2002) and one study utilized

narrative inquiry to gather stories about educators making the transition to more student-centered teaching methods (Bird & Kellam, 2015). While my study also focuses on a transition among educators, it examines the transition from graduate student to faculty member and from an R1 to a non-R1 Institution.

Boice (1991a) examined the experiences of new faculty during their first four semesters specifically with regards to teaching. All faculty in the study were newcomers, but their disciplinary homes were not stated. In comparing between comprehensive (outdated term for master's university) or teaching focused, and doctoral universities, Boice found that new faculty members at both institution types approach teaching defensively and with apprehension (1991a). Many faculty members had no expectation that they would enjoy teaching and were disappointed by the advice their senior colleagues gave them. In this study, Boice found very little difference between the faculty at the two institution types he considered, a finding he states, "would surprise faculty at the teaching campus who commonly asserted the teaching superiority of their campus in comparison with research campuses" (page 172). One of the main recommendations from Boice's study was to provide all faculty with more preparation for teaching and faculty development in their new positions (Boice, 1991a). It is important to see how faculty preparation and development have changed since Boice's work in the early 1990s.

Connolly, Lee, and Hill (2016) additionally identified that the STEM doctoral students that engaged in teaching development programs had greater success as new faculty members than those without teaching development. This is a critical finding that supports the need to include teaching more intentionally into doctoral students' training. This study also found that while most STEM doctoral students who pursue academic jobs after graduation find employment at doctorate-granting institutions (60.85%), almost 20% find positions at non-doctorate-granting institutions. Across all the institution types, almost half of the doctoral respondents had positions that included teaching responsibility (Connolly et al., 2016). The teaching development these doctoral students participated in not only prepared them for their faculty positions, but also increased their interest in teaching. An increased interest in teaching among graduate students has implications for improving STEM teaching effectiveness nationally, since these future faculty might bring more effective and innovative teaching into their future classrooms.

However, as has been explored in the Introduction (Chapter 1) and in this literature review, transitioning from an R1institution as a graduate student to a teaching-focused environment (non-R1) as a faculty member might include specific experiences that have not yet been explored, and leave current doctoral students unsure about what those positions look like. The transition from Doctoral Universities to Baccalaureate Colleges has been explored by some scholars and their findings agree that the change in institution type has notable impacts on faculty experiences (Pifer, Baker, & Lunsford, 2015). Most notably, local departmental contexts were key in providing a positive or negative experience as a new faculty member.

Specifically, there has been scare research on the variation of institution types at which engineering is taught. Some faculty in self-described teaching institutions have reported on differences of various institution types (VanDeGrift & Davis, 2006; Haering, 2005). These publications generally take the form of guidebooks and offer advice.

2.6 Gaps in the Literature

In this literature review, I presented data about the number of institution types that have engineering programs and number of tenured and tenure-track faculty in engineering programs. From this data, we saw that most engineering programs are at R1 Institutions, and most engineering tenured and tenure-track faculty are also at R1 Institutions. The experiences we know of tenured and tenure-track faculty at institutions other than R1 are mostly anecdotal and **there is a gap in our understanding about the experiences of faculty at a non-R1 Institution.**

The literature review also revealed a misalignment between graduate school preparation and faculty careers that focus on teaching. Since most engineering PhDs earn their degrees at an R1 Institution, they have been socialized in that context. **There is a gap in our understanding about the experiences of transitioning from a graduate student at an R1 Institution to another institution type for a faculty position.**

Finally, the literature review showed that teaching is often criticized for quality, yet teaching conceptions of engineering faculty are not fully understood. Thus, since we do not know much about the experiences of engineering faculty at various institution types,

it extends that **there is a gap in our understanding of the conceptions and methods of faculty at various institution types other than R1.**

In this research project, I aim to fill in these gaps in our knowledge of faculty experiences. The research objectives that will be used to guide the research in order to fill these gaps will be described next.

2.7 Research Objectives

While there has been some examination of similar research questions about graduate student preparation for academic positions and faculty experiences, there is no research exploring the narratives of engineering faculty and their graduate preparation for the diverse institutions in academe. In order to understand the gap, two primary research objectives guide this work, namely to:

1) document and describe narrative accounts of the academic pathways of engineering assistant professors at institutions with varying research and teaching activity, and
2) document and describe the teaching conceptions and methods of engineering assistant professors at institutions with varying research and teaching activity.

In order to understand the academic pathways of engineering faculty at non-R1 Institutions, it is important to explore the faculty schema and expectations of faculty life these individuals hold as well as understand their experiences in communities in both graduate school and at their current institution. I will examine their teaching philosophy statements and course syllabi to better understand their teaching practices and methods. The transition to faculty positions in engineering at non-R1 Institutions has been understudied but will be the focus of the research study described in this dissertation. To help me make sense of the experiences of engineering faculty at non-R1 Institutions, I will use the theories of faculty schema, community of practice, and situated cognition to guide my analysis as described in Chapter 3 on my research methods.

Specifically, this study builds on anecdotal evidence of the experience of transitioning from an R1 research focused institution to an institution that focuses more on teaching. VanDeGrift and Davis (2006) and Finley (2001) have provided two notable

descriptions of this experience first-hand; however, a high-quality research study of these experiences has not been conducted. This research will provide a basis for our understanding of the complex and nuanced experience faculty undergo as they transition to various institution types from an R1 graduate school experience.

CHAPTER 3. METHODS

The purpose of this research is to understand the experiences of engineering assistant professors at institutions with varying research and teaching activity. The experiences of interest include graduate school preparation, transition from an R1 Institution to non-R1 Institutions, and teaching conceptions. To the end of collecting stories, creating narratives, and understanding the faculty experience at these varied institutions, I investigated the following Research Questions. Note that these questions seek to understand the experiences, perspectives, and teaching conceptions of engineering faculty as they prepare for, and transition into, academic careers in institutions with varying focus and attention to research and teaching.

3.1 Research Questions

1) How do assistant professors experience the transition from graduate school and/or other previous educational and/or work experiences to their current faculty position?
    a. How do assistant professors experience the process of applying to and choosing the institution in which they are currently employed?
    b. How do assistant professors describe their graduate student experiences and other preparation for their current faculty position?
2) How do assistant professors describe their current teaching conceptions and methods?
    a. How have these conceptions been influenced by graduate school experiences and current institution experiences?
    b. What are the teaching conceptions of the assistant professors in this study?

3.2 Research Paradigm

I align with a constructivist research paradigm (Guba & Lincoln, 1994), meaning that I believe all individuals experience the world in a unique way. This paradigm is

appropriate in conducting an exploratory research study aimed at understanding the experiences of various people. An ethnographic interviewing approach was utilized to align with my constructivist paradigm, since an ethnographic approach places the interviewee at the center of the interview. This meant that I withheld all judgement about the stories my interview participants chose to share with me. I chose to present each of my participants' stories as a co-constructed narrative which uses the participants' words to tell their story. Additionally, narrative research requires that the participants check the narrative for accuracy, which means that each of the narratives presented in this dissertation have been approved by the participants. Finally, I used thematic analysis to further analyze my data. Thematic analysis is a flexible approach to data analysis that both allows for a priori and emergent themes to describe the data. The findings are also presented from a constructivist approach, relying on the participants' quotations to describe the themes.

3.3 Research Design

Since I was interested in understanding the individual pathways and experiences of engineering faculty, I used a qualitative narrative approach, which aligns with my research paradigm. I want to make visible the stories and possibilities of pursuing and being in a faculty position at various institutions. Therefore, I find it is important to examine a variety of types of institutions and also a variety of professors in those institutions.

I used Narrative inquiry (Webster & Mertova, 2007; Creswell, 2012) to examine twelve assistant professors at four types of institutions. One of my main purposes for this project was to create narrative stories in order to provide a thick description (Geertz, 1973) of the experiences of engineering assistant professors and to provide stories that readers will more readily be able to connect with (Kellam, Gerow & Walther, 2015). For example, Brid and Kellam (2013) have explored the changing perspectives of engineering faculty as they move towards student-centered teaching practices through narrative research. There has also been a strong case for narrative research in engineering education, where the researchers emphasize that stories can help people connect with the research in ways that breaking down data does not readily enable (Kellam, Gerow, &

Walther, 2015). In this research, I am looking to understand the phenomenon of transitioning from an R1 to a non-R1 Institution. However, since I am not looking to describe the full space of variation associated with these transition experiences, phenomenography was not an appropriate research method for my specific goals.

Assistant professors in tenure-track positions at four-year institutions will be examined exclusively in this study, although it is noted that the experiences of non-tenure track positions often focus more heavily on teaching. The experiences of non-tenure-track and faculty members at two-year institutions are worthy of study and will be explored in my future work. This work considers the tension associated with pursuing tenure with varying expectations of research and teaching.

In addition to producing narratives about individual assistant professors, I also conducted a thematic analysis considering the assistant professors as a group. This thematic analysis was conducted in order to provide a holistic understanding of the varied experiences and perceptions of assistant professors in engineering at non-R1 Institutions. From examining the stories of twelve assistant professors as a collective, and in comparison, to each other, we learn about similarities and differences that can be useful to understand the broad range of experiences that are possible. The thematic analysis used the full interview transcripts as the data source, which will be described next.

3.4 Data Collection

The primary source of data for this study is semi-structured ethnographic interviews with twelve engineering assistant professors at four institution types (Baccalaureate, Master's, R3, and R2). As discussed in more detail below, I also collected two relevant documents, their statement of teaching philosophy and a recent syllabus, which were then referenced and discussed during the interview in order to elicit richer explanations of their teaching conceptions and methods. The interviews were conducted via Skype and audio recorded. While the Skype conversations did utilize the video feature, the video was not recorded.

Although face-to-face interviews would have been preferred to Skype interviews, interviewing my participants in person was not possible due to geographic constraints. In order to interview twelve participants, I was not able to limit my participants' geographic

location. However, despite the downside of virtual interviewing, I took many measures to ensure high quality interview data. I describe these measures in section 3.6 where I discuss the role I played as the researcher.

All data collection activities were completed under Purdue University IRB Protocol #: 1606017812.

3.4.1 Interview Procedures[5]

I conducted a single interview with each participant surrounding two topics: 1) graduate school experiences and preparation and for their faculty role and, 2) teaching conceptions and methods, including development and current views. These interviews lasted between 60 and 120 minutes and included document elicitation activities, which will be described in more detail below.

I developed and refined the interview protocol (see Appendix B) through a number of steps. The protocol questions are based on the research objectives and research questions. After the initial design, I had members of my dissertation committee review my interview protocol, all of whom have interviewed faculty members in other studies. I conducted one pilot interview (described below). I also received feedback on my interview protocol from an engineering assistant professor at a Master's Institution.

I conducted the interviews using an ethnographic interview approach in which I, the researcher, viewed the interviewee as the informant (Frank, 2011). This interview approach is similar to many other qualitative interview approaches, yet emphasizes a focus on the participant being the expert in the conversation. I began each interview by explaining to the participant that I view them as the expert, will encourage them to do most of the talking, and will ask them to focus on specific events. Since the analysis of narratives relies on critical events within a participant's story (Webster & Mertova, 2007), the assumption that the interviewee is the expert on the subject is a crucial consideration. I made sure to allow for the participants' topics, thoughts, and ideas to guide the conversation within my semi-structured interview protocol. I also allowed for

---

[5] © IEEE. Portions of this section have been reused with permission (see Appendix D)

the participants to tell their story with as few interruptions as possible so that direct quotations could be used as much as possible without much need for clarification.

The interview protocol included three main components: my (the researcher's) personal background and study motivation; questions about the participants' experiences in graduate school and through their transition to their faculty position (Part A); and document elicitation activities with participants' teaching philosophy statements and course syllabi (Part B). For Research Objective 1 (document and describe narrative accounts of the academic pathways of engineering assistant professors at various institution types), Part A of the interview protocol is directly addressed through the interviewee's responses.

In order to address Research Objective 2 (document and describe the teaching conceptions and methods of engineering assistant professors), two documents were collected and used during Part B of the interview protocol. Document elicitation is based on photo elicitation, a qualitative research technique in interviewing that asks participants to respond and react to visuals (Harper, 2002). The two documents I used were: 1) the assistant professor's most recent teaching statement, and 2) a course syllabus for a course they were currently teaching or had recently taught. By asking the participants to walk me through the teaching statements and course syllabi, I expected that their responses about the teaching conceptions and methods would be richer and more descriptive than if I simply asked them to describe their teaching conceptions and methods. I made this assumption based on my own interpretations of photo elicitation methods (Harper, 2002).

The full participation activities, which were shared with potential participants, included:

- One 60- to 120-minute interview via phone or Skype
- Member checking activities (at least once)
- The participant's most recent teaching philosophy statement
- A course syllabus for a course the participant is currently teaching or has recently taught

Member checking activities included reviewing the constructed narrative I wrote based on the interview. I required each participant to review and approve the narrative for publication and dissemination. This participant activity, accompanied with the fact that

the narratives were based almost entirely on direct quotations from the interviews, make the narratives co-constructed.

3.4.2 Sampling Procedures

I used a quota sampling (Johnson & Christensen, 2013) approach to recruit research participants through the use of personal networks. I began my search for participants by collecting names of people in my own personal network and in the networks of my committee members. I also contacted my departmental listserv with a request for contacts that fit my selection criteria. Through this avenue, I asked for formal connections to be made via email.

In addition to recruiting through personal networks, I sought out potential participants at the American Society for Engineering Education (ASEE) Annual Conference in June 2016 and at the Frontiers in Education (FIE) Conference in October 2016.

The above recruitment strategies connected me with ten participants. Yet as justified in more detail below, I wanted to make sure I had twelve total participants, with three participants at each of the four institution types I was examining. My final recruitment approach was to systematically locate potential participants through their institutions' websites and directly emailing them with a request for participation. I used the Carnegie Classification lists of institutions and cross-referenced this list with the ASEE list of engineering schools to come up with a list of institutions that fit my criteria. Next, I examined faculty profiles on institution webpages, sometimes cross-referencing with LinkedIn to confirm a potential participant met my participation criteria, and finally sending an email. I sent approximately 50 emails to potential participants, and this approach helped me locate my final two participants for my research study. One week after finishing my final interview, I received an email from one additional potential participant. However, since my original plan of interviewing twelve participants was met, I informed this final potential participant that my study was closed.

3.4.3 Participants and Participant Selection[6]

I chose to examine three assistant professors at each of four institution types for two reasons. First, I wanted readers to avoid associating a particular institution type with one individual's experience as would happen with one participant at each institution type. Second, I wanted to readers to avoid the possibility of exaggerating similarities and/or differences among participants who may have similar backgrounds or pathways. This over-exaggeration of similarities and differences is more likely if only two individuals are interviewed from the same institution type or who share some other key characteristics. My goal was for readers to become aware of the variation in experiences and to connect with the narratives, and recruiting three participants at each institution type was deemed adequate but manageable in regard to accomplishing this goal.

Since I sampled from ASEE and FIE attendees, I acknowledge that some of the participants to some extent self-identified as having an interest in engineering education. While this might bias the sample towards interest and knowledge of educational theory, scholarship, practice, research, etc., this knowledge is welcomed since I am interested in learning about faculty member's perspectives on the teaching methods they are using. I sought participants from different institutions from all over the United States in order to hear varied stories. I did not make any effort to find multiple faculty members at the same institution since the goal of this work is to learn about individual faculty members at the varied types of institutions and not to classify or understand the institutions themselves.

The participants that were interviewed for this study were assistant professors at one of the following institution types: 1) Baccalaureate, 2) Master's, 3) R3, and 4) R2 as shown in Table 5. As described earlier, the experiences of faculty at R1 are most commonly studied and will not be the focus of this study.

---

[6] © IEEE. Portions of this section have been reused with permission (see Appendix D)

Table 5: Participant Information. (Note that there are three participants from four institution types.)

Participant (pseudonym)	Current Institution	Gender	Start Date	PhD Date	Undergrad	Master's
Steven Bradley	Bacc.	Male	8/14	5/12	R1	R1
Valerie Michaels	Bacc.	Female	8/15	5/15	R1	N/A
Opie Hampton	Bacc.	Male	8/15	12/14	R2	R1
Christopher Davis	Master's	Male	9/14	8/14	Bacc.	R1
Samantha Reed	Master's	Female	1/16	5/16	Special Focus	R1
Jason Talbert	Master's	Male	8/15	8/13	R1	R1
Matthew Land	R3	Male	1/15	5/12	R1	R1
Emma Edgerton	R3	Female	8/15	12/12	R2	R1
Richard Vine	R3	Male	8/13	12/11	R1	R1
Brandon Oakley	R2	Male	8/13	12/12	R1	R1
Molly Sanders	R2	Female	8/16	12/11	R2	N/A
Tyler Colton	R2	Male	8/14	5/14	R1	R1

Specifically, the *original* selection criteria to choose twelve participants included the following characteristics:

- Assistant professor seeking tenure
- Employed at one of four institution types: Baccalaureate, Master's, R3, or R2
- Fewer than three years of experience between doctoral conferral and start of faculty appointment
- Within the first three years of first faculty position
- Doctorate earned at an R1 Institution

- Four women
- Four participants who identify as ethnic minorities

I was intentional about finding at least one female for each institution type. As recruitment of participants ended up being much more challenging than initially intended, I allowed for three of my participation criteria to expand beyond what I had initially intended. First, I relaxed the number of years that a participant could have spent in another role between earning their PhD and starting in their assistant professor role. Second, I relaxed the number of years that a participant could have been in their current position as an assistant professor. The reasoning behind both of these restrictions was to make sure the participant would be readily able to reflect on their graduate school experiences. Despite some larger time gaps, each participant was easily able to comment on their experience as a graduate student and it did not affect data quality. Third and finally, I eliminated my criteria to include four participants who identified as ethnic minorities. While I wanted to collect stories that represent current efforts to diversity academia (Brown II, Davis & McClendon, 1999), I was unable to meet this criteria in this study, but intend to more intentionally explore this factor in future work.

The *modified* participation criteria were as follows:

- Assistant professor seeking tenure
- Employed at one of four institution types: Baccalaureate, Master's, R3, or R2
- Fewer than *five* years of experience between doctoral conferral and start of faculty appointment
- Within the first *four* years of their first faculty position
- Doctorate earned at an R1 Institution
- Four women

For this study, I identified twelve assistant professors seeking tenure in engineering at varying higher education institutions as described in Table 5. The participants are all assistant professors to highlight the experiences of balancing teaching and research responsibilities and tenure requirements. Additionally, participants were selected who either started their faculty position directly after graduate school or after a maximum of five-year postdoctoral experience. By limiting the sample to tenure-track assistant professors, the participants were well positioned to readily reflect on their

graduate school preparation or most recent preparation for their current role as well as the tensions they were experiencing at the time of the interview in pursuit of tenure and promotion. All participants were domestic citizens, although this was not an intentional recruitment decision.

The disciplinary departments of the participants at their current institutions were diverse, including aerospace, biomedical, chemical, civil, computer, construction, electrical, environmental, materials science, and mechanical engineering as well as engineering science. The disciplinary departments are not included in Table 5 in order to protect the participants' identities.

The institutions, which will also not be identified, included seven private and five public universities. The institutions were located all over the U.S. with five institutions in the Midwest, two in the Northeast, two in the Northwest, one on the West Coast, one in the Southwest, and one in the Southeast. Two participants were from the same institution. The sizes of the institutions also varied from below 2,000 students to more than 30,000, with an average student body of 10,000 students.

3.5 Data Analysis

3.5.1 Phase I – Constructive Narrative Analysis

The constructive narrative analysis (Polkinghorne, 2006) process began with transcribing the audio recordings of the interviews. I did most of the transcription myself in order to remain close to, and immerse myself in, the data. With the transcripts I did not personally transcribe (2 of 12), I read through the transcript while simultaneously listening to the interview's audio recording to check for accuracy.

Through multiple passes through the transcripts, I created a constructive narrative based on critical incidents (Webster & Mertova, 2007) for each participant. In the first pass, I identified critical events that were key to describing that participant's story. The second pass was to organize the events into chronological order. The third pass was to choose direct quotations that represented the critical events. The fourth pass was constructing the narrative. I then sought a member-check (described below) from the participant in question, and then performed a fifth pass to make edits in response to

feedback from the participant. In some cases, the participant asked to see the final version before "signing off."

These narratives were built upon the conversations I had with the assistant professors about their graduate school experiences, transition to their faculty position, and current perceptions and practices of teaching and research, including with respect to their tenure requirements. In these narratives, I incorporated elements of participants' faculty schema (Bieber & Worley, 2006); their conceptions of teaching (Torres-Alaya, 2012; Borgford-Parnell, 2006); their perspectives of their communities of practice in both graduate school and currently as a faculty member (Crede, Borrego, and McNair, 2010); the experience of their transition to their faculty position; and their teaching approaches and philosophies in relation to the Engineering Education Inquiry Framework (Borrego & Streveler, 2015). The narratives are told from the first-person perspective and are almost exclusively direct quotations from the original transcripts.

My goal in crafting narratives about each of my participants is to represent their story. I did not attempt to reach saturation or prevalence regarding any themes or types of incidents I uncovered, but instead, attempted to share the wide range of experiences these faculty members have undergone.

I conducted this narrative analysis component of the data analysis with the help of the participants themselves. In narrative research designs, it is expected that the participant collaborates with the researcher in member-checking the stories and checking the narratives for validation and accuracy (Creswell, 2012). Without the approval of the narratives by the participants themselves, the narratives would not hold the same weight with potential readers.

I did not allow for the participants to choose if they would like to be identifiable or anonymous. While some participants might feel empowered by having their name connected to their story (Pawley, 2013), the risks of disclosing this information publicly outweighed the benefits. For example, a participant's reputation might be affected if a negative perspective about an advisor or institution is expressed. Furthermore, if a participant knew their name would be included, they might not have been as candid and honest about their experiences. I did, however, give my participants the opportunity to choose their own pseudonym.

3.5.2 Phase II – Thematic Analysis

The second phase of data analysis involved thematic analysis of the full interview transcripts. The transcripts were coded using Microsoft Excel. I used a deductive-inductive thematic analysis approach to code individual transcripts. (Boyatzis, 1998; Fereday & Muir-Cochrane, 2006). The a priori codes were based on the theories and concepts described above, namely how the participants described their faculty schema development, conceptions of teaching, and communities of practice. Codes were applied at the paragraph level, and multiple (i.e., co-occurring) codes were applied to the same paragraph where appropriate. The final codebook, presented in full in Appendix C, includes both codes I was expecting to see (i.e., descriptions of useful experiences in developing faculty conceptions) and emergent codes that resulted from the thematic analysis process (i.e., the perceived role of luck in the transition process).

The emergent codes were developed throughout the coding process itself. Beginning with one transcript, I began noticing some themes for which I did not have codes. These emergent themes included contextual elements regarding the job application process and perceptions of tenure expectations.

The coding process was completed in a series of three formal passes through the data. As I was already familiar with the transcripts from phase I of the data analysis, I was able to apply a priori codes on my first formal pass through the transcripts. Throughout this pass, I also made note of emergent findings. A second pass helped clarify the emergent findings, and a third pass was made to confirm the codes assigned.

Each participant's transcript was coded individually using the codebook described in Appendix C. Next, the findings were written up as descriptive themes in response to the research questions. These descriptive themes were developed based on the a priori and emergent codes and were refined to best describe the experiences of the participants. Representative examples as they relate to and/or explain a descriptive theme were utilized, but not all examples in the data are included in this dissertation.

3.5.3 Making Sense of the Findings and Development of Narrative Themes

As often happens with qualitative work, my initial approach to data analysis did not go as I had imagined (Patton, 2002). I created the narratives first, and realized I had

some incredible stories to share with graduate students, faculty, and anyone else curious about pathways in academia. My next step was to conduct a thematic analysis. I started this process as many researchers do: I created a codebook based on previous research, I allowed my codebook to evolve as other findings emerged from the data (as described above), and I began to write up the findings as descriptive themes. However, I found that the thematic analysis was incomplete, as it detracted from the richness of the stories of my participants.

I took a step back and with the help of my committee, realized that I needed to find a way to bridge the thematic analysis and the narratives in some way. I did this by coming up with narrative themes that demonstrate how multiple descriptive themes are evident simultaneously in one of the narratives. I used Jason Talbert's narrative to demonstrate how some narrative themes were reflected in his narrative. By walking though Jason's narrative in this way, I am also able to demonstrate to readers how they might make sense of the narratives while they consider the thematic analysis findings.

The development of the narrative themes for Jason's narrative began after all the narratives had been written and the thematic analysis was complete. I realized that wanted to be able to demonstrate how the thematic analysis findings manifested in the narratives, and realized that many themes were occurring simultaneously or reoccurring in Jason's narrative. By focusing on the main themes in Jason's narrative, I created three narrative themes, and explained how one descriptive theme reoccurred for Jason. This process resulted in section 5.1.1 where I walk through Jason's narrative to demonstrate to readers how his narrative might be interpreted, potentially offering a guide to readers as they read the other eleven narratives.

3.6 Role of the Researcher and Trustworthiness

I conducted all of the interviews and therefore took a number of steps to increase the trustworthiness of my data collection and analysis. The use of direct quotations in the narrative itself provides more credibility (Kellam, Gerow & Walther, 2015).

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 (2010) 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 keep the conversation informal and so my participants could get to know me. This demonstrated the sincerity of intensions (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 their individual narratives I constructed and impact the research. This is a common practice in narrative inquiry which allows for participants to feel good about their contributions as well as provide credibility to readers and the community of the quality of the work (Creswell & Miller, 2000; Kellam, Gerow & Walther, 2015).

In order to be aware of my biases as a researcher, I kept a journal that serves as an audit trail. I reflected on what elements of the interviews were a surprise to me and which elements were in line with my expectations. These reflections helped me remember to be judgement free during the interview process, but allowed me to check my assumptions with broader literature. However, it should be noted that Webster and Mertova (2007) emphasize verisimilitude of the researcher, 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.

3.6.1 Validity and Reliability[7]

In narrative research, validity is concerned with well-grounded research that can be supported by the data collected (Webster & Mertova, 2007, p. 90). Since the stories

[7] ©IEEE. Portions of this section have been reused with permission (see Appendix D)

that are collected are not intended to be representations of reality, but rather, representations of reality as experienced by individuals, validity of narrative research should be assessed to be 'believable' by the readers. (Polkinghorne, 2007) However, in order to provide believable narratives and analysis, I made sure to collect the stories of individuals in an authentic manner, allowing my participants to tell their stories truthfully and without judgement from me. Another way to ensure validity, specifically regarding the participant's story being told, was to involve the participant in the narrative construction through member checking and demonstrating alignment between the interview data and the constructed narrative (Kellam, Gerow, Walther, 2015). Finally, one more way I ensured that my narratives are believable and truthful was to write them from the first-person perspective and rely heavily on direct quotations from the original transcripts.

Walther, Sochacka, & Kellam (2013) also suggest a framework to analyze interpretive qualitative research. Specifically, this framework proposes a quality management process model to approach the validity and reliability of making the data and handling the data (Walther, Sochacka, & Kellam, 2013). I now describe how I strove for high quality throughout my research process. Mainly, in order to achieve validation of handling the data, I made many efforts to make sure my version of participants' narratives was grounded in the participants' versions. As described above, member checking was a crucial component of my data analysis.

The first form of validity Walther et al (2013) describe is theoretical validation, which "implies a continuous focus on the question of whether the theories or the knowledge produced appropriately correspond to the empirical reality observed" (p. 641). To this end, I have connected the social reality being examined, i.e., the faculty experience at various institution types, with multiple theoretical perspectives, i.e., faculty schema, conceptions of teaching, communities of practice, and engineering education inquiry. In *making the data*, I followed the authors' recommendation for purposeful sampling. In *handling the data* for the constructed narratives, I organized the narratives by themes found in my literature review. In *handling the data* for the thematic analysis, I explicitly addressed which theoretical ideas apply to codes and interpretations of the data.

Procedural validation examines the way overall threats to the research design can be mitigated, and can be achieved through a critical incidents approach to interviews while *making the data* (Whether et al., 2013). In *handling the data*, I made sure to constantly compare my interpretation with theories and be aware of my personal biases. While constructing the narratives, I made sure to rely on the participant's telling of their stories, and during the thematic analysis, I utilized theories to guide my codebook development. One goal of procedural validity is to mitigate the risk of misconstructing the social reality of the participants. Since I was unable to conduct any of my interviews in person, in order to support my procedural validation, I asked all participants to describe their workplace, university's campus, and office location. In this way, I was able to add observations about the setting and sense of place to my understanding of each participant's story.

For communicative validation, I engaged in genuine dialogue with my participants and checked with them about my interpretation of their experiences in *making the data*. In *handling the* data, I solicited feedback of the community, specifically, I presented my study design and some initial findings with the engineering community at the Frontiers in Education conference in October 2016. I also presented initial findings from the participants at Baccalaureate Colleges and Master's Institutions at the American Society for Engineering Education annual conference in June 2017. I additionally met with my dissertation committee members after the completion of data collection to ensure my next steps were satisfactory.

Pragmatic validation was achieved while *making the data* by collecting data in a natural setting. While observing participants teach would have provided me with more natural versions of their teaching, I was able to achieve similar, and at least highly complementary data, through the use of existing documents in the elicitation part of the interviews. *Handling the data* concerns how my work is used by external customers. I shared my narratives only with limited audiences thus far, for example, at the ASEE conference, and have received positive responses to the data. In part due to the suggestion of people that have already seen the narratives, I plan on making them publicly available online so that those who are interested can read them. A crucial component with sharing the narratives is to include an *Introduction to the Narratives* document so that readers

understand how and why they were constructed. I will also share the introduction document and the narratives at the Frontiers in Education Conference in October 2017. This venue will allow me to understand how the narratives are used and interpreted by members of the engineering education research community, and will allow for me to share them publicly in a more useful manner.

Finally, Walther et al (2013) suggest process reliability through the development and explicit documentation of the procedures when *making and handling the data*. Through the use of an interview protocol and the practice of journaling after interviews, I increased my process reliability.

3.7 Limitations

There are a number of limitations associated with this study, as is common with any research project. My participants have self-selection bias since they all elected to participate by responding to my research request. I have mitigated this bias as much as possible by making sure my participants met my participation criteria and by following an ethnographic approach. I also made sure to be transparent about this limitation when sharing this research with audiences and allowed for readers to make their own conclusions about the views of the participants.

The lack of some diversity measures within my participants also presents a limitation of experiences. For example, there are no underrepresented or ethnic minorities in my study, nor are any participants from oversees backgrounds. Having a more diverse group of participants would have contributed to the variety of experiences and perspectives that this research could have provided.

Another major limitation in this research is that I did not conduct inter-rater reliability checks of my coding. However, I have subjected my research design and approaches to critique by my committee and through publishing two papers at conferences (Trellinger, 2016, 2017). These audiences helped check that my approaches to analyzing the data were sound. Additionally, by co-constructing the narratives with the participants in this study, I was able to confirm that the main thematic groupings made sense.

Finally, I recognize that by the nature of qualitative work and the positionality as a narrative researcher, I carry much bias and potential limitations. I have taken measures to ensure the quality and trustworthiness of my work, but acknowledge that my personal interview style, as well as the way I interpreted and analyzed my data, can present limitations to the data and the findings. An ethnographic approach as described above, member checking with my participants, transparency regarding the research process and findings, and maintaining a reflective research journal were efforts to minimize this bias.

CHAPTER 4. FINDINGS: THEMATIC ANALYSIS OF THE INTERVIEW TRANSCRIPTS

As described in Section 3.5 in the Methods, the data were analyzed in two phases. The first phase concerned co-constructive narrative analysis, and the second phase focused on thematic analysis. Despite having conducted the narrative analysis first, I believe the presenting the thematic analysis first is useful. By understanding the common themes present for all twelve participants, the readers will be able to make more connections to and within the narratives.

All quotations presented in the findings were taken directly from the interview transcripts. However, while many examples are provided in the thematic analysis presented next, not all participant's perspectives on each theme could be included. The narratives include additional examples of the themes. The co-constructed narratives are available to be read in full in Chapter 5, and will be discussed in more detail in the discussion in Chapter 6.

Since this research is all based on twelve participants, Table 6 provides an overview of these twelve participants. The characteristics presented in Table 6 are highlights for each participant and are not meant to be representative of their entire experiences. This table provides information about each participant's gender, Current Institution type, current position start date, and other defining characteristics. These defining characteristics include information about whether the participant went to a non-R1 Institution for their undergraduate degree, spent time in industry, and other salient information about the participant's pathway. Since Table 6 provides only a small window onto the participants' experiences, the reader is urged to read the lengthier and more nuanced individual participant narratives presented in Chapter 5.

Table 6: Overview of Participations and Defining Characteristics

Participant Name and Gender	Current Institution and Start Date	Selected Defining Characteristics
Steven Bradley, Male	Baccalaureate, August ‘14	- Spent approx. 4 years on the job market as a postdoc and an adjunct - Wanted to focus on teaching, turned off from research during graduate school - Supportive yet unhelpful PhD advisor - Found helpful mentors for the application process and teaching skills at conferences
Valerie Michaels, Female	Baccalaureate, August ‘15	- Remembers naturally loving to teach since she was young - Pursued her PhD in order to teach - Systematically applied to faculty positions using the Carnegie Classifications of Institutions of Higher Education and ABET list
Opie Hampton, Male	Baccalaureate, August ‘15	- Bachelor's degree at an R2 Institution - Sought out PhD advisor that could accommodate his teaching goals - Selectively applied to smaller, teaching focused schools for a faculty position
Christopher Davis, Male	Master’s, September ‘14	- Enjoyed teaching as an undergraduate - Took some classes on education in graduate school - Enjoyed teaching more than research - Supportive yet unhelpful advisor
Samantha Reed, Female	Master’s, July ‘16	- Bachelor's degree at a Special Focus engineering school - Spent 8 years in industry while also working on her master's degree - Knew she wanted a position at a place similar to her undergrad and selectively applied for faculty positions
Jason Talbert, Male	Master’s, August ‘15	- Had offers from both his Current Institution and an R1 Institution - Dealt with feelings of "failure" for choosing a teaching focused institution - Support from mentors and family and now in "dream job"
Matthew Land, Male	R3, January ‘15	- Pursued a PhD in order to teach, ended up loving research too - Participated in a future faculty program that exposed him to teaching universities during PhD - Attracted to his Current Institution's "growth" in regard to research

Emma Edgerton, Female	R3, August ‘15	- Bachelor's degree at an R2 Institution - Loved the teaching aspect of mentoring undergraduate researchers as a postdoc - Sought out her university specifically and tailored her application to this place that focuses on undergraduate students
Richard Vine, Male	R3, August ‘13	- Went back and forth between wanting to be a faculty member and finding something else - Loves the lifestyle that comes along with his institution type - Current teaching partially inspired by his dad, who is a high school math teacher
Brandon Oakley, Male	R2, August ‘13	- Main reason for pursuing PhD was to focus on improving undergraduate education - Gained appreciation for graduate education while a PhD student - Sought out a faculty position that could include both graduate students and a strong commitment to undergrads
Molly Sanders, Female	R2, August ‘16	- Bachelor's degree at an R2 Institution - Feels sadness that universities don't focus on teaching -PhD advisor was a perfect fit for research, but discouraged her to spend time on teaching
Tyler Colton, Male	R2, August ‘14	- Worked in industry for 4 years and then pursued his PhD in order to teach - Planning to look for lecturer or more teaching focused positions in the future - Has been advised to spend less time on teaching

Just as Table 6 does not provide a full profile of each participant, the findings presented next do not provide a complete portrayal of each participant. The findings presented here are meant to give a holistic understanding of the experiences of the twelve assistant professors that were interviewed for this study. Their experiences are also not intended to provide a complete overview of the possible experiences in academia, or in being an assistant professor at various institution types, and therefore, frequency counts of various grouping of experiences are not given.

I present the following findings in two parts: In Section 4.1, I present the findings to research question 1 (the pathway) and the findings to research question 2 (the teaching conceptions) are in section 4.2. I provide a summary of the themes and subthemes and the corresponding section in the findings in Table 7.

Table 7: Summary of Descriptive Themes and Subthemes

4.1 Research Question 1 - Pathway		**4.2 Research Question 2 - Teaching**	
4.1.1 Preparation for Job Market and Teaching	4.1.1.1 Swimming Upstream	**4.2.1 Comparisons of Teaching Conceptions and Methods**	4.2.1.1 Overview of the Participants' Teaching Conceptions and Methods
	4.1.1.2 Desired Graduate Programming Focused on Teaching		4.2.1.2 Participants Show Awareness of Evidence-Based Teaching Practices
	4.1.1.3 No Map for Non-R1 Job Search Approaches	**4.2.2 Past and Current Influences on Teaching**	4.2.2.1 Familial Influences on Teaching
	4.1.1.4 The Role of Luck		4.2.2.2 Formal Teaching Program Influences on Teaching
4.1.2 Decision Making Factors	4.1.2.1 A Focus on Teaching was Desired		4.2.2.3 Graduate Program Influences on Teaching
	4.1.2.2 Overcoming Perceived Failure		4.2.2.4 Current Institution Influences on Teaching
	4.1.2.3 Family Matters		
4.1.3 Comparisons Between Institution Types	4.1.3.1 Misalignment of Teaching and Research Expectations		
	4.1.3.2 The Institutional Environment in Comparison to R1		

4.1 RQ1: How do assistant professors experience the transition from graduate school and/or other previous educational and/or work experiences to their current faculty position?

Most of the experiences that the participants described aligned with the expectations based on the literature described in Chapter 2. Most participants developed faculty schema based on their advisors and in the context of their PhD universities, which were all R1 Institutions. These situated experiences helped clarify their goals to pursue a position that focused on teaching. In some cases, the participants described their new community of practice at their current institution as supportive of focusing on teaching.

Whether participants consciously or serendipitously ended up at the institutions they ended up at, many of them had inadequate preparation with regard to teaching during graduate school for their current role. However, some aspects of the participants descriptions of their transition were surprising and unexpected. For example, the level of emotion associated with transitioning away from research intensive institutions was very poignant. Also, the influence of advisors and other faculty on the decision to pursue a teaching focused position was in some cases noticeable. Additionally, some participants were frustrated with the general trend academia as a whole is taking towards more research expectations.

The findings in response to RQ1 will be presented in three sections. Section 4.1.1 will focus on how the participants were prepared for the job market and for their new faculty position, Section 4.1.2 will examine the factors that came into play for making career decisions, and Section 4.1.3 will look at the comparisons the participants made regarding the various institution types.

4.1.1 Preparation for Job Market and Teaching[8]

The participants in this study described their preparation for the job market and teaching in four major ways. First, they described the need to swim upstream regarding their choice to pursue a position that focuses on teaching (Section 4.1.1.1). Second, they described attributes of their graduate program that they wish they had experienced, so

---

[8] ©ASEE. Portions of this section have been reused with permission (see Appendix D)

that they would have been more prepared for teaching (4.1.1.2). Third, they described some job search approaches that were useful during their search (4.1.1.3). Fourth and finally, they described how luck seemed to play a role while they pursued an academic position (4.1.1.4).

4.1.1.1 Swimming Upstream

Some participants made very conscious choices in regard to preparing for the faculty job market and choosing where to apply. In many cases, the participants realized that their choice to focus on teaching experiences was going to cause some resistance. In a sense, they needed to swim upstream and figure out the pathway to a teaching focused institution themselves.

For example, Stephen asked his advisor for help navigating the job market and how to prepare, and he wasn't 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. I looked into, honestly what I found out at first was looking through job postings and seeing what sort of positions are there that I would fit in to, that I would be qualified for, that would hire me, etcetera. (Steven)

Fortunately for Steven, his advisor didn't completely leave him hanging and suggested and supported that he take a course on teaching. Christopher had a similar experience with his advisor, who was also not able to provide much advice for teaching focused jobs, although he was glad that his advisor and committee members provided him with many opportunities to teach throughout his graduate program.

In contrast to Steven's and Christopher's experiences, Molly had quite a negative incident with her advisor. Molly described her frustration with her advisor who told her not to get a teaching certificate during graduate school. As 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)

Molly saw value in getting experience to teach as a graduate student, yet her advisor believed focusing her efforts on research was more important. While some participants were given opportunities to teach, or sought those opportunities out themselves, there were also some other components of graduate programming that the participants wished would have been different.

4.1.1.2 Desired Graduate Programming Focused on Teaching

Some participants had more formal training to teach, e.g., a class like Steven or a program aimed at future faculty. Opie participated in a teaching fellowship program that allowed him to teach his own section of a course, and Matthew attended a multiweek workshop on teaching. However, when I asked participants what they would have changed about their graduate school experience, most of them described wanting even more formal opportunities to integrate teaching into their program.

In almost every participant's graduate school experience, they needed to go out of their way to get a teaching opportunity. In Jason's case, he was required to help teach for one semester, but still described that experience negatively: "all a TA 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 goes 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. And let the research focused people go do research and let the teaching focused people

> kind of bring out more of those opportunities. 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. It's just that I cobbled it together. (Opie)

From Opie's quotation in particular, we can see that the participants felt that the graduate school experience could have better prepared them for careers with teaching expectations.

In multiple cases, the participants were unable to participate in formal teaching programs. For example, a program was started at Jason's institutions as he was graduating, and Molly was advised by her advisor not to participate. Despite not being able to participate in such a program, Molly did have opportunities to be a teaching assistant. However, she thought the experience of being a teaching assistant could have been improved. For example, she described wanting more feedback on her teaching:

> I think having faculty evaluate graduate student teaching would have been a really useful thing to get feedback and say, "These are things you could improve. These are things that you could change," Just to see how the class is going. (Molly).

Yet Molly described not receiving any feedback of this sort, even from the professor whose class she was supporting as a teaching assistant.

As we saw from the examples above, many participants felt like they were not prepared well during graduate school for their teaching duties as professors. Similarly, some participants felt they were left without many resources while they were on the job search. In the next section, I will describe some of the more successful strategies participants had during their job search.

4.1.1.3 No Map for Non-R1 Job Search Approaches

For a few participants, it was crucial to have a mentor guide them through the process of applying for faculty positions. These mentors were especially important since we saw that in many cases, advisors and the participants' PhD Universities did not have many resources for graduate students interested in positions at institutions other than R1 Institutions. In one case, Jason described how valuable it was for him to have conversations with a former graduate student colleague who was teaching at a Master's University:

> I had a good friend who was maybe one or two years ahead of me, I knew him from conferences. He ended up getting a job at [a Master's University]. And I was like, woah, this is a big change for you, and I talked to him a lot, called him up on the phone several times to talk to him about that. (Jason)

Ultimately, conversations with this mentor helped Jason accept his offer at his Current Institution, also a Master's University. Similarly, Christopher had a mentor, his sister, who helped him navigate the job process as well.

Christopher described how it was very useful for him to have a sister who recently started work as an assistant professor at a predominately undergraduate institution. As he explained:

> The main thing [my sister told me is] you want to get across in any of the interviews is that you know you won't have PhD students, that your primary job function will be teaching, that you are ok with that. So, I had spent a fair bit of time thinking about that, and it turns out, that's the kind of stuff they eat up at these types of interviews. For me, I could just talk about my TA experiences, and trying to reach a student who is really struggling with the material, and going from that lived experience, I think made me a much more powerful candidate than someone who hasn't had those experiences, or viewed TA-ships primarily as a funding mechanism. (Christopher)

As this quotation suggests, understanding the context of the institution the participants were applying to was very important. And while Christopher relied on his sister to provide information about undergraduate focused institutions, 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 institution:

> I think the fact that I understood 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 say, hey, if we were to buy this instrument, I can use it for this reason and you can use it for that reason and we can team up and share our resources. So, I think the fact that I was kind of in tune with that helped me get the job. (Emma)

From Emma's quotation, we can see that being familiar with a particular institution, and especially being aware of that institution's goals was perceived to be very helpful in terms of getting a job offer.

Valerie was also aware of specifics associated with the various institution types. In fact, she was so sure that she wanted a position at either a Baccalaureate or Master's Institution that she made a spreadsheet of institutions that met her criteria. As she explained:

> I knew I wanted to teach. So, I didn't want a university that had high research expectations. Or research expectations that I couldn't transition in from a disciplinary field to engineering education. So, I essentially looked at all of the job postings and I also looked at the Carnegie Classifications. I made this spreadsheet with the list, I looked at all of the colleges in the US that offered engineering based on ABET. So, I went first with ABET's list, and then I found their Carnegie Classification based on that list, and then I went from there. (Valerie)

In Valerie's case, she was aware of the teaching focus typically associated with institution type, and made sure to find job opportunities at those institutions.

Samantha also knew where she wanted to apply for jobs. Since she had a very positive undergraduate experience in a "hands-on" program, she knew she wanted to become a professor as a similarly hands-on institution. When Samantha saw job openings at her two ideal institutions, she ended up applying a year before her dissertation was complete. She recognized that job openings at these smaller schools might not come around very often, and decided to apply and see what happened, which ultimately ended with a job offer at one of her target institutions.

Not all the participants were as systematic or specific as Valerie and Samantha. Rather than strictly applying to teaching focused institutions, a few of the participants applied to all types of institutions. For example, Richard describes how he applied to pretty much any institution that had an opening.

> I applied anywhere and everywhere. The only places I did not apply would be positions where they were ultra-specific about what they were looking for. But if there was any even remote area of overlap, I applied. I think I probably even in some cases applied to some institutions that weren't PhD granting. Maybe a couple here or there, but other than that, it was everything form you're [Current Institution] to your [generic state school]. I wasn't really shy. (Richard)

Tyler also applied to a wide variety of institutions, and ended up with offers from a few Baccalaureate Colleges but ended up turning them down for his offer at an R2 Institution. However, as he looked back on that decision now, he described wishing he hadn't done that:

> 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. (Tyler)

From Tyler's quotation above, we can see that he felt that he was unaware of the benefits associated with various institution types, including what a faculty career might be like at an institution that focused more on teaching. In Tyler's case, he would likely have benefited from learning about different institution types during graduate school.

In this section, we saw that mentors played a key role for some participants when they were on the job search. Having a clear idea of the type of institution the participant wanted to be at also helped make the job search process smoother. Finally, with Tyler's example, we saw that a better understanding of various institution types would have been helpful to him when applying for jobs.

4.1.1.4 The Role of Luck

Some participants spoke about how they were "lucky" to get their job, or that they were "lucky" to have such a good mentor during the transition to faculty member. For

instance, 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. Now that he is on search committees himself, he reflected on his luck. As he described:

> And you look through [job applications] and you might go, this person looks stellar. And then you get them on the phone and they have absolutely no clue what they're going to do as a faculty. Like not even the first clue. Like, how much money would you want for startup? And they're like, what's startup? I'm extremely lucky that not only was my PhD advisor really awesome at helping me, but having my friend [Sam] helping me through all that. And knowing what he was doing and all that kind of stuff. (Richard)

As Richard described, having a supportive advisor and friend to guide him through the job market process was beneficial, including by boosting his competitiveness.

A few other participants also described their luck in regard to the job market. For instance, Emma mentioned in describing how she only applied to a couple faculty positions and that she probably would have tried a career in industry before again applying to academic jobs had she not been made an offer at her current institution. As she described:

> I got so lucky. I think a huge part of that was luck. Like I said, if I hadn't gotten this teaching position, I was pretty set on it, I was pretty careful with the application to make sure I was meeting all those criterion, doing my research and homework on what the university was about. But if I hadn't gotten the job, I would have applied to any of the other companies that are in the area and taken some industry experience before coming back. (Emma)

Emma described feeling confident that she could have gotten a job in industry had her position in academia not worked out. Despite putting in a lot work to tailor her application to the specific position, Emma still believed luck played a huge role.

Jason also described how the job market made him feel vulnerable. As Jason explained:

> I will say that I felt the PhD process is a little bit a bait and switch, just like – it just feels like there are so many PhD students and then so few jobs and it's just terrifying to get there and realize, oh, most professors – well what it seemed like –

> most professors spend all their time writing grants and just doing research, and there are very few of these big jobs. It is terrifying to be on the job market, because it's such a weird interview process that you apply in August for something the next August and it just feels like a complete role of the dice, that all the stars have to align. It's just a scary thing, you just feel very vulnerable, and I wish that was not the case. (Jason)

As this quotation suggests, Jason felt very vulnerable while on the job market, since "all the stars have to align" in order for him to get a faculty position. While Jason did not mention luck explicitly, he hints towards luck in terms of getting a job as a professor in general. Jason recognized that there are only a few academic jobs available each year and that whether you are successful in the process feels like a "roll of the dice."

Finally, Richard described how he vacillated between wanting to pursue a faculty position and going into industry, and how he ultimately decided to apply for positions at all kinds of institutions. He also described as lucky the fact that he got two job offers:

> At that point [during my master's] I wasn't necessarily thinking I was going to be faculty even thought I wanted to be. By then I had realized how hard it is, right? How basically everybody wants to be faculty. So, you apply to a position and you're competing with like 200 other people. Going to [PhD University], I decided again, hey I do want to be faculty. I'm going to try and go for it. I am going to publish, participate in these conferences, really try to build a network and all this other stuff. I guess, some people just don't get that lucky, but I guess I got that lucky. Of all the people I know personally that have gotten positions, most people don't get a whole slew of options. I mean you're lucky – I was lucky to get two, frankly. I mean, a lot of times you're lucky to just get one. Anyway. I've been happy with it. (Richard)

Richard also acknowledged that the academic job market is very competitive, and that he felt lucky to have gotten two job offers. However, it is important to note that all the participants that described luck playing a role worked very hard to position themselves favorably on the job market. While they still 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.

With the academic job market being difficult to approach, it might be useful to replace elements of luck with opportunities for professional growth that the participants mention wishing they had during graduate school. For example, more teaching opportunities and mentors that could guide graduate students through the job market process could help support future job seekers for more clear avenues to success. While these recommendations are revisited in subsequent chapters, the next section will turn to what factors influenced the participants' decisions during the job search process.

4.1.2 Decision Making Factors

The choice to accept a position at an institution that had more teaching focus had a number of elements. For example, a focus on teaching was often a large deciding factor, as discussed in section 4.1.2.1. Section 4.1.2.2 describes how family often influenced the decision in some way. Finally, in section 4.1.2.3, overcoming the perceived failure of pursuing these "less prestigious" positions is discussed.

4.1.2.1 A Focus on Teaching was Desired

The ability to focus on teaching, especially without being reprimanded for doing so, was very attractive for many of the participants. For example, Jason, who is now at a Master's Institution, described how it caught him off-guard that his colleagues loved working with undergraduate students. When he compared some of his new colleagues to his advisor, the differences became clear. Jason found it "hilarious coming here [his current institution], where everyone is like, yes, teaching, I love interacting with undergrads." This difference stuck out for Jason, since his experience with other faculty members in the past had been that teaching, and presumably interacting with undergraduates, was a burden.

Some participants previously attended institutions that are similar to those in which they are currently employed. In fact, one participant is now a faculty member at her undergraduate institution. The experience of being at an institution that focused more on teaching as an undergraduate influenced a handful of participants as they were looking for jobs. For example, Samantha really loved her undergraduate experience in a "hands-

on" program. She knew she wanted to teach at a similar institution one day and tailored her job applications to institutions that have much hands-on experiences for the students.

Brandon also particularly enjoyed his undergraduate experience. He described being very happy to be at an institution that focuses on providing a great experience to undergraduate students. He described:

> I think they [Current Institution] affirm that commitment to undergraduate teaching, and I felt like the undergraduate teaching that I got was very, very good. And that's what I try to provide to my students. (Brandon)

Brandon's positive view of his undergraduate education influenced him to seek out an institution that similarly put undergraduates at the focus. Opie had a similar experience. He wanted to pursue positions at an environment that would be similar to his undergraduate institution. He described:

> My undergraduate institution was one of those sorts of places. It has a graduate program, but the whole school is only maybe 5000. So, I knew that kind of environment, that's what I had come out of from undergrad, and I kind of wanted to get back to it. So that's where I focused a lot of my applications, were those smaller schools. More teaching focused institutions.

Being familiar with these institution types that focus on undergraduate education and teaching was beneficial to these participants described above.

Tyler, in particular, noted that he felt pressure to accept a position that had more research requirements, at his R2 Institution, instead of accepting competing offers at teaching institutions. He noted that despite making that decision, he does not regret it. He explained that otherwise he would still be curious if a research focused position would have been what he wanted:

> I always tell my wife that I am so – it was huge blessing to get to come here because if I gone to a teaching school or somewhere else first, I would have always thought that this is what I would have wanted. To do research and then teach some and be at a major university and these things. And I'm glad I got to do that. I guess knowing what I know now, I would have [sought] out opportunities

> at maybe smaller schools or teaching schools, and that probably would have been more satisfying for me. (Tyler)

Here Tyler described that he now would have made a different decision than the one he made: he believes he would have preferred a position that focused more on teaching.

While Richard was not necessarily looking for a position that focused on teaching, he now enjoys the fact that his research expectations are lower so that he can spend much time with his family. Even so, a focus on research, and a university that was growing their research program was an important factor when Richard was making his decision to accept a position at an R3 Institution. He described his perspective:

> I love the [area Current Institution is in] and there's still growth happening here. It's, again, smaller scale than [PhD University], but growth is important. So, I saw growth and opportunities in both places. I like doing research, and that's what I wanted to do when I came in to it. I think the younger generations plan when going into faculty is that you're going to do research, regardless if whether there's even a PhD program. (Richard)

Despite Richard's comment that he thinks all new faculty intend to focus on research, not all the participants were happy about a perceived shift towards more research expectations across academia, as will be discussed in more depth in section 4.1.3.

4.1.2.2 Overcoming Perceived Failure

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

Jason, now a professor at a master's institution, really struggled with a perceived sense of failure associated with choosing a position at a teaching focused institution brought. He ended up getting much support from his wife and a colleague who was also at a teaching focused institution. Their support helped him realize that being a professor at a master's university was not failing at all. As he explained:

> Kind of what happened, I was almost not ready to accept the [Current Institution] job, just because I was like, well, if I do that, I'll be stuck in this tier of institution and all this other stuff. And it was my wife was like, "Jason, this is your dream, this is what you want." And I was like, you're totally right. I had my big pro-con list, describing [Current Institution], this is my dream job that I wanted to take. Why am I internally struggling and fighting myself against what I actually want versus this other job that I would end up hating? There's this really scary thing that once you leave the R1-relm, 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. (Jason)

Matthew also discussed the perceived sense of failure associated with going to an institution that focuses on teaching.

> 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. So, there was never any explicit discussion, like that's a bad thing to do, but it was never anyone's top choice. It was always kind of weighed in the context of everything else. There's a perception, which I think is true, that it's a little bit easier to get jobs at places that don't have research agendas, and it's because bringing in those research dollars is extremely competitive, and you need people that are competitive at that and that want to do it, on top of being good teachers, or that want to do that instead of being good teachers. It's a different thing, which doesn't mean it's bad, it's just different. (Matthew)

The major difference that Matthew described between teaching focused and research focused institutions was related to tenure expectations. Many participants described that one of the main reasons for why they were interested in their current positions was because of the lower expectations for research in addition to the focus on teaching.

Samantha mentioned how it worried her to think about needing to bring large dollar amounts in grant funding. She explained:

> I looked at assistant professor at [PhD University], and I was like – they're entire life is focused on getting grants, and that is not where I see myself, I couldn't see myself, pushing myself to write that many grants. (Samantha)

Steven was similarly worried about writing grants, saying that he enjoyed doing research, but did not feel confident about needing to support his career by coming up with innovative research problems.

As we can see from the above examples, making decisions that are seemingly against expectations can cause emotional responses and be challenging to overcome. We also can see that once the participants accepted the decision to pursue a teaching focused institution, there were many attractive aspects to those institutions. Most notably, these various institution types often included more focus on teaching and encouraged a focus on the student experience. More details on the differences between the institution types will be examined in section 4.1.3.

4.1.2.3 Family Matters

Even with the desire to be faculty at these various institution types, making that decision alone was often not the only factor that led participants to their current positions. In many cases, the participants also needed to consider their spouses and the opportunities for them in the area of their new institutions. For Opie, when his current institution made his wife feel really welcome in the community, he realized that the institution was truly a good fit for him. Here he described how impressed he was by the effort his Current Institution made to welcome his wife:

> I went out with [my wife] to look around and see if it would be ok with her and see if we could find a house there. And they [people at Current Institution] were so accommodating it was amazing. The dean met us for breakfast, they put us up in a hotel. There's a [Current Institution] women's group - they got some people from that group to come and sit down and talk with [my wife] and myself about life in the area. It was a tremendous effort on their part to welcome [my wife], not just me, because I guess they wanted to hire me and recognized that she was an important part of that equation, so they really rolled out the red carpet for her for

> that second visit. Which is something I don't know you'd see at a lot of places. (Opie)

Opie described this kind of welcome for his wife as something he did not believe to be common. It made a difference to him to see that his new institution cared about his family.

Matthew also needed to consider his wife's ability to find a suitable job in the city to which they would end up moving. With his wife in medicine, Matthew wanted to make sure they could find jobs in the same city, rather than where they would both have to commute in opposite directions.

A couple participants described how their spouses influenced their decision to pursue and accept their offers at their current institutions. In Brandon's case, his wife found the current institution job posting and told him to apply. And in Jason's case, his wife helped him realize his current institution was the right fit. He described:

> It was probably my wife was like, [Jason] this is your dream, this is what you want. And I was like, you're totally right. (Jason)

As was described in section 4.1.2.2, Jason really struggled with the perceived failure when he chose an undergraduate focused institution, but his wife helped him remember what his goals were in relation to a "dream job." Additionally, Jason described that his wife, who also has a PhD, helped him make sense of his teaching philosophy during the application process.

Finally, a few participants mentioned that they felt their positions at their universities allowed them to focus more time on their families. Richard enjoys his lower teaching expectations, so he can spend time with his three children, and Emma described how she loves the fact that she has a 9-month appointment, so she has summers off with her son.

As we saw from these examples, the participants were influenced by their family during the decision-making process, and also in terms of their satisfaction with their current institution.

4.1.3 Comparisons Between Institution Types

The participants described a number of similarities and differences between their PhD experiences at R1 Institutions and their current institutions, which are one of four institutions types: Baccalaureate, Master's, R3, and R2. Two major groupings of comparisons will be discussed. First, in section 4.1.3.1, teaching versus research will be examined, and second, in section 4.1.3.2, comparisons in the institutional environments will be described.

4.1.3.1 Misalignment of Teaching and Research Expectations

Perhaps expectantly, tenure expectations regarding teaching and research were the major differences participants noticed between their R1 PhD Universities and their various current institutions. Higher tenure expectations surrounding teaching was attractive to many participants. Having advocates for spending time on teaching was also an important characteristic some participants attributed to their new institution type.

The transition to these various institution types was not as pronounced between the types of institutions as expected. The experiences of transition were similar across all participants in this study: transitioning from R1 to Baccalaureate, Master's, R3, or R2 Institutions. There were a few differences, including that some Baccalaureate and Master's Institutions seemed to encourage more time to think about teaching, but there were still some institutions in the DU categories that had large emphases on teaching innovations. It seems that these emphases were largely based on the commitment of the department to encouraging teaching innovations. For example, in Richard's case, at an R3 Institution, he is encouraged by his Dean to spend time on his teaching. He explained:

> Our Dean is actually very aware of who's doing that [innovating teaching]. Surprisingly aware of it, somehow. I don't know how or why, but she will, in college wide meetings will call out people who are doing some of those more interactive learning type style or techniques or flipping the classroom in their classes. And she'll push toward that, and be like, any of you who aren't doing it or are unsure, or want to but are unsure, talk to some of these folks. (Richard)

The fact that Richard's Dean encourages innovative teaching helps motivate him to try new techniques in the classroom.

Matthew, who is also at an R3 Institution, described the influence of his Dean as well. He described the expectations for tenure at his institution depend heavily on teaching, even though high quality research is 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 sluff 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. And you won't get tenure here if you're not a great teacher. Whether or not you can get tenure without being a great researcher is still yet to be seen. Nobody in the department has gone up for tenure and has not gotten it yet. Because we are so young. But the pressures were different than they are now. (Matthew)

Matthew pointed out that teaching is very important with respect to tenure, but that it seemed you also have to be a good researcher to succeed at his current institution.

Conversely, Valerie pointed out a difference between her PhD University and her Current Institution: At her PhD University, if a professor has a large grant, then bad teaching wouldn't be a big problem and wouldn't cause for change. However, at her Current Institution, a Baccalaureate College, poor teaching would probably be cause for change. As she explained:

> There's a difference in teaching as well. At [PhD University], I would say it's kind of relative, or there's a ratio that exists, that the teaching is, there's even less of a focus on teaching at [PhD University], versus, [Current Institution]. There's not a huge focus at [Current Institution], but the students have some power and if they were to complain or say you're a bad teacher, then they would institute a change. At [PhD University], if you have some million-dollar research grant, then, you know, whatever, there would be no change. That's kind of the major differences I would say. (Valerie)

Similar to Valerie, Molly also discussed the idea that a great researcher can be a bad teacher at her university, an R3 Institution. However, unlike Valerie, Molly experienced this focus on research at her university and describes how that makes her feel sadness. 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. (Molly)

From the perspectives of Matthew, Valerie, and Molly, we can see that teaching and research are often held in tension, with one counting more than the other. However, which one counts more is not always obvious based on institution type.

Tyler, who is at an R2 Institution, described his tenure expectations in comparison to R1 expectations, which he perceived during graduate school. He described:

> There was a big gap – just in terms of research productivity – between [my PhD University] and [my Current Institution]. I guess what I can say is, at [Current Institution], what I've produced so far, they're very excited, everyone's happy. And at [PhD University], it would be maybe average, or maybe below average, and I would need an improvement plan and these kinds of things. At [PhD University], they would be more interested in more research dollars and publications, and at [Current Institution], the benchmark, it's lower than what was required at [PhD University]. (Tyler)

Here, Tyler noted that his expectations at his current institution are lower than what they were at his PhD University. Even with the lower research expectations, Tyler was still discouraged from spending too much time on teaching. He described his department chair advising him from winning teaching awards:

> That [winning teaching awards] would be a bad thing. And this was all in jest, it wasn't like a serious conversation or anything, but that was kind of his advice to me, you have to focus 90 to 95% on research and then teaching, you need to get

> really good at kind of standing up there and faking it, make people like you, and then kind of just go through the motions. So, that's where I am today, I spend way more time on teaching than someone would advise me. (Tyler)

While Tyler was advised to spend less time teaching, he said that teaching brings him joy, and is even starting to look for positions that would allow him to spend more time teaching.

In a handful of cases, the term "research" was replaced with "scholarship," as Samantha, who is at a Master's Institution, explained: "they actually make it a clear point of calling it scholarship and not research, because their very much ok with it being applied; consulting with industry counts towards research here."

For many participants, educational research also "counts" towards tenure. Christopher described the benefit of that distinction:

> I can count educational research. That means – it works out great because anything I do to improve in my classroom, if I can get some measures of the effect, and you know as an engineer, I figure if I am going to do something, I should have a reason for doing it, and if I can get that out to a conference, I can sort of kill two birds with one stone. And have research that feeds into my teaching, and teaching that feeds into my research, rather than kind of having them be two completely different things. (Christopher)

Christopher really enjoyed the fact that he could study the effects of his teaching and have that work count for his scholarship expectations at his institution. Emma also found a way to incorporate her classroom into her research, where she helps students publish their work at conferences. As she described:

> You can write a paper for a conference. So, we did one of those last year with a senior design project. I thought it was perfect because it was student work, they were driving the project. It was a lot of advising and revising and editing of the paper and getting it to the right format, but the data and the content was student driven. (Emma)

In this case, Emma really enjoyed that she is able to count work she does with students towards her own research goals and expectations as a professor.

The amount of time participants were told to spend on teaching ranged from 10% to 70% among the participants. Some participants even said their expectations weren't laid out by percentage but in order of importance and that teaching comes first. For example, Steven described his tenure expectations as:

> There is nothing really definite laid out in terms of you need to be this active in research, or there's nothing really quantifiable, but everything is listed in order of importance, with teaching being first. I've never seen where it's been split up like 50%, 20%, anything like that. Teaching is a high priority, with four courses a semester, they are pretty understanding that you're not going to be able, for any scholarly activity that you're doing, the expectations are certainly not as high as they would be at other places. (Steven)

Here Steven seemed to explain that teaching is the highest priority at his institution. Furthermore, since the engineering program at his institution is newer, he explained that his tenure committee is understanding that the expectations might need to be adjusted to accommodate more of a focus on developing new classes.

Christopher, who is at a Master's Institution, had an interesting way of thinking about research in relation to teaching. He described believing in putting his students' learning above staying on top of brand new research:

> I came here because I really want to be an excellent teacher, and I feel like, from what I've experienced, a lot of that is at the undergrad level. Sure, you have to teach them some concepts, but getting students in the right frame of mind, getting students motivated to do this. So even if, by the time I get tenure, let's say I can't get back to the technical research until I get tenure, even if I am teaching them material that might be six years away from the bleeding edge, I would much rather have them go out with the capabilities to quickly learn what they need to know at any job that they would start up at and have a passion for engineering, and be good at that part of teaching. Because I figure I can always update the technical stuff as needed, or buy a new textbook that has it in it, read through, learn pretty quickly. But if I don't have that fundamentals of the ability to teach and get students excited about learning, who cares what technical stuff you are trying to teach them. (Christopher)

Christopher described that he feels the need to put his students' motivation in front of his need to stay current with research trends.

This section compared the experiences of participants at different institution types, and the next section will examine how the institutional environment factored in to the comparisons as well. In general, it seems that a focus on teaching is more pronounced at Baccalaureate and Master's Institutions, which might be expected since these two institution types are the most distinct as compared to Doctoral Universities.

4.1.3.2 The Institutional Environment in Comparison to R1

The comparisons of the various institution types the participants are currently at with the institutions they were previously at did not only concern teaching versus research. The environment of the departments and institutions were discussed as well. In most cases, these comparisons about institutional environment were made in relation to R1 Institutions. This is likely because that is the context in which all the participants did their PhD work.

Valerie described how her graduate advisor, at an R1 Institution, did not collaborate with other junior faculty in the department because of his pursuit of independent research, and how her current department, at a Baccalaureate College, is much more collaborative in comparison. As she explained:

> One thing I have noticed, well I remember my advisor talking about how he and another professor started with a couple years between each other and they were both in the [same] field, but they did not collaborate at all, whatsoever, in any way shape or form, because they were judged on what they did and if they collaborated with somebody else, you know, maybe the other person did all the work. But at [Current Institution] I've found that people are super friendly and they are way willing to help. And they are way open to collaborations. (Valerie)

While Valerie's example does have to do with research competitiveness, she honed in on the collaborative environment of her new department. She additionally went on to describe that her colleagues are always willing to step in and teach a class if she is sick or traveling for a conference.

Another way that participants described their perception of their current institution's environment was in regard to 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 the search committee, and how the search committee needs to look for applicants that fit into his Current Institution's culture at 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. Because historically, this place has been used as a stepping stone primarily. Get into that faculty position and then move up to somewhere you want to be. I don't view it that way. I mean, I love it here. And I know a lot of the folks who were hired around the same time as me are that way too. I don't think that they viewed it coming in as that. There are enough good things going on and enough excitement that I think it's – they knew what they were getting in to and they are still happy to be here. (Richard)

Richard perceived that the culture of his current institution differed from a typical R1 Institution, but also that the culture suited him very well.

Steven described the difference in institution types in relation to what the university itself focuses on. Steven, who is at a Baccalaureate College, described how his institution places a great emphasis on graduating good engineers rather than advancing scientific research, which he viewed as the goal of R1 Institutions.

> 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)

Here 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 the institution may be different, it provided a culture and benefits many current and future faculty find fitting.

Emma found that her university's commitment to small classes was one thing that attracted her to her current position. As she described:

> I think what really drew me in was the advertising of the university as a whole, and what they sell to the students, so paying closer attention to the admissions package of what the students are offered and the types of classes and the types of interactions. The fact that they commit to 20 students a section – no class is more than 20 students. I've never seen that in any of the experiences I've had. And I think that that's something really special. I know that's something that's challenging because we don't have a huge faculty, and our program is growing and it's hard to maintain that number of 20. But there's a big difference when you have 20 students. That means I know exactly what's going on with every single one of the kids in my class. (Emma)

Emma is able to get to know each of her students on an individual basis, which is something she really liked about her current institution. We can infer that small class sizes like the ones she has at her current institution are not the norm at most institutions, perhaps especially at R1 Institutions, and is a perceived benefit of being a faculty member at her current institution.

A few participants discussed being in environments where they felt that teaching wasn't cared much about. Tyler, at an R2 Institution, described his experience quite negatively:

> And so, the conversations around teaching are mostly about how do we gather content for our ABET reviews, it's just assumed that everyone knows how to teach. And so, there's no instruction on how to become a better teacher, no one has ever observed my classes, ever. And I'm not sure they even look at my teaching evaluations. They may. I think if they go really low, I think someone will look at them. But I don't think those are looked at. So, I would say minimal effort is put into improving or maintaining even, our teaching levels. It's all about

> organization, in terms of teaching, how do we get all this content together, who's going to cover this or that class, and then the rest of the effort is put into research. (Tyler)

Despite the negativity Tyler described feeling from his department about teaching, he still loves teaching, and that he has great students that appreciate the work he puts into his teaching.

> In terms of the job, the teaching is really good. The students are good, they're respectful, they want to learn, and I think a lot of that comes from – the other, not all of them, there are a few other people that they hired at the same time as me that are interested in teaching as well, or they have kind of a unique perspective on it, so the students are just kind of begging for that. (Tyler)

Even though Tyler generally feels that his institution does not support much time and thought on teaching, he described feeling glad to have some colleagues that care about teaching. Tyler implies that the students enjoy and desire innovative teaching, and that perhaps relatively few faculty at his current institution are implementing novel teaching techniques. Another thing Tyler described liking about his job is feeling that the students appreciate the efforts he makes regarding his teaching.

Finally, a handful of faculty described the nature of their campuses and how most faculty have "open-door policies," where the students are encouraged to stop by when they have questions or to engage in conversations with the faculty members. As Steven said, "I am a big tea drinker – I have a big wall of tea. Some students just come in, and say, 'I just need some caffeine.' I like having just the open approach, I'm always open." Many of the participants described enjoying the fact that their departmental culture was open, especially to the students.

In this section, Comparisons Between Institution Types, we saw that the experiences of the participants were varied. Not all participants sought out their position for the focus on research, and not all participants struggled with intense feelings of vulnerability when making the decision to pursue a teaching focused position, as was discussed in section 4.1.2.2. The participants fell somewhere onto a spectrum of teaching

focus and vulnerability, which will be explored in more depth in the discussion in Chapter 5.

4.1.4 Summary of Findings for Research Question 1

Research question 1 (RQ1) intended to examine the transition from an R1 PhD Institution to various institution types, namely Baccalaureate, Master's, R3, and R2 Institutions. RQ1 also included two main sub-questions. RQ1a asked about the process of applying to and choosing their current institution of employment, and RQ1b asked about their graduate school and teaching preparation experiences.

Section 4.1 described the participants perceptions of job market and teaching preparation. I found that participants were largely underprepared for their teaching roles. In fact, most participants, given the chance to change their doctoral training programs, described wishing they had more training in teaching methods. In some cases, mentors and PhD advisors were able to help the participants make sense of the experience of preparing for and applying to teaching focused institutions, but some participants also felt like they did not have much support, and in some cases, even active resistance against teaching.

Many participants described feeling frustrated that they didn't have more information about various institution types during graduate school. For some participants, they eventually found out about their Current Institution's institution type and were very happy in their positions. However, for example, Tyler ended up at an R2 Institution and is now starting to look for alternate positions that focus more on teaching. Perhaps if the experiences of faculty at various institution types were more available and discussed during graduate school, more future faculty could make decisions about where to apply and accept positions that better align with their goals.

Some participants described the major differences between institution types in relation to the attention towards teaching and research. It seems that the differences can be tied to specific institutions rather than uniformly across institution types. For example, some R2 Institutions have a strong teaching focus while research is still required at Baccalaureate Colleges.

4.2 RQ2: How do assistant professors describe their current teaching conceptions and methods?

One of the main goals of this research is to understand the teaching conceptions and methods that are being employed by engineering assistant professors at various institution types. First, I start by comparing the ways the participants described their teaching conceptions and methods in section 4.2.1. Then, in section 4.2.2, I examine how these conceptions and methods were influenced in graduate school and in participants' current institutions. Finally, I summarize these findings in Section 4.2.3.

4.2.1 Comparison of Conceptions and Methods

This section will first provide an overview of ten conceptions of teaching and methods in section 4.2.1.1 and then will present emergent themes from the thematic analysis in section 4.2.1.2.

4.2.1.1 Overview of the Participants' Teaching Conceptions and Methods

In the literature review in Chapter 2, I introduced two sets of teaching conceptions by Torres-Alaya (2012) and Borgford-Parnell (2006). Torres-Alaya found five teaching conceptions among engineering graduate teaching assistants: 1) delivering knowledge, 2) helping students understand and apply concepts, 3) motivating students, 4) helping students learn how to approach problems, and 5) preparing students to make socially conscious decisions. Borgford-Parnell also found five teaching conceptions among professors who had won teaching awards: 1) teacher's power is leavened with responsibility, 2) students are synonymous with positive vision of future, 3) learning to learn takes precedence, 4) teachers are essential to student learning, and 5) new learning fits to the student's lifetime of learning.

I expected the participants in my study to fall somewhere among these two sets of conceptions. However, it is important to note that I did not ask participants specific questions about conceptions they did or did not hold, but rather asked them to walk me through their teaching philosophy statement and a course syllabus. This document elicitation technique did shed considerable light on each participant's teaching philosophy and conceptions of teaching, but it was not possible to touch upon everything a participant believes about teaching. Therefore, if a participant did not mention a

particular teaching conception, no definite conclusion can be drawn about their belief about that particular conception. Rather, the data I collected simply reflect what that participant held at the forefront of their mind in relation to teaching during our conversation, and particularly in relation to the documents they shared with me.

Many of the conceptions identified by Torres-Alaya (2012) and Borgford-Parnell (2006) were held by the participants in this study. In fact, only one conception found by Borgford-Parnell in his study of effective teachers, *teacher's power is leavened with responsibility*, was not explicitly mentioned by any of the twelve participants. All other conceptions these two researchers identified were described to some extent by the participants in this study. In addition to these conceptions, one emergent teaching conception was revealed in the data: all twelve participants believed, to some extent that *Teaching is an evidence based practice***.**

As a further overview of the ten teaching conceptions described by the participants (nine from previous literature plus one emergent conception), Table 8 provides one example for each.

Table 8: Examples of Participant Teaching Conceptions

Teaching Conception		Examples
Torres-Alaya (2012)	**"Delivering knowledge"** In this example, Matthew described delivering knowledge through lecturing and guiding students through a worksheet.	At the beginning of class, I give a little intro, a little clicker quiz to check that everybody's read everything, to keep students reading throughout the semester. And then I'll typically start lecturing for about 10 or 15 minutes before I have students dive in and get started on questions. And if students get stuck, I kind of feed information back until we have worked through the worksheet. (Matthew)
	"Helping students understand and apply concepts" In this example, Molly described that helping students understand and apply concepts is what motivates her as a teacher.	I love seeing them go from not understanding to really getting excited about the subject and taking them from the place where they have no idea what you're talking about to really being able to solve the problems they need to solve, to understand, conceptually, what's happening, to be able to apply what they're learning in new situations. (Molly)

	"Motivating students" In this example, Tyler described how he believes motivating students is an important component of learning.	If you can find a way to motivate students through humor or through – maybe what you're talking about is exactly what they want to do for the rest of their lives or something like that, and I think people are much more interested to learn than they just have to take this class because it satisfies some need for them to get this degree or whatever. And so, if you can connect to them that way, I think that's very important. (Tyler)
	"Helping students learn how to approach problems" In this example, Emma explained how she helps students learn how to approach problems by using worksheets or quizzes.	I do some kind of a worksheet or quiz or something like that to have them work independently or in groups of two to work through an engineering problem. So, they might have to do a structural analysis problem, or calculate Young's modulus of the material, or three different materials, so something simple, but kind of back of the envelope calculation. (Emma)
	"Preparing students to make socially conscious decisions." In this example, Opie described his thoughts on teaching his students about diversity and society in engineering.	And so just as we need to think about it as instructors, we need to get them thinking about it as people and members of society. And ever though that's not something that engineering necessarily would focus on, it's something that we need to think about. So how do we make our examples diverse, and how do we make the context of our problems culturally relevant across cultures and culturally informative for the students who wouldn't otherwise be exposed to that? (Opie)
Borgford-Parnell (2006)	**"Students are synonymous with positive vision of future"** In this example, Emma is helping her student recognize that her future is bright by encouraging her to act ethically moving forward	[In response to an academic integrity issue]: And I said to her "I just know that you're better than this, and you're doing this for the right reason and you're trying to help your classmates, but at some point, it's going to come back and bite you. You need to stop. You need to take care of yourself, you need to take care of your own path forward, and you are going to be successful, so don't risk it, being associated with this type of behavior." And she was just like, "no one's ever said this to me, or put me on the spot like this, I just get the sense

		that you care so much and that you're really making a difference." (Emma)
	"Learning to learn takes precedence" In this example, Matthew is having his students engage in lifelong learning by having them explain concepts to younger students through the development of museum modules.	That element of the class [where students developed a module for a local science museum] went really well. I don't think students really expected how tricky it was going to be to boil something down and teach it. And one of our outcomes is an understanding of the importance of the ability to engage in lifelong learning, so I think that was a really unique way of fulfilling that outcome (Matthew)
	"Teachers are essential to student learning" In this example, Valerie described the environment she creates that she believes is important for student learning to take place.	I'm trying to create an environment where you can learn, I have clear assessment requirements, and I am always looking to improve whatever the heck I am doing. And then saying, if you're a student in my class, you're going to take an active role in your learning, and you're going to commit to learning and collaborating with peers. (Valerie)
	"New learning fits to the student's lifetime of learning" In this example, Samantha described how she believes her classroom in part is where she needs to prepare students for their future industry careers.	Because part of why I came back [from industry to get my PhD] was because I saw such a wide range in preparation in the new grads coming into industry that I was mentoring, and that perspective, I think folded back in to my teaching philosophy. My goal, and where my teaching philosophy comes from, is to prepare engineers to take a job that I had or a similar job. (Samantha)
Emergent	**Teaching is an evidence based practice** In this example, Jason described how is aware of evidenced-based teaching practices and is starting to bring them into his own teaching.	I just read a book and [the author] talked about Bloom's Taxonomy and learning styles and other methods of teaching that are not just pure lecture. So that was me reading a book and kind of learning about that. And saying no, this kind of makes sense. So now I'm trying to wrestle with how can I implement this and what are other ways I can do? So, I am still definitely in the method of trying to find what teaching style works best for me. (Jason)

Evidence for two of the above teaching conceptions were found in interview data collected from all twelve participants. More specifically, all participants described believing that teaching is: 1) "helping students understand and apply concepts," and 2) that teaching is "a research or evidence based practice." The first of these themes was expressed in a variety of ways by the participants.

For example, Steven described how he ensures that his student understand the topic. As he described:

> I'll talk about it for maybe 10 minutes of so. "This is what I meant by this concept, this is how this technique works, this is what this calculation should look like." Because sometimes, honestly sometimes lecturing is the best way to explain something. You can read through a concept 50 times and not get it, but if you have someone explain it to you, who knows what their talking about, and it just clicks. (Steven)

In this quotation, we can see that Steven acknowledged that understanding concepts can be tricky, and takes time to make sure his students understand the concepts. In a similar vein, Molly also described that helping students understand concepts and being able to apply those learnings in new contexts is important. Furthermore, she described that seeing students finally understand something is a reason why she became a teacher. As she explained:

> I love seeing them go from not understanding to really getting excited about the subject and taking them from the place where they have no idea what you're talking about to really being able to solve the problems they need to solve, to understand, conceptually, what's happening, to be able to apply what they're learning in new situations. So, that's why I became a teacher. That's why I'm still here. (Molly)

A few other ideas came up when the participants described their teaching conceptions and methods. For instance, almost all of the participants also described how their teaching practices were always evolving and developing. Even one participant - who admitted that he does the same thing in his class every semester, mentioned that he welcomed opportunities to improve his teaching when possible.

Many participants additionally described how they started off lecturing, because that was the teaching method they were familiar with. However, after trying lecturing, the participants realized that it might not be the best approach. For example, Christopher described how he tried to model his classes off what he was used to from his own PhD experience, but then the students caused him to change his approach. As he explained:

> My first quarter at [Current Institution], I tried very much to replicate that of [PhD University's] approach. I tried to have these big monolithic slide decks that had all this information that they could read at their leisure and just follow along. The students hated it. The feedback was they wanted a lot less slide decks and a lot more me working out problems on the board, defining concepts verbally, because I think that caused them to write it down in their notebooks a lot more. And you do get more out of it when you write it down. (Christopher)

Here Christopher provided a good example of how his teaching changed since arriving at his current institution. Some participants also described how they became aware of other teaching methods, and discussed major influences on their teaching, which will be further described in section 4.2.2.

4.2.1.2 Participants Show Awareness of Evidence-Based Teaching Practices

As shown in Table 8, one new theme emerged from the data, i.e., "teaching is an evidence based practice." Additionally, some themes had unique emergent characteristics, which will be discussed in more detail below.

Showing awareness that teaching is an evidence-based practice was to some extent evident in every participant's interview data. These descriptions ranged from participants acknowledging that active learning is supported by research to describing their own experiences interacting with the educational research community. For instance, Matthew described learning about educational research methods when he took a workshop on teaching. He was impressed that he was learning through the methods and realized that he might consider using them one day as a teacher himself. According to Matthew:

> So, learning the different research that was out there or current best practices, looking at the vocabulary, and seeing these things in person, and being like, wow,

> these are self-consistent. If you can use this to teach me this, then it's something that works, right? (Matthew)

As was already indicated in the quotation appearing in Table 7, Jason started reading about evidence-based teaching methods after being introduced to these methods during his faculty orientation and is working on ways to implement new approaches in his own classes.

In addition to demonstrating awareness for evidence-based teaching practices, about half of the participants made comments related to the theme "new learning fits to the student's lifetime of learning." More specifically, these participants demonstrated that they were aware of the unique challenges engineers might face in the workplace and have adjusted their teaching practices to better accommodate their students' futures. Given that most engineering students pursue industry jobs after earning their bachelor's degrees, it seems that the participants in this study were acutely aware of preparing their students for success in industry jobs. Therefore, any "new learning" the assistant professors in this study introduce to their students "fits into the student's lifetime of learning" on the job. For example, Samantha, who had previously worked in industry for about eight years, recognized the importance of preparing her students for a job similar to the one she held after her bachelor's degree. As she explained:

> Through the project, I have been able to bring in some of the professional skills that are in there, and I have brought in some anecdotes and I try to bridge the math, the theory, and trying very hard to get the students to understand, how the course that I was teaching applies to real life and it's not just math on the board. Which you get a lot. So, I think I've tried – I've been able to get a lot of these skills in there, even some of them by accident, but I definitely bring my industry career into class as often as I can, and I think the students appreciate that. (Samantha)

Similarly, Molly described how her institution was placing a greater emphasis on preparing students for industry, especially as compared to when she was a student:

> Generally, the students here are great, so they're very nice. They work hard. They know they're here to get a job, at the end of the day, so that's their intent. Yeah. There's a lot of focus on helping the students prepare for industry. There's a big

> emphasis on getting the students into internships and co-ops. A lot more than when I was student, so a lot more of the students actually are able to do that before they graduate. (Molly)

Here Molly seems to imply that this change to helping prepare students for internships and co-ops is a good thing. The participants are enacting the conception that "new learning fits into a student's lifetime of learning" by including more preparation for the students' future careers.

4.2.2 Graduate School and Current Institution Influences on Teaching

This section focuses on understanding the influences of graduate school and the participants' current institutions on their teaching conceptions. Communities of Practice Theory (Wenger, 2000), as introduced in the literature review in Chapter 2, is concerned with the communities in which people are situated influence their views of the world. In this study, I was interested to see what aspects of the participants' communities affected their conceptions about teaching. The following four subsections consider the following influences: familial (4.2.2.1), formal teaching programs (4.2.2.2), graduate program (4.2.2.3), and current institution influences (4.2.2.4).

4.2.2.1 Familial Influences on Teaching

During the interview process, it became clear that influences on teaching conceptions came from greater parts of the participants' lives beyond just graduate school and their current institution. Some participants described how they had family members in teaching roles, which in turn, influenced the way they taught and thought about teaching. For instance, Richard's dad taught high school, and continues to be a big influence on Richard's teaching today. As he explained:

> I think back to what my dad did. Who was an awesome teacher and taught thousands and thousands of students over his career. I think back to that a lot and I still talk to my dad about it occasionally. (Richard).

Similarly, Jason's mom was also an educator and helped him while he was trying to make sense of his teaching philosophy statement that he was preparing for his job applications. Jason's wife is also a PhD, and she was additionally able to help him. As he described:

> A lot of this came through talking with my wife, who, she has a PhD, and also when my mom would come to visit. She is an educator, she was a middle school principal and is now an elementary school principal, so nothing higher ed, all elementary middle school, I guess. But a lot of this came from, I would tell her this is what I am trying to say, and she would help me with some of the language that I needed. (Jason)

Both Richard and Jason had familial influences that came from family members who were not in higher education, yet their perspective were still valuable and helpful.

Familial influence also influenced some participants' specific teaching methods. For example, Molly described how her dad's belief about communication skills explains why she includes so much writing and professional development in her classes. She described:

> English ability. That comes from my father. My parents are both scientists. They're both foresters, but, they're also good at language as well, and so my dad always said that you need to speak proper English and you need to write proper English, and so I had really great teachers for English. I was really lucky because I went to a small school and some of our teachers weren't great, but the English teachers I had were pretty fantastic, so I became a pretty good writer. (Molly)

Molly described including writing in her engineering classes because of her dad. Finally, it is worth noting that parents were the largest influences on the participants in my study in regard to their teaching, followed closely by spouses.

4.2.2.2 Formal Teaching Programs Influences on Teaching

One of the most common influences on a participant's teaching conceptions and methods was participation in a formal program of some sort. Some participants took a class on teaching and others participated in workshops or teaching programs. Still others participated in multiple experiences that influenced their teaching. More specifically, Opie described three sources of insight that were important to him in forming his conceptions about teaching:

> One source was by observation, because I was working with my advisor right early on in grad school, teaching classes with him, and then I did the [Teaching] Fellowship which – I was observing another faculty member in ME and then teaching [an introduction class] – so it was observation which turned into experiential learning. And then the second source was taking a [class on teaching], and in that class we did a lot of, how do you prep a teaching statement, for example. The very first draft of my teaching statement came out of that class as one of our deliverables. So that was another big contributor. And then the third one was I did some of the workshops and courses that [Teaching Center] did at [my PhD Institution]. So that was another big source of input. (Opie)

As this passage indicates, Opie named three influences on his teaching: observing others teach, taking a class on teaching, and participating in teaching workshops.

Matthew also participated in a teaching program that introduced him to pedagogical literature. He additionally described how the program introduced him to different institution types. As Matthew explained:

> But it [the teaching program] was awesome. It was a whole month-long thing, where we met twice a week, got lunch both of those days, and it was graduate students from the entire university that had aspirations of being faculty members, and it was kind of the first foot in the pond of pedagogical literature. It was during that, for the very first time I did have exposure to universities that weren't R1 Institutions. We had faculty come in from [local Master's Institution]. I actually visited there, and I was like, oh, this is totally a place I could see myself, that does research but it's really education focused and doesn't have graduate degrees. This is in the cards. (Matthew)

For Matthew, participating in the teaching program was very helpful in knowing about teaching methods and future places of employment. More suggestions surrounding important experiences for graduate students will be discussed in section 5.3 in the discussion.

While a number of participants described these formal teaching programs as being hugely beneficial, about half the participants described wishing they could have

participated in such programs. The desire to participate in more formal programs like those described by Opie and Matthew described was presented in section 4.1.1.2.

4.2.2.3 Graduate Program Influences on Teaching

Many participants also described their advisor effecting their teaching. Sometimes this influence was positive, such as when an advisor was supportive of taking a teaching class, as in Steven's case, but it was sometimes negative. In the case of a negative example, Jason described that his advisor told him teaching was something that had to be done in order to do the research, and distinctly remembers that his advisor hated his teaching job. Richard also described his advisor, whose poor teaching ultimately helped Richard become a better teacher:

> In fact, my PhD advisor is kind of one of those [poor teachers]. In his grad course, it was like – oh my god. His slides. His slides were just equation after equation, and there were no words explaining anything, just his derivation of equations upon equations, oh my gosh, you know. Don't do that. Nobody understands all these crazy equations that you're putting in there. (Richard)

Other professors, besides the participants' doctoral advisors, during graduate school also had an effect on the participants. For example, Tyler remarked on two professors he had as a master's student, and how his perception of them placing a high regard on teaching was even more influential now as he reflected back on the experience. As he described:

> I've had some really, especially at [my Master's University] for whatever reason, I had two really, really exciting, or motivated teachers, that you could just tell they spend a lot of extra preparatory time and were really interested in the topic, and even knowing what I know now, how research is king over everything, I appreciate more the time that they spent. (Tyler)

Here Tyler described being especially impressed with his teachers in his master's program, knowing now about high research demands. These realizations have in part inspired him to be dedicated to his teaching in his current institutional context that focuses very much on research.

In some cases, the participants did not have any formal course on teaching. Nonetheless, some institutional contexts provided other kinds of learning opportunities. For instance, Molly described how she managed to learn about education during her time as a graduate student:

> I've never had an education course. But in spite of that, I had friends who this was their research area, so I'd sometimes go to their dissertations or their talks that they'd give. And then [my PhD University] - the department I came from - they made an effort to promote teaching and improve teaching among the faculty, and so one of the ways they did it was they'd bring in a guest speaker who was a well-known teacher in chemical engineering to give a seminar - two seminars, actually. One on their research area and one on their teaching area, and so some of this [knowledge about teaching] I gained from hearing those talks. (Molly)

Despite never having the opportunity to take an education course during graduate school, she was able to have conversations and attend seminars that focused on teaching. Yet in most cases, the participants had to go out of their way to gain exposure to teaching-related topics during graduate school.

4.2.2.4 Current Institution Influences on Teaching

Now that these participants are assistant professors at one of four institution types other than R1, their teaching conceptions have continued to be influenced. As is common when joining a new community, you need to adjust to the local ways of doing things. In this section, I present the ways the participants adjusted to their new environments, including adjusting their teaching methods, responding to student evaluations, and understanding tenure requirements.

Samantha started out teaching laboratory classes at her current institution, a master's institution, and benefited from observing the professor who taught the lecture classes associated with her laboratory class. As she described:

> I sat in on their lectures because both of those classes are on my trajectory to eventually teach. So, I sat in on their lectures which helped me in the labs as well

> as get a feel for how good teaching professors actually teach around here. (Samantha)

As Samantha indicated, there is a way of teaching at her institution, that she wanted to familiarize herself with. Similarly, Christopher described how he had to adjust his teaching approach at his current institution, mainly because of the students' feedback. As he explained:

> My first quarter at [Current Institution, a master's institution], I tried very much to replicate that approach [like at PhD University]. I tried to have these big monolithic slide decks that had all this information that they could read at their leisure and just follow along. The students hated it. The feedback was they wanted a lot less slide decks and a lot more me working out problems on the board, defining concepts verbally, because I think that caused them to write it down in their notebooks a lot more. And you do get more out of it when you write it down. (Christopher)

Christopher described that slide decks were useful at his PhD institution so that the students could reference the slides later, but at his current institution, the students did not want that sort of teaching presentation. He adjusted his teaching approach to support the students and has found it to be much more successful.

Jason described how his colleagues at Current Institution, a master's institution, have encouraged him to think about teaching and how to improve his methods and approaches. As he explained:

> I did not come from an engineering education background, so where I learned, lecture was a lecture and then you had homework. So, a very traditional learning style, which matched me, which I am now realizing that there's selection bias for PhD candidates. I've had discussion with some faculty here about learning styles and just that not everyone learns like I do, and I'm trying to wrestle with that. So, I'm actively exploring other teaching methods. (Jason)

Here Jason brings up an interesting point: PhD graduates might have learned successfully with lecture, but lecture might not be the best teaching approach for everyone. He

explained that some of his colleagues are introducing him to other teaching approaches, and that he is trying those approaches out in his classroom. The realization that the way Jason learned best would not work for everyone is a realization that is likely important for all teachers to make. Being introduced to multiple teaching methods is a useful way to realize that teaching has many varieties, which will be discussed more in Section 6.3 about future work, where I propose topics for a workshop.

Some participants described how teaching observations factor into their teaching evaluation. In some cases, these peer observations are required, and in other cases, they are encouraged but not expected. For example, Emma described the way her department handles peer observation:

> Our department chair is expected to come and listen to our lecture at least once a semester. And we can invite older faculty that are in our field of interest. I'll just invite them, I'll do a lecture that they think is relevant to their area of expertise, and then they'll write up a half a page document on my ability. (Emma)

Such as with Emma's case, it is encouraging to see that many of the participants described ways of evaluating teaching beyond student evaluations alone.

One participant mentioned a conference as a source of inspiration for his teaching. Steven's current institution provides funding for him to attend the American Society for Engineering Education (ASEE) conference, and he described the camaraderie from the conferences as being very helpful for his teaching practice:

> That was probably the biggest thing I took away from ASEE, but just talking with people about – or what are the tools you use for managing groups, or how do you handle homework when you don't have the resources to grade 100 homework problems every week? The exchange of ideas, different techniques, just to get myself more involved with the education aspect of it. That was something that had been missing. (Steven)

In the quotation above, Steven explained how he gained perspectives on improving his teaching. In some cases, tenure expectations emphasize an improvement model in teaching, by rewarding continued improvement in the classroom with tenure. This finding is encouraging since research is typically most rewarded even at institutions that have larger teaching requirements (Berube and Young, 2002).

For instance, Opie and Christopher are both required to participate in reflective practices about their teaching as part of their promotion and tenure process. Opie more specifically described the expectations around reflecting on the student evaluations:

> All your course evaluations, your department chair reads them and then the dean reads them, and you're supposed to, for every class put together a reflection on your course evaluations. Just a little one pager on what students said in their comments and what your Likert scores were and then what do you think about that. How do you react to it, are you going to change something, do you disagree, do you feel the need to explain something? (Opie)

Similarly, Christopher was also expected to reflect on his teaching evaluations and has a chance to explain any negative comments. He describes this being particularly useful in instances where students do not like a new teaching method that may require them to do more work. As he explained:

> And one big section in that [tenure and promotion portfolio] is you're required to pick out a handful of representative comments, both positive and negative, from your evaluations and address them. So, you do get a chance – if you get low teaching evaluations, and half the comments are "well, I felt like he expected too much from us and I much prefer a class where everything is very straightforward, step-by-step, everything has an easy solution that you can find in the book" which I have actually gotten comments like that before. Then you can say, "look, that may be what they want, but they get more out of the class when you force them to do critical thinking, so I'm planning on continuing with this practice, and I'll try to do more framing at the beginning of the course to tell them why I am doing this, but it's not a bad thing that I am doing this." (Christopher)

As Christopher explained, being able to expand on his teaching evaluations is a practice he appreciated about his current institution.

Finally, Steven also had the opportunity to reflect on his experiences and discuss them with his tenure and promotion committee. He explained:

> Every year you write up a report, these reports are sent to the department chair, the dean. But the department chair and the dean, you get together and meet with them and discuss how things are going. So, the evaluation, it gets sent to the rank

> and tenure committee, and they meet – it's a small enough school, they only have a handful of these a year. From what I understand, they can spend a lot of time going through them without having to rely overly on student evaluations or other quantitate measures. They can evaluate your portfolio as a whole. You put together a list of your accomplishments as well, that would go into your yearly report too. Whether they are officially recognized ones, or whether its feedback you got, a note you got from a student saying thank you for making statics fun when it shouldn't have been, things like that. (Steven)

Steven seemed very content with the process of his tenure and promotion evaluation, describing that his portfolio is evaluated "as a whole."

From the examples above, we can see that the teaching conceptions of the participants were affected by current institutional practices in various ways. It is especially encouraging to see modes beyond student evaluations being introduced, such as observation of and reflection on teaching.

4.2.3 Summary of Findings for Research Question 2

Research Question 2 (RQ2) examined the teaching conceptions and methods of the participants in this study, namely, twelve assistant professors of engineering at - various non-R1 Institutions. RQ2 also included two sub-questions. RQ2a aimed to understand how the teaching conceptions and methods of the participants were influenced by past and current experiences, and RQ2b sought to understand more specifically what teaching conceptions the participants hold.

Section 4.2 examined the ways participants described their teaching conceptions and methods, and I found that the participants often realized that the teaching methods they saw as students were not the best. Sometimes participants realized this through teaching workshops, from their advisors, or from the students they were teaching at their current institutions.

The participants generally believed that teaching is a very student-centered activity and that it is an evidence-based practice. Even though most participants described being underprepared for the teaching aspect of their positions, they also described working towards improving their teaching practice. Some participants had structured

opportunities to reflect on their student evaluations and innovative teaching practices as part of their tenure preparations, and are encouraged to try innovative practices in their classrooms.

Chapter 4 presented the findings of the thematic analysis that was conducted with the twelve interview transcripts. From these findings, we have a better understanding about the participants' pathways to their current positions and their teaching conceptions and methods as a group. However, each participant described their unique and individual story in their interview, and those stories will be presented and examined in more detail next in Chapter 5.

CHAPTER 5. THE CO-CONSTRUCTED NARRATIVES

5.1 Bridging the Thematic and Narrative Analyses

Sections 4.1 and 4.2 of the findings presented responses to the main two research questions of this study, using examples from all twelve participants to make claims. However, one apprehension I had as the researcher, is that the thematic analysis breaks down the stories too much, and that the sense of the individuals I interviewed gets lost. While the themes from the thematic analysis can help us have an understanding about the specific facets of the experience (i.e., transitioning from an R1 Institution to a non-R1 Institution), we are missing other aspects of the stories, namely the nature of the individual, lived human experiences of the research subjects.

The narratives were initially written for the purpose of being shared with graduate students and other stakeholders who are interested in supporting graduate students' pathways in academia. However, the narratives also present the findings in a way that the thematic analysis alone cannot do. First, through the narratives we can see that multiple descriptive themes are connected in the participants' experiences and that pulling those themes apart denatures the experience. Second, the narratives capture the nature of a descriptive theme occurring over multiple instances, which is not easily captured when describing the theme by itself. By using one narrative as an example, I will walk through Jason Talbert's narrative to demonstrate how considering the narrative as a whole allows us to see the thematic analysis findings in a different, and possibly richer, way.

5.1.1 Walking Though Jason's Narrative

Using Jason Talbert's narrative, I will first describe how the descriptive theme, Swimming Upstream, (4.1.1.1) was a time-dependent theme that occurred over multiple instances. Next, I will describe three *narrative themes*, which I present as higher order themes that combine multiple themes that resulted from the thematic analysis. Those narrative themes are: 1) Support for Pursuing Non-R1 Pathways was Critical, 2) Faculty Identity Developed in Contrast to the R1 Environment, and 3) the Current Institutions Viewed as Different in a Good Way.

5.1.1.1 Swimming Upstream

Jason went against expectations a number of times throughout his experience. In his narrative, Jason described two points in time where he went against his advisor's expectations, and also how he went against his perceptions regarding the general expectation of PhD graduates. To begin, Jason described how he initially went against his advisor's expectation that he would work in the tech industry and instead decided to pursue an academic position. As Jason described:

> My advisor was big on pushing me to work in the [tech industry] type path and getting a non-academic type job. And at one point, I was interviewing [at a tech company], and just, and I don't know, I was there, stuck in traffic, they're making these ridiculous sums of money, and I was just breaking down – I don't want to do this. This is not at all what I want. That was I think, that was the fall before I defended. So, then I came back, and said, ok, I'm going to go the academic route.

Since Jason's advisor had been pushing him to pursue a position in the tech industry, Jason viewed pursuing an academic position as going against his advisor's expectations of him.

The next instance of Jason going against his advisor's expectations was in regard to pursuing a faculty position. Although Jason's advisor was supportive of him pursuing an academic position, his advisor seemed to expect Jason to pursue a position at an R1 Institution. As Jason explained:

> When I finally told him I was going the faculty route, he was happy to help me. He read over statements and gave some advice there. He was pushing – he told me, he basically told me, you should go to [an R1], he talked about the back channel of communication, the chair of the search committee I think, contacted him, and he – and was pushing me.

Although Jason's advisor suggested that he should pursue a position at an R1 Institution, Jason applied to multiple institution types, including Master's Institutions. Jason ended up getting job offers from both an R1 and his current institution, a Master's Institution. When Jason had the option of taking a position at an R1, just as his advisor had suggested he pursue, it was challenging for him to go against his advisor's expectations and choose

to accept the position at the Master's Institution. Yet Jason went on to describe how his advisor was ultimately supportive of his decision:

> When I finally called him the last time and told him, I got these – I forget how many offers I got, three or four offers on the table, and he was like, he finally said, "[Jason], that's great. At this point, it's all preference, you should go wherever you want." At the very end, he finally kind of relinquished that. And I really told him I was thinking about this, and I know I didn't need that from him, I was going to take the job anyway, but that was kind of relaxing, when he finally said, "you know, at this point, when you have job offers and stuff, get what you want, go where you think you'll fit in best." That was – it was just hard to overcome that bias coming from him.

In Jason's case, he needed to *swim upstream* against his advisor's expectations multiple times during his job search process. In addition to his advisor's expectations of him, Jason also perceived more general expectations from the culture of his PhD institution, including challenges associated with not pursuing a position at an R1 Institution:

> I interviewed and got a job offer from an R1 school. And that was kind of like, alright, this is great. Because coming from [PhD University], that's the goal. To get a job teaching and doing research, even though I really didn't want to do the research and get grants, I just wanted to teach, but I was like, whatever, you have to do this. I was almost not ready to accept the job [at Current University], just because I was like, well, if I do that, I'll be stuck in this tier of institution and all this other stuff.
>
> I think it was probably my wife was like, "[Jason], this is your dream, this is what you want." And I was like, you're totally right. I had my big pro-con list, describing [Current University, and I finally reminded myself], this is my dream job that I wanted to take. Why am I internally struggling and fighting myself against what I actually want versus this other job that I would end up hating? Just because of the bias that you should go to an R1. That was just really hard to overcome.

As the preceding series of examples suggests, *swimming upstream* is a time-dependent theme, in which the notion of going against expectations happens multiple times, as Jason's narrative demonstrates. In this final example, Jason's wife helped him make his decision to pursue his own goal, rather than pursue what he believed others expected of him. As we can see, *family matters* also came up when examining the *swimming upstream* theme. This idea of multiple themes occurring simultaneously is explored further in the following three subsections.

5.1.1.2 Support for Pursuing Non-R1 Pathways was Critical

As was just shown in the final example in section 5.1.1.1, Jason's wife influenced his decision to pursue a position at a non-R1 Institution. Additionally, Jason relied on support from another mentor while he was making his decision. Not only did *family matters* come into play, but *overcoming perceived failure* affected Jason as he chose to pursue his current position. As we can see, examining these themes individually does not adequately capture the whole of Jason's experience, while the narrative theme *support for pursuing non-R1 pathways was critical* gives a better sense of the experience.

In his interview, Jason described how he reached out to a colleague who ended up being a critical mentor along Jason's pathway. This quotation especially demonstrates how Jason needed to *overcome perceived failure*:

> Coming from [PhD University], as being a big R1, and I had a good friend from [another R1], he was maybe one or two years ahead of me, I know him from conferences. He ended up getting a job at [a master's institution]. And I was like, woah, this is a big change for you. And I talked to him a lot, called him up on the phone several times to talk to him about that, and we were both talking that, there's this really scary thing that once you leave the R1-realm, there's a huge bias there. There's this – 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.

Jason found someone to talk to about the sense of failure he felt for breaking the expectation to go to an R1 Institution. Having a mentor to reassure him helped Jason pursue his pathway to his current position at a master's institution. As he described:

> My friend who ended up at [a master's institution as well], because I knew he had gone down this path, and it was really just reassuring to talk to him and hear that there are other people who make this crazy jump –leaving your R1 bubble to go to these small schools, even though that's – It's just ridiculous looking back how I thought I was failing, leaving that, but you're not at all.

As we can see from Jason's description of his mentor, it is obvious that this mentorship and ability to connect with someone who supported him on this pathway was critical. Through Jason's mentor, he saw that someone went from an R1 to a Master's Institution and succeeded. It was also reassuring to Jason that his mentor had similar concerns and had to overcome his own sense of perceived failure. Similarly, without his wife encouraging Jason to pursue his dream of being at an institution where he can focus on teaching, Jason may have ended up at an R1 Institution as he thought was expected of him.

Looking beyond Jason's case, the narrative theme of *support for pursuing non-R1 pathways was critical* was evident in many of the twelve narratives. This was especially the case for the participants who are at Baccalaureate and Master's Institutions, possibly because those institution types are most distinct from R1 Institutions. In some cases, the participant's advisors offered support, but in most cases, this support came from family members and peers. For example, in Christopher's case, his sister had recently gone through the job search for a non-R1 position, so she was able to support Christopher as he pursued a similar pathway.

5.1.1.3 Faculty Identity Developed in Contrast to the R1 Environment

In having done all of his degrees at R1 Institutions, it makes sense that Jason first developed an understanding of what it means to be a faculty member in that context. In the next few quotations, we see a number of related themes come up, including *no map for non-R1 job search approaches*, and *the institutional environment in comparison to R1*.

During his interview, Jason described his frustration with the PhD process as a whole. Here we can see that in addition to not having a map to navigate the job search

process, Jason felt that non-R1 Institutions were disregarded completely. As he described:

> [During my PhD], there was just kind of a disregard for teaching based institutions. I remember I went to one seminar about job searching, and they would talk about how you need to have your research ready, and you should have parts of your dissertation ready to discuss, and I think another guy raised his hand and said, "why is there no one representing any teaching positions or anything like that?" There's a whole list of institutions that have been swept under the rug, and I wish that wasn't the case. I wish it was mentioned more, that there are institutions for teaching in your job search, and actually give students opportunities in teaching.

As Jason described, "institutions for teaching," most likely non-R1 Institutions, were barely mentioned to Jason as he was going through his PhD program, even at a seminar about job searching. This quotation from Jason demonstrates the theme *no map for non-R1 job search approaches*, since Jason had to learn about non-R1 Institutions, and how to prepare job documents for these applications, without much institutional support.

As Jason was navigating his time as a PhD student, he was also trying to make sense of what it would be like to be a faculty member. But he described his understanding of faculty members to be biased towards R1 Institutions, which highlights the theme *the institutional environment in comparison to R1*:

> I will say that I felt the PhD process is a little bit a bait and switch, just like – it just feels like there are so many PhD students and then so few jobs and it's just terrifying to get there and realize, oh, most professors, well what it seemed like, most professors spend all their time writing grants and just doing research, and there are very few of these big jobs. I don't know, it just felt odd to finally get this realization – and this is biased to the R1s – but professors spend the majority of their time writing grants, managing students instead of teaching and doing research is what you think as an undergrad.

Once Jason had decided to pursue an academic position, as was described in the previous section, he explained how he "happily found that a place like [current institution] existed," since his PhD experience did not make him aware of non-R1 schools.

Reflecting on his PhD experience, Jason also described how he talked with his advisor about faculty life. Now that Jason is in a faculty position at a master's institution, he realized that he was not given a good understanding of what faculty actually do at non-R1 Institutions.

> I really don't know [how I learned what faculty do]. I talked to my advisor a lot about just what he does, but his life looks so different than from what mine looks like now. He would fly all over the place talking to funding agencies and doing talks, that sort of thing.

Jason went on to say that his advisor's attitude about teaching and students set him up for surprise once he started in his position at his current institution. This quotation again demonstrates the theme *the institutional environment in comparison to R1,* as he described:

> It definitely is hard because – at [PhD University], I was told by my advisor that teaching is something we have to do, he openly hated his teaching job. So, it was hilarious coming here, where everyone is like, yes, teaching, I love interacting with undergrads! That wasn't something necessarily to overcome, it's just almost shocking how different attitudes are of faculty who are advising PhD students versus faculty who are predominantly teaching undergrads.

Additionally, Jason described his perceived difference in faculty attitudes based on advising PhD students versus teaching mostly undergraduate students. Jason also described his institution in comparison to his other institutional experiences in other ways, including how he felt the faculty at his current institution were much happier than at his PhD Institution, which will be discussed next.

In the previous quotations, we saw that Jason's identity as a faculty member was hugely influenced by his experiences at R1 Institutions. As he was learning about non-R1 Institutions, he became aware of the fact that he did not really have much of a *map for non-R1 job search approaches*. In addition, he described many instances of how his current institution environment compared to R1 Institutions. By presenting examples of these two themes, we can see how the narrative theme, *faculty identity developed in contrast to the R1 environment*, captures Jason's experiences more holistically.

The narrative theme discussed in this subsection came up for most participants as they were navigating their PhD process and their job searches. The amount of contrast varied depending on how different the participant wanted their job to look in comparison to their perceptions of their advisor's experience as a professor at an R1 Institution.

5.1.1.4 Current Institutions Viewed as Different in a Good Way

Jason described how he needed to develop his sense of what a faculty member does in comparison to the R1 expectation. In doing so, he realized that a job at a non-R1 Institution would be different – but in a good way. Some of those differences are explored next. A few related themes come up as Jason describes how his current institution, a master's institution, is different, including a *focus on teaching was desired, misalignment of teaching and research expectations,* and *institutional environment in comparison to R1*.

To begin, Jason interviewed for his current position while he was a research scientist at his PhD institution. He described what stuck out to him during his interview at his current institution, which was in high contrast to his PhD institution:

> [During my interview at Current University, I noticed] the faculty here were so phenomenally happy. They just get along with each other, they're just happy people, they look like they're enjoying their lives. The other thing was that the department chair who I interviewed with knew just about every student's name in the hallway and would stop and ask questions and just chat about stuff. And he just knew things that were going on in their life. And I was just like, this is amazing. I've never seen any other environment like that, and that really stuck out in my mind as I was comparing everything. It made it feel like the department is a team, but there is a sense here that the students are part of that team, they're not the antagonist, they are – we're all in this together, and that just totally – I got that feeling on the interview, seeing our department chair just know so many people.

Jason was attracted to the environment of his current institution during the interview, especially because he got the sense that the department was a team.

When Jason described his current institution's expectations for scholarly activities, he also described how it's much less pressure than anywhere else he

interviewed. In his description, the theme *misalignment of teaching and research expectations* is apparent as Jason describes how scholarly activities are counted:

> So scholarly activities, it's expected but in terms of evaluation and that sort of thing, its counted very little both in our annual reviews. I think, just talking to the chair, everyone expects you to get one or two journal articles by the time you're up for tenure, and then a few other conference papers. So, research is expected to keep up, but also, they said, teaching is the main thing we are here to do; if we are not good teachers, we will not get tenure. That being said, I also – it's much less pressure here than anywhere else that I interviewed, which is awesome. It goes back to all the faculty being happy when I interviewed. But I think, they've said, maybe one person in twenty years has gone up for tenure and not received it, so that takes a lot of the pressure off, which is also something I was looking for in that faculty search.

Jason really enjoys the fact that there is not a lot of pressure on him in terms of research expectations, and that was something he was looking for while on the job search. He went on to describe being very happy with the balance at his current institution. Again, we see the theme *misalignment of teaching and research expectations*, but in this case, Jason is describing how his teaching and research is well aligned with his goals. Additionally, the theme a *focus on teaching was desired* is evident when Jason describes being respected for enjoying teaching:

> I am totally happy with [my balance of expectations], because, I mean, I think anywhere I would go, I think I would spend a lot of effort teaching, because I want to be effective. That's a personal goal of mine as a professor, as an academic. I want to be an effective teacher, so it's nice here that I am rewarded for the amount of effort I put in getting classes together and coming up with active activities and stuff like that. So, it's rewarding knowing that if I put in a lot of effort, then that will be reflected in my annual survey. In terms of balance, I am totally happy with it. I get to spend a lot of time with my family, I feel well rewarded, and I am respected for enjoying to teach. That's good.

In this last example, Jason described being happy with his lower expectations, in comparison to an R1 Institution, in part because he has time to spend with his family. He

implies that he would not have this balance at an R1 Institution, and this is in part why his current institution is *different in a good way*.

Almost all the participants described their institutions as *different in a good way*. Some participants had higher research expectations than Jason, yet they were happy with those expectations. Comparing their institutions to R1 Institutions was the case for all participants, since they all went to R1 Institutions for their PhD at minimum. Seeing that the participants view their current institutions as *different in a good way*, even with every participants' definition of the differences and what made them good varying, it is encouraging to see that most of the participants are content with their institution.

5.1.1.5 Reflection on Jason's Narrative

In the preceding four sections, I walked through parts of Jason's narrative to demonstrate how the thematic findings can be experienced through reading the narratives. In addition to understanding the thematic findings in the context of Jason's full narrative, three *narrative themes* were discussed. These narrative themes became evident when considering multiple descriptive themes within a single narrative. Additionally, I also discussed how the descriptive theme, *swimming upstream* became more evident when considering how often Jason needed to challenge expectations, which was clear when considering his narrative as a whole. We saw that Jason was challenged by his advisor about his choice to pursue a faculty position, and then challenged about pursuing a non-R1 position – *swimming upstream* was a long process for Jason, where he needed to consider his personal goals and needs again and again.

Section 5.1 was meant to demonstrate how the thematic and narrative analyses can provide even more insight into the experiences of the assistant professors considered in this research. Section 5.2 presents all twelve narratives; however, I do not walk through each of these narratives as I did with Jason's. I believe that individual readers will connect with the narratives based on their personal experiences and will benefit from making their own conclusions about the narratives.

Additionally, I do not claim that all the narratives will have the same narrative themes as I described for Jason's narrative. The narrative themes described were

especially salient for Jason's experiences, but the themes might manifest differently in other narratives, with additional narrative themes potentially arising.

5.2 The Co-Constructed Narratives[9]

Each narrative was organized into major sections that are consistent across each narrative, but the narratives can be read individually or as a group. The four sections are: "How I got here," "My preparations for teaching," "My early days as a professor and what I am doing now," and "What tenure looks like here." Some narratives additionally have a fifth section, "Other thoughts," for considerations that were important to include but did not fit within the other themes.

The narratives were constructed by me, Natascha Buswell. However, they were written in first-person from the perspectives of my participants. This was done intentionally, so that the narratives could act as the stories of more competent others (Chaiklin, 2003) to better convey the stories of engineering faculty at institutions of varying research and teaching activity, particularly to current graduate students and faculty. Since the stories of people taking a path less traveled in engineering academe are not well known, I wanted each narrative to stand alone and tell each participant's story, as well as enable comparison and contrast with the other narratives. Readers might connect with the participants' stories as well as see how the stories are similar to and different from one another, as well as other stories of pathways and perseverance.

Although the narratives are written in first-person, I was not able to capture everything about each person. Each narrative is meant to convey the way in which each participant told her or his story. Direct quotations from the interviews dominate the narratives and my words (Natascha's) that are used for deidentification, clarity, and flow are indicated by brackets. By hearing the story in the participant's words, the narratives will function as a conversation with the reader.

Since all of the narratives were deidentified to protect the participants' privacy, the names of schools were changed to very generic versions indicating when the

---

[9] ©ASEE. Portions of this section have been reused with permission (see Appendix D)

participant was at that school. For example, each participant went to "Undergraduate Institution." The institution that the participant is at currently is called "Current Institution." Each institution is also described by its Carnegie classification the first time it is referenced in the narrative.

Each narrative is based on a 90- to 120-minute interview with each individual participant. After I transcribed the audio interviews, I identified critical incidents (Webster & Mertova, 2007) in the transcriptions. I organized each narrative into major themes that are consistent across each narrative, but the narratives can be read individually or as a group. The transcripts were coded verbatim, which means word for word, except for the exclusion of crutch words and phrases, such as "umm", "you know", and any instances of stuttering.

Once the first draft for each narrative was constructed, I asked each participant to examine the draft and check for any inconsistencies or misrepresentations. I also asked the participants to comment on their thoughts regarding the incidents that I highlighted; I wanted to make sure they felt that the narrative represented their story accurately, both from a factual and emotional perspective. In some cases, a participant may have adjusted some wording and/or added additional thoughts. These modifications are included; however, they are not differentiated from the interview transcriptions. All the narratives were approved for publication by the participants.

The twelve narratives are presented in the following order, organized by institution type, as shown in Table 10. Each narrative is organized into four sections: 1) "How I got here," 2) "My preparations for teaching," 3) "My early days as a professor and what I am doing now," and 4) "What tenure looks like here." Some narratives additionally have a fifth section, 5) "Other thoughts," for considerations that were important to include but did not fit within the other sections.

Table 9: Participant Overview

Narrative	Participant (pseudonym)	Current Institution	Gender
1	Steven Bradley	Baccalaureate	Male
2	Valerie Michaels	Baccalaureate	Female
3	Opie Hampton	Baccalaureate	Male
4	Christopher Davis	Master's	Male
5	Samantha Reed	Master's	Female
6	Jason Talbert	Master's	Male
7	Matthew Land	R3	Male
8	Emma Edgerton	R3	Female
9	Richard Vine	R3	Male
10	Brandon Oakley	R2	Male
11	Molly Sanders	R2	Female
12	Tyler Colton	R2	Male

5.2.1 Narrative 1: Steven Bradley

Steven Bradley is an assistant professor at a Baccalaureate College. At the time of the interview, he had been there for two years after spending a few years working as a post-doc and adjunct professor. Steven realized during graduate school that he wanted an academic position that allowed him to focus on teaching as his primary activity. In this narrative, he details the pathway to his current position which is very much in line with his expectations.

How I got here

I guess it comes down to not ever fully deciding what I wanted to do, and just sort of going with the opportunities that presented themselves. It goes all the way back to my undergrad. When I was in high school, the areas I was most interested in were astronomy and materials science, materials engineering. [My Undergraduate Institution didn't have the major I was interested in, and] although there were interesting aspects of [disciplinary] engineering, the field as a whole didn't really sell me on this is what I want to do. I had always had an eye on [continuing] on with my education and [doing] something more oriented [towards my original interests]. I ended up applying to a few different grad programs. My girlfriend at the time, now my wife, was also applying to programs in linguistics, right, so completely separate, and we ended up – the best fit where we both got accepted was at [PhD University, which is a Doctoral University: Highest Research Activity].

So, I was there, it was actually a really nice department, a very close-knit community compared to some of the other schools I visited, which was one of the reasons that drew me there. I didn't have – I wouldn't say it was a bad experience in grad school at all, like a lot of people. It was stressful at times, but I had a really good advisor, a really good understanding advisor. I did not feel pressure to be in the lab 24/7 like some of my colleagues who I noticed were, and I think he was a really good model in terms of work-life balance, especially as compared to some of the other professors I observed.

Even still, it's a balance, it's always sort of comparative. It was very good balance for R1 academia. And I – if this is the best-case scenario, I'm really not sure this is the sort of life style I want to be in. Additionally, I was coming to realize that while I was

fine at doing lab work, at taking a problem and figuring out how to do it, I wasn't really good at coming up with problems in the first place. Which meant that I didn't feel confident in my ability to support myself through grants as my primary objective.

At the same time, I was realizing, what I really like about academia is helping people, helping students. And helping them to know the material first, but on a broader scale, helping them to know the field, to know life, to figure out what sort of career did they want. Somewhere halfway through [my doctoral studies] is when I decided, you know, I like academia, I could probably go into industry and be fine, but it's not really what I feel passionate about. But at the same time, the R1 route is definitely not for me. That's when I decided to focus on getting in somewhere where I would be able to teach, where my primary responsibility was to teaching.

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. I looked into, honestly what I found out at first was looking through job postings and seeing what sort of positions are there that I would fit in to, that I would be qualified for, that would hire me, etcetera.

Through a couple conferences and what not, I did end up making a couple connections at teaching based institutions, and so I started to leverage them a little bit. Just like, hey can you check out my teaching portfolio, can you give me some advice on what to look for in schools and interviews? There was a course that was offered through the school of education at [PhD University], it was basically college teaching 101. That was really helpful, although it wasn't scientific teaching, it was just teaching in general. I was in there with one other person from my department and then 5 or 6 other students from various departments across campus, including I think something like women's studies, Chinese, psychology. That was interesting to see what the – how the different disciplines approached teaching. That was really helpful. The instructor for the course, he ended up being a reference of mine for a while, he was very helpful. He was very encouraging.

I talked with my advisor and he suggested taking this course at [PhD University], so he was supportive of that. I found it very helpful and I did apply to a few positions.

However, I wasn't sure - what sort of experience do these schools want you to have if you're going to be mainly teaching? So, I did apply to a few schools [as a PhD student], and then I did a year of post-doc [and taught one class as an adjunct], and then a year of half adjunct, half post-doc. The post-doc - basically, the funding for it ran out over the summer [after one year]. I didn't have a position yet, and, the department head at which I was an adjunct, they liked what they were getting from me, I guess, and they basically gave me as many credits as their policy would allow for a part time faculty.

Overall, I was satisfied with how that went. In the meantime, I was continuing my job search, and by the time that semester ended I had interviewed here at [Current Institution, a Baccalaureate College], and had accepted the job.

The reason I ended up selecting it is because they offered me the job. And at the time, I didn't have another interview. I think I had another phone interview, and I ended up telling them, hey I got another position. The interview, I think was pretty typical of a lot of the interviews that I went on. It was one day. I had a teaching demonstration, they let me pick the topic.

My preparations for teaching

In the spring and early summer [during my first year of my post-doc], I decided what I need to do is get more experience teaching directly. Pretty much I looked at all the schools in the [area] and looked for any that had adjunct or part-time positions that they were advertising in chemistry, physics, engineering. Just to get something. And I did get one – I got invited by [Adjunct University, a Doctoral University: Moderate Research Activity].

I started off teaching physics labs, they started me off slow. That first semester I was still doing a full-time post-doc as well, I had a lab section. I was able to carve out some time. That was really good. Looking back, I had pretty good students in that section. It wasn't full either, so I wasn't spending the entire time running around keeping everyone's experiment going and I was able to give a lot of individual feedback as well, in terms of lab reports. So that was really good. In the spring then, of 2013, I think at that point, they bumped me up to two or three sections, and at the same time, my post-doc advisor, we realized that our project funding – basically our results hadn't been

interesting enough to keep the funding body interested, so we weren't going to be able to extend the year and a half's worth of funding. So, I just worked it out that I would become part-time, half-time essentially at [Post-Doc University, another Doctoral University-Highest Research Activity], and pick up a little more teaching experience at [Adjunct University].

And so that's what I did. And it was physics labs still – I was learning a lot about teaching, really a lot about students, interacting with students, and dealing with students who were not really all that interested in being in the class. Because I had never had that experience myself. I mean, even if I didn't care about the subject matter, I still wanted to do good in the class – I still wanted to achieve as much as possible. It was a bit – I would say it was eye-opening in that sense, like hey, there are actually, it may be a minority of students who are in that boat, it depends on the class and the field and all that.

The physics lab itself was mainly taken by engineers and biologists. And it was an interesting mix, the engineers took it as freshmen – they ended up taking physics 1 in the spring and physics 2 as a sophomore in the fall. So, it's freshmen – first year, second year students. The biologists needed physics 1, but they are mostly interested in biology, so they put it off as long as possible. So, there were seniors and getting ready to graduate, so anyone who wasn't really particularly interested in school was cleared out by that time from the biologists, but I did get some of those in the engineers. Students who hadn't caught on yet to what it takes to be a good college student, or even a passing college student.

My early days as a new professor and what I am doing now

Some background on the program here: my hire in 2014 coincided with the acceptance of the first incoming class of freshmen for the program, so it's still very new. They had an engineering 3-2 transfer program where students would take three years of math, science and liberal arts at [Current Institution, a Baccalaureate College], transfer to – most of them transferred to [Post-Doc University]. We also have agreements with [a few other nearby research universities], and a catholic university. And [the 3-2 transfer program has] been around for a long time, I don't even know – it started in the 90s maybe even earlier. It's been around for a while. As I understand, it was pretty successful but

there was enough student interest in having a degree that was 100% at [Current Institution].

In fact, what would happen is, some students would come, they would start in the 3-2 transfer program, and then realize, "I really love it at this school here." They didn't want to leave their friends, they wanted to continue playing on the sports teams, and so they would switch their major. They could still graduate in four years with a mathematics degree, the way it was structured. That had been around for a while, the head of the engineering program had been hired mid to late 2000s, with the longer-term goal or expanding the engineering offerings and so they got that approved, they got the program started, and they hired me to come help teach some of the courses.

Because we already had some engineering presence on campus, there were some students who were able to switch their majors once they learned there was a four-year degree here. So even in our first year, we had three graduates. That's kind of the background of the program.

The standard teaching load at [Current Institution] is four classes per semester. So, it's high. I knew that going in. It's even a little bit worse for programs like engineering that don't offer a large service course, a course that fulfills requirements for other general education requirements. Because we only have one class that has more than one section. So not only is it four classes, it's also four different preps every semester. But I knew going in – I had seen enough programs, either from interviews, from application descriptions, to know this is fairly typical for a non-elite liberal arts school. I knew what to expect going in, especially that first year. I knew that I was going to be full on course preparation for a bunch of courses that I had not taught before. They started me off – I only had three courses during my first year – three courses a semester, so it was a little bit lighter. And that's continued a little bit as well, I think that at least my dean – he realizes that there are some of these cases you need to transition up a little bit before you reach that full load. Even my second year was a little bit – credit hour wise – it was a little below what the contract actually states.

It's been interesting. My broad background helped a lot in this type of program, where we have students who are interested in all different types of engineering, but at the same time, I've been expected – I have taught a couple courses that are courses that I

didn't specifically take as an undergrad. The biggest examples would be statics and dynamics. As a chemical engineer, we weren't required to take those. I had some notes to work from, there are a lot of resources, it's a very common course at other schools, so there are a lot of resources to work from. But essentially, during my first year, [I was] teaching myself how to do statics and dynamics. I also picked up this book "Teaching What You Don't Know."

It's [the book, Teaching What You Don't Know] pretty good. It's pretty helpful. It's not technology or science related, but it was a good – it basically gave me some confidence that it's alright, that people do this stuff a lot. That students will trust me. That they'll understand – and I can be upfront, like hey, this is not something that I have a lot of expertise in, but we can work through it together. Actually, one of the points I took away from it is that in some cases, students learn more when they are taught by a non-expert, because someone who is just learning the material recently will have seen all the common pitfalls. The conceptual mistakes, so students end up actually learning more from those experiences than someone who maybe expects them to know things that they don't, that they haven't had a chance to learn already.

There's two reasons [I started going to the American Society to Engineering Education (ASEE) conference]. One is professional development, because I didn't have a lot of teaching experience. With the adjuncting, I had a fair amount of lab experience, a little bit of lecture teaching, I had the class that I took in grad school. I didn't mention it, but there was a short seminar that I took that [Post-Doc University] offered: Teaching Engineering, which was essentially a two-day seminar, but that was basically it. I knew that I wanted to get away from lecturing. It's not really my strong suit, and it was not the way that I liked to learn when I was in class. So, it was kind of two-fold – just to join the organization to learn more about different research supported classroom methods that are out there, and attending the conferences would let me see some of these. The workshops have been extremely helpful. The other reason I've been there is to learn more about ABET, essentially, because that's a goal of ours. As a new program –we haven't really been mature enough as a program to give any evaluators something to go off of. But [accreditation] is an eventual goal of ours. And my dean was very interested in sending me, because ABET holds workshops and presentations about the accreditation process.

That was a big reason why [Current Institution covered the expenses for me] to go to ASEE.

At ASEE, I attended a workshop about team-based learning, and I knew nothing about it going in. The description of it sounded like a technique that would fit well with what I wanted to do in class, so I attended it and I was really impressed. I ended up implementing it in a couple courses – one per semester this past year. In a couple of courses that I was not super satisfied with how things went the first time through, even considering that it was my first time through them, I was very happy with the results. That was probably the biggest thing I took away from ASEE, but just talking with people about – "what are the tools you use for managing groups?", or "how do you handle homework when you don't have the resources to grade 100 homework problems every week?" The exchange of ideas, different techniques, just to get myself more involved with the education aspect of it. That was something that had been missing.

The concept of team based learning in miniature is that it's supposed to encourage discussion and arguments of students, and in the idea that they have to come to some sort of consensus. And I think it works – it is essentially a model of the flipped classroom, and I think it works for me and for a lot of students because there is a fair amount of structure to it. It's not just that the teacher gives you a couple of problems to work on and they'll come around and help you if you need it – I mean I do come around and help them out, but the idea that you have to come prepared, and that's enforced with these quizzes, and you have to be prepared enough. You're not just responsible for your own knowledge, but for the success of your team as well, and that can be a stronger motivator for students. If they are going to be held accountable by their team members. Discussions and arguments among team members, it also takes advantage of the idea that you really learn something when you are teaching it to someone else. There's something about your brain circuitry that solidifies that knowledge when you have to synthesize that into language that is understandable by someone else. So, I really like getting the students discussing, arguing, talking things over, hashing things out, and then they have to show something for the discussions.

The goals [I have] for myself [as a teacher]: is it cheating to say, "have students that meet their goals?" I guess to have as many students as possible meet the learning

objectives, understand the material, and be able to, contextualize it into the broader – for design, you can start thinking about very broad communal topics if you want, and we probably do touch on that a little bit. For [my engineering design] course, what I want them to take away is: be familiar with the process, get some experience. There's the lab where they basically have a couple of big projects that they work on. I am successful if my students are successful. I don't know if I have a lot of personal goals beyond that.

What tenure looks like here

Every year you write up a report, basically a yearly report after your – it's called the second-year review, but really it's at the beginning of your second year. After your first year and after your third year, these reports are sent to the department chair, the dean, the VPAA [Vice President of Academic Affairs]. The VPAA basically just says, yeah, I received it. But the department chair and the dean, you get together and meet with them and discuss how things are going. That report goes through all of the different expectations for tenure. Every bullet point of the faculty handbook under teaching, under research, or scholarly activity – and that's the process up until, during the fourth-year review, a lot of the material gets sent to the rank and tenure and your committee and they go through it as well.

You would include things like student evaluations, syllabi, basically, one thing you want to do is show that – how your syllabus has progressed, based on what you've learned from your earlier times of teaching that course. Basically, like the ABET continual improvement process. So, the evaluation, it gets sent to the rank and tenure committee, and they meet – it's a small enough school, they only have a handful of these a year. From what I understand, they can spend a lot of time going through them without having to rely overly on student evaluations or other quantitate measures. They can evaluate your portfolio as a whole. You put together a list of your accomplishments as well, that would go into your yearly report too. Whether they are officially recognized ones, or whether they its feedback you got, a note you got from a student saying, "thank you for making statics fun when it shouldn't have been," things like that.

After your fourth-year review, they give you very detailed feedback and then you basically have – technically, you have – they give that back to you mid-way through your

fourth year, so you have spring and then your fifth year, and then during your sixth year, you submit your tenure package. So, stuff that's going on currently doesn't really get in there. So, you have three semesters to basically take their advice and incorporate it into what you've been doing. And that applies not just for teaching but for all aspects of it. And they evaluate you – they really do evaluate you as a whole. And they are understanding of things like, it's a brand-new program, I am spending a ton of time developing courses, and so maybe it's alright in that case, that other areas are maybe not quite as high as other faculty members might be.

I like that I can get into the lab a little bit, that I can help students out if they want to do some research, and when we start getting more capstone projects being done, I think that will be a really fun experience. Just helping them succeed and carry out what it is they want to do. The teaching has been good. The students are – we get a good mix of – we do get some very bright students, some that have the goal coming in that they want to go on to a PhD research program, not everyone does, but I would not say the quality of the students has been an issue. I enjoy teaching, in a couple years it will get to the point where I might not have to be developing a new class every semester – that's probably the one thing I don't like – it takes a lot of time to do the course preparation. I do have time over the summer, I'm maybe not as proactive about it as I should be, but it also wasn't something that was unexpected to me coming in. I was prepared, especially to spend the first couple of years, spending a lot of time doing this stuff.

Other thoughts

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. But like I said, I felt pretty aware of that going in, so I wasn't really surprised to see that. I would say even more so at [Current Institution], perhaps because it feels more of a community here. [Adjunct University] – they cater a lot to – they get a fair amount of people going back for degrees, non-traditional students I guess. [Current Institution] is more, come here for four years, there's a monastic community on campus that is its own little – 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.

5.2.2 Narrative 2: Valerie Michaels

Valerie Michaels is an assistant professor at Current Institution, a Baccalaureate College. At the time of the interview, she had been in her position a little over one year. In this narrative, she describes her systematic approach to her job search and how she managed to get teaching experience as a graduate student on fellowship.

How I got here

I went to grad school knowing that I would want to teach. [During undergrad], I [thought] it would be pretty fun to be a professor. It was always about teaching for me, it was never about doing the research. I went to grad school so I could get a PhD so I could teach. Looking back on it, it was probably a really poor decision because when I was in undergrad, I did do research, but I would do homework; I would do everything possible and then I would do the research. It was always the last thing that I wanted to do. And then I [thought], I'll go to grad school.

I got a non-thesis [master's degree], but I always wanted to teach. Because that was my goal, I chose my advisor because he got people out fast, so I figured I could get out fast and teach faster.

The one drawback was that I was lucky enough to be on fellowships for five years, but when you're on fellowship, you're not supposed to teach. It was a curse and a gift at the same time. It gave me the ability to finish quickly, but at the same time I did not have the opportunity to teach. [But I did] manage to weasel my way into teaching [by volunteering during one summer].

I took an [engineering education] class the second to last fall I was at [PhD University], which was really interesting. I knew [this class] was a good way to learn the ins and outs of how to become a better teacher. And then I taught a junior level dynamics class for a summer which was a lot of fun. And I did pretty well. Everyone liked me so

that was good. I [thought] yes, I am doing something right. And then that following fall I started applying for positions.

I knew I wanted to start off at least trying for a tenure track position. And I [figured] if I don't get tenure track I'll move down the ladder and start looking at adjunct or non-tenure track positions. Well, ok, more like adjunct positions, because there were a couple of universities that I applied to that did not offer tenure and that did not bother me. But nobody had tenure instead of the one person that sits in the class and teaches five classes doesn't have tenure. Tenure for me wasn't necessarily a draw, it's just that there seem to be more options for tenure than for non-tenure track, and I didn't particularly want to start off in an adjuncting role. Because of the whole horror stories in the news lately, which are probably true.

Then I interviewed a bunch my last year. [Since] I knew I wanted to teach, I didn't want a university that had high research expectations. Or research expectations that I couldn't transition in from a disciplinary field to engineering education. Which I still haven't done, but there's still time. I looked at all of the job postings and I also looked at the Carnegie Classifications. I made this spreadsheet with the list, I looked at all of the colleges in the US that offered engineering based on ABET. I went first with ABET's list, and then I found their Carnegie Classification based on that list, and then I went from there.

Then I would look at job postings and see which job postings were available and put it in my spreadsheet. I'd [notice], this is a job but it's at an R1 Institution, so I'd put it low on the list. Or [Carnegie calls it] "Highest" now. Then when I was looking at schools, I would apply for ones that had "higher" research, or "moderate". I did interview at [one university that had "higher" research activity].

There were higher research expectations [at "higher" research activity university]. But [that institution was] my first interview, so I was really excited. I went there and [thought] this is awesome! But then afterwards, [I realized], oh maybe one journal article per year isn't necessarily something that I want to do. But then when they [said], you only teach one class per semester, I [thought], yes, I can make it the best class ever. Not realizing – well kind of realizing that that meant that the other 45% percent was going towards research. And they told me that I could only do technical research there, no

engineering education research in that department. And I [thought], crap, my [technical] research is not fundable, and it's not going to go anywhere. That was the school that I interviewed at that had the highest level of research. They didn't have any women in the department so they were probably looking for a female too.

I applied to 40 different positions and I heard back from about half of those. I had a bunch of on campus interviews. It was probably eight interviews.

At [Current Institution, a Baccalaureate College], I was required to give a research talk and a teaching talk. [Both] were open for students to come to but not a lot did. They [told me to] pick a topic on a junior level engineering topic, so I chose integrals of the motion, because I had taught a dynamics class and that was something I was familiar with. I gave a talk on integrals of the motion, and I did an example of two astronauts. It was conservation of momentum and I had two astronauts who were floating and hanging on to each other.

[I was attracted to my current institution because] I know it's a teaching focused institution. That's what really excited me. In our interview our chair [said], "I was researcher of the year. I brought in $100,000 one year." That was really exciting to me, because I [thought], ok I don't have to have research expectations. There's not a lot of pressure in that sense, and I get to teach a lot. Which was what really drew me to [Current Institution].

I did a terrible job negotiating, and by terrible, I mean I did not negotiate. I got this position, they [actually] offered it to me on-site, which was really unusual. I was leaving and they [said], we want to offer you the job, and I [said], "thanks guys, but I still have three more interviews lined up and I feel bad saying no to them." We had already booked the travel, so I finished up my interview rounds and [then] they [said], ok, it's been a month. And then the other school I was really interested in shot me down, so then I went to [Current Institution].

My preparations for teaching

It was always something that I found relatively, I wouldn't say easy to do, but it's something that I've always enjoyed doing. Even in undergrad, I had a couple guys I did math with, and I was the strongest person on the team, but I was always willing to help

them along as well and it didn't really upset me that they were super slow or not really good. One of my math buddy's parents – I went over to his house once, and they [said], thank you for getting him through the math classes.

It's always been something that I've done. My mom even said that when I was growing up, in elementary school, she would have to push the teachers to make things harder for me so that I wouldn't just be the helper around the classroom telling people what to do. My homeroom in high school was a tutoring room, so I had an open hour, and I would spend my open hour tutoring, helping people in that, in math and various other aspects. And then in undergrad, I was a tutor for all four years, and I did math and chemistry, and I was terrible at chemistry but I still tutored.

The only [teaching experience] I had in grad school was teaching a summer class, a junior level dynamics class to twenty some students. I feel bad because I [had said], you're not paying me so I need a grader because you can pay a grader. So, one of my lab mates was the grader for my class. I didn't have to grade, but I taught it, and [then] they had to back-pay me, and I feel bad for that.

That was the only teaching experience that I had in a more formal setting. I never did any guest lecturing because my advisor was always there, so it was only teaching that class. I was fortunate to be able to do that to have an experience listed on my resume.

[Getting that teaching experience was tedious.] Since I knew I wanted [the teaching experience], and I didn't want to be paid, I just wanted to volunteer. I knew that they taught dynamics over the course of the summer, so then I asked my advisor, "hey is it ok if I teach dynamics, I want to teach," or "I want to be a professor and this would bolster my resume," and he was totally fine with it.

Then I talked to – I was also pretty close with our admins, so I kind of could figure out what classes they wanted offered, and I [said], I'll teach anything, anything at all. And I knew other grad students had taught over the summer as well. I was going to teach a controls class but it fell through, so the only thing left was dynamics. My advisor usually taught it and another professor usually taught it as well. But my advisor was ok with me teaching it so I went to the undergraduate chair first, and [said], hey is it ok if I teach dynamics over the summer, and he [said], yeah, you have to go to the grad chair. I

went to the grad chair and I was [told him], I'm going to teach this class and you don't have to pay me, and he [said] sweet.

So that went through. And [the other professor that taught it], she let me talk to one of her grad students and use her notes for that semester. Then I collected all my advisor's notes for the class and all of her notes for the class and used those to make my own notes. So that's how I did it, sneakily.

It was a lot of fun. It was my whole summer, I didn't do any research, or maybe just a little research, but that's ok. It was an eight-week class, and I got to be in charge and I tried to do some active learning. And looking back on it, I'm sure I was pretty terrible, but I got great reviews, because I'm pretty sure I was better than everyone else there because it's an R1 university.

[In terms of being more prepared for teaching], if I had to go back and redesign [my graduate program], I would include a teaching component. More engineering education – I'd say more practical classes than [educational] theory. I'd want to take an upper level statistics class so I know statistics beyond basic statistics. [That] would be what I would do for redesigning. [It would have been great] if I could have gotten more teaching experience, but I know I couldn't have. [Having] a way to get a teaching certificate for people who didn't have the opportunity to teach [would also be good].

My early days as a professor and what I am doing now

Going from being a student to being a faculty member [was the most obvious transition]. One thing I have noticed, well I remember my advisor talking about how he and another professor started with a couple years between each other and they were both in the [same] field, but they did not collaborate at all, whatsoever, in any way shape or form, because they were judged on what they did and if they collaborated with somebody else, maybe the other person did all the work.

But at [Current Institution], I've found that people are super friendly and they are willing to help. They are open to collaborations. [For example], I am going to a conference in a couple of weeks, and I wrote a paper with two other guys that are in our area. I am the first author because I pressured the other two into writing a paper for this conference, because I wanted to go. And it has nothing to do with what I'm in. And the

third author [said], I need a publication, I'll definitely do it. There's no – we are not competing with each other to find funding, which is really nice. And if you are gone for a conference, you just ask somebody, "hey can you cover my class?" and if they are not busy, they'll cancel [their] office hours and cover your class for you.

Last year I didn't really have any service at all because they protected me from it. I did get advisees, so we'll see how this year turns out instead. But for now, I'd say I'm pretty satisfied [with the balance between my roles]. I should do more research, but it's not necessarily particularly what I want to do.

It's pushing yourself to do that instead of focusing on teaching. It's also just you going out and if you feel like you want to make changes to your classes, they're fine with that. You have to seek out the people you want advice from. We have a [teaching support] person and I've gone to a bunch of her workshops to try to improve my teaching. And I'm the only one of the few engineering people that does that.

I do feel it is important to show students how what they are learning actually applies in real life, or to the people that actually use it in real life. By going on my externship/fellowship [in industry] or whatever you call what I did this summer, I got a lot more examples that I can bring to class and say this is how you use this information. That was really helpful.

[I am also working on creating an] inclusive environment, and that's being – I guess you could say it's almost being student centered. Adapting your class so you hit everyone, not necessarily just someone that learns like you. That's trying to be adaptive in your teaching style. I'm trying to create an environment where you can learn. I have clear assessment requirements, and I am always looking to improve whatever the heck I am doing. And then, if you're a student in my class, you're going to take an active role in your learning, and you're going to commit to learning and collaborate with peers.

This past year has also been me discovering who I am as a teacher and how I teach. [I am also exploring] how I like to teach, and I would say that *my* teaching statement is more of a theoretical framework, more so than what's actually happened over the course of the year. But the overall premise still holds true.

What tenure looks like here

Teaching is a very big component in terms of our tenure. From what I've heard from faculty members, you need one published peer-reviewed [journal article] in the six years to get to tenure. I've got my one publication from my grad school work, so I'm [thinking], check. I think I'll still go to conferences to make sure that I hit those deadlines. And you're supposed to apply for internal grants. I don't know if you need to get external grants. If you go that route, you're teaching is expected to be very good or excellent. They value teaching and service higher than other institutions do.

But, I don't feel the pressure that I have to do a lot more for tenure than I would do otherwise. They are starting to implement more of a research focus. They're not really sure what's going to happen. They are talking about having a second track for people that are more interested in doing research, so their teaching loads might be reduced so their service load would be increased, or something to that effect. Because there are some faculty members that want to do research, and there are faculty members that just want to teach. It's an interesting dynamic.

[Our teaching is evaluated with] end of the course surveys from students. And our chair sat in on one of my classes one time and told me I did a good job. His only comment was that maybe I should slow down, but that was all the feedback I got. So, no, even though we are a teaching university, there's no feedback on your teaching.

People going up for tenure are stressed out about it. But everybody else isn't. It doesn't seem to have quite as much focus as a top – highest research institution. You hear about tenure, but I don't feel [that] – at least I guess my perception is, maybe I'm just too cocky or something, and I'm [thinking], I could totally get tenure. Piece of cake, no worries. From that perspective, I'm not worried. But I might get more worried as time goes on. But for now, not a lot of pressure. But I mean it was just my first year.

[In terms of research], any research goes, [which is] nice. So, I can do either [technical or educational], it's not one or the other. Students don't like it as much because I don't have any research for them to do. This fall, I'm continuing on with the research I did last year with my friend from undergrad. And that is looking at student assumptions in simulations, so whether or not students go the extra mile, or which students go the

extra mile on problems. We are going to try to reformulate problems so they are more stretch problems that they require students to go out and look for extra information.

5.2.3 Narrative 3: Opie Hampton

Opie Hampton is an assistant professor at a Baccalaureate College. At the time of the interview, he had been in his position a little over one year. In this narrative he describes his unique graduate school experience that allowed him to do a lot of teaching and then pursue a position that focuses on teaching. Opie also describes his research, which he still does with enthusiasm even though it's not necessarily required for tenure at his institution.

How I got here

So, when I was in high school, there was a class – enrichment – it was one of those kind of, the special kids. And there were a couple teachers there, one in particular who I'm still in contact with – it was one of those [classes] which was very open ended, and you could take it several times and so one semester I did two independent studies at the same time within the one class. It was one of those sorts of things. And that [teacher] was kind of one of those people that inspired me that maybe teaching was something I could do.

And then on the other side of that, I had another class my senior year that was scientific research – something like that. It was run by the head of the science department who was a civil engineer by training. There were eleven, twelve of us maybe, that got into that class and did an engineering or science project. Between talking to [those two teachers], they really shaped my direction in engineering and science in general, and started that thought process towards teaching.

And then undergrad, I actually started as a physics major, for almost two and a half years. I got pretty far. [And then I took a class where] the whole class was just complex equations and everything, and I was like, no. I'm done with this. I'm going to engineering. But all along the way, both when I was in physics and engineering, I was a TA for a physics 1 class. So right from the very beginning, it was like, ok maybe teaching is what I want to do. I very quickly found out that I liked to explain things to people, I

was good at it. My Dad still tells a story about me and my brother. He was at a large public institution taking a physics class, one of those 100+ weed out courses where the professor gets to know maybe 1% of the students and 90% of them are only there because they have to be. Spent the entire semester struggling with the content until over Thanksgiving break he sat down with me back home and I gave him a crash course in Physics 1. Rocked the final and ended up boosting his grade by a letter grade.

I knew pretty much by the time I graduated from undergrad, I knew I wanted to teach. And I knew I wanted to teach higher ed. I wanted to go into college, university teaching. I wanted the extra freedom that comes with being able to teach at higher ed and not have to worry about the structure and all the overhead that comes with K-12. And I wanted to teach students that, at least for the most part, wanted to be there, and had an interest in what I was teaching. And so, when I was applying to grad school, I knew that even when I was applying. And that was something that, going into it, factored into my decision as to where I went. I knew that to get into academia at a high level, I needed to have my PhD from a well-respected institution and I needed opportunities to teach while in grad school.

And at the time, I didn't know that engineering education was a thing at all. I didn't figure that out until years later. But when I was looking at schools, I [was] looking for the big name, and at the same time, I was looking for an advisor who I think can accommodate the fact that I don't want to be the all-star researcher. That's not something that interests me, that's not something that ever interested me, and even then, I don't know what made me aware of it, but I knew that if I didn't find an advisor that recognized that, I was setting myself up for a bad time. And I have no idea where I picked that up, but I did, somewhere. Somebody told me.

I talked to [my advisor] about the fact that, hey this is what I want to do, this is my long-term goal, and he was remarkably accommodating. And his background – so [my advisor] was one of the research stars of the department. He was on a bunch of the marketing brochures, he was bringing in million dollar grants all the time, a huge researcher. So, it was interesting to me that he would be so accommodating to the fact that I don't want that.

It was probably my second year into grad school, he had me – I wasn't officially a TA, but he was teaching a dynamics class, and he had me, basically I wrote all the exams for him, and helped with some of the grading. I was a very informal pseudo-TA for that. And then he had me do a guest-lecture for his vibrations class. [He] encouraged me strongly to apply for a [teaching fellowship for graduate students]. I did, I got it, and ended up teaching statics as part of that fellowship. And that was awesome. Because that was the first time that I had a class that was mine and I was teaching it, and it was just awesome. And it was around that point in time that I thought, hey this teaching thing is pretty cool and there's a department over here that does engineering ed, maybe I should think about switching.

I had a very long conversation with [a professor in engineering education] about what engineering ed was and was it something that I wanted to do, and we eventually decided no, because I was – because when I came in the door I needed an accelerated research program, because that's not what I wanted to do, because I was like, let's get in, get out, let's move on with life. So, I actually, I walked in the door and was handed a project ready to go, and I was on track to be done in like four years. So, we decided after talking about it that I'm set up with my dissertation in [my current department] – I was going to be done in four years.

And so, at that point I was two and a half years into it, and so switching after, basically I was almost done with my data collection, so I was like, that's probably not a good idea, let's stay in [my current department]. But, she put me in touch with [a woman], who, I have absolutely no idea why, but for some reason [she] decided that I would be a great person to teach a section of [introduction to engineering] and just brought me onboard. And I still don't totally understand what led her to decide that that would be a good connection, but she did, and I went for it. And that's how I ended up teaching [introduction to engineering]. My little foray, informally, into engineering ed, that's how that all got started.

So, I'm in grad school, venturing off into engineering ed. I've taught [an engineering course], I've taught [introduction to engineering] a couple of times. Oh, so my advisor left, he actually left the university, probably 2013, I want to say. So, a year before I graduated, I was orphaned. Yeah, which was fun, and then the lab packed up and

left, which was also fun. I was literally orphaned with nowhere to go, and I think that was actually kind of a blessing in a lot of ways, because without my major advisor, I was really forced to pick up a lot of my dissertation work early and get it done before he was out of contact.

Because a lot of times you end up – once your dissertation work is kind of wrapping up and you're in that writing and getting things put together phase, you get random extra projects, right? I didn't have any of that because my advisor and lab were gone. And that bought me a lot of time to get to do whatever I wanted to do. So that was really what let me to get into the teaching [introduction to engineering] and everything else. And doing everything that I did over in engineering ed, because I didn't have anybody saying, hey, you need to get in the lab and run this test for me for an unrelated project, or go talk to this potential project client or whatever. I was free to do whatever, and so that really opened up a lot of opportunities for me to kind of find my own way, and that was hugely impactful for my trajectory.

I started applying to schools – there was one semester that was a mess. I was putting together application materials, I was teaching two classes, and I was trying to finish my dissertation. That was a nightmare. That fall of 2014. That was awful. I would not wish that on anyone. But I got through it. And I found some cool places [to apply for permanent positions].

When I was going through the job application process, I really – I knew at that point that I wanted to teach specifically, and I knew from having talked to people, especially over in the engineering ed department, that I could find smaller schools that would give me the leeway to focus on the teaching. And my undergraduate institution was one of those sorts of places. It has a graduate program, but the whole school is only maybe 5,000. So, I knew that kind of environment, that's what I had come out of from undergrad, and I kind of wanted to get back to it. So that's where I focused a lot of my applications, were those smaller schools. More teaching focused institutions.

So, I went through all that process and ended up finding [Current Institution, a Baccalaureate College] just on a job site, I don't remember which one, Academic Keys, I don't know, found it, applied, came to visit, loved it.

[During] the visit, I had interviewed with the dean, I had interviewed with the provost and the associate provost, interviewed with all of the engineering faculty all at once, I was just put in a room for an hour and they told the faculty, show up and talk with this guy. So that was interesting. It was kind of a free-form discussion. It really provided an opportunity to observe the culture of the department, see how the faculty interacted with each other, and kind of envision whether or not I could see myself here. This was actually a really important factor for me. Every big decision I've made, grad school, undergrad, I base a big part of it on how the place feels. And [Current Institution] really just fit.

I had to do a presentation, and I was asked to do a research presentation, which was interesting, since the expectation of research at [Current Institution] and places like it is actually pretty small. But they asked me to talk about my research, but it was a presentation to students, I think they were juniors who I was presenting to. And the faculty all sat in. So, I had to explain, basically my dissertation work, to a bunch of juniors in a way that was interesting and exciting for them, for half an hour. So that was fine, that was fun. At the end of the presentation all of the faculty left and it was just me and the students for a while, with them asking questions and kind of evaluating me. That was also pretty cool. It gave another chance to kind of evaluate the culture and see how I fit in.

I think it was a total of five weeks from first phone interview to, I had an offer and was bringing [my wife] out to make sure that accepting it was going to be ok for her. It was a really quick process once it got moving. And that's how I got to where I am.

My past experiences and preparations for teaching

[One way I learned to teach was through] observation, because I was working with my advisor really early on in grad school, teaching classes with him, and then I did the [teaching] fellowship, in which I was observing another faculty member in ME and teaching statics, and then also teaching [introduction to engineering] and – so it was observation which turned into experiential learning. And then the second source was taking [an engineering education] class, and in that class we did a lot of, how do you prep

a teaching statement, for example. The very first draft of my teaching statement came out of that class as one of our deliverables. So that was another big contributor.

And then the third one was I did some of the workshops and courses that [the teaching center at Master's and PhD University] offered, and I didn't actually do the paperwork for the graduate teaching certificate, but I did most of the requirements. So that was another big source of input.

[While at Master's and PhD University], I taught [introduction to engineering] both semesters [of my last year], and then they kept me on after I graduated. I actually finished in December 2014, and they kept me on in Spring as a lecturer, and I taught two sections of [introduction to engineering] that semester while I was applying [for jobs]. Because I finished at kind of a weird – graduating in December is kind of odd for the hiring cycle. So that's what I did.

I don't know that I would change [my graduate school experience] that much [if I had the chance], and the reason why is, I think for me, it was really important to get that teaching experience and all of the opportunities that came with that, but that's not for everybody. So, I don't know that I would ever say, everyone is required to teach. Because if you don't want to go into teaching, I don't want you teaching a lab, because you're not going to like it, you're not going to want to do it, you're not going to do well.

I guess 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. And let the research focused people go do research and let the teaching focused people kind of bring out more of those opportunities. 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. It's just that I cobbled it together. I guess if I could change something it would be to create a defined teaching track, and scaffold in some of those opportunities that I had but make it available to everybody that wants to take advantage of them.

My early days as a professor and what I am doing now

We teach five courses a year. Whether you do that three in the spring, two in the fall, whatever. And that's a little variable, like some people have a little more than that

because they'll teach labs, like the thermal sciences folks for example, they've got a bunch of labs with their classes, so their contact hours are a little bit more involved. Versus some people like me, on paper, my load actually looks a lot less than some of the other faculty. Because I teach – none of my classes have labs, so I teach both of our first-year engineering classes, I teach statics, dynamics, and I teach a sophomore computers course. And so, none of those have labs, they're just straight lecture or studio. So, my contact hours on paper are a little bit lower.

The flip side to that is, being someone who can't sit still, I showed up and threw out the entire first-year curriculum and we started over. So, a lot of my time goes into teaching because last year was developing the entire curriculum as we went and then this year it's going back and polishing and readjusting things. So, I have a lot of non-contact teaching duties right now, that have filled a lot of time.

And then I'm also – I teach our freshman orientation class for the department, and that doesn't count for teaching load because it's a zero-credit class. So that's fun. And as part of that, I advise half – so everyone advises basically half of a cohort, because that's the numbers that we have. So, I have thirtyish advisees every year, they take some time too.

We have a requirement of five [office] hours, set by the university, in a week, you are supposed to have five. I have six because it was easier to just make it consistent. But then at the same time, [Current Institution] has a very open-door policy, so most everybody's door is pretty much always open and if it's not open, [the students will] knock. So, they kind of expect to be able to come ask questions whenever. That's just the culture.

What tenure looks like here

Teaching, scholarship, and service, are the three. And service, they include both service to the campus and service to the community. So, you not only have service in the sense that I'm on committees, or search committees or whatever, but you're also expected to interact with and integrate with the surrounding community.

Teaching is the bulk of it for sure, I don't know if I could put a rough percentage on it because it changes year to year, but teaching is far and away the most important. All

your course evaluations, your department chair reads them and then the dean reads them, and you're supposed to, for every class put together a reflection on your course evaluations. Just a little one pager on what students said in their comments and what your Likert scores were and then what do you think about that. How do you react to it, are you going to change something, do you disagree, do you feel the need to explain something?

So, every course, every semester that we write one of those, the department chair reads it and writes a paragraph response after reading your course evals and then it goes to the dean, and the dean reads all of that and writes a response. And then that whole form goes into your tenure packet. So yeah, teaching is – there's a big, very directed, reflective process that goes along with that.

We also do, with the teaching, FCARs, faculty course assessment reports, is what I think it stands for. We look at the student data and all of our course outcomes, and say these outcomes, we had how many As, how many Bs, how many Cs on each outcome, and then we talk about what changes we made, did it work, what changes we are going to make going forward. And those are filed – they don't go into our tenure binders, but the first couple department meetings of every semester are talking through the FCARs form the prior semester. So even the teaching – you say, hey, I tried this, it didn't work, does anyone have any ideas, and there's a discussion among the department, hey I did this in my class, you might try it. So that's interesting.

Back to tenure, the scholarship piece is – they define that as scholarly activity. So that's not just you did research and got the big journal publication. It's, as long as it's peer-reviewed, conferences and journals are great. You are expected to do some of that, but there's no hard number. Grants are a piece of it, you're not expected to bring in any dollars, but if you do, that's a big plus, and applying for grants, even if you don't get them, you get credit, and attending conferences and workshops, and just saying current in your field.

And, doing consulting work, if you do any consulting work with industry or anybody, all of that counts as scholarship. So, it's really less scholarship in a researcher-y sense as it is scholarship that is stay current in your field and do something. Whatever that may be. So that's important, but it's not – you go to [a doctoral university with very high research activity], and they say you must publish six journals in these particular

journals and you must bring in your salary times three in grant dollars or whatever – there's none of that.

Every year, we meet with the dean and the college tenure and promotion committee and talk about what we've done over the last year and what their expectations are as far as what else we might need to do going forward, to really set us up that after we hit the actual – when we are actually applying for tenure, it's basically automatic, is their goal.

So, I am probably overly active [in terms of scholarly activity]. I am now in my third semester and I have – so in the technical scholarship, I'm not doing a whole lot, I'm probably going to try to get something going over the next year or two, I just got a bunch of equipment with some start-up money, but mostly I'm just digesting my PhD research. Like, I just got a journal article accepted last week, that came out of my doctoral work.

But most of my new activity is in the pedagogical side of things. So, I just got a grant at the end of last semester, joint with a couple other people, we got like ten grand to develop a non-destructive testing elective, and so the two other people, their research field is in non-destructive testing, and they brought me onboard to basically help them design the course piece. And so, I've got that going, so that's a big plus. And then I've got some internal grants, I'm helping coordinate this effort to develop some online courses for our mechanics sequence: statics, dynamics, strengths of materials, so there's four or five faculty developing those courses. I'm helping with basically all of them. I think I'm kind of – I'm not the norm. Between revising first-year and all the other projects, I've had just a ridiculous amount of scholarly activity over my first year, that I don't think anyone expected. That's mostly pedagogy. Like I had a paper at ASEE this summer, and had another paper at a first-year conference. That's where most of my activity is.

I think I probably need to pick up the service piece and that's probably going to require a step back somewhere else. I think I'm also – I think the balance, I mean you have some much time in your life, and right now, I think my first year, I dumped a little bit more time than I should have into work. So especially now with [my baby], I think I need to pull back a little bit. But within the box that is work, I think it's decently balanced.

Other thoughts

A week after [my interview], they called and said they had an offer for me, and then the following weekend I went out with [my wife] to look around and see if it would be ok with her and look at [a neighboring town] and see if we could find a house there. And they were so accommodating it was amazing. The dean met us for breakfast, they put us up in a hotel, there's a hotel attached to campus, they paid for it. They organized a group of – there's a women's group at [Current Institution] – they got some people from that group to come and sit down and talk with [us] about life in the area. It was a tremendous effort on their part to welcome [my wife], not just me, because I guess they wanted to hire me and recognized that she was an important part of that equation, so they really rolled out the red carpet for her for that second visit. Which is something I don't know you'd see at a lot of places. So that was very cool. That was very indicative of the culture at [Current Institution]. It's a very welcoming – family is important; life-balance is important - kind of a place.

5.2.4 Narrative 4: Christopher Davis

Christopher Davis is an assistant professor at a Master's Institution. At the time of the interview, Christopher had been in his position for two years. After graduate school, Christopher was also considering looking for jobs in industry, but wanted to see if teaching was really what he wanted after he thought it was for so long. In this narrative, he details his pathway to a faculty position, the way he teaches, and the expectations his institution has for tenure.

How I got here

What really got me interested in teaching as a career was in undergrad at [Undergraduate Institution, a Baccalaureate College]. Starting my sophomore year, I got the opportunity to be the student teacher for an introductory lab. It was basically a freshman seminar; we took them through a few basic design experiences. Honestly, I just

had more fun doing that than I did working on the high stress projects and other course work.

So, from there I decided I really wanted to be involved in education, but I kind of settled on teaching college students because, I figured anything pre-college level, you always have a good number of students who just don't want to be there, who have no interest in your subject matter. And I figured with college students, you would get a dedicated group of hard working, talented students, who at least value education to some extent.

From there, I worked hard, applied to a bunch of different grad schools because I figured to do the type of teaching I wanted to do, I would need a PhD. And, especially to teach at a top level undergraduate focused place, because they don't produce as much research, it seems like, at least at the time it seemed like, one of the ways that [Undergraduate Institution] distinguished itself was by recruiting these faculty who did their graduate work at top tier institutions. So, I really focused on trying to get in to a top tier grad school. And I was lucky enough that I got into [Master's and PhD University, a Doctoral University: Highest Research Activity] for the MS/PhD program.

For a while, honestly, I considered leaving with my master's and going into industry, rather than continuing on with the, sort of thankless work that is grad school. At first, I was doing it because I really wanted to teach, and I sort of felt that leaving and going to industry – I thought there might be something wrong, something selfish about that. But after a while, I was working so hard on my own research that it really pushed me and shaped me in a lot of different ways; to the point where I thought maybe academia wasn't this magical place where everyone should end up anymore. I ended up staying on and changing my work life balance to more suit where I wanted to be. Actually, after I did that, I think the quality of my work improved, I was happier, my advisor was happier with me. So, it all really worked out.

By the time I got through to the end, I still liked the idea of teaching but I wasn't as married to it as I was out of undergraduate school. So, I actually applied to jobs both in industry and in academia. Also, I knew that I didn't have a ton of publications during my grad program, and I knew that if I did go into teaching, I really didn't want to be the R1 type professor, where I spend all of my time writing grants and was expected to publish

all the time, and where the track to tenure would be this awful journey of no sleep and working all the time. And maybe it's not like that at all the R1s, but seeing what the tenure track professors at [Master's and PhD University] went through, – they just didn't sleep.

I ended up applying to PUIs [primarily undergraduate institutions] and institutions that granted master's but no PhDs as well as some of the industry jobs. For the most part, [during my interviews at PUIs], I just [tried] to give honest answers to the different questions that I got. Tried to have some anecdotes and lessons learned from my TA experience ready to go before the interviews, just keeping that sort of thing in mind, so I'd be prepared. One thing that made it much easier for me looking at a PUI, my older sister, she is a professor too, and she had just done the search a year or two before I did for a PUI, so I got a bunch of good advice from her.

One of the things she told me is, with these types of schools, a lot of the applicants, they're mainly looking at an R1, they don't really know what it's like to be at a PUI, to put teaching first, so the main thing you want to get across in any of the interviews is that you know you won't have PhD students, that your primary job function will be teaching, that you are ok with that, and that any sort of research that you propose to do at the institution can be done in the limited amounts of time you have with undergrads. So, don't propose some big multi-million-dollar research program.

And so, I just tried to focus all my answers on that. And I think, for me, given my teaching style, I always felt I was the best, most effective, in things like office hours when I had one-on-ones with students because you really get to know them, get to see their challenges, their struggles, tailor the content to them. And think a lot about – find out about their background, and it makes you rethink a lot of the assumptions you have about what your average student is like. That sort of thing.

I had spent a fair bit of time thinking about that, and it turns out, that's the kind of stuff they eat up at these types of interviews. For me, I could just talk about my TA experiences, and trying to reach a student who is really struggling with the material. And going from that lived experience, I think made me a much more powerful candidate than someone who hasn't had those experiences, or viewed TA-ships primarily as a funding mechanism.

I ended up getting an offer from [Current Institution, a Master's University] and looking at it, I still wanted to teach and give teaching a try. I think it was that combination of factors that led me to accept the position at [Current Institution], both still wanting to teach while recognizing that going into industry wouldn't be a bad choice either, just not my first choice, and kind of wanting to get away from the culture [of the area where I went to grad school] a little bit.

My preparations for teaching

I did have support in the sense that my advisors and committee members were always happy to take me on as TA and give me opportunities to help design some course material, that sort of thing. And I've heard there are some advisors who are kind of hostile to that idea, because they want their students to go out, and go to an R1 and do great things research-wise.

I will say the flip side is coming from a place like [Master's and PhD University] where a lot of people will either – most of the people who go into academia go into R1s and a lot of people also go to really high-power jobs in industry, research labs for computer companies. They didn't have a lot of knowledge of what it meant to be a PUI. So, a lot of times the best advice they could give me was to say, "well one of my former students I think is teaching at that type of institution now, here's their email, you should ask this question to them."

I guess it's kind of supportive in the sense that, I would be supportive of a student who came to me said they were really interested in writing poetry professionally. I'm all for it, I just don't have any expertise that could be of use.

I would TA where I could, and for the most part, that was a lot of fun, and you always had some great students. It was always kind of a mixed bag, but it was still enjoyable, so I still signed up to do it. I [also] took some courses from one of the professors there in pedagogy and teaching engineering for fun during various quarters during my PhD. For fun and also potential professional interest. I did some workshops on how to teach, that sort of thing.

If I could go back to change it, I would think having a master's track that emphasizes engineering education would be a breadth area, or we could take courses in

that. Because I felt, some of the breadth courses I took, they were definitely interesting, but after a certain point, stuff that I really didn't have that much interest in, may be good to know, but I was kind of just looking at what course requirements I still hadn't met, and go on ratemyprofessors to figure out how I could satisfy those with the least number of hours. I think I would definitely change that.

Also make it so that some of the classes that focused on some of the softer skills like communications and leadership and that sort of thing, counted towards credits you need for a master's or PhD. And I actually was able to successfully petition to get a leadership class I took in the business school to count towards generic PhD sort of technical units under the argument that in order to do my research within the context of my research group, I have to work with ten other PhD students, and PhDs aren't the easiest people to work with or get them to do what you want. So, this is a huge thing for me to be able to do what I need to do effectively.

I think part of the reason why I still found teaching to be fun in grad school [is because] my research in engineering is very much stuff that you can do alone. Either in your office, not talking to anyone, or from your apartment, working from your laptop. And with teaching, there is a social aspect of it, and a connectedness aspect.

My early days as a professor and what I am doing now

It [was] a culture shock going from having a lot of teaching experience at [Master's and PhD University] to [Current Institution]. At [Master's and PhD University], the culture – well pretty much all the engineering classes are recorded and offered to remote students at the same time that they are offered to on-campus students. Because of that, the class sections tend to be – you know, your slide deck for lectures, you want them to be very complete, with all the bullet points written out, and then you scatter in a few different practice problems throughout there, but you sort of have your lectures in this self-contained thing, and the students just open up the lecture notes, download them from online, go through them with you.

And a lot of students don't even show up to class physically, they just watch the video later at their own convenience. And I think in part, because of that, teaching there, you do a lot less to sort of shop around and move your students around. You just assume:

all right, you're an adult, here's the material, here are my office hours, show up when you need to, and that's that.

My first quarter at [Current Institution], I tried very much to replicate that approach. I tried to have these big monolithic slide decks that had all this information that they could read at their leisure and just follow along. The students hated it. The feedback was they wanted a lot less slide decks and a lot more me working out problems on the board, defining concepts verbally. Because I think that caused them to write it down in their notebooks a lot more. And you do get more out of it when you write it down. For me, a big culture shock, with a lot of these digital design and computer engineering classes, from my undergrad and [graduate school], there had always been labs assigned to have us implement some of the concepts, but we never got in class lab time for that. It was in addition to homework and exams and sort of the culture was, yeah, of course you're going to spend a lot of time working on this class, there is a lot to learn. Whereas, I ran into, especially with some of these sophomore level students at [Current Institution], if they couldn't finish the lab in the allotted in class time, telling them that anything they didn't finish, they had to go home and do, was a shock to them.

They thought, wow, we have all this stuff to do outside of class already. A lab should be contained in lab time. And I think in general, especially compared to [Undergraduate Institution], you spend so much time working on your classes that, there weren't that many extracurricular groups, and there weren't that many people who participated in them, because in the rare event you did have free time, you just wanted to relax and hang out with friends. Whereas at [Current Institution], I think they are used to having a little less official work but – we have these amazing extracurricular programs, where outside of class the students will – we have all the different racing teams, we have a huge student oriented cube-sat program, all sorts of different competitions. Human powered vehicles, robotics clubs, underwater autonomous vehicles club that competes nationally. It's interesting because [Current Institution] is a big agriculture school, so we have teams that build tractors for tractor pulls, and compete nationally.

I think going from – especially an undergrad where your learning was very much inside the classroom and you learned a ton through structured learning, then going through grad school where you spend all your time working on your PhD research, and

that's your learning, then going to a place like [Current Institution], where there was sort of some push back from the students of "why do I have to spend all this time learning these concepts, doing this required course?" that was a difficult culture shock for me too. Now that being said, when I got to the final project at [Current Institution], I tried to make them open ended, and these students get really into it. They use their outside skills, they'll bring in outside components, they'll make custom enclosures for whatever digital device their building, do a lot of machining, bring all these skills together and really go far and do a lot of impressive work in that sense. I think that is one place where they have an edge because they do all this extracurricular stuff and develop all these skills, when you give them an open-ended project and inspire them to go further, they'll work really hard. But when you are trying to teach them the concepts, you have to frame it just right, otherwise it can be a little bit like pulling teeth.

[In the summer course I am teaching] for each class period they have some assigned reading that they are supposed to do, and at the beginning of the class I try to do about 30 minutes of, basically just recapping some of the key points from the reading and giving them a chance to ask questions. Then, after that I give them another half an hour to 45 minutes to work in groups on some of the optional practice problems just to make sure they are spending some time doing that, and can ask me questions if they need to. And then the rest of the class, I have dedicated to them working on the lab. So, since we are doing this class over summer in a five-week format, I see them – class periods are four hours long, three times a week. During a normal quarter, it's normally one lab per week. During the summer I have them try to do two labs per week, so they definitely have plenty to do in that class time. I'd say after about the first hour, or hour and a half, they are just working on their labs and asking me questions when they run into trouble.

And when they ask me questions on the lab, I try – and I guess this partially depends on the student – but I try to ask them leading questions that will get them to their own answer. [For example, if a student says to me]: "The system I am trying to build is exhibiting this weird behavior" I'll try to walk them through the process, and say "ok, what module in your design do you think might be causing this weird behavior? Based off that can you develop some sort of hypothesis for what might be going wrong? What signals would you want to look at in your simulation to test your hypothesis? Either

prove it true or prove it false." That sort of thing. And I say it really depends on the students because, some of the more advanced students, if they run into some weird simulation error they've never seen before, I can just walk them through the error message once, tell them what they need to fix, and they'll learn from that and won't ask me again. But there are other students where if I do that for that, what they'll learn is that they can just get the answer from me, so every time they run into even a minor road block, they'll immediately ask me for help. So, I definitely try to push back harder on that second group of students to make sure that they actually learn something, learn a generalizable concept from the questions they ask me, and try to get them to be more selective about when do they ask me a question, versus when do they spend another ten to fifteen minutes trying to figure it out, versus when do they ask their peers for help.

I guess that's how I really try to shape my classes, shape my lectures, I try to use as many real-life examples as I can, use a lot of analogies, well explain concepts of equivalent domains that they might be more familiar with.

In my lectures, I try to make them interactive, keep the students engaged, get them working with their peers as much as possible. I'd say the biggest motivational thing – I always try to keep my final projects open ended to some extent. Give them somewhat of a domain to work in, to prevent the thing where they have so many choices that they have no idea what they want to do.

What tenure looks like here

So, teaching is evaluated a couple ways. First, at the end of the quarter, they hand out surveys to the students, both numerical questions and then free-response questions. And in order to get tenure, you generally have to have scores that are higher than the departmental average. I think that works out to say somewhere around four out of five, for a lot of different measures. Which after my first quarter, and especially as I go back and teach classes multiple times, doesn't seem like it's that difficult to do. Although it does bring up an interesting question for me. Because every time you introduce new material, every time you try to experiment with new techniques, you can risk frustrating students, which can cause your evaluations to sink, so I get a little frustrated that I kind of have this impression, that once I get a class to that four level, I could not change it

between now and tenure, and that would do good things for me in terms of tenure considerations, whereas, if I kept trying to change it, make it more relevant, make it more impactful, I may have more variations in the scores, or make some mistakes, and that could hurt me. Which to me it just seems like a bad incentive structure.

On the other hand, in addition to those scores, every year that you're probationary, basically, until you get tenure, one of your classes is observed by your department chair, and the people on your tenure committee, and they write up a report based off of what they see. So, I guess that's an area where if you're really pushing the envelope, they'll get a chance to see that, see what you're doing, and the portfolios we turn in, part of the teaching activities, you can write about all the different things you're doing, mention any publications that you have related to your teaching. And one big section in that is you're required to pick out a handful of representative comments, both positive and negative, from your evaluations and address them. So, you do get a chance – if you get low teaching evaluations, and half the comments are "well, I felt like he expected too much from us and I much prefer a class where everything is very straightforward, step-by-step, everything has an easy solution that you can find in the book" which I have actually gotten comments like that before. Then you can say, "look, that may be what they want, but they get more out of the class when you force them to do critical thinking, so I'm planning on continuing with this practice, and I'll try to do more framing at the beginning of the course to tell them why I am doing this, but it's not a bad thing that I am doing this."

I would say one of the really nice things about [Current Institution] that isn't universally true across PUIs is that for my professional development, I can count educational research. That means – it works out great because anything I do to improve in my classroom, if I can get some measures of the effect, and you know as an engineer, I figure if I am going to do something, I should have a reason for doing it. If I can get that out to a conference, I can sort of kill two birds with one stone. And have research that feeds into my teaching, and teaching that feeds into my research, rather than kind of having them be two completely different things.

To the extent that I still do technical research, for a lot of it, I am advising master's students, so it still, very much for me, falls into this area of teaching, because I

can give them an interesting digital design project, that they're interested in, and grow them as students, as engineers, as part of the research. Whereas, I had always kind of felt in grad school that my research work and my teaching work, they were two orthogonal things.

Right now, I'm trying to pursue a collaborative NSF grant. Between that and trying to develop my courses and also trying to write some papers based off of those, and trying to do some of the service and really trying to modernize some of the design curriculum, and navigate some of those departmental politics, I don't really have a ton of time to read all the papers I need to get a huge technical research program going. And even if I could, outside of having master's students and some volunteer undergrad students, I don't have the hours to actually do the research.

I think in a couple of years, I'll definitely want to start getting back into that some, or spending summers working in industry just to make sure that I stay current in the field. But the way I see it, coming in [Current Institution], I have a unique opportunity to have an outsider's perspective, having seen how subjects are taught elsewhere, also having some knowledge of the state of art, or at least a state of the art a year or two ago of the field, and really developing new tech electives around that, pushing to change the curriculum, that sort of thing. If I didn't start doing that right away, I might start to forget or become too engrossed in the way that [Current Institution] does things and start to suffer from "not-invented-here" syndrome, and lose some of the good that I could offer the institution and the students in that domain.

The flip side is that means that I don't have funding to offer students paid summer opportunities, but a lot of our students are interested in going into industry, so they are spending their summers at internships. The other thing is, I came here because I really want to be an excellent teacher, and I feel like, from what I've experienced, a lot of that is at the undergrad level. Sure, you have to teach them some concepts, but getting students in the right frame of mind, getting students motivated to do this.

So even if, by the time I get tenure, let's say I can't get back to the technical research until I get tenure, even if I am teaching them material that might be six years away from the bleeding edge, I would much rather have them go out with the capabilities to quickly learn what they need to know at any job that they would start up at and have a

passion for engineering, and be good at that part of teaching. Because I figure I can always update the technical stuff as needed, or buy a new textbook that has it in it, read through, learn pretty quickly. But if I don't have that fundamentals of the ability to teach and get students excited about learning, who cares what technical stuff you are trying to teach them.

5.2.5 Narrative 5: Samantha Reed

Samantha Reed is an assistant professor at a Master's Institution. At the time of the interview, Samantha had been in her tenure-track position for a total of three months, and in a visiting professor position for six months before that. Since she knew that a position that focused on teaching was a priority for her, Samantha applied for jobs a year before being done with her PhD since she knew these jobs weren't as ubiquitous. In this narrative, Samantha details the experiences, motivations, and decisions that led her to be an assistant professor at a Master's Institution where her primary focus is teaching.

How I got here

I went to [Undergraduate Institution], and because I was a first-generation college student, that was the first time I was exposed to faculty members and the whole idea of academia as a career path. However, I appreciated the faculty that had engineering experience, and since I had no clue what it meant to be an engineer, I basically said, "I'll look at both paths when I'm done, and explore all of my options." Ultimately, I decided to go in to industry after I was done, and basically what I said was, I'll find a company that will pay for my master's degree, and give myself 5 to 10 years. If I do the master's degree and still like the advanced classes, at some point in the 5 to 10 year point, I'll go back and get my PhD.

So that's what I did. I hired on at [a company] right after I finished my bachelor's degree as a systems engineer. The next fall I started on my master's degree, and after I finished my master's degree, [my supervisors] started pushing me into more leadership roles. And I realized I could do the leadership roles, but it wasn't as fulfilling to me as the engineering roles were. I was getting more drained with what I was doing at work. So

that's when I started looking at going back. It actually took me three times of applying to PhD programs before I got in.

I finally got in at [PhD University, a Doctoral University: Highest Research Activity, at] which my primary advisor appreciated my industry experience and that I wanted to come back. And I was very open with him from the get-go that the R1 path was probably not for me but that I was keeping an open mind while I was there. You know, pointing out that I did this really intensive hands-on undergrad degree, that what I liked, that's where I thrived, that's where I think I want to go, but I've never been at an R1 school, so I'll keep an open mind.

So, I started at [PhD University] in August of 2013, took [qualifying exams] in August of 2014, got a contingent pass on both my written and oral [qualifying exams] and then started applying for positions in the fall of 2014, which everyone was quite surprised with. But when I started, because I already had my master's degree, it was possible to fit [my PhD] in three years, and so my advisor said, "look for job opportunities for the end of your third year, but if nothing happens, I have funding for you for your fourth."

When I was in industry, my favorite part of the job was mentoring the new engineers. And I liked working with – because I was a lab assistant and grader at [Undergraduate Institution], so I liked working with the students and so forth, and I'm like – I want to actually work with the undergrads, and I don't want to be penalized for doing that. I was getting the impression and I was told by more than one person that if you're teaching evaluations are too high on the tenure-track, you are doing something wrong.

The writing is hard for me, in some respects. So, the thought of having to bring the dollar amount of grants for tenure was just daunting for me. And I looked at assistant professors at [PhD University], and I was like – their entire life is focused on getting grants, and that is not where I see myself, I couldn't see myself, pushing myself to write that many grants.

So, August of 2014 comes around and there are positions open here at [Current Institution, a master's institution], and there are [two] positions at [Undergraduate Institution], which were my top two schools to go teach. Through some digging, I

realized I knew somebody close on the search committee for all three positions. And so, what we decided, I talked to both of my advisors, and I said, "alright, here's my two dream jobs, I know it's a little early, but should I go after them? At the very least, I have a mentor on at least two of the search committees that if it doesn't go well, I'm sure I can get feedback from them which would help for the real job search the next year." And they said "yeah, you're right, these positions at these small schools don't come up every year, go ahead and apply."

[I] went through the whole process [during] the spring of 2015, so I was a year out from graduation at that point. I got the phone interview here [at Current Institution] and then the in-person interview here. The couple unique things here – they didn't require a research statement in my application package, which definitely sets the tone for what their emphasis is. Because in the job description, it explicitly states the percentage for teaching, research and service for their expectations. And their expectations are – I think it was 45, 45, and 10, from a teaching, research, and service perspective. Or maybe 50, 40 and 10. So they were definitely upfront in the job description.

Then I applied, did the formal application process. Then – I want to say it was probably the end of January, beginning of February, I did about a 15- to 20-minute phone interview with the department head and two members of the search committee. I think it was basically just – it was really short; I think just to make sure that what I was saying sort of aligned with what they were seeing on paper.

My job talk was a traditional research job talk, however, the advice I was given was to make it more interactive than you might do with an R1, so that people might get an idea for your teaching style. It wasn't an actual teaching demo, but they wanted it not to be a dry "here's a slide with a ton of data" sort of job-talk.

And the cool thing was, sometime between my application and when I arrived on campus to do my in-person interview, they had someone put in for a really oddly timed retirement. They were going to retire in December of 2015, which then opened up a position on top of what they were already searching for, so [the department chair] was like "what if you started in January?" and I thought "Oh, January sounds good, because that still gives me all of fall to work on my dissertation." From writing my master's thesis while working, I was really not looking forward to doing my entire dissertation while

working. So that was really cool. I can get most of my dissertation done then before I started teaching in January. It ultimately ended up working out.

My preparations for teaching

Back [when I was] in industry, we were doing a new feature for my department and they actually had me put a three-day workshop together for our department. Plus, I led some training sessions – we did some domain training, where an expert on one feature would teach the flight test engineers about that. So, I had a little bit of teaching experience [in industry], plus I went back and guest lectured at [Undergraduate Institution] every time I went back for the career fair, just to get some experience in front of a classroom. Which was good because then when I got to [PhD University], I was getting ready for my first position as a TA, and said [to myself] "whose grand plan was it for the introvert to go teach?" I had completely freaked myself out about teaching the first time. So basically at [PhD University], my first two semesters there I was a TA for our controls class in the department, and I was essentially completely in charge of two lab sections.

We did do [TA Training] with the teaching and learning center before school started, so we had a least two full days of teaching workshops before we started, and we were required to do micro-teaching, we went and did an eight-minute lesson for other grad students, and we were video recorded, and then we had to go watch ourselves, and get critiqued on that eight-minute lesson. Which was really – it really freaked me out, but it was really helpful.

Along the way, [during my PhD], I did things like [take] a college teaching class [taught by a man named Richard]. That class was really helpful in getting up and running here. Actually, [for my first class here], I started with the syllabus – I had a syllabus from the faculty member that taught it before me here, but a lot of it came from the syllabus I make in [Richard's] class, I mean, that was a huge help. And having done that, and reading the literature, as far as getting myself up and running, because I defended my dissertation three days before I started teaching and had to have the syllabus and everything ready to go. So [Richard's] class definitely [helped], I'm glad I was able to take it.

I think that if – especially if you are going teaching, that [Richard's] class, or a similar class should be required. I wish I had – that was just one semester, and it was very intense, and then I did a few workshops with the teaching and learning center after that, but I feel like a more, longer-term focus on – as a future faculty program, would have been helpful. Because I feel like I lost some of that by not being able to keep up with it.

I did teaching certificates through our teaching and learning center while I was there, but all of that is elective. From an engineering perspective, there was only a handful of us getting those teaching certificates every year. So, I went ahead and did those teaching certificates – they don't really hold any weight, they are not official certificates that show up on your diploma or anything, but because I knew where I was going, I sought out those and I made time for those activities. And it helped that my research was closely aligned with those things so I could double-dip.

[My program at PhD University] was a lot more flexible in what classes you could take. I had to take 16 credits in the department, and the other 16 credits could be anywhere in the college of engineering. Because of the flexibility of my degree and being able to take classes anywhere in the college of engineering, I was able to take classes that helped me hit the ground running [as a faculty member], because I had already taken a lot of the technical classes during my master's degree.

I think that flexibility really helped, because not everybody has the time, or gets permission from their advisor to take the college teaching class. So that was a big help, and then right before I left, I took a creativity class, which really helped from a brainstorming and interacting with other folks' perspective. And then [for another class, I was] a project manager [and worked as a TA with another graduate student]. Basically, I was running an undergrad class, doing the lesson plans. We were given some handouts and some guidance, but the lesson plans were pretty much up to us, the grading was up to us, providing student feedback was up to us. I did that. There were two of us that were in the project manager role for that time, [the other woman] was an undergrad with very different career goals, so we thought about that as we split up [the tasks]. She was definitely more on the project manager industry path, she wanted to get more of the project management skills out of the class, where I wanted to get more of the classroom

management – teaching skills out of the class, which actually worked really well with how we split up the work.

And then the other thing that I did, TAing for that class in my last semester, I already knew I was getting [the assistant professor job] and I knew what classes I might teach, so I went to the faculty member and said "I am going to be teaching this class in the spring for real, so instead of you cancelling lecture when you travel, can I just take over?" and so she actually did let me take over lecture at least three times that fall. And unfortunately, when I did – from early feedback with my lab students, more than one of them asked me to take over lecture from her, and told me that they only learned when I was there. Like – ok, that wasn't intentional!

It was reassuring, like hey, maybe I happen to be ok at this teaching thing, despite the freak-out and the introvert thing at the beginning. And I did have – at my first American Society for Engineering Education (ASEE) conference, I went to a workshop with a [professor from my undergraduate institution, and] he talked about putting his teaching-cape on. Which is an analogy or metaphor that has stuck with me, so I put my teaching-cape on and then come back [to my office] and hide.

The early days as a professor and what I am doing now

[The] transition [from graduate school to being a professor] actually went pretty smoothly from my perspective. A couple things helped with that. The first term I was here, my department head knew that I was going to be finishing up my dissertation, so he scheduled me – a normal teaching load here is eight contact hours a week, which means eight hours in front of students per week. And because we don't have teaching assistants, that can be all labs. Which looks a lot like being a TA if you've just come from [PhD University]. For my first term here, [my department chair] put me into four lab sections, and two on Tuesdays, and two on Wednesdays, both in the afternoon, so it was a marathon of teaching labs because they are two hours and five minutes and there were only ten minutes in between, but it was a very small chunk – it was very blocked time from that perspective.

I sat in on their lectures because both of those classes are on my trajectory to eventually teach. So, I sat in on their lectures which helped me in the labs as well as get a

feel for how good teaching professors actually teach around here. So, I was sitting in class for six hours on top of the eight hours in lab, and then, for one of the labs I actually went to her lab section to see how she did the pre-lab intro sort of thing, which made it really easy for me to recreate the lab later in the afternoon.

So, they were really great in getting me up and going, and because of how much prep was already done, all I basically had to do was grade, which was really helpful. But they gave me a lot of great tips along the way and watching them teach was really awesome. So that term actually went pretty smooth.

This [current term] has probably been my hardest term so far, just because of the unknown and trying to figure out what's the appropriate level to hit for a 100-level class. Especially because I've got the gamut – I did a quick survey on the first day, I have students, because of various reasons, because of transfer or otherwise, so I've got upperclassmen in there, as well as the entire range that you would expect for a freshman class. Like one of my students hasn't even had high school physics. And then about half of them have some sort of programming or first-robotics experience. So, trying to craft something so that you don't lose the people who are upperclassmen or had really awesome high school experiences, because it's too easy, but you also don't completely frustrate and overwhelm the students who are not as prepared, and that's been a real struggle for me.

What tenure looks like here

Everything seemed way more laid back than I expected, but it was also a little weird because of the first six months being a visiting [professor] and not tenure-track; some things didn't start until now from that perspective, like I didn't have to do any service until now. I didn't get my first thesis student until the end of spring term. My department head told me my focus, other than my minimum for teaching for the first six months, was getting done at [PhD University]. So that was really helpful. Although that being said, I'm now in my third term and I feel like I haven't done anything research, I haven't done anything service, so now I feel like this term is sort of another transition in a way, because now I am officially tenure-track, now I have to start thinking about service, about my own research program and that sort of thing.

We actually have fairly detailed tenure requirements within our department, which is really helpful. They were provided to me when I got here. Basically, from a research perspective – and they actually make it a clear point of calling it scholarship and not research, because they're very much ok with it being applied; consulting with industry counts towards research here. Basically, their expectations are roughly three journal papers total, not per year, and then one to two conference papers per year. That's roughly the minimum paper count.

The research funding is essentially non-zero, not six-figures or anything absurdly high, and it can be industry funding, it can be NSF funding, and you have to show a track record of seeking funding, and again that can be consulting, that can be actual research funding through NSF, or even, I can go after the smaller grants at National Instruments or MathWorks for developing labs, and teaching related stuff.

From a research expectation, they are ok with me doing engineering education [research], but it can't all be engineering education. It has to be a balance of technical and engineering education. They haven't given me a specific breakdown, but I am trying to go down a path where there's overlap between my technical research and my engineering education research.

From a teaching perspective, eight contact hours a week is the expected load, and then you are supposed to show in tenure that you are making improvements in your class. I haven't heard anything specific like I heard at [Undergraduate Institution] that there are so many times you have to teach a class before tenure, but they want you to show that you're improving in the classroom. They do look at your teaching evaluations all the way through, a teaching evaluation is required at some point on your way through. And then you also have to show how you are incorporating your expertise into the classroom. And sometimes that means developing a class; I am actually on the path to develop at least one elective in my area before tenure.

And then, from a service perspective, it's fairly modest service. Usually, the minimum they say is advise one student group, one department committee, and one university committee. And from a service perspective, we also have to show professional service and have professional homes, and one of those professional homes can be ASEE.

So, for me, I have to show that I am regularly contributing to ASEE as professional service as well.

And then there's some other little nebulous things about contributing to [Current Institution's] Culture, those sorts of things, like collegiality, and those sorts of things. The institution culture [at Current Institution is] not entirely different than [Undergraduate Institution], but there's definitely, within a significant portion of the faculty, a lot of collegiality. I started right away – our teaching and learning center has weekly lunch talks, where they provide lunch and we go over something from a teaching and learning perspective, and that sort of community that regularly goes to those lunches is very collegial, very willing to help out and get you up and running.

5.2.6 Narrative 6: Jason Talbert

Jason Talbert is an assistant professor at a Master's Institution; however, the college of engineering at this institution grants only bachelor's degrees. At the time of the interview, Jason had been in his position for one year. In this narrative, Jason describes how he overcame the bias that made him feel like he needed to want a job at a research university. He also describes the moment he realized that there were institutions that focus on undergraduate teaching, and how his current institution is a perfect fit for him.

How I got here

I did not know what I wanted to do, really. I was attracted to engineering because I had this curiosity for how things actually work. I was like – computers, how do they actually run? That's what attracted me to engineering. I did a co-op [during my undergrad], I worked in a cubicle and hated it, and so I had this, not quite an existential crisis, but I was like, oh my gosh, what am I going to do? I don't want to work in a cube my whole life.

Around that time, a professor approached me and asked if I wanted to be a teaching assistant for a lab based course. And I said, ok, and he said, we'll pay for your master's, and I said, great! I get to stay in school [at Undergraduate and Master's University, a Doctoral University: Highest Research Activity] and not graduate. So later,

the year before I actually finished my master's, the chair approached me and said, hey would you like to teach a course over the summer semester, we have a need, and I was like, ok, great! So, I taught introduction [to engineering course] and just fell in love with teaching at that point, and said, alright, this is what I want to do. Had a blast.

I talked to the professor, and he said, well you need a PhD, which is a research degree, and you have no research. So, I said, alright, I guess I'll do something. So, I jumped on a project and applied to grad school. Really, I only applied to two grad schools, and [PhD University, a Doctoral University: Highest Research Activity] offered me more money, so that's where I went. That's when I realized I want to pursue the PhD path, finding the joy in teaching.

At [PhD University], there really weren't many opportunities to teach, and I was just like, well this is the necessary evil of doing research, but I absolutely fell in love with the research when I was there and had a lot of fun, so I don't know.

My advisor was big on pushing me to – he was an alum at [Doctoral University: Highest Research Activity], he was at [PhD University], but he was big in pushing me to work in the [tech industry] type path and getting a non-academic type job. And at one point, I was interviewing [at a tech company], and just, and I don't know, I was there, stuck in traffic, they're making these ridiculous sums of money, and I was just breaking down – I don't want to do this. This is not at all what I want. That was I think, that was the fall before I defended. So, then I came back, and said, ok, I'm going to go the academic route. I had one round of academic interviews that just flopped. I had a research scientist appointment at [PhD University], a glorified post-doc, so I didn't have all my chickens in one basket, or chips in the game, or whatever.

The next round came about and I threw it all in, and I got a bunch of interviews, and happily found out that a place like [Current Institution, a Master's Institution] existed. So, I didn't realize that there were teaching universities that had undergraduate engineering, that was not pure research focused, and I was like, this is great. [During my interview at Current Institution, I noticed] the faculty here were so phenomenally happy. They just get along with each other, they're just happy people, they look like they're enjoying their lives.

The other thing was that the department chair who I interviewed with knew just about every student's name in the hallway and would stop and ask questions and just chat about stuff. And he just knew things that were going on in their life. And I was just like, this is amazing. I've never seen any other environment like that, and that really stuck out in my mind as I was comparing everything. It made it feel like the department is a team, but there is a sense here that the students are part of that team, they're not the antagonist, they are – we're all in this together, and that just totally – I got that feeling on the interview, seeing our department chair just know so many people.

[But before that], coming from [PhD University], as being a big R1, and I had a good friend from [another R1], he was maybe one or two years ahead of me, I know him from conferences. He ended up getting a job at [a master's institution]. And I was like, woah, this is a big change for you. And I talked to him a lot, called him up on the phone several times to talk to him about that, and we were both talking that, there's this really scary thing that once you leave the R1-realm, there's a huge bias there. There's this – 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.

I interviewed and got a job offer from an R1 school. And that was kind of like, alright, this is great. Because coming from [PhD University], that's the goal. To get a job teaching and doing research, even though I really didn't want to do the research and get grants, I just wanted to teach, but I was like, whatever, you have to do this. I was almost not ready to accept the job [Current Institution], just because I was like, well, if I do that, I'll be stuck in this tier of institution and all this other stuff.

I think it was probably my wife was like, "[Jason], this is your dream, this is what you want." And I was like, you're totally right. I had my big pro-con list, describing [Current Institution, and I finally reminded myself], this is my dream job that I wanted to take. Why am I internally struggling and fighting myself against what I actually want versus this other job that I would end up hating? Just because of the bias that you should go to an R1. That was just really hard to overcome.

[Back to my advisor] – *w*hen I finally told him I was going the faculty route, he was happy to help me. He read over statements and gave some advice there. He was pushing – he told me, he basically told me, you should go to [an R1], he talked about the

back channel of communication, the chair of the search committee I think, contacted him, and he – and was pushing me. When I finally called him the last time and told him, I got these – I forget how many offers I got, three or four offers on the table, and he was like, he finally said, "[Jason], that's great. At this point, it's all preference, you should go wherever you want." At the very end, he finally kind of relinquished that. And I really told him I was thinking about this, and I know I didn't need that from him, I was going to take the job anyway, but that was kind of relaxing, when he finally said, "you know, at this point, when you have job offers and stuff, get what you want, go where you think you'll fit in best." That was – it was just hard to overcome that bias coming from him.

My friend who ended up at [a master's institution as well], because I knew he had gone down this path, and it was really just reassuring to talk to him and hear that there are other people who make this crazy jump –leaving your R1 bubble to go to these small schools, even though that's – It's just ridiculous looking back how I thought I was failing, leaving that, but you're not at all.

My preparations for teaching

[My first teaching experience was in undergrad as a teaching assistant for a course], and I did that for several semesters. I really enjoyed it. I think I learned a lot, because I was pretty much in charge of the lab and I just did a lot of – I guess now, I see, teaching by walking around, is our term we call it, but I was going through with all the students and actually talking with them and asking them questions, to help them understand, and loved it.

[Then at PhD University], we were graduating PhD students without any experience teaching, so they had a mandatory TA assignment you had to do in the graduate school, for two units, two courses basically. Which on paper sounded awesome, but in practice, all a TA did was grade papers, they were a grader and that was it. It was horrible.

There was no push to actually have you teach or anything like that, and I think that was a big missed opportunity. I was a grader and I gave a few guest lectures, just one offs every now and then about the subject. Nothing much more than standing up and going – pretty much giving a research talk, it just happened to be in front of students.

There weren't really any other opportunities. In hindsight I probably could have sought out more opportunities and been a lot more vigilant with that for myself. I don't know, I just didn't because – I was so busy with research and other things, and it wasn't readily apparent where I needed to go and who I needed to talk to, to seek those out.

I think they are trying – there are a couple of programs out there: preparing the professoriate, preparing future faculty, those types of things – that was getting started on my way out. I was ineligible for some reason, because I didn't finish one of my exams on the proper timeline. I really don't know [how I learned what faculty do]. I talked to my advisor a lot about just what he does, but his life looks so different than from what mine looks like now. He would fly all over the place talking to funding agencies and doing talks, that sort of thing. One thing that somewhat helped, I read a book, *The Academic Job Handbook*. That actually helped to get a good idea for what faculty do. All their advice about the actual job search was not that useful, but just in terms of how you balance teaching and all that, *that* was helpful. Really, it was probably my first interview that I totally flopped, but that actually gave me a really good sense, like, oh, this is kind of what professors do and how they think. It feels like something that just kind of pieced together through about seven years, and at the end I finally realized it.

[During my interview at Current Institution], I did have to give a teaching talk, so I did not have to give a research talk, it was just a teaching presentation. They gave me a topic to talk about and then I prepared how I would teach a 50-minute class on that topic. And that is so intimidating to do, because you have no idea what teaching technology you'll have, you have no idea what the room looks like, you don't know the students. That was massively intimidating much more than any other research talk, just because of the unknowns.

I will say that I felt the PhD process is a little bit a bait and switch, just like – it just feels like there are so many PhD students and then so few jobs and it's just terrifying to get there and realize, oh, most professors, well what it seemed like, most professors spend all their time writing grants and just doing research, and there are very few of these big jobs. I don't know, it just felt odd to finally get this realization – and this is biased to the R1s – but professors spend the majority of their time writing grants, managing students instead of teaching and doing research is what you think as an undergrad.

The professor I worked with when I was getting my master's and I TAed for, he cared about the students in his class almost to a fault, I felt like. He wanted them to do well, he would always know what was going on. Like, oh, so-and-so is involved with this extracurricular thing, or so-and-so's sick, he would know crazy stuff, and I think he really cared about his students. And I will say his students would always avoid his office when his door was open because he would stop them in the hallways and say come in here, let's talk. But, that really influenced me. He would really think about the students in his classes and think about what is best for them, and didn't want to over burden them, and just worried himself sick about every assignment he made, and he just wanted to be an effective teacher. I think that really stuck with me, because he asked me a lot about students, and what I thought about how the class was going and if concepts were landing, so I think a lot of what I have been doing kind of comes from that initial shaping. Hearing the struggle of trying to be a good teacher.

That would probably be the biggest influence I had, and kind of developed in a lot of that. Other than that, I think it may have been from my experiences as a student, just seeing what works and that sort of thing. Just dreaming about: what kind of teacher do I want to be?

My early days as a professor and what I am doing now

It definitely is hard because – at [PhD University], I was told by my advisor that teaching is something we have to do, he openly hated his teaching job. So, it was hilarious coming here, where everyone is like, yes, teaching, I love interacting with undergrads! That wasn't something necessarily to overcome, it's just almost shocking how different attitudes are of faculty who are advising PhD students versus faculty who are predominantly teaching undergrads.

I did not come from an engineering education background, so where I learned, lecture was a lecture and then you had homework. So, a very traditional learning style, which matched me, which I am now realizing that there's selection bias for PhD candidates. I've had discussion with some faculty here about learning styles and just that not everyone learns like I do, and I'm trying to wrestle with that. So, I'm actively exploring other teaching methods. And one of my goals was to do some active learning.

And I had no idea what active learning was – I thought that meant have a group discussion, and I thought, that's dumb for a math equation. But I'm now trying to integrate other methods and other styles, and I found out that this one [method based on the "flipped classroom"] just worked really well. I think that's how this course was taught previously, and I had some material that was teaching in that style. I'd never done it before, so I said, alright, I'm going to give it a few weeks and see how it goes, and might switch to something that better suits me.

But I found that I loved it. I could walk around and talk to students more and actually felt like I was covering material in more depth than I could have with a traditional lecture for this class. So, I don't know how it's going to work for other classes, but it had me start thinking about doing more in class exercise type, walk around assignments in my other more theoretical classes even.

[At Current Institution, we] are required to keep six office hours per week. I don't include those office hours [in my syllabus], partially because those will change and I don't want to update those every year. So, I post office hours on my door, and I just tell students, come by and see those and you can figure out when office hours are. And I also tell them most of the time I'm in my office and if the door's open, come see me. So, I do keep a fairly open-door policy, and I try to be as available as possible. So, I don't include that in my syllabus, that usually gets mentioned the first class. Basically, where to find out where my office hours are and if you need me, just come by and I'll try to help you.

What tenure looks like here

There are scholarly requirements for tenure here, like there would be anywhere. I'm encouraged to publish and all of that, but its more that I want to publish and stay active. It's a little bit of the requirements, but I think it's just that I personally want to succeed, and I think it's self-driving in a lot of ways. Definitely too thought, I mean, I guess if there were no requirements for tenure, I wouldn't do any research, and that would not be good for me as a professor in terms of just that my teaching would suffer because of that. I think a lot of the pressure though is coming from me personally.

It's been, just in terms of transition, it's been a little bit hard, I'm still trying to wrap my mind around where I should be in terms of scholarship, because there's

technical scholarship and then there's pedagogical scholarship. I am trying to dabble into pedagogical research, but it's a whole new language. I think I saw Likert scale, and was like, what is this? And someone's like, oh that's like the agree-neutral-disagree scale, and I was like, oh, well ok. But it's just like, stuff like that, I have no idea what open questions are, I have all these students that I would love to take assessment based, but I'm trying to wrap my head around doing that, and trying to transition to some more pedagogy in terms of research, while also trying to figure out where I lie in terms of technical research and what I can do with undergrads.

So, scholarship is kind of the hardest transition, and going from – the other crazy thing – is going from where I had, I completely made up my own schedule, had as many hours I wanted a week just for research, to now teaching three courses, and that takes up every single hour of your time. During the semester it's hard – time management, I guess is kind of the other – teaching takes so much, but I also want to do something scholarly. It's hard to balance that.

Teaching is 70% of our – you have the pie-chart – teaching takes up 70%, that's what we are evaluated on every year. That includes peer evaluations from tenured faculty, student evaluations are factored in there which is always awesome. You know – if anyone at [Current Institution] is not a good teacher, they will not get tenure, that's kind of right off the bat. And then there are plenty of options for us to get help. But teaching is the main thing.

Scholarly activities are then; I think are 15%. And then there are other things like campus citizenship, basically service is the remaining part. So scholarly activities, it's expected but in terms of evaluation and that sort of thing, its counted very little both in our annual reviews. I think, just talking to the chair, everyone expects you to get one or two journal articles by the time you're up for tenure, and then a few other conference papers. So, research is expected to keep up, but also, they said, teaching is the main thing we are here to do; if we are not good teachers, we will not get tenure.

That being said, I also – it's much less pressure here than anywhere else that I interviewed, which is awesome. It goes back to all the faculty being happy when I interviewed. But I think, they've said, maybe one person in twenty years has gone up for

tenure and not received it, so that takes a lot of the pressure off, which is also something I was looking for in that faculty search.

I am totally happy with [my balance of expectations], because, I mean, I think anywhere I would go, I think I would spend a lot of effort teaching, because I want to be effective. That's a personal goal of mine as a professor, as an academic. I want to be an effective teacher, so it's nice here that I am rewarded for the amount of effort I put in getting classes together and coming up with active activities and stuff like that. So, it's rewarding knowing that if I put in a lot of effort, then that will be reflected in my annual survey. In terms of balance, I am totally happy with it. I get to spend a lot of time with my family, I feel well rewarded, and I am respected for enjoying to teach. That's good.

Our annual review process is that you would talk with the department chair and dean of the college. I think the options for help would just be having more detailed mentoring and meetings and just saying, try this in you class, let's figure out some methods that work, and that sort of thing. I think that would be the options. And then, our college dean will also pay for trips to things like NETI [National Effective Teaching Institute]. So, there are other options like that to get training. But I think the biggest thing is just have the teachers mentor a little more intentional about that, versus just kind of open door policy mentoring. In terms of formal teaching support, the biggest things are peer-reviews. The tenured faculty are required to visit our classes and write up a report and meet with me about that. So that has to happen every semester.

Other thoughts

[During my PhD], there was just kind of a disregard for teaching based institutions. I remember I went to one seminar about job searching, and they would talk about how you need to have your research ready, and you should have parts of your dissertation ready to discuss, and I think another guy raised his hand and said, why is there no one representing any teaching positions or anything like that? There's a whole list of institutions that have been swept under the rug, and I wish that wasn't the case.

I wish it was mentioned more, that there are institutions for teaching in your job search, and actually give students opportunities in teaching. I think one of the good things that they could do would be to let students co-design courses with teachers. I know other

schools have done that and I wish [PhD University] had a chance to do that. They have stuff to work on grants together, but that's great for a research focused job, but there are no opportunities for that in teaching. The one thing I would like to change could be something about co-teaching or something about opportunities to get in the classroom.

I have three young kids and with a family at home, just trying to balance that [has been hard], but I will say that everyone in this department has been very supportive of that, saying, if you need to spend time with your family, or if something comes up, just tell us and we can cover a class or we'll help work it out. So that's just really nice to know that there's that safety net, with the faculty here.

5.2.7 Narrative 7: Matthew Land

Matthew Land is an assistant professor at a Doctoral University: Moderate Research Activity. At the time of the interview, he had been in his position for just shy of two years. In this narrative, Matthew describes how his initial desire to teach at a teaching focused university grew to include conducting research as well. He discusses how his current position is a perfect fit for him on many levels, including that his department is aspirational in terms of research, which was an important characteristic for him as he was considering where he wanted to become a professor.

How I got here

In a class in undergrad, my professor had just gotten tenure and he came into the room and he was really, really happy. And I was like, this guy has been a good teacher all semester, he just had this weight lifted, and I was like – I want what this guy is having. That was the first time I thought maybe I want to be a professor.

But then in parallel with that, I had always kind of begrudged bad teachers, and always thought, I can do this better, I should do this better. If I think I can, I probably should. That's like, if you're going to offer criticism about something, you have to fix it, you can't just knock it down, you have to build it up. So that's when [I thought] ok, I'll get my PhD to go teach.

So, I started doing research at the [university where I got all my degrees, a Doctoral University: Highest Research Activity], so I stayed there for my PhD. Part of that was because I didn't get in anywhere else, but also my wife, then girlfriend, came to [Undergraduate, Master's and PhD University] for medical school, and we had been long-distance for four years, and so I was like, now I can't leave.

I started off wanted to get my PhD to be a professor so that I could teach. From a couple different angles – one was, at a giant research institution like [Undergraduate, Master's and PhD University], you have a bunch of faculty members that don't want to teach, and you're like, come on, this isn't what everybody said. But I also noticed a couple of different times when I didn't think I liked something, and then did later. And the difference there was teaching. One was computer programming. I hated computer programming all of undergrad, and then got to do it professionally. And another was this old board game my dad kept trying to teach me when I was little and I hated it, because he always won. There's all these things in the teaching literature about, you know, make it an enjoyable experience. If you keep losing, then you don't want to do it.

Those were two experiences when I was like ok, there are things that you can learn to be a better teacher, and that's kind of why I wanted to go into education in the first place. And then as a graduate student at a research university, I was forced to do research, and then I got good at it, and I was like, oh this is fun too! Maybe I will be competitive for "real" professor positions. So, it was [at] the end of graduate school and the beginning of my post-docs. I think my publication record is kind of competitive, where I can start applying, and I think that there's a little bit of an x-factor when someone is personable as an engineer that goes a long way. So, I think that when departments meet me, they're like, oh, even if his research isn't that great, we want him here. And so, I kind of knew I had that, so I was kind of aggressive about applying, and I got four interviews and ended up choosing [Current Institution, a Doctoral University: Moderate Research Activity] because it was a place that was a good fit from the research perspective and the teaching perspective.

At [Undergraduate, Master's and PhD University], they have a [teaching center], there's an engineering focused one and a broader one there, and I did a future faculty seminar at one of them. It was awesome. It was a whole month-long thing, where we met

twice a week, got lunch both of those days, and it was graduate students from the entire university that had aspirations of being faculty members, and it was kind of the first foot in the pond of pedagogical literature. So, learning the different research that was out there or current best practices, looking at the vocabulary, and seeing these things in person, and being like, wow, these are self-consistent. If you can use this to teach me this, then it's something that works, right?

It was during that, for the very first time I got exposure to universities that weren't R1 Institutions. We had faculty come in from [a local Master's Institution], and I actually visited there, and I was like, this is totally a place I could see myself, that does research but it's really education focused and doesn't have graduate degrees. This is in the cards.

I finished my PhD and then got a post-doc at [Postdoc University, a Doctoral University: Highest Research Activity]. That was picked because of its co-locality with my wife's work. She was doing her fellowship at [Nearby University], and so that was the closest place where something made sense for me. Later, I got really lucky and got a post-doc at the [National Lab in the area], which was just down the road. So, I did [two] post-docs there for about three years. Then at the same time I got the job at [National Lab in the area], I also got an offer from [Current Institution], and accepted those in parallel and delayed the start at [Current Institution] so that we could finish my wife's fellowship and move up to [Current City] together.

I think the pushback [to go to a non-R1 Institution] was mostly cultural, in the sense that it was never something that [I] had talked about before, and if it's not in your stated goals, it kind of feels like failure. So, there was never any explicit discussion, like that's a bad thing to do, but it was never anyone's top choice. It was always kind of weighed in the context of everything else. There's a perception, which I think is true, that it's a little bit easier to get jobs at places that don't have research agendas, and it's because bringing in those research dollars is extremely competitive. And you need people that are competitive at that and that want to do it, on top of being good teachers, or that want to do that instead of being good teachers. It's a different thing, which doesn't mean it's bad, it's just different.

I got interviews at [a Baccalaureate college], which is an undergraduate teaching focused institution. I got an interview at [an R1 Institution] which is a pretty standard R1,

but small. I got an interview at [another R1 Institution], which is very much R1, and an interview at [Current Institution]. And it was during the interview at [the "very much R1" institution] that I accepted the offer at [Current Institution] – where I was like, I can't live in [the city where R1 is], it's a place I don't understand. But [Current City] is a place that has the mountain biking that I like, a really high quality of life, the faculty seemed pretty balanced in work-life balance, or at least that was something that was a stated value, that you didn't hear stated at a lot of places.

I knew that [a teaching center] was [at Current Institution], but also the [disciplinary] department here is kind of an outlier in the university as a whole. It's an R1 department in an R2 university. So, there are aspirations to make the program world class. There's a little bit of a bait and switch there, where I was a great fit for the university, and the new faculty that have showed up in this department, we have hired seven people in the last three-ish years, they really have the pressure on us to be world-class researchers. And that's fun, but it's also a little bit stressful. It's important context.

[Current Institution] was, until recently, a majority commuter campus. But it's turning into kind of a regular R1 school – slowly. And so, you can still see the aftereffects of being a startup new thing, – like our PhD program is only five years old, we are just graduating our first students. The department is only 12 years old or 14 years old, but it's also quite young. So, it's – the culture is more of one in motion, where the culture is something that is being built on the fly, which was an attractive part of coming to [Current Institution].

[I was also attracted to] the culture of the department. A whole bunch of the faculty mentioned biking during my interview, so basically everyone is the same cycling team, how can I not come here? This is the perfect fit. Also, the intentionality with work-life balance and, again, I think that it was a place where faculty members can be like, "I think that I would like to go half-time, and concentrate on my family for a while." and having a department that's like, "yeah, we support that," I think it really pretty unusual.

It felt like it was a place where the culture fit, the culture of the town was a fit, and in a department that was very aspirational. I mentioned that an element of what was exciting, was that this thing is so new. So as a new faculty member here, I would get to

shape what the culture is, and I think that was a unique opportunity compared to a lot of places, where there is a lot of institution momentum.

My preparations for teaching

I was a pretentious math kid. My dad [who was a math prodigy] made me do math competitions all growing up, so I was pretty much always the smartest math kid around, so I kind of identified with that, and liked showing other people the things that I could do. Then, kind of in parallel, when I was growing up, I was a camp counselor, that involves elements of teaching that aren't direct teaching, or like, not teaching course material, but a lot of the classroom presence sorts of things, you kind of learn there on the fly. And managing the hundreds of kids.

In graduate school, because I knew I wanted to teach, I sought out teaching opportunities. When I was a graduate student, I was a visiting professor for a programming class at [Local Baccalaureate College]. I volunteered for an NSF study that was being run by our center for teaching and learning, and I co-taught a math class at a high-school in [Undergraduate, Master's and PhD University city] with the algebra teacher there.

And that particular experience was pretty horrible. I learned that – I kind of walked in the room as the good cop, and the teacher was the bad cop, and I was the new fun guy, and immediately turned the class against her. So, we had this real friction between us, and so even though she and I don't get along and still don't speak, learning that that could be a thing and that being a good team-member is really crucial to effective teaching, I think was way more important than what I would have learned teaching algebra that semester. And then, I think I didn't have any formal teaching opportunities between graduate school and starting here, because those post-docs are very much research focused.

I think [I learned about being a faculty member by] just watching my professors when I was a graduate student. The teaching side was very visible as a student, and that was something that I thought I always wanted to do. The research side I got to discover as a graduate student, and at first, I had some push back against that and then got onboard.

The service side, in terms of advising students, and helping make a machine run, I think – [those are] things that I have interest in anyway.

My early days as a professor and what I am doing now

I have a one-one load, I teach one course a semester. Next semester, I think – we also have this issue of needing to provide enough courses for our graduate students to graduate on time with this new department, and we require a bunch of electives. But then all of sudden, we don't have enough hands to go around teaching those electives, so that's kind of a problem. And I think the only way we are going to do this is if some of the faculty double up and teach more courses than their contract asks them to. So, I think next semester, I am going to teach two classes instead of one.

On the one hand, I like the two classes that I am going to teach, so that part sounds fun. But it will necessarily take away from the balance that I have to spend on other things. And I don't know if that will have a significant impact on the papers that I need to get out, and proposals that I would like to submit to, or if it will be manageable. I don't know how that will go yet.

I think that the culture of the department at [Current Institution] really encourages playing around with one's curriculum, trying new things out and – so for example, something that I honed in on in my programming class is I used two different colored sticky notes in class, this is my introduction to programming class. Every day at the beginning of class, everyone picks up a pink one and a green one, or a yellow one or a blue one, two different colored ones. And as we are working on the day's worksheets, if you get stuck, you put up your red flag, and it's a visual reminder for me to come over and help. And if you're done with this thing, you can put up a green flag. So, it helps me pace the class. There's immediate feedback in the classroom that helps me manage everybody's learning in the room, and at the end of class, on their green ones, I have everybody write something that went well, and then on the pink ones, something that didn't go well, that they'd like to fix.

And so, these post-it notes are huge. I can take that and make the class the next week even better, and doing this semester on semester, I think is way more effective than just working on your end-of-course evaluations and try to teach stuff too late. I think

students really appreciate that because there's a sense of agency in the class. Like, when they see that I fix something because of them, they know that I care. It's a little thing that goes a really long way.

What tenure looks like here

Our department wants to be competitive on the world stage as a research department, but that doesn't mean we get to sluff 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. The culture is very much supportive of improving as teachers. And you won't get tenure here if you're not a great teacher. Whether or not you can get tenure without being a great researcher is still yet to be seen. Nobody in the department has gone up for tenure and has not gotten it yet. Because we are so young. But the pressures were different than they are now.

Formally, [for teaching] the only thing that goes before the provost are your teaching evaluations. The department chair and the dean get those teaching evaluations also, but within the department, there are opportunities for teaching observations, so other faculty have been to my classroom to see what I do. But formally, it is only the number.

My impression of the tenure requirements are that they're not unusual - Research, Teaching, and Service with percentages and particular metrics that depend on the department, and there aren't mutterings about them being unfair or surprising. It's good that departments have their own internal metrics, so the "conference paper" in computer science is "counted" the same as a traditional journal article in engineering, and so the departments can specify priorities for things like journals over books, etc.

My annual weights are something like 60% research, 20% teaching, 20% service. I love to ask people how they'd use 20% of a 40-hour work week to prep, teach, and grade a class that meets 3 hours per week. I use that thought experiment and example for how 20% time, or, alternatively 8 hours, is not sufficient to teach a class. I also tried out only spending 8 hours per week on teaching, some summer prep, plus 4 hours per week during the semester delivering, and still got better than 4.3 out of 5 evaluations, so maybe the bean-counters are right from the diminishing-returns perspective. More importantly, based on their work I think my students learned and could do what I wanted them to do,

so if I can get students to achieve my learning outcomes, with above-average evaluations, with minimal time, I probably should keep doing that.

The 20% number is probably right for the time I spend advising a cohort of [approximately 30] undergrads about their class schedules, registration, and progress towards their degree, plus my time spent on other committees.

Everything else is research. Advising a postdoc, three graduate students, and six undergraduate researchers takes more than 24 hours per week, so either the 60% weighting is wrong or the 40 hours per week assumption is wrong. Still, we're learning things about the world and getting publications out and having fun, so it feels like the 25 to 40ish hours I do devote there are well spent. I'm also committed to trying to stay as close to 40 hours per week as possible overall while maintaining the sense that I'm on-track to be awarded tenure.

That's a roundabout way of saying that I am confident about tenure and I feel I have a plan for the next three years that'll keep me confident both about tenure and my family continuing to like having me around. The way I think about this is informed by really enjoying my lab, my classes, and my department, but having those responsibilities prioritized after the responsibilities associated with the enjoyment of my kids, spouse, and being outside.

5.2.8 Narrative 8: Emma Edgerton

Emma Edgerton is an assistant at a Doctoral University: Moderate Research Activity. At the time of the interview, she had been in her position for a year and a half. In this narrative, Emma describes how she recognized her teaching goals as an undergraduate instructor and how those goals shifted and developed throughout her educational path. She also describes how she tailored her application to one specific university, demonstrating that she understood the university's goals during her interview which she believed was instrumental in getting the position.

How I got here

My dad was an engineer, and two of my older siblings both became engineers, so I knew I was going to be an engineer and applied to a bunch of schools. Knew that I didn't want to be at [elite Doctoral Universities: Highest Research Activity], wanted to be at a more hands-on technical school, so I applied to schools like [example institutions], all the technical schools. And I got in to most of them that I applied to and I was beyond thrilled because I not only got into [Undergraduate Institution, a Doctoral University: Higher Research Activity], which was kind of my number one because they had a [disciplinary] engineering program and I knew I wanted to do [disciplinary] engineering, but I also got an amazing scholarship.

So, got the scholarship, got in. Knew I was going. Sophomore year, I really struggled. I was playing soccer on the team and struggled with my academics, was not the best student. Probably wasn't putting in my best effort, wasn't really engaged in the courses. So, I was really struggling.

And [I thought], ok, maybe I need to not be an engineer anymore and stay at [Undergraduate Institution], or maybe I need to go to a different school and be an engineer at some place like [University of Home State]. I'm from [Home State], so go to a smaller school and get a little bit more support, where I'm not just a number. And I kind of had a heart to heart with my parents and my dad was like "you are an engineer, you have been an engineer your whole life, this is your path, you just have to stick it out. It's ok if you're a C student. It's ok if you're not at the top of your class, we just want you to get your degree."

So, I got into it, and stayed at [Undergraduate Institution] and stayed in the engineering program. And then once I started taking the engineering classes related to my major, I thrived. I was a fulltime student, I stopped playing soccer, and I got all As in the rest of my classes. When I got to the point when I was thinking about career readiness, I met with my advisor and I said I really want to go and get my PhD because I want to teach at a university.

And she said to me, and this is a day I will never forget, she was like, "you'll never get into a graduate program, you are wasting your time." And I was heartbroken, I was devastated. And then I met again with my parents and they were like, just apply,

what's the worst that's going to happen? You don't get in? Well then you apply in November, and if you don't get in then you can start applying for jobs in March. So, I applied to seven schools. I got into all seven schools. I got funding at some places, but didn't get funding at other places.

I chose [Master's and PhD University, a Doctoral University: Highest Research Activity], I went in knowing exactly the lab I wanted to work with, exactly the advisor I wanted, and the type of study I wanted to do. So, I got to jump in and take over on this study that was ready and well suited for me. So, the races were running, everything went smoothly, and that helped me rapidly get through my master's thesis in the first two years and allowed me to finish my PhD in two additional years.

What I realized while I was there is that I absolutely love the research. I love the protocol development, I love research development piece. I hated the idea of what my advisor did. I didn't want to sit behind a desk and write grants. I didn't want to be the planner of studies, I wanted to execute them. So, then I was like, ok I'm going to go work for a lab and be a technical engineer working in a lab doing studies for a company. So, I started applying, applying, applying, applying like crazy because I was coming towards my thesis defense, but I couldn't get a job. I applied to probably 50 jobs and I could not get an interview.

I started fretting and panicking a little bit, being like, what the heck is going on here, what can I do? Someone had suggested doing informational interviews, so I did some informational interviews with some top people in [relevant] companies. I met with a guy from [a relevant company], and he said to me, "listen, you're now overqualified for the positions we want to hire you for. You have a PhD and we can't pay you as a PhD, we want to pay for people with a master's." So, I asked, "should I just take my PhD off my CV, what do I do, how do I get myself into this position?" And he said, "no, what you really need to do is, you've had all these great experiences in [specific research area], you're clearly an expert in [that], but we don't know if those skills are transferable. Why don't you go and do a postdoc and learn a new skill set, and just show that your skill set is transferable, and that you can work in any [related] field."

I took his advice, and I started applying for postdocs, knowing that it was going to be a two-year post-doc, and that this isn't what I want to do for a long time, I'm just

getting this experience so I can be a manager in a lab rather than a technical person working there. Then I'm at a postdoc at [Postdoc University, a Doctoral University: Highest Research Activity]. I got that position from connections, networking, it was a friend of my husband's, was a new faculty member that worked at [Postdoc University]. He was brand new to the department, he had just started this lab. He knew that my objective was to get a job in industry. So, my role was to be the lab manager, to maintain all the equipment, run the lab. I trained students, I dealt with all the protocol development, all of the subjects, all the kind of management stuff that I didn't have experience doing before.

But I got really involved with the research and writing grants and helping him develop some of the great researchers that they have there, to getting funding so they were able to do the work that they wanted to do. And I kind of fell in love with the whole teaching aspect again. Because I was teaching students in the lab, it was ten students at a time, learning a protocol from me. Almost an academic teaching environment, but in a lab setting. I was kind of getting frustrated with that I wasn't getting paid very much, working ridiculously long hours, was thinking about having a kid. At this point, I actually was pregnant. And I said, I have to move on, I have to get a real job. I've been here three years instead of two. I'm going to try to get a job.

I [asked myself], what do I really want to do? And I said, so what I love about my job right now is the teaching component. How can I teach and maybe not have the pressure of R1? When I was at [Postdoc University], we submitted 7 or 8 grants and we didn't get any of them. And I'm thinking, we had a three-million-dollar startup, we had all the resources in the world, we had [Postdoc University] facilities, we could do anything we imagined, and we did it, we actually did it. Anything we said we were going to do, we ended up accomplishing our goals. But we couldn't get external funding in the three years I was there.

But I also got a firsthand look at the process and the stress [my postdoc advisor] was under and the emotional toll it took to submit these grants and not have them get through. When we got revisions back from grants and still didn't get through, it just seemed like we were butting our heads up against the wall, and I realized I don't want to

do the R1. It's too much stress. The emotional frustration of having those grants rejected was too hard. It's like your life's work being put forward and they were just saying no.

[Then I asked myself], how can I get the balance? I still like teaching, I love the teaching. I enjoy the research, but I really want to be at a school that's not so tied to external funding. So, I started looking for smaller schools. I was kind of set at that point on staying in [Postdoc State], and I just stumbled upon this job at [Current Institution, a Doctoral University: Moderate Research Activity]. I applied and wanted to see what happens, and it was a perfect fit.

I applied to my current position and I applied to a position at [a Baccalaureate College], which is more of a [related field] school. So not a great fit, but they were looking for someone with an experience in [my field], so I thought, oh, that could work. And then I applied to a community school, it was [local community college] but it was kind of more of an adjunct position. And I wasn't really putting my resume out there, it was more let's just see if anything sticks. I put together a package and focused on my current school pretty much entirely and then rolled it over to the other two programs without making any changes. But I was applying to this position specifically.

They were looking for someone with a little more [other disciplinary] engineering background than I had, but I just felt like the size of the school, the scope – you're teaching three classes a semester, so it's teaching focused. And when I was applying and interviewing, it seemed like the research wasn't as important. Which is what I was looking for.

The first thing was a Skype interview which lasted 20 or 25 minutes. Once I got the Skype interview, I then interviewed for the position in person. And any faculty interview is the same, from the people I've talked to, but it's a full day, sometimes it's even two days. I was local, so I asked them if I could just make it a one-day thing.

I came in first thing in the morning and I met with twelve different faculty members, told them about myself, told them about my research, the classes – everybody wanted to know what classes I could teach. That was probably the number one question. Can you teach this, can you teach that? That was the most stressful question that they asked, because I had never taught any of these classes that they were asking me about. I kept thinking to myself, I should say yes, because I'm sure I could figure it out, but I also

was [asking myself]: am I overselling myself and am I committing myself to something that I'm really not prepared for? But I was solid in [my field]. But they asked, "what experience do you have teaching?" It was very geared towards teaching.

They were interested in my research, but you could get the sense that the teaching was what – at least within the faculty that I met with, that was really what they wanted to make sure that I was confident to do. I had a presentation where I met with the dean and the people on the search committee, and presented my research in a twenty-minute talk, just to say, this is what I did, this is how I did it. This is the type of research that I think I could do at [Current Institution]. I remember everyone was so excited because one of the things I did in my presentation was to say, this is what we are doing, and this is what I could do here, and these are the people I could collaborate with. So, there's a couple people in my audience that had actually seen their name up there, being like, oh she wants to collaborate with me. I wasn't intending it to be like, oh I'm sucking up to you, I really didn't know who was going to be in the audience. It was more like, I'm the kind of person, I want to reach across the aisle and make a connection with someone and we can work together as a team to submit a grant. Because that's how we are going to be successful here.

I think the fact that I understood 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 say, "hey, if we were to buy this instrument, I can use it for this reason and you can use it for that reason and we can team up and share our resources." I think the fact that I was kind of in tune with that helped me get the job.

I didn't actually have a teaching demonstration. I have been on two search committees now where both of them have had a teaching demonstration. I am grateful that I didn't have to go through that, because now that I know what classroom teaching is all about, I probably would have done it much differently than I would have in my interview.

My preparations for teaching

I had a really good professor at [Undergraduate Institution] and he was flexible. He was really flexible in his lecture and he let his lecture evolve as the discussion happened, rather than "this is what we are talking about today and these are the topics that we have to get through." That helped structure my style as an instructor. And then in graduate school I didn't get a lot of chances to teach in front of a class, but my advisor had a couple lectures that I could give when he was out of town, so I lectured a couple times. It's really hard. It's not anything like what you expect it to be. You think you have enough information to cover six days' worth of material and it covers twenty minutes. One of the things that I still struggle with is answering questions on the fly. Having students ask me a question and knowing what the answer is, or having to come back the next day and say "ok, so that thing I told you last week, that's wrong." So that's always been a struggle for me and I think that that's just a confidence issue and it will get better with practice.

My [PhD] advisor was very hands-off with me as a graduate student as well as with the undergrads. I never saw students in his office. He taught one class every other semester, so he really had little teaching load. In terms of teaching, I helped him with his biomechanics class and I was TA for that class, so I got to help with writing some of the lectures and writing some of the questions on the exam. But not that much involvement in terms of teaching. I TAed for the instrumentation lab in graduate school so I got to work with another faculty member and saw a different teaching style. But again, kind of hands off, not so much engagement with the students, undergraduate students. And these professors were very, very focused on the research.

I was the TA for a lab, which was basically me teaching the students in the lab. They would have a lecture component taught by a professor, but I was the one in the lab showing them how the equipment worked, showing them how to set up the experiment, helping them run through the actual protocol. I liked being up there, I liked the PowerPoint format and feeling prepared, I was always big on preparing some kind of worksheet that they would have to do in class, just something simple, to get them off their phones and on to the paper. I loved that. That was amazing. That helped structure my [current] class.

I didn't teach at all at [Postdoc University], it was mostly just in the lab training. But again, big groups of students learning technique from me. That was probably more frustrating than the former because they weren't being graded. Undergrads, if they're not being graded for the work they're doing, they tend to sleep in, tend to skip out, tend to be hungry at 11:30 and need to go get lunch.

At [Postdoc University], my advisor, again, is new, so he's still developing where he's going to fit in to the whole ecosystem there. So, he taught some classes. I didn't have much involvement with his classwork, but I always felt like it was second fiddle to him, like it wasn't his first priority, he just taught it because he had to. His research was what was important. He had to establish his research lab, he had to get funding, in order for him to get tenure. That was his focus. He was also extremely smart and could probably teach [those classes] in his sleep if he had to.

Seeing that, I knew that [a Postdoc University] type of career was off the table for me, because I knew I wanted to teach primarily. I wanted to have students that I interacted with. I always went to get my PhD to teach. I lost sight of what it meant to teach when I saw what my advisors and faculty were doing at big research institutes. They weren't primarily teaching, they were teaching maybe one class a year, they were writing grants, they were doing research, they were advising students in the lab, but they weren't teaching.

My early days as a professor and what I am doing now

At [Current Institution], it's been a completely different story [compared to my other institutions]. We teach three classes a semester – so six different classes throughout the year. And I have more advising, service burden, than probably anything else I do. It takes up more time, just meeting with students, talking about homework, helping them with their resumes. Advising them on what they want to do when they graduate. Helping them with team conflict. That's a big one with senior design, I have a lot of students coming to me about how their team is not functioning and helping them work together, and giving them strategies to be successful with conflict management and all that.

At a place like this, we mostly teach from textbooks. Senior design, and even [my field] is such an evolving field, it's harder to, but we have this very structured flow of the

material that we work together as a university and even within the department. To make sure that they take [the right sequence of classes]. So, I'll meet with my colleague throughout the semester just to say, "hey, I'm going to go over this concept, how much do they know about this from last year's version of the class?"

There's a lot of collaboration across the faculty. We talk a lot about curriculum, and class flow from one year to the next. It's all about improving the quality of their education, the quality of their teaching structure and style and whether the students are happy with it. I think one of my biggest pressures as a faculty member is student evaluations. They put a lot of emphasis on how important those evaluations are to the tenure process and your success as a young faculty member.

I'm teaching two classes this semester, so I'll have four [office] hours. But it really depends on the classes. This semester, I'm teaching two senior level classes, so I meet a lot outside of class for senior design with the students. I think the expectation is you have to have four posted hours so if you have advisees that have to come see you, you have to have some time when you know you're going to be in the office. But my office hours really fluctuate depending on the classes I'm teaching.

I'm involved in this leadership group here that helps women develop their skills and develop their career path, and that has been awesome. It's kind of like a mentorship program, and a chance to learn more about yourself as an educator. The one thing that I'm struggling with, as an instructor is that I identify as a "learn for the sake of learning" [person]. I don't care about the grade, I don't care about the deadline, it's just I want to learn it to know it and understand it. Whereas that's not how undergraduates operate. They are there for the grade, so if they're getting one point off for this, they're like "why am I getting this point off?" and I'm like "it doesn't matter, if you learn the material, that's all that matters, right?" That's been a struggle.

When it comes to the organization of the university, I was surprised with how limited the resources were. I had one amazing mentor who I went to with all of my questions and concerns. Without her, I would be lost, I would be drowning. She has guided me through the whole process and given me advice at every stage. I've been very fortunate to have her as a mentor, but that's not traditional. There's not an organized mentoring system in place here, I'm really advocating to create one university wide, but

it's not something that is traditionally available. That being said, I don't know how to say this, but there's a lot of pressure as a young faculty member – we hired you and you need to step up to the plate and figure this out on your own. This is what we hired you for, this is the class we hired you to teach so go teach it.

I think there's a lack of education or teaching preparation [in graduate school]. How do you actually teach a lesson? How do you engage five different learning styles? I still don't know what that means. You can't teach everybody the same way, well, I don't know how to teach five different ways. This is who I am and I try to incorporate different types of projects and ways to look at the work and homework and quizzes and tests, and in-class problems – so that's my way of teaching to different people, but what does that even mean to teach people with different learning styles? Understanding how to structure a lecture so that it's engaging, and also giving you the content that's necessary is my biggest challenge as a teacher.

One of the things that's really important to me as an educator, is that you can't just teach them content, especially in senior level classes, you need to teach them job skills, you need to incorporate into that how to communicate. If you're going to have presentations, you need to not only make them do presentations, but you have to provide feedback to those presentations and give them the opportunity to present again and fix the problems. It's not just good enough to say, ok do a presentation. Well what are you going to learn from that presentation besides the fact that you get nervous when you stand up in front of your classmates. That's something that's kind of a given. But how can you, as an educator, encourage learning during presentation. The one thing that I'm doing this year that I've never done before is peer-evaluations of the presentation and student-let feedback and discussions – so giving the students an opportunity to really think critically about what that person did well or what they could do better, and knowing that they are going to get that same feedback from that person at another point in time, I think that helps.

What tenure looks like here

[Teaching is] probably the number one thing. The thing they tell us over and over again is you have to tell your story. Let's say you get a bad student evaluation in a class

one semester – you have to talk about why that evaluation happened, what you did in your syllabus and structure of your course to change the outcomes going forward, and you have to address it in a dialog. We have these faculty merit sheets we fill out every year. That's mostly a way to build our tenure package, but you show progress. You show, ok, I didn't do so well this semester, but that's ok because I made these changes and look how much better it got in the next year I taught it.

We use our student evaluations to directly change the concerns. This past semester, I had an incident of cheating, and I got nailed, I got ones out of five from two students, ones all the way down the line, and there's nothing I could do about those kids, so you kind of have to throw those evaluations out.

But then you look at things like – one of the things I ranked low this past semester on student evaluations is 'clearly defined expectations,' so I'll address this next semester by doing things like, I'm going to incorporate rubrics in all of my assignments. Providing templates for the style of the report, which I thought I did, but maybe the students didn't have access to it, and use it more appropriately during class time so they knew how to use my template. Just discussing that – how you improved, and then hopefully you show improvement, if I don't show improvement, then I'm in big trouble, but I think overall, I should be fine. Other things like 'enthusiasm' and 'dedication to the students,' no problem there, but finding ways to tell the story that shows you're evolving and improving as an instructor is really important.

Our department chair is expected to come and listen to our lecture at least once a semester. And we can invite tenured faculty that are in our field of interest. I might ask one of the tenured faculty in [other disciplinary] engineering to come and talk about the relevance of the concepts or something like that, so that he can say, technically she is doing a good job of introducing some of the key components into her class. I'll just invite them, I'll tell them to observe a lecture that they think is relevant to their area of expertise, and then they'll write up a half a page document on my ability. And those are basically the ways that we are judged on our teaching.

[In terms of research,] I think, if they were going to put a number on it, it would be some kind of publication per year. I think at a place like this, what that publication means is very different than [Postdoc University]. We were working for years and years

to get a Nature publication. We didn't end up in Nature, but we got into Scientific Reports which is a second tier of Nature – that took four years of crazy hard research, forty to sixty hours a week, four people working on the data collection for a single paper. So, the expectation is not the same in terms of the type of publication. But I think they would like us to publish every year in something, it could be a conference proceeding.

We did [a conference paper] last year with a senior design project. I thought it was perfect because it was student work, the students were driving the project. It was a lot of advising, revising and editing of the paper and getting it to the right format, but the data and the content was student driven. We got published in a conference, and to me this is the demonstration of success for someone in my position. I think that type of paper, if I could do one of those every year, I would be all set. My goal is to take those and submit it from the best senior design project every year. But then also have some basic research-related project going every year. If I can get two, maybe three papers related to my core research focus in a more classical journal article, my goal is three of those before I got up for tenure, I would feel really good about my package.

[And then service,] mostly service to students. Advising, I have 40 advisees, so I work with them on their schedules. Again, I teach mostly seniors, so I do a lot with them in terms of resumes, career readiness, letters of recommendation. Then the other piece of service would be serving on committees. I've served on a college committee, a department committee, and a university committee this past year. Three committees, that's a lot. That's probably the most you'd serve on. But you're usually supposed to be always serving on at least one.

Other Thoughts

I think what really drew me in was the advertising of the university as a whole, and what they sell to the students, so paying closer attention to the admissions package of what the students are offered and the types of classes and the types of interactions. The fact that they commit to 20 students a section – no class is more than 20 students. I've never seen that in any of the experiences I've had. And I think that that's something really special. I know that's something that's challenging because we don't have a huge faculty, and our program is growing and it's hard to maintain that number of 20. But

there's a big difference when you have 20 students. That means I know exactly what's going on with every single one of the kids in my class.

5.2.9 Narrative 9: Richard Vine

Richard Vine in an assistant professor at a Doctoral University: Moderate Research Activity. At the time of the interview, he had been in his position for a little over three years. In this narrative, Richard describes his balance as a faculty member, including that he enjoys both his institution's shifting focus to research, as well as the more relaxed atmosphere and comparatively lower expectations for tenure.

How I got here

My dad was a high school math teacher for 36 years in [hometown]. I had him twice during high school, and it was just always really emphasized that education was important. Both my parents were educators. My mom had taken some time off to raise us kids, but it was always just kind of – it's important and you're going to college, somewhere, for something. Period. When I was a kid, my dad sold pencils to his students for a dime apiece for my college fund when I was growing up. Kids would forget to bring supplies to class, and he had this little side gig where he was selling them, and even as a kid growing up, we'd see his one of his former students at the store or something, and they'd be like, "oh [Richard], how is the college fund going? Boy, I must have contributed like fifty bucks to that college fund."

It was just always a thing that I was going to go. So, I [went to Undergraduate Institution, a Doctoral University: Highest Research Activity], and probably I was one of the only people that I know, that didn't change my major the whole time. That was it, I just liked it. And during that time, I was doing pretty well at it, and really wanted to, at that time, be a faculty. Or kind of knew that I wanted to do research, and I also liked teaching and interacting with people.

I had been, at that point, a lifeguard and swimming instructor during the summer for five or six years. I liked teaching, and I also really liked the really nitty-gritty research-y, engineering type stuff. I was like, ah, it would be really cool to be a professor.

So as an undergrad, you have no clue what that really actually means. It's just kind of a thing. Like, hey, people have these jobs, without any clue about how to possibly get one.

Even when I was [at Undergraduate Institution], I didn't do any research, I didn't really interact with any of the research groups. I mean, I talked to a few faculty about doing it, but I was too busy with music, and it just never really materialized. But I knew that I wanted to go to grad school, and I had met my now wife, and she was wanting to go to grad school. And luckily, mostly based on her motivation and fortitude honestly, we both got into [Master's University, a Doctoral University: Highest Research Activity], and that was kind of the next step. I was still going into [Master's University] thinking, yeah, it would be really cool, and [Master's University] is a great school, and maybe I'd have a good shot getting into a faculty job, if I got my PhD there.

And it's funny. I look back, I got to [Master's University] and my whole perspective changed. There's a group of about five professors that are seriously crazy world-famous, like Academy of Engineering, fellows of every society. So, I worked for one of those guys, and the way that we had it, it was just all those research groups in one giant room. This was like, everybody is just in this one giant room, all these people who are graduate students and postdocs and research scientists and there's like 50 of us. And I was the only American student in that group.

It was like the United Nations in there. I don't want to say culture shock because it wasn't really a culture shock, but it was totally different. I mean, India, Pakistan, Bangladesh, China, there was one Canadian guy, so close enough, one kid from Japan, a few people from a couple different countries in Europe, one from Austria, one from Switzerland, and Korea, obviously. I can't even name them all, you know what I'm saying. And some from countries that don't necessarily get along, like India and Pakistan, but everybody got along. It was really great.

Also, there were some of the absolute smartest people in the world, and so I felt like an idiot, basically. I don't want to say I was "top dog" at [Undergraduate Institution], but maybe close. I probably had the best GPA and what not and went off to [Master's University], and then I was just like, wow. People that were in that group, I'm still friends with a lot of them, there's one that's a faculty at [Elite Doctoral University: Highest Research Activity] now who just won the presidential early career award. There's some

that are big managers at [Big Tech companies] and faculty at various other universities. They just kind of went off everywhere and became important people. It was kind of a rude awakening, but it was a lot of fun, and I got my master's degree and I think I did well, and still keep in touch with a lot of those folks.

My wife and I both went to [Undergraduate Institution] for our undergrad and then we both went to [Master's University] for our Master's. We were getting our master's at the same time and she got a job offer at [Food Company] down in [another State]. And although being at [Master's University] was an awesome experience, because it's one of the best universities, right? We just couldn't see how we could possibly stay apart like that while I take three more years and finish my PhD at [Master's University].

I kind of always wanted to get my PhD. And I initially went to [Master's University], basically saying, yeah, I want to get my PhD. But then, her landing her dream job offer at [Food Company] was one of the factors, and the other factor was that I was doing computational and theoretical work. Just a lot of computer simulations [and] I just kind of was getting to be sort of over sitting at a computer all day. And it was really interesting, the physics of it, and the group members, everything. It was awesome. That was another factor though, because I was thinking I want to get my hands on some things, and actually build something and test it, and all that.

At that point I wasn't necessarily thinking I was going to be faculty even though I still wanted to be. By then I had realized how hard it is, right? How basically everybody wants to be faculty! You apply to a position and you're competing with like 200 other people. But then, basically my wife got the job offer and I just felt like maybe it was a good time to kind of move. [PhD University, an R1 Institution], when I first went there, I started in 2007, they just built this huge engineering and science research lab. A big four-story thing, brand new clean room facility and all this other fancy stuff, so they were really starting to make this giant push. They had gotten like 300 million dollars from [Tech Company] and the state to make this big giant push to become tier one. They are now, but at the time, it was kind of like, well, there's a lot of cool stuff here and it's improving and they're hiring, it's a good time to go there and I got to go through grad school with my wife working a good job and making a lot of money, so I didn't have to be the super poor grad student.

It was exciting and fun, and going there, I decided again, hey I do want to be faculty. I'm going to try and go for it. I am going to publish, participate in these conferences, really try to build a network and all this other stuff. So yeah, maybe I spent a little bit longer doing my PhD than maybe some people, but whatever. It was a good time. And unlike most people, I would say, who at some point [say] "God, I want to quit," I never had that moment. Not really bad, anyway. I really liked everything, and I got to do some teaching.

When I joined the group [at PhD University], the postdoc in the group was [Sam], and he is one of my best friends now. As a postdoc, [Sam] was pretty much looking for faculty positions during that time, while I was starting ramping up my PhD. It turned out that we became really good friends and, so I knew everything that he was going through in terms of searching for faculty positions and finally getting some offers.

Now he's a faculty at [PhD University]. But it was really awesome and eye-opening to have that experience and to be able to witness first-hand what actually happens. And then have him help me when the time came, I started sending out applications about when I was getting ready to graduate. Have him help me put together my application package and all that stuff. My PhD advisor was also very helpful and supportive. That first year, it was a good year for faculty applications because I think I sent out 50 applications, which is a crazy number. I hadn't graduated yet, I graduated in December 2011, so I was graduating during the cycle, so I was semi-finalist, or whatever you want to call it, at a couple places. I applied anywhere and everywhere. The only places I did not apply would be positions where they were ultra-specific about what they were looking for. But if there was any even remote area of overlap, I applied. I think I probably even in some cases applied to some institutions that weren't PhD granting. Maybe a couple here or there, but other than that, it was everything from your [Current Institution] to your [generic state school]. But no interviews or phone interviews or anything that time.

What ended up happening was that I stayed at [PhD University] for a postdoc, the reason primarily being that my advisor had moved to [another Doctoral University: Highest Research Activity] and basically still had money at [PhD University] that he couldn't move with him. So, there was money available to pay me and I stayed to do

more research and run the group, which is a pretty great experience. More or less run – watch over the remaining grad students to try and make sure they're doing the right things, since [my advisor's] in [another city].

And so, it was that next year, I sent out a few more applications and got interviews at [two institutions, one at R2, and one at Current Institution, a Doctoral University: Moderate Research Activity]. I got phone interviews. I was also a semi-finalist at a couple places, but the funny thing is – the phone interviews, I guess I excelled at those. In terms of – I got actual on-site interviews after both phone interviews. So, everybody who gave me a phone interview, I guess seemed to like me. It was awesome, you know. I got to go visit [an R2 Institution] and see what they're doing out there. And come out to [Current Institution], which I was mostly already familiar with from having grown up not that far away. My parents only live a four-and-a-half-hour drive [away]. So, they were thrilled when I got this job offer.

I had two offers. For my career at that point, [the other school] would have been a better move. I mean, the start-up package was better, they had just built a new clean room. A smaller clean room, but a brand new one. It's a minority serving institution. But the problem was it's in [US city where R2 Institution is located], frankly. My wife is a food-process engineer, and they paid for her to come over for [a visit] as well. But she just [said] there's not going to be a job there for [her]. Not in food. They have a nut processing plant or something like that, and the campus is nice, but we couldn't see our family living there.

In contrast, [Current City] is like back home for me, effectively. Like I said, I love the [area it's in] and even though there's still growth happening here, I mean [the other institution where I got an offer], as part of a [state university system], they were kind of undergoing something on a smaller scale than [PhD University], but huge growth and research expansion. But [Current Institution] has been doing that as well. It's, again, smaller scale than [PhD University], but growth is important. So, I saw growth and opportunities in both places.

I thought [the interview] was a good experience. I felt very welcome and at home, probably in part because I was really excited to come here and have the chance to be a faculty member. Basically, it consisted of a 45-minute research seminar, then personal

interviews with most of the faculty, some tours of campus and labs, then the final meeting was with the dean. All-in-all, it was about two full days. It was basically exactly the same as the other place I interviewed as well. I didn't have to, and we typically don't make people do a teaching demonstration. I would say that in my own opinion, you can generally tell whether someone will be an effective teacher by the presentation and personal skills, both of which come out over the course of an interview.

I saw a lot of good positive things going on at [Current Institution]. I mean, the opportunity to move basically back home, and just a better probably fit for our family and for my wife to find a job. She had a job offer before I did. It was a fairly easy transition in terms of – the other thing that was hard was that she was pregnant with our second kid at the time. So, we were like, ok we are going to have to make sure this transition works out in terms of healthcare and making sure that everything is taken care of on that end. So that's sort of the path that led me here.

That second year of faculty applications, at that point, I was basically thinking, well, if I don't get any this year, I'll go work at [Tech Company] or something, or wherever. I guess, some people just don't get that lucky, but I guess I got that lucky. Of all the people I know personally that have gotten positions, most people don't get a whole slew of options. I was lucky to get two, frankly. I mean, a lot of times you're lucky to just get one. I've been happy with it.

My preparations for teaching

My parents were educators and I've always liked teaching. I just always loved teaching. I taught trumpet lessons and I taught swimming lessons and that was just always a fun thing for me. At [PhD University], I didn't do a lot of teaching. I never even got to be an instructor for a class. I was a TA for a class and I gave quite a few guest lectures or substitute lectures for my advisor and some other people's classes. When they had to travel, if they had to travel, then they'd be like, hey, can you give this lecture on topic X, you know? So yeah, it was kind of known that I was seeking that out and trying to gain some experience standing up in front of a classroom and being able to say that I taught part of this class. That's usually what it was.

It's funny – I go through all these faculty applicants now, and I basically judge their teaching and their research and sort of the other intangible aspects of their applications, and I look at the teaching and I'm like, I would have given myself a terrible score. That's obviously not as heavily weighed.

Graduate programs aren't always preparing someone to be a teacher, right? But in my experience, most of the time, if you think you want to do that, and you want to try and get some experience in that, there's usually that opportunity. I think there were people at [Master's University] doing that. I know at [PhD University], I got enough of an opportunity, I guess. It seems that there's always those opportunities. And in fact, at [Current Institution], graduate students can go to the [teaching center] workshops, too. Some of them do. If they are interested in that, that's something to put on a resume, or a CV, that says I was a TA at least, and this is basically the bare minimum as far as I am concerned. And other than that, I personally don't care too much. I do evaluate it, and I give them a score on a scale from zero to ten on how experienced I think they are in teaching, but as long as it's at least a three, that's probably enough. I mean, if they've been a TA and their application is well written, then I expect that they are a good enough communicator.

My early days as a professor and what I am doing now

I like doing teaching, I like my balance right now. Which is, right now I only teach one class a semester. We have a fraction of our department who essentially only teach, and we have a fraction who do research as well. So, the workload distribution is somewhat variable. In terms of teaching. I only teach one class a semester right now, since I'm considered fairly research intensive, which is nice. I usually switch off an undergrad class to a grad class by semester but this year, I only taught grad courses actually.

Basically, the president of the university wants us to become a metropolitan research university of distinction, or something like that. They want us to be doing more research. So, the emphasis has been shifting to graduate programs, graduating PhDs, but the irony in that is that I am not sure a lot of the administration and leaders at the state

level know what that entails – I mean in terms of how many resources it requires to run a successful PhD program.

I have four PhD students in my group right now. They take up way more time than it takes me to teach my class. In terms of resources and time, it's like, you guys should be graduating PhDs but at the same time – oh, but they're just an afterthought, right – you should be graduating more PhDs. The emphasis has shifted, or is shifting, and that makes it hard for a lot of the folks who are more teaching intensive. I like doing research, and that's what I wanted to do when I came in to it. Most new faculty in engineering, that's their intention. That shift [towards research] does not bother me whatsoever, but if you haven't been doing research for five or ten years, how are you going to restart doing research? What are you going to do? That's challenging.

[Current Institution] is hugely supportive of evidence based instructional practices and achieving better outcomes with newer techniques. There are several very large grants, like NSF grants that are supporting evidence based instructional practices, particularly in engineering and sciences, or in STEM, and that is a huge emphasis. So, the fact that I've done it a couple times or tried it, or starting to develop those materials and look at what's happening in my classroom, and at least try it, that's seen as positive basically.

Our dean is actually very aware of who's doing that. Surprisingly aware of it, somehow. I don't know how or why, but she will, in college wide meetings will call out people who are doing some of those more interactive learning type style or techniques or flipping the classroom in their classes. And she'll push toward that, and be like, any of you who aren't doing it or are unsure, or want to but are unsure, talk to some of these folks.

What tenure looks like here

I'm pretty sure I'll get tenured at this point. The dean said something a few weeks ago – I mentioned something about tenure, and she essentially said you're getting tenure, don't worry. I'm like, well, ok, I mean I'm not too worried. I never was worried about it though. There is this really good article in The Scientific American Blog: "The Awesomest Seven Year Postdoc" written by Radhika Nagpal in 2013. Also titled "how I

learned to stop worrying and love the tenure track faculty life." She's basically saying, do what you want to do, do your best, view it as a time to have fun, and if you don't get tenure go do something else fun. It's not like it's the end of the world if you don't get it. I'm not too worried about it, and I never have been too worried about it. It's a really good article and I do take that to be my view on it.

What we do at [Current Institution is] we submit an annual evaluation. It's actually really nice. They're helpful to us in terms of making us, basically, make our tenure portfolio, so that at the end we're not scrambling to figure out what we did five years ago and mark down every detail. And that's about it. Every year you get a letter from your tenure committee and the dean, saying you've done this, and this, and this well. You need to work more on this, and this, and this. Making great progress, or not.

I get a really high rate of return on my course evaluations too, and all of my evaluations are generally good, so I don't know. I haven't had any comments about teaching. We have [a teaching center] on campus, and they offer workshops and stuff, so I've gone to a few workshops and taken a week-long class with them. I think I'll get the feedback, oh take more [teaching center] workshops, but other than that, teaching is ok. So, for me, it hasn't really been an issue.

I remember another faculty member was driving me around during my interview, and was like, yeah, the bar for tenure – if you get one pretty good grant as PI before you go up, you're probably going to be alright. So that first year I submitted several proposals, and literally the first one I ever submitted as faculty, I got. I submitted it in September 2013, and I got it, which was pretty ironic. And so, I was immediately feeling pretty good about things, and then – I remember very specifically, I was talking to that very same faculty and he said, don't think you got tenure in the bag already. I didn't actually feel like I had it in the bag. It's a good launching point, but it's not all I'm going to do productivity-wise. I won't be like, alright, I got it in the bag and that's it. I think the process is fairly straightforward, and honestly maybe the bar is a little too low in a lot of ways.

When I go up for tenure, I think they'll come in and observe [my teaching]. But mostly it's based on student evaluations. Every semester, I make my students in my class do their evaluations by cleverly offering them all a bunch of extra credit. Which then they

all do the evaluations, and then they all get extra credit points, so it really doesn't get them much except for making them feel good.

I am a big grass-is-always-greener kind of guy. Of course, we have problems. There are faculty that don't get along and always seem to be at each other's throats. We definitely have issues with research and administrative support. Even though we are trying to grow research programs, it's [Current State]. When I came here, you know, my advisor was like, hey don't forget, the state of [Current State] has the same number of people as the city of [PhD city], like in the whole state. So, the resources – there's not a lot of money available and they don't put a ton of money into it. So, there are definitely still some challenges. But at the same time, the expectations are a lot lower. My wife and I ended up having a third kid! And then, it was like, ok, now what?

But it's nice that the bar is not set ridiculously high. Sometimes I obviously feel like I'm totally swamped, but other times I feel a little bit stressed, or more relaxed. It's been fun for the most part. I mean, I guess the great thing for me about faculty is the flexibility. That's the main thing. You work more hours at lower pay, but at least they can be flexible. I have a good friend, one of the faculty in [another department] is a good friend of mine now, and we go fishing and camping together, and we can – when we have the opportunity, we can take a Friday off and just ditch out of work and go fishing, which is awesome to me. And so, it's been about what I expected, honestly.

I didn't desire it [the lower expectations], I think I fell into it. I always have pushed myself pretty hard, and had high expectations for myself. So, it's more of like falling into this position and my expectations for myself kind of exceed what they are from the university side. It would bother me if I didn't want to work hard and was being pushed, pushed, pushed anyway.

Other thoughts

Let me tell you this: I [have] to be honest about [Current State], it doesn't seem like there are as many people around that are highly driven. I mean, most people, even in their normal jobs do that kind of stuff. I mean like, take some days off. People love their time off here. They love taking off on a Thursday evening or afternoon to go camping for a long weekend or something like that. That's just the pace of life here. My wife and I

talk about this with a lot of our friends. Most of our friends are a little more like us, and it's just a common theme in everybody, apparently, that works around here, where it seems like there might be a percentage of people who aren't quite as serious about their job. Like their life is not their job. Which is, in a lot of ways, a good thing. And so, it reduces stress in a lot of ways, but like I said, sometimes it adds to stress as well. But no, I haven't had a problem adjusting to it. Not so far.

Historically, [Current Institution] has I think too often been used as a stepping stone. People get into that faculty position and then move up to somewhere they want to be. I don't view it that way. I mean, I love it here. And I believe a lot of the folks who were hired around the same time as me are that way too. I don't think that they viewed it coming in as that. There are enough good things going on and enough excitement that I think they knew what they were getting in to and they are still happy to be here. We know that we are not R1. So, we are looking for people who are going to come in and be good at what they do and a good asset for us and hopefully aren't just going to jump ship after two years.

5.2.10 Narrative 10: Brandon Oakley

Brandon Oakley is an assistant professor at a Doctoral University: Higher Research Activity. At the time of the interview, Brandon had been in this position for just over three years. In this narrative, Brandon describes how his own undergraduate education inspired him to give back as a professor focusing on undergraduates. Brandon also describes his graduate school experience which made him recognize his desire to educate graduate students and lead a research group as well. In his current position, he is able to dedicate his time to both undergraduate and graduate students while also pursuing his technical research interests.

How I got here

I did not consider becoming a professor at all during [my undergraduate years]. I did not consider going to graduate school. And [my department was] in a really weird situation where for spring semester of my senior year. There were a lot of professors on

sabbatical, a lot of professors who, I don't know if they had course buyouts or what, but the number of senior year elective classes was at an all-time low, and definitely, certainly in the areas where I was interested in. I liked my [engineering] class sophomore year. It wasn't necessarily what I was going to go into. And there was an advanced [version of the] course that was being offered that semester.

So, I stopped by the professor's office to talk about it, and by the end of our conversation, the conclusion was, "No, you are not prepared to take my [advanced] class. You do not have the prerequisites, but you should go to graduate school. And if you go to graduate school you will not pay, because you can get an assistantship."

I kind of got bit by that bug and realized I wasn't ready to leave the university and stop learning in that context. So, between Thanksgiving and Christmas I managed to study for the GREs, put together some applications and took the GREs on New Year's Eve of that year, just in time. I managed to get an offer at [Master's University, a Doctoral University: Highest Research Activity]. I had a research assistantship and needed to go through some personal growth. My thesis didn't get published, I kind of burned out, took the master's and took a job.

For the first year I think I was giving the job a chance and learning the business. And it seemed like everything I wanted to do to make our product better, I wasn't given the latitude to do. Ultimately my job consisted of firefighting. As an engineer it was not really fulfilling. And I also noticed that a lot of my engineering colleagues just did not know their engineering skills. We'd have parts that were breaking, and instead of calculating the stresses on those parts, and in comparing that to the fracture stress or yield stress, they'd just throw another rib in there and hope for the best.

I got pretty frustrated and when my wife got her master's degree, I was a free man, professionally speaking, and we were getting out of there. So, in my wife's final year of her program, I was applying to graduate PhD programs with the goal of becoming a professor and giving undergraduates a good education.

I went to [PhD University, a Doctoral University: Highest Research Activity] and worked on a project. It was good, I was very proud of the work. I was very fulfilled and satisfied by it. And one thing that happened at [PhD University] is I gained an appreciation for graduate education, which hitherto fore I hadn't really appreciated. I was

really intended to be focused on undergraduates only, and I had really thought of going to a teaching school. By the time I graduated, I thought it might be nice to have some grad students of my own someday. So, I started looking for postdocs where I could really burnish my research credentials and get a few good publications while I looked for a long-term teaching and research position.

A position popped up with a very well-known [researcher in my field]. [I decided to] apply for it and, and culturally speaking, getting to live in Europe for a while would really give me a broader perspective and my wife and daughter, I had become a father by that time, give them a broader cultural perspective. It was a very different experience working for a more established person. I learned some very good things from [my advisor]. He did not have a lot of time, which is completely understandable, so I did not get a lot of personal mentoring. His goal was to teach me to be autonomous, and that was really trial by fire for me. But I think he did a good job mentoring me with the time he had available. I was just part of a large research group, and so I saw what it looked like.

One thing I hadn't counted on about [European Country] was the immigration system. As a husband and father, it was very hard for me – I wanted us to be together as a family, and by and large we were. But I had to put a lot of time and energy into navigating the immigration system and getting my wife and daughter there in [European Country] legally. And it really took its toll on my research productivity. We managed to get a conference paper and a journal article out of my work, but it really wasn't what I hoped for in terms of what I would have produced as a postdoc.

About a year in I said I'll go ahead and apply for faculty positions the first round, and [my advisor] gave me his blessing to do that because I felt I needed the practice. My hope was that I'd get maybe one job interview out of it and have an interview experience so that the second year when my contract was about to be up, I'd be more competitive, and I wouldn't blow the interview if I got one when it really counted. What I hadn't counted on was getting offered a position through that experience. [Current Institution, a Doctoral University: Higher Research Activity] popped up on my radar screen. Actually, my wife found it because she was really frustrated about some of the difficulties of living in [European Country] and the immigration experience. She said, "You need to apply more places. Why don't you-" She gave me a list.

While we were separated due to immigration reasons, on New Year's Day I put in an application to this faculty position at [Current Institution], which in many ways looked a lot like [Undergraduate Institution]. And I got the job. [My postdoc advisor] was very gracious about me taking the job after having been there just under a year. I used the remaining time as a postdoc to work as hard as I could. We did manage to get what I was working on published after my arrival at [Current Institution]. For family reasons, being back in the United States was good for us.

Conventional wisdom, the [R1] wisdom, would have said no, turn it down, stay in your postdoc, get more publications, get more experience. I had a friend who was a postdoc at the same time who said, "I would never go there because it's in [Current State]."You know, said, "A [Doctoral University: Higher Research Activity] is a good stepping stone." There were a lot of people who said, "Well, [Current Institution] is not really where it's at, you need to be at an [R1] school. You'll never get good students unless you're at an [R1] school." My reservation about going to a [R1] is I felt like I wouldn't be able to do justice to undergraduate teaching at a [R1], and quite frankly I felt I probably couldn't handle the pressure. What I've realized now is I probably work just as hard as somebody at a [R1] for less research output. But I decided to take my chances and by and large it's been a very good experience.

[I had a] wonderful advisor [at PhD University]. I was his first student, so this was the cauldron of assistant professordom. And he treated me very, very well, he always respected me, and he always put my interests before his own. I asked him about [accepting the job offer at Current Institution] and what he told me was, "Don't worry about it, go ahead and go to the [R2]. When I was applying for schools, I applied to [R2] schools and if I'd gotten the offer there instead of [PhD University], I would have taken it. I would have not held out for a better offer," is what he said. Better offer meaning [R1], because at [PhD University] the goal is for your PhD students to become professors at [R1] institutions. I am not a favorite son there the way [another former graduate student] is for instance who is a professor at [an R1 University].

My preparations for teaching

During my final year at [PhD University] I went to an NSF career workshop that was really intended for faculty, but one of my buddies said we have got to go to this thing. They had a panel of NSF CAREER award winners, one of whom who had moved to [where I got my PhD] from [Undergraduate Institution]. So, he won a CAREER award and that was his ticket out.

As a proud [Undergraduate Institution graduate], that felt like a betrayal. I was really upset that somebody would win a CAREER award and then leave [Undergraduate Institution]. But I think what it boiled down to is he was probably not willing to make the commitment to undergraduate education that [Undergraduate Institution] expects. It's a school that manages to thread the needle pretty well and have faculty who are producing as much research, as many publications, pulling down as many grants, as someone at [another R1 Institution]. But, I think they affirm that commitment to undergraduate teaching, and I felt like the undergraduate teaching that I got was very, very good. And that's what I try to provide to my students.

I think it really started from just getting excellent teaching at [Undergraduate Institution], and getting the sense that you have to learn this, this is important, this is not just a rite of passage. You're going to learn this, and you're going to use it in your career, and here's how you're going to use it in your career. That made a tremendous impression on me; that was modeled for me so well.

I did have a little bit of a teaching experience at [PhD University]. I substitute taught for my advisor. Being at [PhD University] he had to travel, and he had places he needed to be. So, I covered for him several times. For PhD students, [PhD University] requires a one semester teaching practicum. I really wanted somebody else's input into my professional development, so I approached a different professor [other than my advisor and said], "Will you be my teaching mentor for the teaching practicum?" And I wanted to do a different class because I think I'd already substitute taught for my advisor once, [and] I knew it would happen again. So, I knew I'd get some experience with that class, and I wanted to have a different class under my belt, so I wasn't just going into it with one class experience.

Another graduate student had been doing a workshop for K-12 teachers through an NSF-sponsored math/science partnership. During the second year they needed an additional graduate student, so he pulled me in and my advisor said I could do it and I wouldn't lose my assistantship. So, I'd make a little extra money, (I was a new dad, a little extra money was helpful). It also gave me an opportunity to work with K through 12 teachers. My friend was the fifth-grade science content advisor. He said, "We need a fourth-grade content advisor, will you do it?" So, I went in to interview for the position and I came out being selected as the fifth-grade math content advisor, which was great. Because the science content advisor has to order a whole bunch of supplies and make these whiz bang demonstrations. And the math content advisor just has to use his brain.

At the same time as this happened, something was kind of forming in my mind about STEM education. And this is why I'm the most feared and loathed and reviled professor in [my] department [at Current Institution]. It's because of the M [in STEM]. People don't understand fluid mechanics and they don't understand fluid mechanics not because they don't understand that there's a relationship between pressure and flow that you can model with an equation, it's that they don't understand the math. It's not that they can't memorize the equation.

I had a good time with these teachers teaching them the most fundamental things about mathematics. Trying to help them have a deeper understanding of mathematics, and it was hard work, it was stressful, but it was a lot of fun. And I really enjoyed it. So, as I write NSF proposals, I normally try to center my broader impacts around doing similar kinds of things. And I also bring that mindset into the classroom.

My early days as a professor and what I am doing now

Here I am [at Current Institution]; we do graduate education. Graduate education is very important to me. I currently advise three wonderful graduate students, one who's a pretty recent addition to my group. They're working hard, they're intelligent young men. I also have a number of undergraduate volunteers. I really enjoy advising undergraduate research. But what I'm coming to realize is, you don't get a lot out of it in terms of productivity.

At [Current Institution], undergraduate research is our special sauce. I think we do undergraduate research better than any other school I know of. But after three years I only have one peer reviewed publication with an undergraduate researcher as lead author. It takes a lot of time and energy to complete a bachelor's degree, so no matter how smart you are and how good your intentions are, the amount of time you have to devote to research is rather small.

I feel like I'm extremely fortunate to have been able to attend both of [my] graduate schools. It gave me a really varied perspective. As far as for my own satisfaction, I felt like I would be more at home at a school that was like [Master's University] than a school that was like [PhD University]. I chose not to apply to [a couple R1 Institutions] that had open positions at the time. I'm very happy to be at the kind of institution where I am where we have a commitment to undergraduate teaching, where it's not like, "Oh no, I've got to go teach class. Oh my goodness, I was just getting some work done." I'll admit that I still feel that way sometimes because, when you're a researcher you want to get research done.

I felt like [Master's University] and especially [PhD University] did not have a strong enough commitment to undergraduate teaching. Here, I think the balance is off the other way. I don't think we support our graduate students well enough. And I guess once I get tenure I'm willing to be the man with the megaphone about that. I think we need to move the other direction as an institution to where we are more about where [Undergraduate Institution] is, where we expect our professors to do good research and we're realistic about what that takes.

I think we could do a lot of things to improve our graduate program, and the sacrifice to our undergraduate program would be negligible or at least at worst minimal. That's my political opinion about my institution and where we are. At graduation we have about half a row of doctoral students. That's way too few; we should be graduating more doctoral students.

I teach two classes a semester. And every single class I teach is a serious workload class; exams, large sections most of the time. Except for the graduate classes, those are small sections. I'm not teaching seminar classes and blow off classes. I've got a tremendous teaching workload compared to [an R1]. Actually, a colleague at [an R1] that

I met at a conference recently said, "I don't know how you do it. How do you have a research program at all?" This shows a little bit of the [R1] mindset there.

The teaching culture here: number one, teaching two classes is somewhere between 50% to 150% more teaching. I'm okay with doing less research and doing more teaching. That's something I'm okay with. But the teaching culture here is also, there are many faculty for whom teaching is all. Research is for your spare time. I don't think [my] department feels that way, but in some other departments there are faculty who said, "Yes, I did research to get tenure and now I'm done. If I do any research at all, I'm going to do research in engineering education," which is a good, worthy field. However, that wasn't their training and expertise, so I think what they were doing is maybe they plot some graphs on test scores and maybe, maybe do a little bit there. But, I do hear a little bit of this, "I'm just really about teaching."

[But I don't think] you shouldn't be ignoring [the] formation of graduate education, and use undergraduate teaching as an excuse to work less. Or an excuse to keep polishing [lecture notes or something for class] that you can already see your face in. I think there's some who would say, "Well, you should be redoing your teaching notes every semester. You should rebuild them every time, you know." And the reality of that is the only way that I see that you could pull that off is to give up on graduate education, to give up on publishing. And some people have made that choice, but I think they're outside of my department. Everyone in my department does research.

Another thing about the teaching culture here, and I like it and dislike it at the same time, is that we're very available to our students. So, students can just barge into your office at any time and you can talk. And it's great. I really like talking to undergraduates, and getting to know them, helping them understand these difficult engineering concepts. But you can let that get to the point where you don't take good enough care of your graduate students.

So, I'm three years in, I go up for tenure in 2018. I've been teaching both graduate and undergraduate classes, more undergraduate classes than graduate. I enjoy teaching.

What tenure looks like here

I think I knew that the balancing act [of being a faculty member] was going to be hard, but I had no idea [of exactly how hard]. It's incredibly hard. But I had a chance to do something easy with my life, [when I was in industry], and I hated it. So, if that's the price I have to pay, bring it on. I just got reviewed, and so we have two reviews between hire and tenure. The second review, what that forced me to do is go back and look at my teaching evaluations. I'm below average. The average is 4.2 out of 5, the teachers are well liked, and I'm in, cracked four in a couple areas and I'm in the high threes in others. I don't think that's terrible, but that came up in my review.

But I teach [hard engineering classes] which [do not make me the] most popular engineering professor. But I love the material, I'm excited about it. I'm never going to win a teaching award; I'm never going to have the highest teaching evaluations. I believe it's because of the courses that I teach. And students who really want to learn love me. Students who are becoming engineers because their uncle is an engineer and said it's a good career and are just trying to get their degree with as little effort as possible hate me. So, I was completely unprepared for the level of vitriol that I saw in those teaching evaluations.

As far as a balancing act, I try to do the best job I can in teaching with the time I have to devote to it. Somehow, I have to be a good teacher and I have to be a good research advisor, and that's not negotiable. I am not going to be a bad research advisor so that I could be a good teacher. I am not going to let people get run out of our graduate program financially because I didn't write enough proposals to give them assistantships. It still might happen. I can't write nearly as many proposals as I want to.

My goal in my [class] is not to be the most dynamic and beloved professor. It's for them to learn. And I have three 50-minute periods a week this semester to do that, and maybe a little more if they come to office hours. And that's all the time I have. I don't have prep time. I'm not going to spend 20 hours a week prepping my class, because I couldn't teach [my other class], for one, and my research group would wither and die, and I wouldn't be taking good care of my graduate students. So, I prep my notes and if there are mistakes I deal with them. But I'm doing the same thing every semester, I'm not doing

demonstrations that take a lot of time and effort to put together. I try to do what I can when there are opportunities.

When I'm in the classroom, I'm committed. I'm prepared and ready and I give it the best I can. But I only have that 50-minute period and I try to make it count. But I'm not popular because I want them to learn math. And I'm not going to, I guess, entertain them more than teaching them to get better teaching evaluations.

I think the prevailing wisdom by and large is true, which is, “teaching may sink you, but it will never float you.” So, they're looking at research funding and publications probably more so than teaching, even though they talk a good game about caring about teaching.

Other thoughts

I was also involved in Graduate Christian Fellowship on campus [during my MS]. And professionally, not only was that important spiritually, but professionally that was also really important for me too. Because I got to know graduate students in other disciplines who weren't engineers, who had a different outlook on things. And there were a couple professors who came to that because it really is graduate and faculty ministries, so that, that wing Intervarsity Christian Fellowship really tries to - I think they've recognized the graduate student experience is more like the faculty experience than like the undergraduate experience. And so, they run programs for those groups together.

There was a professor in psychology who had gotten a position at [a Baccalaureate college], same metro area as [MS city], and he continued coming to the meetings because his friends were still there, and it was supportive for him and all that. I learned a lot from him and getting a perspective of people in the humanities and people who were committed to a faculty career in areas other than engineering.

5.2.11 Narrative 11: Molly Sanders

Molly Sanders is an assistant professor at a Doctoral University: Higher Research Activity. At the time of this interview, she had been in her position for about 6 months, however, she had been at her Current Institution for about three years. In this narrative,

she describes her graduate school experience and why she was drawn to teaching. She also talks about how the students are what drive her to keep going and innovate her teaching.

How I got here

I had an opportunity to teach - I was an undergraduate TA in college. I actually did my undergrad here at [Current Institution, a Doctoral University: Higher Research Activity] as well, and realized that I really liked teaching. At first, I wasn't thinking of going to graduate school, but then I heard a talk from the person who eventually became my advisor.

The research that he was doing was very related [to my interests], and so I decided, "Well, I'll go to grad school." I took about a year off and then I applied for grad school and went to [PhD University, a Doctoral University: Highest Research Activity] and ended up working with him as my advisor, with the intent that once I finished, I would get a faculty position so that I could teach.

Graduate school - I came because they guaranteed funding. I think if they hadn't done that I might not have gone because by that point I'd gotten a job in industry and I liked it, so it wasn't in engineering, but I liked what I was doing and there was room to advance, so, if [PhD University] hadn't guaranteed me funding I probably would have stayed where I was.

I came to [PhD University] and that first semester, we didn't start with an advisor, so they give those who they believe have the academic and the English capabilities TA positions. I enjoyed TAing. Part of me wanted to TA again, but part of me also said, "But, research is partially why I'm here, so being able to get my degree - if I don't have the time to do research, then it's harder to get out, and get everything done that I need to get done." My university - 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 think I was fairly angry. I was angry because I'm like, "Well, shouldn't you get training to teach?" And I have good colleagues - they both wrote their dissertations on education and looking at how graduate students are trained to be teachers, and I thought, "Why isn't training us to be teachers important if we're going to go into faculty positions? Because isn't that the point of going to university is to be a teacher?" And then finding out, well, actually a lot of the focus from administration and departments is on bringing in research funding, and so for a long time I was very frustrated by that.

I still am a little bit. The issue is partially culture. I think it's partially metrics. It's easier to measure productivity in terms of doing research as opposed to teaching, and also even though students complain about high tuition – I don't know how much of an impact it makes on the overall operating costs of the university, why research is so emphasized compared to teaching oftentimes. I think if I'd known as a student that this was the way this system worked, I probably would have been a bit up-in-arms. I knew faculty did research, but I didn't realize that the emphasis was so heavy on that.

[During graduate school, I] discovered that - I mean, research has its ups and downs, so you hate it and then you say, "Oh, no, I actually like it," and then you hate it again when things go wrong. I realized I do enjoy research, but I still wanted to focus on teaching. When I first finished my PhD, I ended up applying for positions everywhere. I just applied everywhere. Small schools that had teaching focus, large universities, so I applied to a couple tier one universities as well.

My advisor was working really hard to try and give me suggestions on places that I could apply. So, he knew I wanted to teach, so he was suggesting some more teaching-focused universities for me to apply to and try to make contacts there. He was very supportive. I never had any feeling that people were looking down on me forever wanting to do that.

I interviewed a lot of places. I interviewed at [a Doctoral University: Highest Research Activity], which is tier one, and I interviewed at a number of smaller, teaching-focused colleges, and what I discovered was that even the smaller schools were expecting you to have a research program. So even the schools where teaching was a focus.

I didn't go up and get a post-doc. I ended up being a research faculty at my [PhD] institution because it was the type of research that I was still interested in pursuing. We decided to have [my husband] look for positions first, and then we would see what sort of options I had at any places that he got interviews, and so he interviewed three locations. He actually didn't get offers, and one of them was [Current Institution]. He didn't get offers at any of them, but then [Current Institution] called back part way into the semester and said, "We're having someone retire mid-way, would you like a job?" He said, "All right!" And it was my undergraduate institution, so I loved it here and have really fond memories and my research is a good fit for some of the other work that's being done, so I thought, "Well, there might be opportunities for me as well," Which isn't true in some of the other places that he interviewed, so that's why we decided to come.

I became a research faculty. We came here, and I was excited because they had [my field of] engineering, which not every university does, so I was like, "Well, there are great options for me." There are people doing research in related fields to what my research is, so [I was] hoping there would be room. Took a couple years to actually get a tenure track position, which I started this fall.

At [Current Institution], because I was already here, the interview process was different. I came in, gave a talk, talked to some of the faculty, but I didn't do most of the other you generally would do, like talking to the deans and things like that.

My preparations for teaching

[During my PhD] I TAed for a junior-level class and what we did at our university was we actually taught recitation, so it wasn't a grading position, which at some universities it is. I would have them - I think one day a week, and I'd prepare example problems to go over with them that were related to the topics. I sat in on their class so that I knew what they were going over and then we could address it more in the recitation, and so we went over example problems. They'd come to office hours and work through homework, and that was generally what it is. I did grade projects, written projects.

I was an undergrad TA for botany. I also taught English conversation classes, so I coordinated a program and also taught small groups of people. I learned how to teach

phonetics to international visiting scholar's spouses, graduate students, and our class was free, so people would come and practice speaking. That was my teaching fix when I couldn't teach in graduate school anymore, was I'd teach English.

Going back [to graduate school] I would probably have done that [teaching] certification just because I think even though it may not have been useful for landing a position, I think doing the best by the students, it would still have been a useful experience, because you have to take some education classes. Which, now that I'm here [at Current Institution as an assistant professor], I'm never going to have a chance to do that, so my best chance would have been to do it in graduate school and just trying to work it in in the midst of my research.

And pretty much, the TA's, we [didn't] get any training. We're just thrown in and said, "Here. Do your best. Do your best to teach this recitation." If you're lucky, you'll get a professor who's willing and able to mentor you and how best to do that, but most don't, so you just wing it. Figure out what to do. You get evaluated by the students, but the faculty don't evaluate you at all really, so I think having faculty evaluate graduate student teaching would have been a really useful thing - to get feedback and say, "These are things you could improve. These are things that you could change," Just to see how the class is going.

I think if I'd asked for help they probably would have given me feedback and advice, but I felt fairly comfortable doing it myself and they were comfortable just letting me do what I wanted to do. And I think that's true of most of the faculty where I was coming from.

It was a slow process [to learn what professors do]. You come in [as an undergraduate] and you think, "Professors teach. That's what they do," And then slowly you learn by your classmates who start doing research projects with faculty, "Oh, they do research, too." But you don't really realize what that means, and then in graduate school, I realized, "Oh. Well, they do teaching and research, but chances are the research might have been more of a focus for them," Because you learn from your own advisor what their life is like and what types of emphasis they place on you for your own work, and so I think it was a gradual process, and then when you go and start interviewing [for faculty positions] you realize what universities are looking for in candidates.

I wouldn't say that I learned overnight what life of a faculty member is, but I think it was a slow process of going through this until the point where I am now faculty and I have a pretty good understanding of what most faculty do. But no one ever sat you down and said, "Well, faculty do this and this and this." You just slowly pick it up from your environment and your interactions with other people.

My early days as a professor and what I am doing now

If you go to a very supportive department they'll give you a reduced teaching load. That's what I have. I'm actually not teaching this semester, and I'm only teaching one class in the spring. And so normally our teaching load is two-one, so we teach two courses one semester and one course the other semester, but for the first two years we have a reduced load, and that's so we can focus on getting our research set up, which is very important. I mean, if you want to be successful in researching, you need that time. And, I mean, for better or worse, teaching does take a lot of time and a lot of preparation, a lot of investment. So, I'm torn. There's a torn feeling. I want to be a great teacher, but that takes time. I want to be a great researcher, but that takes time. You've got to find a balance – learning how to do that is part of the challenge.

I taught a graduate course last fall for the department part time, so I taught a grad course and I coordinated the intro course for the freshmen. That was my first time actually teaching. In grad school I TAed two courses my first year, but after that I was fully funded on research, so I didn't TA after that. That's pretty much where I am now. This semester I'm not teaching. I'll be teaching again in the spring.

I feel as though [Current Institution] is still heavily invested in teaching. Not that [PhD University] is not, but – How do you compare? It's a cultural difference. It feels like [Current Institution] is striving to go that direction. I feel like there's a lot of more emphasis – recently, at least, on getting research funding in than there may have been in the past. Not that people at [PhD University] didn't care about teaching, but sort of a mindset that they enjoy teaching, but it also is what enables them to do their research as well.

I feel like here, there's a little bit more effort on integrating the two, so integrating what your research is with your teaching among the faculty so that they're not necessarily

disparate things. Seeing them as combined, in a sense, and not sacrificing your teaching for the research. At least not entirely. The main difference, I'd say, is that [Current Institution] feels like it's playing catch-up. They're trying to get to where [PhD University] is, and so the culture is changing a bit, and I sense some unhappiness, a little bit, among some of the older faculty. Because they want the focus to still be on teaching, and this shift to having most of the metrics for evaluation of our performance being mostly weighted toward research is frustrating for them, because they can see that that could lead to negative impacts on the students.

I think I do have a little bit of a gift for teaching, and I enjoy it. And I think that when your teacher enjoys teaching and you can tell that they enjoy the subject and that they enjoy helping you learn. I think that that can make a very big difference with the students. I love the students. I love seeing them go from not understanding to really getting excited about the subject and taking them from the place where they have no idea what you're talking about to really being able to solve the problems they need to solve, to understand, conceptually, what's happening, to be able to apply what they're learning in new situations. So, that's why I became a teacher. That's why I'm still here. Not every student likes you. But you stay here for the ones that you're able to help learn.

[Current Institution] has a [teaching center] and they provide support for instructors at the university and, so they provide different opportunities to go to seminars and sometimes they bring in speakers and they have things where you go and have lunch and learn about topics and talk about them with other faculty members, and so I'm participating in some of those. Every so often I'll find a research paper related to engineering education that I'll save. So, I have a bunch of papers saved and I just don't have time to read them. That's pretty much about it for both research and for teaching, and it's just, I'm in the same boat, you know? I don't have time to read everything, so I save papers with the hope that I eventually will read them.

I think my struggle now is that, now that I'm faculty and now that I have [graduate] students, I have students come to me and [I] say, "Well, what do you want to do when you're done?" And they're like, "I want to teach!" And part of me is like, how do I respond to them? How do I encourage them and at the same time say, but the reality of the situation is that research is ultimately going to be the focus most places that you go? I

want to give you the opportunities that - If you really want to teach, I want to help provide you with opportunities to do so, so that you can learn and grow in that, take advantage of the opportunities provided at the university. Learn in that area and I'll support you in that, but at the same time, research is really what's going to get you your job at the end of the day, so trying to be encouraging at the same time realistic is where I'm working right now with my [graduate] students.

What tenure looks like here

It was roughly 40-40-20, so 40% research. 40% teaching, 20% service. I don't think I have the list of what their expectations are for teaching. That includes teaching evaluations. I don't believe our department actually requires any observation. My husband's department does teaching evaluations by peer evaluations by other faculty members, but I don't believe ours does. I'm actually a little hazy on the teaching requirements. Mostly because, well, I'm a little more confident that I can meet them without keeping up on what they are, so I'm not that keyed in on the actual requirements.

The research is evaluated based on grants that you've applied for. Funding that you've brought in. Not number of grants, but actual dollar amount. I believe graduate students advised is in there as well. Publications. Publishing papers. That's also included in research evaluation. The sense is that I need to at least have a grant funded where I'm sole PI. But I think it's very dependent on the person. That's the sense that I get here, is that there's not a set criteria.

Service is a slew of things. It's serving on committees within the department. I'm currently an advisor for one of the student groups. That's included in service. Nominating people for awards is apparently included in service as well, writing letters of recommendation, things like that. Getting outside lecturers to the community I believe would be included in that as well. I think it's flexible and it really depends on what you report.

There's the statement that you can't be a terrible teacher. You have to be at least a decent teacher, but you can't be a terrible researcher. 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. The idea in that statement in itself tells you where the university is

placing its focus. And I've gotten that from multiple people, and it's the impression I got at [PhD University] and it's pretty much the same thing I'm getting here. People say that reluctantly, as though this is the way it is, we can't do anything about it to change it. You just have to deal with it. So, be a decent teacher, help your students learn as much as you can, but make sure that you do sufficient research and get enough funding to get tenure.

They just need to show that you care enough that - And the students are actually learning something, so if after multiple years we do evaluations for different subjects in the following year. If your students are showing that they're understanding the subject material, and you're getting decent evaluations, I think that you'd probably do fine. For better or worse. So, do your best. They say the first two times you teach something it can be a little rough. The first time is the worst. The second time you're still working out kinks, and then the third time you should be good.

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. And that makes me sad because people are paying a lot of money to come here and be educated and you're hoping to have the best teachers and hoping that that's their focus, but it's not always the case. A lot of people love teaching and that's why you're here. You don't make a lot of money as an engineer doing this, and so most people I know, they do it because they love it. They want to teach, but it's hard because you don't get rewarded as much for that.

5.2.12 Narrative 12: Tyler Colton

Tyler Colton is an assistant professor at a Doctoral University: Higher Research Activity. At the time of this interview, he had been in his position for a year and a half. In this narrative, Tyler describes his pathway to his current position, one that focuses on research much more than he would prefer. Tyler also describes how his Current Institution might not be the best fit for him, and what he is looking for in the future.

How I got here

I kind of knew that I always wanted to teach. My parents and both of my sisters, they're all actually teachers, and they all teach elementary school. But I knew what their life looked like and I knew what they did, especially my parents. I really was interested in that and really wanted to do that. And I'm not sure why it went to the college-level, but I guess it just kind of did. I liked engineering and it was such a fast-paced environment, I don't ever remember sitting down thinking, is this engineering stuff, is this what I want to do the rest of my life? It was just always looking at the next class, the next test, and all these kinds of things.

I'm not sure I had a revelation moment or anything like that in terms of me wanting to do engineering. When I got in the field and started working there, I knew pretty early on that I didn't want to do that for the rest of my life and that I wanted to come back to the university environment and do that, so maybe that's what geared me towards where I am now.

I love to teach. If I can do anything in my job, just currently, research is just kind of something I have to do in order to teach, basically that's how I feel about it. That's how it is. But I got a master's scholarship at [Undergraduate and Master's University, Doctoral University-Highest Research Activity], I was doing my MS and I got to teach. It was a really small blueprint reading lab. I totally spent way more time than anybody should on it, and I just fell in love with it. I would stay up late at night working on it.

I actually left that and did a different job for four years, working in industry. And then I always wanted to come back and teach. And so, I met with some people, some PhD professors basically at [Undergraduate and Master's University] and they said if I want to teach at the college level, I have to get this PhD, that's kind of where my motivation for – I had never done any research before then. I just applied to [PhD University, R1], for family reasons that was the only place I could really live. I got a research position at [PhD University], and that's where I learned to do research. It was new and interesting, and I knew I had to do it in order to get my degree. And so, I went through the motions there and did that. I sought out opportunities to teach at [PhD University] and got to do that a lot as well.

I got to teach a lot [at PhD University], kind of more I think than the average person does. So that was very fulfilling. I got to be the lead instructor for a few classes and TA a whole bunch. But the research part of it, it was something I had never done before so that made it interesting just on its own, that I'd never done this. I got to do presentations to industry groups a lot, so that was similar to teaching so that was kind of exciting. But the rest of it, all the writing, all the research steps, I basically knew that this was a four-year window and that there was a light at the end of the tunnel to this thing that I really wanted to do. And so, I just kind of did it. And being a graduate student is a lot different than being an assistant professor, I would say, or at least for me. [During graduate school] I was given individual tasks, write this paper at the end of this week, just very achievable tasks that didn't last very long basically. So that made it easier I think, just to kind of check-list through and go through this process.

That took four years. I was more interested in research, I still really liked to teach. At least this is what I thought when I was leaving [PhD University] – that the high paying academic jobs, you have to do research. And that may not be true, but up until today, I still haven't found another path really, that all the money is in research basically, and that may not be true.

With that, I thought, I have this PhD, so I need to go find a research position and I'll get to teach some as well. I just applied for everything that was open that year and I had a few interviews, I was very blessed by that. Basically, out of all those, [Current Institution, Doctoral University- Higher Research Activity] seemed to be the best fit. There's not so much drama as there was at [PhD University] or some other places I went to. It's really crazy though, 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.

So, I picked [Current Institution] because the faculty, the facilities, and then it's pretty close – it's relatively close to family versus to other places I got interviews. And

then it's a major research university, so I thought that's what I have to have. And I've thought about this before, but going back, I would have spent more time focusing on what exactly do I want, and kind of seek out those opportunities.

[When] I interviewed here, I think I met almost everyone on the faculty and I presented my research, that was maybe thirty minutes, and then the rest of the time was just meeting all the deans and the department heads and people in my area. It was a two-day process here. At the teaching school, it was a one-day process. That was actually much more informal. The faculty in [the teaching university's] department was maybe ten people so they all just met me in one room at one time, and then I prepared a sample lecture for them and did that for maybe thirty minutes. That was basically it. I looked through their facilities and talked to some of the students, and so that was actually much more enjoyable than here [at Current Institution]. I went to a few other major universities where it was two or three days long of meeting people one-on-one and just the same conversation over and over and over.

During the interview [at Current Institution], as I was interviewing, you know we have our three areas of work. Basically, we have research, teaching, and service. And after I was hired there, some maybe long-term people there, people that have been successful there, really kind of ingrained in me that you have to do research – without research, there's no way you'll get tenured or be successful here.

One of the quotes from my boss, was that your teaching level should be at an average pace and as long as the parents and students aren't complaining, you need to spend more time on research. That was kind of the message there, was that the more time you can spend on research and make teaching average or adequate, the more successful you'll be basically. He even told me that I should not win any teaching awards. That that would be a bad thing. And this was all in jest, it wasn't like a serious conversation or anything, but that was kind of his advice to me, you have focus 90 to 95% on research and then teaching, you need to get really good at kind of standing up there and faking it, make people like you, and then kind of just go through the motions.

So, that's where I am today, I spend way more time on teaching than someone would advise me. But I really just enjoy it and I find a lot of success and personal satisfaction from that. And I get exposure to people, and I still do a lot of research, and I

guess I find some joy in that when I'm successful in terms of getting a paper published or getting a project or interacting with the students, but most of the time, it's literally me, sitting in front of a computer, just writing. That's kind of how it goes. I don't enjoy that part so much.

I'm actually kind of seeking out positions, and it may not be immediately, it may be later on, but I am seeking out positions, where I can just do teaching, or teach most of the time and just do a little bit of research on the side. [Even so] it was huge blessing to get to come here because if I had gone to a teaching school or somewhere else first, I would have always thought that this is what I would have wanted. To do research and then teach some and be at a major university and these things. And I'm glad I got to do that. I guess knowing what I know now, I would have sought out opportunities at maybe smaller schools or teaching schools, and that probably would have been more satisfying for me.

Even, tenure, I used to think that was so important. But it's such a rouse. With our generation, I feel like, no one wants to build a castle at this one specific place and live there their whole life. I don't want to live at one place my whole life and so it's – I have no interest in getting tenure at [Current Institution], it's just a process I have to go through.

My preparations for teaching

My first experience [was] a really small, it was called [Math Workshop Name], but I was a junior or senior at [Undergraduate and Master's University] and it was a recitation class for calculus one or two. It wasn't teaching but it was just walk around and help people work calculus problems. So that's kind of where it started, that wasn't such a great experience. I was an undergrad and didn't care about my future. I mean I cared, but I just went through the motions and got the paycheck from that I would say.

But as an MS student, the laboratory that I [taught], it was maybe 60 or 70 people per semester on Tuesdays and Thursdays, something like that. So, it was that type of class, it was mainly lecture and then maybe twenty minutes at the end they would start to go through the drawings and we would talk about that individually or in groups.

That was my real first [teaching] experience, I would say. And then, after I left there I had a few opportunities. I was [at Undergraduate and Master's University], so I had a few classes that I taught to the other engineers there, it wasn't really college style, but it was me sharing how to do some software, or something like that, with a group of engineers. So that was some teaching that I did there.

And then at [PhD University], I was an instructor for [an engineering introduction class], I did a seminar, and then I was a TA for several of our classes there. And as a TA, I substituted maybe like five or six classes a semester, something like that.

My advisor was really successful in getting research sponsorships, so he was constantly traveling everywhere and, so he made a – I guess it was a deal or something with the dean to allow me to be lead instructor on a few classes for semesters where he was going to be traveling a lot. So that really helped. And then, on the TA side, if there was a random open Friday, where he couldn't be there or didn't want to do it, then I would volunteer to teach that class as well. We did a seminar, and that wasn't really me teaching so much, but I would organize speakers and companies to come and talk to students, so that was fulfilling as well.

[PhD University] was even crazier than where I am now. It was just all research all the time, constantly, and the students in these classes would just have to figure it out. That wasn't anywhere near the high priority list. And so, it was just all about my advisor couldn't come or didn't want to teach. And so, I basically sought out those opportunities. But it wasn't necessarily to improve my teaching skills or anything like that, it was just to meet a need.

So, my experience has increased from when I started until now. I am a lot better at it now than I was, I think, at least from my perspective, then when I started. I think I'm much more creative and willing to innovate and things like that, then at [PhD University], there was, you know my advisor was looking over my shoulder constantly, so I just did whatever he said and went with that. It's much better, I'm much more experienced and willing to try new things now, I would say than when I started.

This idea of what [professors] do formulated as I was watching my advisor, and at [Undergraduate and Master's University]. This is crazy, but as a master's student, I didn't really understand. A lot of my friends were research assistants, I had no idea what they

were doing, I really didn't understand what they were doing. And I remember, but as an undergraduate we had our senior exit interviews where we met with the department head and told him what we thought, and I think everybody complained about the professors are only interested in research, they're not spending time teaching classes, and I understand why that's the case now. It totally makes sense.

I guess I started to get a picture of the teaching side of what [professors] did at [Undergraduate and Master's University], and then at [PhD University] I learned about the research things that they do, kind of how to manage research projects and all these kinds of things there. And at the very end of my time at [PhD University], they started teaching a course, or something like that, for graduate students that wanted to do academia for their career. I took a few of those classes and really kind of got the full picture of what goes on, basically. And then obviously since starting here, I've learned a lot more about how you come up with a budget and where the money goes and all these kinds of things in terms of research.

My early days as a professor and what I am doing now

Now I'm teaching four different classes. Those are across two semesters. Teaching at the college level is really unique as opposed to maybe like high school or lower-aged group or adult education or something like that, because – I guess in engineering I would say this, at least for [Current Institution], there's a ton of opportunity to do new and exciting things [in your teaching] and I feel like the students have been beaten down so much with PowerPoint and just random PDFs that they're supposed to read, and I don't think people learn like that. And I've noticed that anything I do, unique, whether it's effective or not, they just can't get enough of doing something unique.

I really want to look at education in terms of engineering education and how we educate people. At [Current Institution], everybody makes a PowerPoint slide, we share them with everyone else and we all get up there and give our best impromptu about whatever the heck we're talking about. And the students, they get the same content repeated over and over through many different classes. And it's really crazy – they're paying a lot of money to take these classes, and I would argue, especially for private high

schools, I think the education there is much greater than what we are providing here at our university, or at least what I've experienced.

And so, the conversations around teaching are mostly about how do we gather content for our ABET reviews, it's just assumed that everyone knows how to teach. And so, there's no instruction on how to become a better teacher, no one has ever observed my classes, ever. And I'm not sure they even look at my teaching evaluations. They may. I think if they go really low, I think someone will look at them. But I don't think those are looked at.

I would say minimal effort is put into improving or maintaining our teaching levels. It's all about organization, in terms of teaching, how do we get all this content together, who's going to cover this or that class, and then the rest of the effort is put into research. I think people that are research driven, they seem to really enjoy the balance here. People that like to do research and that are kind of all into that, seem to enjoy. But it's basically maybe like 90% research and then we do some service, which basically it's highly encouraged that we seek out some research service opportunity to kind of foster with our program. And whatever classes we are assigned, then that takes care of the teaching aspect.

I even signed up for [a Teaching English Program]. It's foreign students that come here, they're freshmen level, they don't know English so well. I just teach basic engineering classes to them. We basically interact in English, is the major take-away from that. And that was actually frowned upon by my department head. It's not a criticism or anything like that. We are very research driven so all aspects of what we do in terms of our job here is how can that improve research, basically.

In terms of the job, the teaching is really good. The students are good, they're respectful, they want to learn, and I think a lot of that comes from – there are a few other people that they hired at the same time as me that are interested in teaching as well, or they have kind of a unique perspective on it, so the students are just kind of begging for that. If you even just turn the projector off and just talk to them without PowerPoint, they just love it. It just blows them away and so things like that are really – I find fulfilling in doing that and just teaching people. And finding students jobs, that's really exciting, or

being able to recommend them to a really good company and the company actually following through and the student getting the job, that's really fulfilling and exciting.

The faculty – they're very friendly, there aren't any problems. The facilities are really good in terms of the classes and the offices and those things. And then the actual community outside of the university is really good for family and we are close to our extended family. So, all of those kinds of things are good. They're good reasons for us to be here now, I would say.

What tenure looks like here

On paper [teaching] is supposed to be a third of what we do. I haven't gone up for review or anything like that but my preliminary reviews, all the comments always focus around – they're happy about my research productivity, or they're happy that this student graduated with his PhD and these things. My teaching evaluations are really good or above average, so maybe if those drop down, maybe they would start to talk about that, but it's hardly ever any discussion. I don't think I've received a single comment about teaching.

[Teaching is evaluated] mainly through surveys, through student evaluations at the end of the semester. I guess that works. The students get to express how they feel. I think a lot of that – I don't know – my wife is a teacher here as well, and she gets crazy comments on her reviews and it's very frustrating. I don't know if that's the best way, I think it's a very subjective way to measure the effectiveness of a teacher. But that's what we do. We do [student] evaluations, and that's basically it. We are not observed or anything like that.

I picked up one class that was outside of my field just because no one else would do it, and so I got a pat on the back for that, but no, this was a good class, or good job, nothing like that. And so, I would say [teaching factors in to tenure], very, very minimally. [That bothers me] a lot, actually. The really hard part is I have a family and kid, and so my most valuable resource is time, it always is, and I think it always will be until I die, I guess. I always have to look at these 24 hours a day that I have and how I am going to use them. It's really tough because I love to teach, and I love to spend a lot of time on that and make it really good, make a good lecture, make a good class. And the

hours I spend doing that aren't rewarded, and they're actually frowned upon to some degree because it's less time that I spend doing research. and so, it's not a criticism of the university, so much as maybe, I'm not the best person for this specific research-driven position.

But yeah, it is frustrating, it's really hard to manage time because I see people that have been here for a really long time, and they're still teaching on transparencies and overhead and all this really old school technology. You know, you can kind of watch yourself slowly creep in to that, because you're battling yourself in terms of I want to spend three hours making a really good experiential learning exercise for this class, and it's never heard of again, no one seems to care. And [some people have] PowerPoint slides and just walking in five minutes before it starts and talking about it. And it's kind of like, ahhh, I'm a fool for continuing to spend so much time doing this. It's not easy, it is a little bit frustrating sometimes.

Just the actual activities of the work related to research are pretty boring to me, and they seem like – I guess it just seems very non-impactful to the rest of the world, or to anything really. So, with higher research productivity comes all kinds of management tasks and more writing and more students, and on and on and on. So, it's good, I mean I feel like I'm on track to get tenure and there won't be any problems there. But the amount of work and the amount of time it takes me to get to that level to where they're satisfied or higher, it's a lot of hours of staring at my computer and writing. Just things I don't like to do, basically.

The actual achievement metrics for both research and service are very vague. Some of my senior departmental members assure me I am on track and should not worry. People often encourage me to continue on my path. I have been instructed that research grants are most important for tenure with regards to research and journal papers are second most important. It seems the requirements for service are even more vague. After inquiring several of my senior colleagues, I have been instructed that as long as I have some record of service, I should be fine for tenure.

I do wish the metrics were better defined. I understand, specifically for service, that it may be impossible to clearly define metrics. I do think an estimate of metrics would better direct young faculty members. The balance seems to be heavily weighted

towards research. The most important thing for my tenure is research funding. I do wish the balance was more evenly weighted among research, teaching and service.

5.3 Summary of Co-Constructed Narratives

The narratives presented in Chapter 5 provided accounts of the experiences of twelve assistant professors in engineering at various non-R1 institutions. In Section 5.1, I walked through Jason Talbert's narrative, which is presented in full in section 5.2.6. I presented Jason's narrative through the use of narrative themes. These themes helped bridge a connection between the thematic analysis findings and the narratives themselves. By walking through Jason's narrative, I hope to have provided an example of how the narratives could be interpreted. I imagine that individual reader's will resonate and connect with, and make conclusions about the narratives in unique ways.

In Chapter 6, the discussion, I again examine the participants as a group. I do this in order to draw conclusions about the participants as a whole and demonstrate how the findings from this dissertation have implications for graduate education and teaching quality.

CHAPTER 6. DISCUSSION: PATHWAYS IN ACADEMIA

This research study aimed to understand the experiences of assistant professors who have transitioned from their time as PhD students at institutions that focus mostly on research to their experiences as faculty members at institutions with more emphasis on teaching. These foci terms need to be used lightly, since it is understood that many R1 Institutions have people and professors that do focus on and care about teaching, and institution types other than R1 still often focus on and care about research. However, the literature points to a gap in understanding about professors at institutions other than R1, and therefore this study explored the pathways of assistant professors that went elsewhere, namely to Baccalaureate, Master's, R3, and R2 Institutions.

The first objective of this research was: *To document and describe narrative accounts of the academic pathways of engineering assistant professors at institutions with varying research and teaching activity.* While documenting the narrative accounts of the participants, and throughout the thematic analysis, I found that there were two main archetypes of characters that can be used to describe pathways they took. On one side of the spectrum, there were the participants who "dared greatly," to borrow language from Brené Brown (2012). On the other side of the spectrum were the "passively daring" participants. The point I am making by placing participants on this spectrum is to have a better understanding about the landscape of teaching engineering at the university level, and not to suggest that one is better or worse than the other.

The second objective of this research was: *To document and describe the teaching conceptions and methods of engineering assistant professors at institutions with varying research and teaching activity.* In documenting the teaching conceptions and methods of the participants in this study, I found that all the participants believed that "teaching is an evidence-based practice," at least to some degree. The participants also fall on a spectrum regarding their beliefs in teaching, from "teaching as taught" to being involved in "engineering education research," as proposed by Borrego and Streveler (2015).

In the next four sections, many participants will be referenced by name to provide examples. As such, it might be useful for readers to orient themselves by revisiting Table 6 at the beginning of Chapter 4. Section 5.1 looks at the behaviors of the participants as

they moved through their transitions from graduate school to their various institution types. In particular, I describe how all participants dared to be different and challenge expectations in some way. Section 5.2 focuses on how the participants approached engineering education inquiry in their own teaching practice. Implications for graduate education are discussed in Section 5.3, and implications for teaching quality are addressed in Section 5.4.

6.1 Daring Greatly and Daring Passively

All the participants described their current institutions as different from their PhD Universities, i.e., R1 Institutions. While the degree to which the participants' institutions differed from R1 Institutions varied, in all twelve cases, the participants had to take a chance on a different institution type. They dared to be different.

Brown (2012) defines daring greatly as: "Every day we experience the uncertainty, risks, and emotional exposure that define what it means to be vulnerable, or to dare greatly." The participants who I have identified as "daring greatly" exhibited signs of great vulnerability. These participants were worried that they were doing something that their peers in academia would advise them not to do. The participants who seemed to dare most greatly, as perceived by me, were Jason, Samantha, and Steven. They worried that they cared about teaching more than they should. Yet despite such worries and concerns, these participants decided that pursuing a position at an institution type other than R1 was worth it. Most participants described feeling worried about focusing on teaching during graduate school. Yet these participants decided to pursue what was in their hearts and find a position that focused on undergraduate teaching.

In many cases, the participants at either a Baccalaureate or Master's Institution seemed to fall more on the "daring greatly" side of the spectrum. This is understandable since these universities typically had higher teaching loads and were more of a contrast to the R1 pathway expectation. However, every participant in this study demonstrated vulnerability in some capacity.

In order to help readers get a sense of where the participants fell on the spectrum of daring behaviors that were exhibited in the interviews, Figure 3 provides a rough comparison of some of the participants that fell most to one side or the other. Again, it is

important to note that the placement of these participants is not meant to determine if one is better or worse than one another, but only provide a basis to understand their experiences. The participants that fell more in the middle still exhibited daring behaviors as well, but not as extremely. This figure might be useful to help guide readers through the narratives. By choosing to read a narrative from one person from each side of the daring spectrum, the readers might better come to see how varying the experience of transitioning to a non-R1 Institution can be.

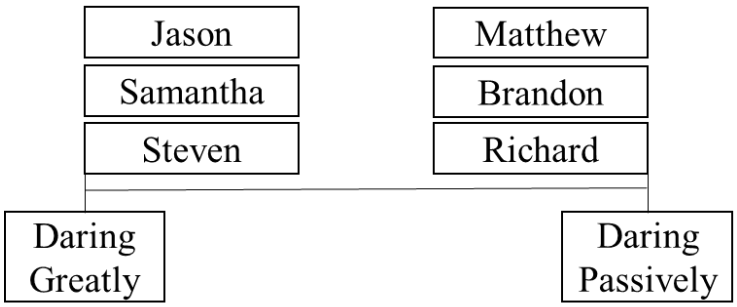


Figure 3: Comparison of "Daring" Behaviors Among Participants

There were some common points along the pathway to a faculty position that caused participants to feel vulnerable. Below is a non-exhaustive list of points along the participants' pathways that caused feelings of vulnerability, which required daring behavior of some sort. The points below were drawn from all the participants, however, most of these examples come from those participants that seemed to *dare greatly*. From Figure 3, we see that participants from both sides of the spectrum had examples that contributed to this list, and also includes participants that fell more in the middle.

- Choosing to pursue a teaching focused position, recognizing there would be risk and judgement from peers, both graduate student peers and advisors/faculty, (e.g., Jason, Matthew)
- Feeling like R1 Institutions had too much research pressure, including not feeling confident writing grants (e.g. Steven, Samantha, Brandon)
- Applying to faculty positions, recognizing that there is vulnerability associated with putting oneself out there, declaring this is the position that best aligns with one's identity and knowing that one could be turned down (e.g., Jason, Steven)

- Trying new teaching methods, recognizing that this might cause teaching evaluations to decrease, and lead to possible student resistance (e.g., Christopher, Emma)
- Spending more time on teaching than is advised, recognizing that this might decrease your chances for promotion and tenure (e.g., Tyler)
- Resisting the (national) focus on research, a shift that is noticeable for all, even those participants at "teaching focused" institutions (e.g., Molly, Tyler)
- Having less time for research, and realizing that you care more about being an effective teacher (e.g., Steven, Christopher)

In encountering many of these vulnerabilities, once the participants acknowledged the vulnerability of the situation and embraced the possible positive outcome, the participants were able to overcome the challenges and embrace the experience.

The participants that fell more on the "passively daring" side of the spectrum were not necessarily seeking a teaching-focused position, but obviously considered working at one, given that they were employed at one at the point of the interview. For example, Richard did not explicitly seek out an R3 Institution, in fact, he described applying "anywhere and everywhere." Yet, now that Richard is at his current institution, he recognizes its unique qualities and as a member of search committees, he looks out for prospective faculty members who have good teaching skills and fit in the culture of his institution.

Some others came to the realization that teaching is what they wanted to focus on later in their pathway, and one participant, Tyler, is even considering leaving his current position at an R2 Institution to pursue a position in which he can focus on teaching. Using the example of universities trending towards more research, we can see how some of the participants are moving counter to the status quo and therefore daring greatly. While many participants acknowledged the shifting focus of all universities towards more research, some thought this was a welcome shift, while others feel that this shift is adversely affecting students. The participants who spoke out against the current of research focus that has taken over our universities, e.g., Molly and Tyler, are swimming upstream. The research focus was also often an influence while the participants were

graduate students. For instance, some participants sensed that research assistantships are more prestigious than teaching assistantships while they were in their doctoral programs.

Yet despite this general trend of greater prestige around research, the participants in this study, and likely many others, pursue teaching opportunities anyway. As Crede, Borrego, and McNair (2010) found, both graduate students and faculty often perceive research as more prestigious than teaching. Perhaps if the status of teaching were elevated, more graduate students and faculty would feel rewarded for spending time developing and improving their teaching, and teaching quality would improve. More attention to teaching conceptions and methods will be presented in the next two sections.

6.2 Teaching and Engineering Education Inquiry

The second objective of this study was *to document and describe the teaching conceptions and methods of engineering assistant professors at institutions with varying research and teaching activity.*

By documenting the teaching conceptions and methods of the twelve participants in this study, we can see that the general trend of academia is moving towards more evidence-based instructional practices (also called research-based instructional practices) and continuous improvement goals in teaching. While some scholarship on engineering teaching has found that many engineering faculty continue to rely on lecturing as a dominant approach (Rugarcia, Felder, Woods, & Stice, 2000; Finelli, Daly, Richardson, 2014), it is encouraging to see that this group of participants are interested in evidence-based instructional practices, including how to bring more of such methods into their own teaching. Bird & Kellam (2013) also found this trend among engineering instructors at R1 Institutions. This finding is encouraging since other researchers have found that many faculty are aware of evidence-based innovations but do not adopt these innovations as readily into their classrooms (Borrego, Froyd, & Hall, 2010).

This study also provides a glimpse of current conceptions and methods that are being employed in classrooms today, or at least within the last year when these interviews were conducted. Borrego and Streveler (2012) created a useful framework (see Figure 2 in Section 2.4) to understand approaches to engineering education inquiry adopted by engineering instructors. It is encouraging to see that all the participants in this

study express interest in using evidence-based teaching methods, yet the degree to which the participants are doing so varied. As described in the introduction of this chapter, I noticed that the participants' level of teaching inquiry also landed somewhere on a spectrum between teaching as taught and conducting engineering education research (EER). Figure 4 below shows an exemplar participant for four of the inquiry approaches, since none of the participants "teach as taught" exclusively. By "teach as taught," I mean those who teach in ways they were taught without much additional reflection about how to improve their teaching practice or if that teaching approach is best for students. I did not specifically ask the participants about where they fall on this spectrum, so this figure is only meant to provide a rough guide. This figure might be useful to help guide readers through the narratives and understand how the various participants bring engineering education inquiry into their teaching and classrooms. In the figure, the acronym SOTL refers to the Scholarship of Teaching and Learning.

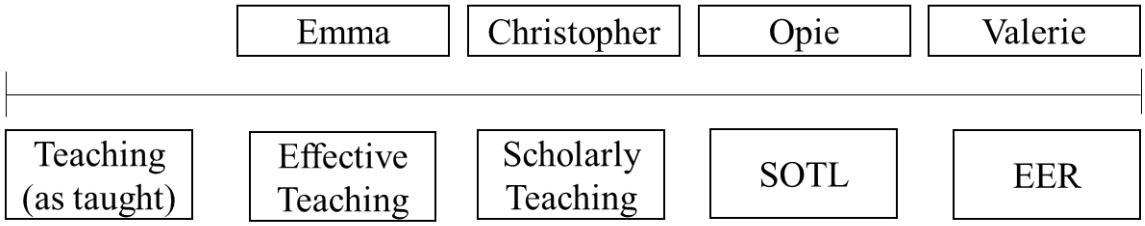


Figure 4: Comparison of Participants on "Engineering Education Inquiry" Framework by Borrego and Streveler (2012)

Breaking down Figure 4 down further, I will explain why I used these four participants as an example for each category. Emma is a good example for Effective Teaching since she uses accepted teaching theories and practices, such as "incorporating rubrics in all my assignments" in her teaching. Christopher described measuring effects of changes he makes in his classroom, which is why I placed him in the Scholarly Teaching category. Opie has opened his teaching practices to critique and evaluation by publishing his work at conferences, placing him in the Scholarship of Teaching and Learning category. And finally, Valerie conducts Engineering Education Research by asking how and why questions about student learning. For instance, she described

studying “whether or not students go the extra mile, or, which students go the extra mile on problems.”

It is encouraging to see that all the participants subscribed to evidence-based teaching practices in some way. Many of the participants became aware of these practices because of a personal interest in teaching, so it is important to think about what their teaching practices would have been like had they been more formally trained and exposed in graduate school. In the next section, we will consider implications the findings have for graduate training.

6.3 Implications for Graduate Education

Many of the participants were passionate about teaching, but were given few, if any, opportunities for formal education about how to teach or how people learn. They were going through the process first-hand: recognizing that teaching as taught is not necessarily the most effective way of teaching, and trying to figure out ways to improve the experience for the students. In a sense, the participants recognized that they needed to increase their level of inquiry in regard to teaching (Borrego & Streveler, 2012), bringing evidence-based practices into their teaching.

In their 2012 American Society for Engineering Education report, Jamieson and Lohmann describe “a need for more educational innovations that have a *significant impact* on student learning and performance, whether it is through widespread and efficient implementation of proven practices or scholarly advancements in ideas, methods, or technologies” (p. 5). In this study, all twelve participants described being aware of research and evidence-based teaching practices, and many of the participants described ways they were incorporating these methods into their classes, even if these attempts were small. The fact that all the participants showed some awareness of evidence-based teaching practices is a promising result, as it shows that these practices are becoming more widespread. Prevost et al (2017) asserted in their evaluative study of a teaching fellowship program that graduate students might be more open to trying evidence based teaching in their classroom, and perhaps that is the case with new faculty as well. However, the participants in the study might be a biased group since they self-

selected into this research project as professors who were interested in talking about their teaching conceptions.

Despite promising evidence that evidence-based instructional practices are possibly making their way into more professors' classrooms, most of the participants described changes they would make to their doctoral training. While the participants in this study are only a subset of assistant professors in academia, it is clear that there is a desire for more instruction on teaching in graduate school. Specifically, suggestions made by the participants in this study to improve doctoral training included:

- More educational classes that count as part of a degree plan (e.g., Christopher, Samantha)
- Information and resources about various institution types (e.g., Jason, Tyler)
- Possibly have two types of PhDs – one that focuses on teaching and one that focuses on research (e.g., Opie)
- Receive feedback about teaching from faculty as teaching assistants (e.g., Molly)

Some participants said they would not change anything about their graduate program. They stated that if someone wanted teaching opportunities, they were available. However, as has been stated before, almost all of the teaching experiences the participants described having in graduate school were in addition to the baseline expectations of their program. If we do not expose all graduate students to teaching, then we might not reach some students who want to learn more about teaching, or who did not know that it was a kind of professional development they would find useful. Some graduate students might argue that learning about teaching and how people learn might not be useful to them, especially if they are going into industry position. However, I argue that all positions require teaching in some capacity (depending on the definition), and gaining these skills could benefit all doctoral students. For example, in my definition of teaching, I include mentoring, such as in the process of onboarding new employees. Therefore, anyone who mentors another person would benefit from knowing about teaching and learning theory.

Participants also described wishing they knew more about the various types of institutions that exist. In addition to exposing graduate students to various institution types, it would be similarly valuable to expose students to various types of faculty

positions, including non-tenure-track and full-time teaching positions. More types of full-time faculty positions are starting to be incorporated into the faculty at all institution types, but perhaps particularly at R1 Institutions, such as teaching professors, professors of practice, and instructors that have promotion and job security structures similar to other faculty members (Etzkowitz &Dzisah, 2015; AAUP, 2004).

The participants in this study, who were all interested in seeing the perception and prestige of teaching increase across the country, demonstrated that we have great potential to improve engineering teaching in America. Imagine what kind of educators these participants could have been had they been given more built-in opportunities for teaching in graduate school and were encouraged to spend time thinking about teaching, rather than being socialized to believe research is always superior?

As stated at the beginning of this section, one objective of this research was to document and describe the narrative account so assistant professors at institutions of varying teaching and research activity. The products of this dissertation are the co-constructed narrative accounts of the twelve participants in this study. By sharing these narrative accounts with current graduate students and faculty, I believe that more graduate students will feel empowered to face and wrestle with the vulnerability associated with the choice to pursue a teaching focused position at non-R1 and R1 Institutions. Similarly, by sharing these stories with current faculty, I hope that these faculty can act as more informed mentors who can guide their mentees towards academic pathways that are more aligned with the mentees goals by being exposed to more options.

6.4 Implications for Teaching Quality

I was originally hoping to find evidence that the professors in my study were better teachers and more innovative, on average, than those at R1 Institutions. While this was not the case, the participants I interviewed are trying hard to improve their teaching. They all believe in evidence-based instructional practices and are working to get those practices into their classrooms. One specific lesson we can take from some of their institutions centers around the more diverse ways they evaluate teaching. Even though student evaluations still dominate how teaching quality is evaluated at most schools, some participants described additional ways their teaching is appraised. These

approaches include teaching portfolios with reflections on how the course went that are shared with the department chair and promotion and tenure committees, as well as peer observations of teaching. I believe that adopting these approaches to make teaching more of a public activity, and more similar to research efforts that are open to scholarly critique, could help improve teaching quality across all institution types. Borrego and Streveler (2014) made a similar assertion, stating that by inviting public critique of teaching, through publishing results of educational interventions for instance, "allows for the often very solitary act of teaching to be opened up to the community and for best practices to be more easily assimilated" (p. 549).

Despite a focus in this section on educational scholarship, many of the participants described continuing to do research in their technical engineering domain. Through presentation of teaching versus research, I may have implied a dichotomy between a commitment to teaching versus research, but a number of participants in this study demonstrated that a commitment to research does not necessarily mean low-quality teaching. For example, consider Richard, who described enjoying the national shift towards more research, while still integrating new teaching methods into his classroom.

By exploring the pathways and teaching conceptions of these twelve participants, I have come to believe that all institutions are unique with regards to climate and support for teaching. While taxonomies like the Carnegie Classifications of Institutions of Higher Education can be useful, a given institution has the capability to define what it is going to support and reward. For example, the dean of college can have a large influence over the value of teaching and encouraging teaching innovation in a more local context, as reported by Matthew, who is at an R3 Institution. The mix of teaching and research will be different at all institutions, with possibly more focus on teaching at most Baccalaureate and Master's institutions. While this research does not provide a generalizable understanding about the differences between institution types, it has provided the perspectives of twelve participants at four different institution types that are not often described.

Taking a systems perspective, we can see that engineering education might be on an upward trajectory of improvement. All the participants believe in "teaching as an evidence-based activity" and therefore, will likely begin to look for future faculty with

similar views. In fact, a few participants described their experiences on search committees and how they were looking for good teaching ability as well as “fit” associated with the university culture.

CHAPTER 7. CONCLUSIONS AND FUTURE WORK

7.1 Project Recap

In this dissertation, I have examined the academic pathways and teaching conceptions and methods of twelve assistant professors at various institution types, namely, Baccalaureate, Master's, R3, and R2 Institutions. The project had two primary research objectives:

1) to document and describe narrative accounts of the academic pathways of engineering assistant professors at institutions with varying research and teaching activity, and
2) to document and describe the teaching conceptions and methods of engineering assistant professors at institutions with varying research and teaching activity.

In order to address these objectives, two overarching research questions guided my inquiry:

1) How do assistant professors experience the transition from graduate school and other previous educational and/or work experiences to their current faculty position?
2) How do assistant professors describe their current teaching conceptions and methods?

Twelve assistant professors, three at each of the four institution types identified above, were interviewed about their pathway in academia and about their current teaching conceptions and methods. The transcribed interviews served as the data for this study.

A thematic analysis was conducted based on the interview transcripts. The findings from the thematic analysis were presented in response to the two research questions and provide a holistic understanding of the transition experiences and teaching conceptions of the participants.

Co-constructed narratives were written about each participant in the study and were entirely based on the interviews. These narratives are intended to act as "more

competent others" for current graduate students and faculty who are interested in learning about diverse pathways in academia. "More competent others" is a concept derived from Vygotsky's Zone of Proximal Development (ZPD). In the ZPD, a learner can greatly benefit when learning from someone who is slightly more advanced than they are (Chaiklin, 2003). For example, future graduate students could learn from the narratives presented, since the narratives document the job search process and other experiences graduate students might encounter themselves.

Finally, in order to bridge the thematic analysis findings and the co-constructed narratives, one narrative, namely Jason Talbert's, was presented with narrative themes. Through the use of these narrative themes, I was able to demonstrate how the descriptive themes from the thematic analysis were evident in Jason's narrative. Additionally, by walking through Jason's narrative in considerable detail, readers are given an example of how to possibly make sense of the other narratives, and draw meaningful conclusions for themselves.

7.2 Final Conclusions

In this dissertation, I introduced twelve stories of varying pathways in engineering academia, specifically, pathways to non-R1 Institutions.

In response to Research Question 1: How do assistant professors experience the transition from graduate school and other previous educational and/or work experiences to their current faculty position?, I found that most participants felt underprepared for teaching and were socialized to believe teaching mattered less than research. Most participants specifically sought out institutions where they could focus on teaching in an environment where their dedication to teaching was supported. However, some participants still focus very much on research and engineering scholarship, but enjoy the less intense expectations of their current institutions. About half the participants experienced great feelings of vulnerability associated with their pathway to their current positions, since pursuing these positions is viewed as "less prestigious" than pursuing a position at an R1 Institution.

In response to Research Question 2: How do assistant professors describe their current teaching conceptions and methods?, I found that all participants believe that

teaching is an evidence-based activity, at least to some degree. However, most participants described wishing they had more teaching experiences and training during their doctoral studies. The participants all reported interest in working to improve their teaching in the classroom, implying that teaching methods are improving in engineering overall. While the teaching approaches of the participants in this study were not extremely innovative, we can learn from this group of participants that by supporting teaching, we see dedicated professors in engineering who are providing good experiences for their students.

7.3 Future Work

I envision three follow-on studies to this dissertation work. First, the main objectives of this dissertation were to document and describe the pathways of assistant professors and describe their teaching conceptions and methods. One of ways this objective was met was through the co-constructed narratives. The most important next step of this work is to understand how the narratives are interpreted by current engineering graduate students and faculty. An effort to begin this future work has begun and will be described in more detail in the next section on dissemination.

Second, I believe qualitative and quantitative research can greatly complement one another. Now that I have a better qualitative understanding of some of the main challenges and experiences encountered for assistant professors at these various non-R1 institutions, I would be interested in gathering larger datasets to understand the phenomenon of transitioning to non-R1 Institutions more broadly. Furthermore, understanding the transition from graduate school to non-academic positions is also of great importance. New research suggests that many engineering graduate students lose interest in an academic career (Roach & Sauermann, 2017), and therefore, understanding how to best prepare all graduate students for their desired career path is invaluable.

Third, other types of faculty within all institution types, most notably non-tenure-track faculty and faculty in adjunct or part-time roles, are also understudied and are important members of engineering academe that we need to understand better. This study design could easily be adapted to examine the pathways of non-tenure-track faculty, whose stories need to be told and would benefit many in academia to hear.

7.4 Dissemination

I envision disseminating my work through research to practice channels as well as through peer-reviewed journals. Since one of my main goals is to better prepare engineering graduate students for faculty roles that include teaching, I think it is imperative to share my findings through workshops and the construction of a website. I believe the narratives that I will construct have the potential to impact people as they look for a "more competent other" as they explore the possibilities of teaching engineering at various types of institutions.

Additionally, studying the impact of the narratives themselves is a natural next step to understanding this research and the findings more fully. Among current engineering graduate students and faculty, I am interested in asking: what sort of emotions do the narratives evoke? Do the narratives promote change in intended pathway and/or teaching methods? Building upon these questions, I presented the narratives at a Special Session (Trellinger, Jesiek & Nittala, 2017) at the Frontiers in Education Conference on October 19th, 2017. In the workshop evaluation, I was told by an attendee that he or she thought the narratives were a "great way to share data and engage others in the community." I was also told that the workshop helped broaden the workshop participants' schema about what it means to be an engineering professor. I plan on sharing the narratives with many more engineering graduate students and faculty in the future, and collecting data on their responses to the narratives.

More generally, I believe my findings could be utilized in professional development workshops for future engineering faculty, as well as at orientation workshops for new engineering faculty. These workshops would be based on the co-constructed narratives that resulted from this dissertation study. In particular, the findings regarding vulnerability (Section 5.2) would likely be beneficial and influential in professional development workshops for future faculty. Often, when people find out they are not alone in their feelings of vulnerability and uncertainty, they are able to embrace the vulnerability and succeed (Brown, 2012). Through reading the narratives of participants who have recently been on the search for jobs that focus on teaching, graduate students will be able to interact with "more competent others" and learn from those experiences to guide their own.

In workshops geared toward new engineering faculty, I would focus the workshop material around the engineering education inquiry findings (Section 6.2). One of the main goals for these workshops would be to demonstrate how the twelve participants in this study described their awareness and use of evidence-based practices in the classroom. Since there was a large variety among the participants in terms of their "engineering education inquiry" approach, new engineering faculty would likely be able to resonate with one or more narratives and see how they too could begin integrating evidence-based practices in their own teaching using an inquiry approach that makes sense for them.

7.5 Epilogue

I began this dissertation with a preface (Section 1.1) explaining my personal connection and motivation for this research. It seems fitting to conclude the work with a few more personal reflections. Through the dissertation process, I kept a journal noting any reactions to the interviews I was conducting or thoughts I had while analyzing data. The main purpose of this journal was to keep an audit trail and keep any biases at the forefront of my mind, as I described in the role of the researcher section (3.6). However, I found that my journal also became a place for me to experience the impact the research had on me, a graduate student grappling with where, and if, I fit in the academy. I was on the job market while I was working on the co-constructed narratives, and found that my twelve participants truly acted as mentors to me through the stories they shared in their interviews.

For instance, many of the participants described their on-campus interview experiences. So, when it was my turn for an on-campus interview, it was hugely beneficial to read through Emma's narrative and remind myself that faculty would likely ask me "what courses can you teach?" I also knew to look for discussions surrounding teaching beyond organizational conversations, and because of Jason, I knew I wasn't the only person to feel vulnerable during the academic job search.

Like many of my participants, I entered graduate school wanting to get my PhD so that I could one day teach. I wanted to learn more about institutions where I could focus on teaching, which in part is why I conducted this dissertation study. However, I was excited to learn about a position type that was gaining popularity in engineering

programs, namely, the “teaching professor” track in Doctoral Universities. In these positions, faculty essentially flip the research and teaching components of their appointments, i.e., most of their time is spent on teaching, some on research, and a little on service. This seemed like a great fit for me, since, like a few of the participants, I came to the realization during graduate school that I loved research and being part of the research community, as well as being substantially engaged with teaching.

I am happy to say that I accepted a position as an assistant teaching professor. The position is at an R1 Institution, which would not have been my first choice, but became my first choice because of the position itself. I am thrilled to see this institution’s desire to improve their undergraduate engineering education and include teaching professors in the conversation. Furthermore, since I love understanding the experiences of graduate students, I am glad to be going to an institution that educates graduate students as well. I will even have the opportunity to share my research and the narratives in a course on engineering teaching for graduate teaching assistants.

Thank you to the twelve participants that shared their stories with me. I hope that this dissertation and the twelve narratives can have a similar impact on many other graduate students and faculty, just as it did on me.

REFERENCES

AAUP (American Association of University Professors). (2004). *Professors of Practice*. Reports and Publications. Retrieved rom https://www.aaup.org/report/professors-practice

Adams, K. A. (2002). *What colleges and universities want in new faculty: Preparing future faculty occasional paper series*. Washington, D.C: Association of American Colleges and Universities. Retrieved from http://www.aacu.org/pff/pdfs/PFF_Adams.PDF

Adams, R. S., & Felder, R. M. (2008). Reframing professional development: A systems approach to preparing engineering educators to educate tomorrow's engineers. *Journal of Engineering Education*, *97*(3), 239-240.

American Society for Engineering Education (ASEE). (2016). Electronic Membership Directory. Retrieved from https://www.asee.org/member-resources/resources/electronic-membership-directory

American Society for Engineering Education (ASEE). (2015). 2011 ASEE Profiles of Engineering and Engineering Technology Colleges [Data file]. Washington: ASEE.

Austin, A. E. (2002). Preparing the next generation of faculty: Graduate school as socialization to the academic career. *The Journal of Higher Education*, *73*(1), 94–122.

Austin, A. E. & McDaniels, M. (2006 a). Preparing the professoriate of the future: Graduate student socialization for faculty roles. *In Higher Education: Handbook of Theory and Research*. 397-456. Netherlands: Springer.

Austin, A. E. & McDaniels, M. (2006 b). Using doctoral education to prepare faculty to work within Boyer's four domains of scholarship. *New Directions for Teaching and Learning*, (129), 51-65.

Austin, A. E., Campa III, H., Pfund, C., Gillian-Daniel, D. L., Mathieu, R., & Stoddart, J. (2009). Preparing STEM doctoral students for future faculty careers. *New Directions for Teaching and Learning*, *Spring*(117), 83–95. http://doi.org/10.1002/tl

Baker, V. L., Pifer, M. J., & Lunsford, L. G. (2016). Faculty Challenges Across Rank in Liberal Arts Colleges: A Human Resources Perspective. *The Journal of Faculty Development, 30*(1), 23-30.

Berube, W. G., & Young, S. (2002). Tenure and promotion and the scholarship of teaching: two conversations or one? *Academic Exchange Quarterly, 6*(3), 161-168.

Bieber, J. P. & Worley, L. K (2006). Conceptualizing the academic life: Graduate students' perspectives. *The Journal of Higher Education*, *77*(6), 1009-1035.

Bird, S., & Kellam, N. N. (2013). *Teaching Journeys of Engineering Faculty: Stories of Transition.* Paper presented at 2013 ASEE Annual Conference, Atlanta, Georgia. https://peer.asee.org/22530

Boice, R. (1991a). New Faculty as Teachers. *The Journal of Higher Education, 62*(2), 150–173. http://doi.org/10.2307/1982143

Boice, R. (1991b). Quick starters: New faculty who succeed. *New directions for teaching and learning, 1991*(48), 111-121.

Borgford-Parnell, J. L, Turns, J., Atman, C. J., Yasuhara, K., & Fryhle, L. (2017). A pedagogy of larger concerns used as a lens to reflect on the design of student learning experiences. *European Journal of Engineering Education,* 1-16.

Borgford-Parnell, J. L. (2006). *Conceptions of teaching in a research-intensive university: what effective teachers think* (Doctoral dissertation). Retrieved from The University of Washington Research Works Archive.

Borrego, M., Cutler, S., Prince, M., Henderson, C., & Froyd, J. E. (2013). Fidelity of implementation of Research-Based Instructional Strategies (RBIS) in engineering science courses. *Journal of Engineering Education*, *102*(3), 394-425.

Borrego, M., Froyd, J. E., & Hall, T. S. (2010). Diffusion of engineering education innovations: A survey of awareness and adoption rates in US engineering departments. *Journal of Engineering Education*, *99*(3), 185-207.

Borrego, M. & Streveler, R. A. (2015). Preparing engineering educators for engineering education research. In Aditya Johri and Barbara M. Olds (Eds.) Cambridge Handbook of Engineering Education Research. Cambridge University Press. doi.org/10.1017/CBO9781139013451.029

Boyatzis, R. E. (1998). Transforming qualitative information: Thematic analysis and code development. Thousand Oaks: Sage Publications, Inc.

Boyer, E. (1990). Scholarship reconsidered. Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.

Boyer, E. L. (1991). The scholarship of teaching from: Scholarship reconsidered: Priorities of the professoriate. *College Teaching*, *39*(1), 11-13.

Brown, B. (2012). Daring greatly: How the courage to be vulnerable transforms the way we live, love, parent, and lead. New York, NY: Gotham Books.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational researcher*, *18*(1), 32-42.

Brown II, M. C., Davis, G. L., & McClendon, S. A. (1999). Mentoring graduate students of color: Myths, models, and modes. *Peabody Journal of Education,74*(2), 105-118.

Buller, J.L. (2010). The essential college professor: A practical guide to an academic career. San Francisco: Jossey-Bass.

The Carnegie Classification of Institutions of Higher Education (Carnegie). (n.d.). About Carnegie Classification. Retrieved (February 2016) from http://carnegieclassifications.iu.edu/.

Carnegie Classification of Institutions of Higher Education (Carnegie). (2015). 2015 update facts and figures: Descriptive Highlights. Retrieved (April 2016) from http://carnegieclassifications.iu.edu/downloads/CCIHE2015-FactsFigures-01Feb16.pdf

Case, J. M., & Light, G. (2011). Emerging methodologies in engineering education research. *Journal of Engineering Education*, *100*(1), 186-210.

Chaiklin, S. (2003). The zone of proximal development in Vygotsky's analysis of learning and instruction. *Vygotsky's educational theory in cultural context,1*, 39-64.

Chism, N. V. N. (1998). Developing a philosophy of teaching statement. *Essays on Teaching Excellence*, *9*(3), 1-2.

Connolly, M. R., Savoy, J. N., Lee, Y.-G., & Hill, L. B. (2016). Building a better future STEM faculty: How doctoral teaching programs can improve undergraduate education. Madison, WI: Wisconsin Center for Education Research, University of Wisconsin-Madison.

Crede, E., Borrego, M., & McNair, L. D. (2010). Application of community of practice theory to the preparation of engineering graduate students for faculty careers. *Advances in Engineering Education*, *2*(2), 1-22.

Creswell, J. W. (2012). Educational research: Planning, conducting, and evaluation quantitative and qualitative research. (4th Ed.). Boston: Pearson.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into practice*, *39*(3), 124-130.

The Chronicle of Higher Educaton. (July 28, 2017). Teaching Ph.D.s How to Teach. Retreived from: http://www.chronicle.com/specialreport/Teaching-PhDs-How-to-Teach/131

Cox, M. F., London, J. S., Ahn, B., Zhu, J., Torres-ayala, A. T., Frazier, S., & Cekic, O. (2011). Attributes for success for engineering PhDs: Perspectives from academia and industry. In *Proceedings of the 2011 American Society for Engineering Education Annual Conference and Exposition*.

Department of Education (DOE). (2016). Programs: Graduate Assistance in Areas of National Need. Retrieved from http://www2.ed.gov/programs/gaann/index.html

Etzkowitz, H., & Dzisah, J. (2015). Professors of practice and the entrepreneurial university. *International Higher Education*, (49).

Fairweather, J. (2005). Beyond the rhetoric: Trends in the relative value of teaching and research in faculty salaries. *The Journal of Higher Education*, *76*(4), 401-422.

Fairweather, J. (2008). Linking evidence and promising practices in science, technology, engineering, and mathematics (STEM) undergraduate education. *Board of Science Education, National Research Council, The National Academies, Washington, DC*.

Felder, R. M., Brent, R., & Prince, M. J. (2011). Engineering instructional development: Programs, best practices, and recommendations. *Journal of Engineering Education*, *100*(1), 89.

Felder, R. M., Woods, D. R., Stice, J. E., & Rugarcia, A. (2000). The future of engineering education II. Teaching methods that work. *Chemical Engineering Education*, *34*(1), 26-39.

Fereday, J. & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods*, *5*(1). pp. 80-92.

Finley, D. R. (2001, June), *Tips for Greasing the Tenure Track 3* Paper presented at 2001 Annual Conference, Albuquerque, New Mexico. https://peer.asee.org/9903

Finelli, C. J., Daly, S. R., & Richardson, K. M. (2014). Bridging the Research-to-Practice Gap: Designing an Institutional Change Plan Using Local Evidence. *Journal of Engineering Education*, *103*(2), 331-361.

Frank, C. (1999). Ethnographic Eyes: A Teacher's Guide to Classroom Observation. Portsmouth: Heinemann.

Frank, C. (2011). Ethnographic Interviewing for Teacher Preparation and Staff Development: A Field Guide. New York: Teachers College Press.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America, 111*(23), 8410–8415.

Geertz, C. (1973). Thick description: Toward an interpretive theory of culture. In C. Geertz, The interpretation of cultures: Selected essays (pp. 3–30). New York: Basic Books.

Golde, C. M., & Dore, T. M. (2001). At Cross Purposes: What the Experiences of Today's Doctoral Students Reveal about Doctoral Education.

Golde, C. M., & Walker, G. E. (2006). *Envisioning the future of doctoral education*. San Fransisco, CA: Jossey-Bass.

Goodyear, G. E., & Allchin, D. (1998). Statements of teaching philosophy. *To Improve the Academy,* Vol. 17, 103-122.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105-117). Thousand Oaks, CA: Sage Publications, Inc.

Harper, D. (2002). Talking about pictures: A case for photo elicitation. *Visual Studies, 17*(1), 13–26. http://doi.org/10.1080/14725860220137345

Haering, W. (2005). *Technical Engineering Research, Publication and Pedagogical Scholarship in A Teaching Oriented Small Campus Environment* Paper presented at 2005 Annual Conference, Portland, Oregon. https://peer.asee.org/14184

Henderson, C., Dancy, M., & Niewiadomska-Bugaj, M. (2012). Use of research-based instructional strategies in introductory physics: Where do faculty leave the innovation-decision process? Physical Review Special Topics-Physics Education Research, 8(2), 020104.Johnson, C. (2006). Best practices in syllabus writing: Contents of a learner-centered syllabus. *The Journal of chiropractic education, 20*(2), 139.

Jamison, L. H. & Lohmann, J. R. (2012). Innovation with impact: Creating a culture for scholarly and systematic innovation in engineering education. American Society for Engineering Education (ASEE): Washington, D.C.

Johnson R. & Christensen, L. B. (2013). *Educational research: Quantitative, qualitative, and mixed approaches*. (5th Ed.). Thousand Oaks: Sage Publications, Inc.

Kellam, N. N., & Gerow, K. S., & Walther, J. (2015). *Narrative Analysis in Engineering Education Research: Exploring Ways of Constructing Narratives to Have Resonance with the Reader and Critical Research Implications* Paper presented at 2015 ASEE Annual Conference and Exposition, Seattle, Washington. 10.18260/p.24521v

Kober, N. (2015). Reaching students: What research says about effective instruction in undergraduate science and engineering. Washington, DC: National Academies Press.

Lave, J. (1991). Situating learning in communities of practice. *Perspectives on socially shared cognition*, *2*, 63-82.

Lewandowski, G., & Fried, J., & Bishop, P., & Kukreti, A., & Purdy, C. (2003). *A Model Preparing Future Faculty Program for Engineering* Paper presented at 2003 Annual Conference, Nashville, Tennessee. https://peer.asee.org/11833

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalist inquiry*. Beverly Hills, CA: Sage Publications, Inc.

Marra, R. M., Rodgers, K. A., Shen, D. & Bogue, B. (2012). Leaving engineering: A multi-year single institution study. *Journal of Engineering Education*, *101*(1), 6-27.

National Academies of Sciences, Engineering, and Medicine. (2016). *Quality in the Undergraduate Experience: What Is It? How Is It Measured? Who Decides? Summary of a Workshop.* Washington, DC: The National Academies Press. https://doi.org/10.17226/23514.

National Science Foundation (NSF). (2016). Early career doctorates project. Retrieved from: http://www.nsf.gov/statistics/srvyecd/

National Science Foundation (NSF). (2016). Introduction to the IGERT program. Retrieved from http://www.nsf.gov/crssprgm/igert/intro.jsp

Olson, S., & Riordan, D. G. (2012). Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics. Report to the President. *Executive Office of the President*.

Parkes, J., Fix, T. K., & Harris, M. B. (2003). What syllabi communicate about assessment in college classrooms. *Journal on Excellence in College Teaching*, *14*(1), 61-83.

Patton, M. Q. (2002). Qualitative Research and Evaluation Methods (3rd Ed.) (2002). SAGE Publications.

Pawley, A. L. "Learning from small numbers" of underrepresented students' stories: Discussing a method to learn about institutional structure through narratives. Proceedings of the American Society for Engineering Education Annual Conference and Exposition, Atlanta, GA.

Pifer, M. J., Baker, V. L., & Lunsford, L. G. (2015). Academic departments as networks of informal learning: faculty development at liberal arts colleges. *International Journal for Academic Development*, *20*(2), 178-192.

Polkinghorne, D. E. (2007). *Validity issues in narrative research*. Qualitative inquiry, 13(4), 471-486.

Polkinghorne, D. E. (1995). Narrative configuration in qualitative analysis. *International Journal of Qualitative Studies in Education*, *8*(1), 5-23.

Pratt, D. (1992). Conceptions of teaching. Adult Education Quarterly, 42:203-220.

Prevost, L. B., Vergara, C. E., Urban-Lurain, M., & Campa, H. (2017). Evaluation of a High-Engagement Teaching Program for STEM Graduate Students: Outcomes of the Future Academic Scholars in Teaching (FAST) Fellowship Program. *Innovative Higher Education*, 1-15.

Prince, M. J., Felder, R. M., & Brent, R. (2007). Does faculty research improve undergraduate teaching? An analysis of existing and potential synergies. *Journal of Engineering Education*, *96*(4), 283-294.

Preparing Future Faculty (PFF). (2016). The preparing future faculty program. http://www.preparing-faculty.org/ (accessed on 4/4/2016).

Preparing Future Faculty (PFF). (2016). Similar versions of PFF. http://www.preparing-faculty.org/PFFWeb.Like.htm (accessed 4/4/2016)

Rogers, S. W., & Goktas, R. K. (2010). Exploring engineering graduate student research proficiency with student surveys. *Journal of Engineering Education*, *99*(3), 263-278.

Roach, M., & Sauermann, H. (2017). The declining interest in an academic career. *PloS one*, *12*(9), e0184130.

Rugarcia, A., Felder, R. M., Woods, D. R., & Stice, J. E. (2000). The future of engineering education I. A vision for a new century. *Chemical Engineering Education*, *34*(1), 16-25.

Seidman, I. (2013). Interviewing as qualitative research: A guide for researchers in education and the social sciences. Teachers college press.

Seldin, P. (2011). The academic portfolio: A practical guide to documenting teaching, research, and service. San Francisco: Jossey-Bass.

Seymour, E., & Hewitt, N. M. (1997). Talking about leaving. Westview Press, Boulder, CO.

Smith, M. F., & Razzouk, N. Y. (1993). Improving classroom communication: The case of the course syllabus. *Journal of Education for Business*, *68*(4), 215-221.

Solem, M., Foote, K., & Monk, J. (2008). Aspiring academics: A resource book for graduate students and early career faculty. Upper Saddle River, NJ: Prentice Hall.

Sorcinelli, M. D. (1994). Effective approaches to new faculty development. *Journal of Counseling and Development: JCD*, *72*(5), 474.

Sorcinelli, M. D., Austin, A. E., Eddy, P. L., & Beach, A. L. (2005). Creating the future of faculty development: Learning from the past, understanding the present.

Sroka, Z. J. (2015). Engineering education vs. teacher training of academics. *International Journal of Mechanical Engineering Education*, 0306419015590718.

Stice, J. E., Felder, R. M., Woods, D. R., & Rugarcia, A. (2000). The future of engineering education. IV. Learning how to teach. *Chemical Engineering Education*, *34*(2), 118-127.

Tracy, S. J. (2010). Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative inquiry*, *16*(10), 837-851.

Torres Ayala, A. T. (2013). Future Engineering Professors' Conceptions of Learning and Teaching Engineering (Doctoral Dissertation). Retrieved from University of South Florida Scholar Commons.

Trellinger, N. M., & Loui, M. C. (2015). Learning philosophies: A glimpse into students' approaches to learning. In *Frontiers in Education Conference (FIE)*, pp. 1-8. IEEE.

Trellinger, N. M., & Jesiek, B. K. (2016). Teaching pathways in the academy: A narrative study of engineering faculty at institutions with varying teaching and research activity. In *Frontiers in Education Conference (FIE)*, pp. 1-5. IEEE. © 2016 IEEE.

Trellinger, N. M., & Jesiek, B. K. (2017). How six assistant professors landed their jobs at baccalaureate colleges and master's institutions: A focus on pathways and teaching (un)preparedness. In *2017 ASEE Annual Conference & Exposition*, Columbus, Ohio. https://peer.asee.org/28449 © 2017 ASEE.

Trellinger, N. M., Jesiek, B. K., & Nittala, S. (2017). Special Session: Workshop – A narrative approach to broadening schema about engineering professors. In *Frontier in Education Conference (FIE)*, pp. 1-4. IEEE.

Turner, J. L., Miller, M., & Mitchell-Kernan, C. (2002). Disciplinary cultures and graduate education. *Emergences*, *12*(1), 47–70. http://doi.org/10.1080/104572202200000344

VanDeGrit, T. & Davis, J. (2006). The journey to a teaching oriented faculty position: A handbook of advice for graduate students. . In *Proceedings of the 2006 American Society for Engineering Education Annual Conference and Exposition*.

Walther, J., Sochacka, N. W., & Kellam, N. N. (2013). Quality in interpretive engineering education research: Reflections on an example study. *Journal of Engineering Education*, *102*(4), 626-659.

Wankat, P. C. (2002). The effective, efficient professor: Teaching, scholarship, and service. Allyn and Bacon.

Webster, L., & Mertova, P. (2007). Using narrative inquiry as a research method: An introduction to using critical event narrative analysis in research on learning and teaching. New York, NY: Routledge.

Wenger, E. (2000). Communities of practice and social learning systems. Organization, 7(2), 225-246.

Yin, R. K. (2001). *Case-study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

APPENDIX A: CARNEGIE CLASSIFICATION DESCRIPTIONS

All information retreived from Carnegie (n.d.)

Doctoral University:

Institutions were included in these categories if they awarded at least 20 research/scholarship doctorates in 2013-14. Professional practice doctoral degrees (J.D., M.D., Pharm.D., Aud.D., DNP, etc.) were not counted for the purpose of this criterion. These categories were limited to institutions that were not identified as Tribal Colleges or Special Focus Institutions.

Highest Research Activity (R1) vs. Higher Research Activity (R2) vs. Moderate Research Activity (R3) Universities:

Doctoral universities were assigned to one of three categories based on a measure of research activity. The research activity scale includes the following correlates of research activity: research & development (R&D) expenditures in science and engineering; R&D expenditures in non-S&E fields; S&E research staff (postdoctoral appointees and other non-faculty research staff with doctorates); doctoral conferrals in humanities fields, in social science fields, in STEM (science, technology, engineering, and mathematics) fields, and in other fields (e.g., business, education, public policy, social work). These data were statistically combined using principal components analysis to create two indices of research activity reflecting the total variation across these measures (based on the first principal component in each analysis).

One index represents the aggregate level of research activity, and the other captures per-capita research activity using the expenditure and staffing measures divided by the number of full-time faculty within the assistant, associate and full professor ranks. The values on each index were then used to locate each institution on a two-dimensional graph. We calculated each institution's distance from a common reference point, and then used the results to assign institutions to one of three groups based on their distance from the reference point. Thus, the aggregate and per-capita indices were considered equally, such that institutions that were very high on either index were assigned to the "highest research activity" group, while institutions that were high on at least one (but very high

on neither) were assigned to the "higher research activity" group. Remaining institutions and those not represented in the NSF data collections were assigned to the "limited research activity" category. Before conducting the analysis, raw data were converted to rank scores to reduce the influence of outliers and to improve discrimination at the lower end of the distributions where many institutions were clustered.

Master's Colleges and Universities (Large, Medium, and Small):

Institutions were included in these categories if they awarded at least 50 master's degrees in 2013-14, but fewer than 20 research doctorates (as defined above). Some institutions with smaller master's programs were also included (see below). These categories were limited to institutions that were not identified as Tribal Colleges or Special Focus Institutions.

Baccalareate Colleges:

Institutions were included in these categories if bachelor's degrees accounted for at least 50 percent of all degrees awarded and they awarded fewer than 50 master's degrees (2013-14 degree conferrals). In addition, these categories were limited to institutions that were not identified as Tribal Colleges or as Special Focus Institutions.

Special Focus Institutions:

The special-focus designation was based on the concentration of degrees in a single field or set of related fields, at both the undergraduate and graduate levels. Institutions were determined to have a special focus with concentrations of at least 75 percent of undergraduate and graduate degrees. In some cases, the percentage criterion was relaxed if an institution identified a special focus on the College Board's Annual Survey of Colleges, or if an institution's only recognized accreditation was from an accrediting body related to the special focus categories.

APPENDIX B: INTERVIEW PROTOCOL

Background:

Who am I (Natascha)? My story and journey to the research objectives and purpose.

Tell me about yourself.

Part A (Pathways)

1. Walk me through your pathway to your current position.
    a. When did you decide to pursue graduate school and why?
    b. When did you decide to pursue a faculty career and why?
    c. Why did you select your current position and what factors came into play?
    d. What was the interview process at your current institution like?
    e. How have you experienced the transition between institution cultures of your undergraduate, graduate, and faculty institutions?
2. Walk me through your pathway to teaching.
    a. What, if any, formal opportunities did you have to teach?
    b. What, if any, informal opportunities did you have to teach?
    c. How did you learn what faculty do?
3. If you could redesign your graduate program, what are the key things you would include?
4. How do you perceive teaching in relation to tenure?
    a. Are you encouraged to spend time on teaching?
    b. How is your teaching evaluated?
    c. Are you satisfied with the balance you have between your duties as a faculty member?
    d. How does your department/institution support or deter you from teaching?

Part B (Artifact Elicitation)

1. Walk me through one of your course syllabi for a course that you are currently teaching or recently taught.
    a. What were your goals for the students in this course?
    b. What were your own goals for yourself as the instructor of the course?

    c. What are your grading policies?
    d. Walk me through a course assignment for the course.
    e. Walk me through a typical class period.
2. Walk me through your current teaching philosophy statement.
    a. What experiences were you drawing on when you wrote this statement?
    b. Are there any especially good or bad events that have influenced your conceptions about teaching?
    c. Was there any person(s) you used as a model or tried to emulate?
    d. Are you able to practice your ideology of this statement?
        i. Why or why not?

APPENDIX C: THEMATIC ANALYSIS CODEBOOK

The codebook used for thematic analysis of the data is presented in Table 9 below. The codes are mapped to the research questions, which are restated here for convenience:

1) How do assistant professors experience the transition from graduate school and/or other previous educational and/or work experiences to their current faculty position?
    a. How do assistant professors experience the process of applying to and choosing the institution in which they are currently employed?
    b. How do assistant professors describe their graduate student experiences and other preparation for their current faculty position?
2) How do assistant professors describe their current teaching conceptions and methods?
    a. How have these conceptions been influenced by graduate school experiences and current institution experiences?
    b. How do the teaching conceptions of the assistant professors in this study compare?

Table 10: Codebook used for Thematic Analysis of Interview Transcripts

Code		RQ	Description
Context and Relationships			
	Current Institution	1, 2a	Descriptions of Current Institution contexts and relationships
	Graduate School	1, 2a	Descriptions of graduate school contexts and relationships, including advisor and other mentors
	Postdoc/Industry	1, 2a	Description of postdoctoral, industry, or other intermediate experiences
	Undergraduate	1b, 2a	Description of undergraduate context and relationships
	External/Other	1, 2a	Description of familial context and influence, or other context and relationships (such as networks made at conferences)
Faculty Conceptions			

	Useful Experiences	1	Description of teaching experiences prior to faculty position. Also includes desired (but unavailable/inaccessible) useful experiences in graduate school
	Socialization/Apprenticeship	1	Description of experiences related to socialization regarding faculty life, and/or apprenticeship into the role during graduate school
	Self-Efficacy	1	Descriptions about emotional experiences and/or regarding the participant's self-efficacy as faculty members
	Expectations	1	Descriptions about faculty life expectations including those related to tenure
	Research-Teaching-Service	1, 2	Descriptions about faculty life relating to research, teaching, and/or service
Teaching Conceptions			
	Methods*	2	Descriptions about teaching methods employed in the classroom
	Philosophies	2	Descriptions about teaching philosophies, including philosophies about classroom teaching as well as more general and broad philosophies about education
	Role of Students/Teacher	2	Descriptions pertaining to the role of students/teachers in the classroom and on decision making
	Inspirations	2	Descriptions of teaching inspirations, including classes and/or people
	Enacted vs. Ideal	2	Descriptions of desired improvement in teaching and comparisons between what is practiced/enacted in the classroom vs what is ideal in terms of teaching
Transitions			
	Turning Points	1, 2	Descriptions of significant events, aha moments, and/or critical incidents along the pathway to becoming an assistant professor
	Role	1, 2	Descriptions of various roles participants might take on (such as parent, student, teacher, researcher), also observations of roles in different institution types

	Goals/Plans	1	Descriptions of goals and plans along the pathway to faculty position
	Competencies	1	Descriptions of key competencies that have been important in getting the job and/or on the job
	Hesitations/Challenges	1	Descriptions of hesitations and/or challenges along the pathway to faculty position
	Luck	1	Descriptions of "luck" playing a role in the pathway to faculty position
	Tenure	1	Descriptions of tenure and promotion criteria and/or perceptions of these criteria
	Application Process	1a, 1b	Descriptions of the job application process on the pathway to faculty position

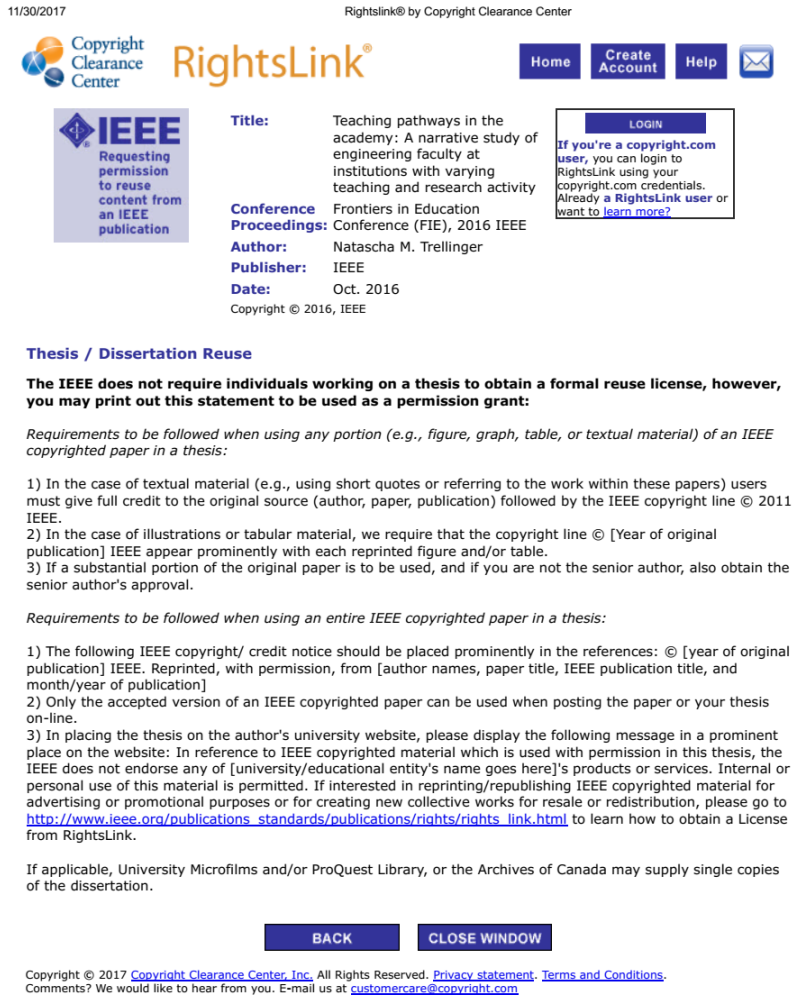
*Codebook for teaching conceptions

Framework	
Torres Ayala (2012)	1) delivering knowledge 2) helping students understand and apply concepts 3) motivating students 4) helping students learn how to approach problems 5) preparing students to make socially conscious decisions
Borgford-Parnell (2006)	1) teacher's power is leavened with responsibility 2) students are synonymous with positive vision of future 3) learning to learn takes precedence 4) teachers are essential to student learning 5) new learning fits to the student's lifetime of learning
Emergent	Teaching is evidence-based

APPENDIX D: COPYRIGHT

© 2016 IEEE

Portions of this dissertation were originally published in the 2016 IEEE Frontiers in Education Conference Proceedings (citation below) and are reused with permission of the IEEE.



11/30/2017 Rightslink® by Copyright Clearance Center

Copyright Clearance Center RightsLink® Home Create Account Help

IEEE Requesting permission to reuse content from an IEEE publication

Title: Teaching pathways in the academy: A narrative study of engineering faculty at institutions with varying teaching and research activity

Conference Proceedings: Frontiers in Education Conference (FIE), 2016 IEEE

Author: Natascha M. Trellinger

Publisher: IEEE

Date: Oct. 2016

Copyright © 2016, IEEE

LOGIN

If you're a copyright.com user, you can login to RightsLink using your copyright.com credentials. Already a RightsLink user or want to learn more?

Thesis / Dissertation Reuse

The IEEE does not require individuals working on a thesis to obtain a formal reuse license, however, you may print out this statement to be used as a permission grant:

Requirements to be followed when using any portion (e.g., figure, graph, table, or textual material) of an IEEE copyrighted paper in a thesis:

1) In the case of textual material (e.g., using short quotes or referring to the work within these papers) users must give full credit to the original source (author, paper, publication) followed by the IEEE copyright line © 2011 IEEE.
2) In the case of illustrations or tabular material, we require that the copyright line © [Year of original publication] IEEE appear prominently with each reprinted figure and/or table.
3) If a substantial portion of the original paper is to be used, and if you are not the senior author, also obtain the senior author's approval.

Requirements to be followed when using an entire IEEE copyrighted paper in a thesis:

1) The following IEEE copyright/ credit notice should be placed prominently in the references: © [year of original publication] IEEE. Reprinted, with permission, from [author names, paper title, IEEE publication title, and month/year of publication]
2) Only the accepted version of an IEEE copyrighted paper can be used when posting the paper or your thesis on-line.
3) In placing the thesis on the author's university website, please display the following message in a prominent place on the website: In reference to IEEE copyrighted material which is used with permission in this thesis, the IEEE does not endorse any of [university/educational entity's name goes here]'s products or services. Internal or personal use of this material is permitted. If interested in reprinting/republishing IEEE copyrighted material for advertising or promotional purposes or for creating new collective works for resale or redistribution, please go to http://www.ieee.org/publications_standards/publications/rights/rights_link.html to learn how to obtain a License from RightsLink.

If applicable, University Microfilms and/or ProQuest Library, or the Archives of Canada may supply single copies of the dissertation.

BACK CLOSE WINDOW

Copyright © 2017 Copyright Clearance Center, Inc. All Rights Reserved. Privacy statement. Terms and Conditions.
Comments? We would like to hear from you. E-mail us at customercare@copyright.com

Trellinger, N. M., & Jesiek, B. K. (2016). Teaching pathways in the academy: A narrative study of engineering faculty at institutions with varying teaching and research activity. In *Frontiers in Education Conference (FIE)*, pp. 1-5. IEEE. © 2016 IEEE.

Trellinger, N. M., & Jesiek, B. K. (2017). How six assistant professors landed their jobs at baccalaureate colleges and master's institutions: A focus on pathways and teaching (un)preparedness. In *2017 ASEE Annual Conference & Exposition*, Columbus, Ohio. https://peer.asee.org/28449

VITA

Natascha Trellinger Buswell

natbuswell@gmail.com

Education

Doctor of Philosophy, Engineering Education, December 2017
- School of Engineering Education, College of Engineering
- Purdue University – West Lafayette, IN
- Committee: Brent K. Jesiek (Chair), Ruth A. Streveler, Michael C. Loui, and Jim Borgford-Parnell (University of Washington)
    - Dissertation Title: Swimming upstream: Pathways of new engineering faculty at non-R1 institutions

Bachelor of Science, Aerospace Engineering, May 2013
- Second Major: Mathematics
- Syracuse University – Syracuse, NY

Honors and Awards

Engineering Education Outstanding Graduate Student Service Award, School of Engineering Education, April 2016

Graduate Research Fellowship Program (GRFP) Honorable Mention, National Science Foundation (NSF), April 2015

Purdue Doctoral Fellowship, The Graduate School, Purdue University August 2013 – July 2017

Charles Libove Memorial Award for Outstanding Aerospace Senior, College of Engineering and Computer Science, Syracuse University, May 2013

Yueh-Ying Memorial Award, College of Engineering and Computer Science, Syracuse University, May 2013

L.C. Smith College of Engineering Graduation Marshal, Syracuse University, 2013

Remembrance Scholar, Syracuse University, 2012-2013

Brill Family Scholarship, Society of Women Engineers, 2012-2013

Astronaut Scholarship Nominee, College of Engineering and Computer Science, Syracuse University, 2012

Record Scholar, Tau Beta Pi, 2011-2012

Ellen H. Honnold Scholarship, Awarded twice, College of Engineering and Computer Science, Syracuse University, 2011-2013

Founders Scholarship, Syracuse University, August 2009 – May 2013

Grants

Women in Engineering Program (WiEP) Travel Grant, Purdue University, October 2017.

Women in Engineering Program (WiEP) Travel Award, Purdue University, June 2016.

Women in Engineering Program (WiEP) Travel Award, Purdue University, October 2015.

Research Appointments

Graduate Research Assistant, School of Engineering Education, Purdue University

- **CAREER: Becoming Boundary Spanners Investigating, Enhancing, and Assessing the Experiences of Early Career Engineers,** NSF 1254323, January 2014 – present
    - Coordinated over 20 interviews with early career engineers and intern and co-op students; conducted over 15 of these interviews; analyzed data to thematic categories; co-authored multiple papers
- **Research Initiation Grant: Writing to Learn Engineering: Identifying Effective Techniques for the Integration of Written Communication into Engineering Classes and Curricula,** NSF 1340491, January 2014 – present
    - Contributed to data collection efforts including survey development and deployment, and textbook identification; contributed to data analysis efforts including quantitative survey analysis and qualitative textbook analysis; first-authored and co-authored multiple papers
- **Engineering Education Explorers: First-Year Engineering Choice of Engineering Major,** Purdue University, School or Engineering Education, Fall 2013
    - Analyzed first-year engineering student data about reasons for choosing their major using thematic analysis

Research Assistant and Trainee, Center for Engineering Learning and Teaching (CELT), University of Washington

- **Engineering Education Pioneers and Trajectories of Impact,** NSF Grant No. 1263512, January 2014-August 2014
    - Conducted an interview with Dr. Stephanie Adams; constructed a narrative profile about Dr. Adams; analyzed data of all graduate student project participants; first-authored a paper

Teaching Appointments

Co-Instructor, Purdue University

- ENGR 20100: Engineering in Global Context, Spring 2016
    - Created in-class worksheets and provided detailed feedback on students' writing

Faculty Apprentice, Purdue University

- ENE 50600: Content, Assessment, and Pedagogy: An Integrated Engineering Design Approach, Fall 2015
    - Included a pre- and post- self-assessment for students to recognize their learning and growth as engineering educators

Graduate Teaching Assistant, Purdue University

- ENGR 20100: Engineering in Global Context, Spring 2015
    - Conducted a scholarship of teaching and learning (SoTL) project on students' beliefs about learning in a nontechnical course, published at FIE 2015

- ENGR 49400: Women in Engineering Seminar: Gender in the Workplace, Spring 2015

Academic Excellence Workshop (AEW) Facilitator, Syracuse University

- Subjects: Calculus II; Engineering Mechanics: Statics; Engineering Mechanics: Dynamics; Engineering Thermodynamics

Leadership and Mentoring Activities

Purdue Graduate Student Government (PGSG), Purdue University, August 2017 – Present.

- Reviewer: Travel, professional, and organizational grants

Women in Engineering Program (WiEP) Graduate Mentoring Program (GMP), Purdue University, June 2014 – June 2016

- The Graduate Mentoring Program plays an instrumental role in the support and retention of female graduate engineering students. The peer-mentoring program formally met once a month and had additional informal meetings based on students' interests
- As a Leadership Team Member, I played an integral role in coordinating the monthly meetings with external speakers, creating and distributing newsletters, and the recruitment and retention of our membership.

Engineering Education Graduate Student Association (ENEGSA), Purdue University, May 2014 – May 2015

- Graduate Student Advisory Board Representative, elected position.
  - Attended meetings with the Associate Dean of Graduate Education to report on issues and concerns of the engineering education student body.
- Professional Development Chair
  - Organized the visit of a Distinguish Lecturer.

Journal Publications (note: name change in 2017)

Jesiek, B. K., Mazzurco, A., **Buswell, N. T.**, & Thompson, J. D. (*accepted*). Boundary spanning and engineering: A qualitative systematic review. *Journal of Engineering Education.*

Buswell, N. T., Jesiek, B. K., Troy, C. D., Essig, R. R., & Boyd, J. (*under review*). Engineering faculty on writing: What they think and what they want. *IEEE Transactions on Professional Communication.*

Peer-Reviewed Conference Publications (in reverse-chronological order)

14. **Trellinger, N. M.**, & Jesiek, B. K. (2017). How six assistant professors landed their jobs at baccalaureate colleges and master's institutions: A focus on pathways and teaching (un)preparedness. *124th ASEE Annual Conference & Exposition*, June 25-28. Columbus, Ohio. https://peer.asee.org/28449
13. Jesiek, B. K., & **Trellinger, N. M.**, & Nittala, S., & Campbell, S. J. (2017). Interns in the wild: Using structured reflection and interviews to investigate early career

engineering practice. *124th ASEE Annual Conference & Exposition*, June 25-28. Columbus, Ohio. https://peer.asee.org/28575

12. **Trellinger, N. M.** & Jesiek, B. K. (2016). Teaching pathways in the academy: A narrative study of engineering faculty at institutions with varying research and teaching activity. In *Frontiers in Education Conference (FIE), IEEE* (pp. 1-5), October 12-15. Erie, PA.
11. **Trellinger, N. M.,** Jesiek, B. K., Troy, C. D., Boyd, J. & Essig, R. R. (2016). Engineering faculty on writing: What they think and what they want. *123rd ASEE Annual Conference and Exposition*, June 25-28, New Orleans, LA.
10. Jesiek, B. K., **Trellinger, N. M**. & Mazzurco, A. (2016). Becoming boundary spanning engineers: Research methods and preliminary findings. *123rd ASEE Annual Conference and Exposition*, June 25-28, New Orleans, LA.
9. Troy, C. D., Essig, R. R., Jesiek, B. K., **Trellinger, N. M.** & Boyd, J. (2016). Writing to learn engineering: Identifying effective techniques for the integration of written communication into engineering classes and curricula. *123rd ASEE Annual Conference and Exposition*, June 25-28, New Orleans, LA.
8. **Trellinger, N. M.** & Loui, M. C. (2015). Learning philosophies: A glimpse into students' approaches to learning. In *Frontiers in Education Conference (FIE), IEEE* (pp. 1-8), October 21-24. El Paso, TX.
7. Jesiek, B. K., Mazzurco, A., **Trellinger, N**. & Ramane, K. (2015). Becoming boundary spanners in engineering: Identifying roles, activities, and competencies. In *Frontiers in Education Conference (FIE), IEEE.* (pp. 1-5), October 21-24. El Paso, TX.
6. Kong, N., Forin, T. R., Jesiek, B. K. & **Trellinger, N. M**. (2015). *Purdue-Tsinghua undergraduate research dual exchange: A new programmatic implementation for enhancing global learning. 122nd ASEE Annual Conference and Exposition*, June 15-18, Seattle, WA.
5. **Trellinger, N. M.**, Essig, R. R., Troy, C. D., Jesiek, B. K. & Boyd, J. (2015). Something to write home(work) about: An analysis of writing exercises in fluid mechanics textbooks. *122nd ASEE Annual Conference and Exposition*, June 15-18, Seattle, WA.
4. **Trellinger, N. M.**, Sattler, B. & Turns, J. (2015). "I realized that I myself am on the path to being a pioneer": Characterizing the experiences of graduate students in an

innovating interviewing experience. *122nd ASEE Annual Conference and Exposition*, June 15-18, Seattle, WA.

3. Adams, R., Berdanier, C. G. P., Branham, P., Choudhary, N., Fletcher, T., Goldstein, M., Joslyn, C., Mathis, C., Siverling, E., **Trellinger, N. M.** & Wilson, M. D. (2014). A community of practice approach to becoming an engineering education research professional. *121st ASEE Annual Conference and Exposition*, June 15-18, Indianapolis, IN.
2. Essig, R. R., Troy, C. D., Jesiek, B. K., Boyd, J. & **Trellinger, N. M.** (2014). Adventures in paragraph writing: The development and refinement of scalable and effective writing exercises for large-enrollment engineering courses. *121st ASEE Annual Conference and Exposition*, June 15-18, Indianapolis, IN.
1. Troy, C. D., Essig, R. R., Jesiek, B. K., Boyd, J. & **Trellinger, N. M.** (2014). Writing to learn engineering: Identifying effective techniques for the integration of written communication into engineering classes and curricula. *121st ASEE Annual Conference and Exposition*, June 15-18, Indianapolis, IN.

Book Review

Jesiek, B. K. & **Trellinger, N. M.** (2014). Book Review: Arguments that count: Physics, computing, and missile defense by Rebecca Slayton, MIT Press. *IEEE Annals of the History of Computing, 36*(4), 88-90.

Presentations (in reverse-chronological order)

How six assistant professors landed their jobs at baccalaureate colleges and master's institutions: A focus on pathways and teaching (un)preparedness. 124th ASEE Annual Conference & Exposition, Columbus, OH, June 27th, 2017

Your engineering toolbox in action. University of California, Irvine, MAE 145, Irvine, CA, April 17th, 2017.

Teaching pathways in the academy: A narrative study of engineering faculty at institutions with varying teaching and research activity. Frontiers in Education Conference, Erie, PA, October 14th, 2016

Engineering faculty on writing: What they think and what they want. ASEE Annual Conference and Exposition, New Orleans, LA. June 28th, 2016

Learning philosophies: A glimpse into students' approaches to learning. Frontiers in Education Conference, El Paso, TX, October 24th, 2016.

Something to write home(work) about: An analysis of writing exercises in fluid mechanics textbooks. ASEE Annual Conference and Exposition, Seattle, WA, June 17th, 2015.

"I realized that I myself am on the path to being a pioneer": Characterizing the experiences of graduate students in an innovating interviewing experience. ASEE Annual Conference and Exposition, Seattle, WA, June 16th, 2015.

Participation outcomes of the pioneer interviewers. Center of Engineering Teaching and Learning (CELT), University of Washington, Seattle, WA, August 13th, 2014.

First Year Engineering (FYE) Choice of Major Research. School of Engineering Education Seminar at Purdue University, West Lafayette, IN, November 21st, 2013.

Professional Development Activities

Reflections Workshop led by Drs. Jennifer Turns and Cindy Atman, attendee, University of Washington, September 14-15, 2017

NextProf Workshop, invited attendee, University of Michigan, September 27-30, 2016.

Women in Engineering ProActive Network (WEPAN) Annual Conference, attendee, Broomfield, CO, June 14-16, 2016.

Effective Teaching Workshop moderated by Drs. Richard Felder and Rebecca Brent, attendee, Purdue University, March 2nd, 2016.

Conference for Pre-Tenure Women, attendee, Purdue University, September 24-25, 2015.

Other Scholarly Work

Trellinger, N. M., Sattler, B., & Turns, J. (2014). Participation outcomes of the pioneer interviewers. CELT Technical Report, CELT 14-04, Center for Engineering Learning and Teaching, University of Washington, Seattle, WA, USA.

Trellinger, N.M. (2014). Engineering Education Pioneers Profile on Stephanie G. Adams. http://depts.washington.edu/celtweb/pioneers-wp/?p=477

Graduate Level Engineering Coursework

Course Work:

- AAE590: Mechanical Behavior of Materials, Purdue University, Spring 2015
- AAE590: Air Transportation Systems, Purdue University, Fall 2015
- ME577: Human Motion Kinetics, Purdue University, Spring 2016

Service Activities

Purdue Graduate Student Government (PGSG) Grant Reviewer, Aug. 2016 – May 2017

- Travel Grant
- Professional Grant

- Graduate Student Association Grant

Reviewer – Journals

- Journal of Engineering Education (JEE), 2015 – Present
- International Journal of Chinese Education (IJCE), 2015

Reviewer – Conferences

- American Society of Engineering Education (ASEE) Annual Conference and Exposition, 2014 - Present
- Frontiers of Education (FIE), 2015

Industry Experience

Launch Operations Intern, United Launch Alliance (ULA), Cape Canaveral, FL, Summer 2013

- Acted as Person in Charge (PIC) leading technicians and inspectors supervising procedures and conducting tasks including the installation of the flight ground wire on the vehicle's first stage (Atlas).

Mission Design Intern, United Launch Alliance (ULA), Centennial, CO, Summer 2012

- Designed and programmed a graphical user interface in support of a manual data manipulation project.
- Acted as the Project Manager for the Intern Rocket Recovery Team

Structures Intern, United Launch Alliance (ULA), Centennial, CO, Summer 2011