The Motivation and Identity Development of Graduate Teaching Assistants in First-Year Engineering Programs

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Abstract

Many engineering programs have a common content based first-year curriculum that all engineering students are required to take. These courses tend to be large in size, having multiple sections requiring the use of Teaching Assistants (TAs) who may be graduate students (GTAs) or undergraduate students (UTAs). The roles of TAs in first-year engineering courses vary from instructional staff to lab supervisors to graders, but despite their widespread use, little is known about the TAs' experiences. This study fills a gap in the literature by taking a participant centered approach to GTA motivation to teach and identity development as a teacher specifically in the context of first-year engineering programs (FYEPs).

To guide this research, a combined motivation and identity framework was developed based on Self-Determination Theory (SDT) and Possible Selves Theory (PST). In the framework, PST serves as the foundation for the SDT constructs of competence, relatedness, and autonomy. The framework supports that the various constructs lead to increased motivation and identity development but that each experience through the process is based on one's own identity and views of themself in the future. This was studied through an exploratory sequential mixed methods design where 12 semi-structured interviews representing five different FYEPs served as the foundation for the development of a national survey completed by 33 GTAs representing seven different FYEPs. Priority was ultimately given to the qualitative strand, but mixing occurred throughout the study.

The results indicate that there are seven factors that affect GTA motivation and identity and there are profiles, lenses, and filters can be used to understand GTAs' experiences in FYEPs. While each individual is unique, general trends among experiences were observed. Additionally based on the results, the framework was found to be an appropriate tool but that a slight modification was needed to better align the framework with GTA developmental trends. This research allows future research-based GTA training programs and appointments to be developed that specifically aim towards meeting the motivational and identity developmental needs of GTAs, ultimately improving the quality of higher education.

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CHAPTER 1: Introduction of the Research

Each and every day, the world changes with new technology and information. Engineers contribute to this evolution and are needed to meet the demands and challenges resulting from change. To be prepared to support and advance progress, engineers need appropriate skills and knowledge. For many engineers, preparation begins in the first year of undergraduate education in a first-year engineering program (FYEP). It is in these FYEPs that students begin developing skills, constructing knowledge, and starting a path to becoming a successful engineer. While this journey is self-driven, the teachers who educate, mentor, and lead these students have a great impact on the students' future and commitment to engineering. One type of teacher engineering students often encounter in their first year is the Graduate Teaching Assistant (GTA). In higher education, the use of GTAs is common, so ensuring GTAs are well prepared and equipped to educate engineering students to face the future is necessary for continued progress and advancement as a field and society. The first step to creating successful educators is to understand their motivation for teaching and their identity as a teacher as these two constructs are fundamental to how we act and who we are. By understanding the motivation and identity of GTAs in engineering, we can create programs specifically designed to enhance their teaching based on their unique needs, ultimately enhancing the education of future engineers. It is in this perspective that my dissertation resides.

1.1 The Research Problem

GTAs are an integral part to higher education often serving as instructors and having direct contact with students both in the first-year and beyond. Due to their presence in many classrooms, they play a significant role in all aspects related to higher education including retention. Before we can begin to improve the retention of undergraduates, I argue that we first must understand the factors affecting GTA motivation to teach and identity development as teachers. Figure 1 below captures the overall issue of retention and how that focuses to the problem of interest for this work.

Figure 1: The Need Related to Retention

To summarize this figure, improving retention is a goal in higher education especially in engineering. One way to improve retention would be to improve the quality of teaching, and one way to improve teaching would be through the use of training programs. Before effective training programs can be developed, we must first understand the experiences of teachers in the classroom. Finally, before we can understand their experiences, we must identify the factors affecting their motivation and identity because those are fundamental constructs affecting how we act and who we are. Therefore, the problem for this research is that the retention of engineering students is a critical issue and little is known about the experiences of those who teach the student so to begin to address this my research focuses on understanding the factors affecting GTA motivation to teach and identity development as that is a crucial jumping off point for the global topic of retention. In the next section, these ideas are expanded upon in reference to the current literature.

1.2 Past Studies Supporting the Problem in Engineering

Retention of undergraduate engineering students continues to be a problem, and the quality of teaching is an underlying cause. Unlike other disciplines, many students leave engineering but very few students transfer into the field (Ohland, Sheppard, Lichtenstein, Eris, Chachra, & Layton, 2008). Other fields experience similar attrition rates to engineering, but those fields often receive transfers into their fields which engineering does not. It has been reported that 40% of students who start off in engineering graduate with a degree in another field or do not graduate at all (Vogt, 2008). Additionally, there have been reports that over 50% of all

attrition in engineering occurs in the first-year (e.g., Imran, Kalil, & Hayati, 2013; Shuman, Delaney, Wolfe, Scalise, & Besterfield-Sacre, 1999). This requires that in engineering we employ numerous strategies to retain the students who initially enter the field to ensure a strong and diverse group of future engineers who graduate from our programs. According to recent studies, students leave engineering for a variety of reasons, but one of the main factors reported by students for leaving is the poor quality of teaching (e.g., Litzler, & Young, 2012; Marra, Rodgers, Shen, Bogue, 2012). Focusing on the quality of instruction in the first year is then particularly important because the first year is when students are at a higher risk of attrition compared to the other years of their college education (Litzler, & Young, 2012).

Many engineering programs across the United States have a common first-year curriculum that all engineering students are required to take during the first year of study (Brannan & Wankat, 2005). Currently, focus on improving instruction in these programs is lacking. As stated by Brannan and Wankat (2005), "Over the past few decades, first-year [engineering] programs have been enhanced in numerous ways to improve academic performance, stimulate interest and improve retention, help students make a successful transition from high school to college, update the content coverage, and better prepare students for future coursework" (p. 1). However, while all of these items have been the focus of recent FYEP changes, little work has been done to improve the quality of teaching, which as stated above, is a key reason for attrition in engineering.

Improving the quality of teaching in these programs is not easy as FYEPs are often very large in size involving many different people. For example, in fall 2011, Virginia Tech had over 1,400 students in their program (V. K. Lohani, personal communication, August 22, 2011), The Ohio State University had over 1,500 (J. A. Merrill, personal communication, December 28, 2011), and Purdue University had just about 1,800 first-year students enrolled in their program (G. D. Ricco, personal communication, November 23, 2011). In recent years, these numbers have only continued to grow. Due to their large size, implementing these programs often requires the use of Teaching Assistants (TAs) (e.g., Gieskes, Bryant, & McGrann, 2009; Louis & Matusovich, 2012; Mullin, Lohani, & Lo, 2006). Within any program, TAs may be GTAs or undergraduate teaching assistants (UTAs) serving as instructional staff, lab supervisors, graders, etc. (e.g., Nicklow, Marikunte, & Chevalier, 2007; Mullin et al., 2006; Louis & Matusovich, 2012). Any TA involved in these roles should be included in the quality of teaching

improvement as they have direct contact with undergraduate students impacting undergraduate education. This sentiment is echoed by Stice, Felder, Woods, and Rugarcia (2000) who believe that GTAs should be a part of the many faculty preparation programs available to improve the quality of teaching in engineering.

While improving the quality of teaching of TAs in FYEPs has not been a focus in FYEP reform as stated above, FYEPs have taken the first steps to achieve this change. For example, recent studies have examined how TAs are part of FYEPs reporting on their roles and responsibilities (e.g., Louis & Matusovich, 2012; Mullin et al., 2006). Additionally, a few studies have examined training programs designed for TAs (e.g., Cho & Predebon, 1996; Csavina, 2002; Lewandowski & Purdy, 2001), but these studies generally lack information related to the training programs' long term impact and do not explore the fundamental concepts of motivation or identity or even the teaching experience. Therefore, there is a gap in engineering education research related to TAs in FYEPs. This gap is problematic in that to improve the quality of teaching in higher education by TAs, we need to first understand TA motivation to teacher and identity development as teachers as these are fundamental building blocks to success in a role.

My research addresses this gap by focusing on the teaching motivation and identity of GTAs in FYEPs. For this work, Self-Determination Theory (SDT) was combined with Possible-Selves Theory (PST) to provide a holistic understanding of why GTAs do what they do in the classroom through the identification of factors affecting their motivation to teach and identity development as teachers. In recent studies, identity and motivation have been linked and examined together allowing a more complete picture of an experience to be developed (e.g., Wallgren & Hanse, 2011; Wigfield & Wagner, 2005, Leondari, Syngollitou, & Kiosseoglou, 1998; La Guardia, 2009). By understanding experiences relative to these constructs, we can then create research-based training programs and appointment structures targeted at motivation and identity leading to increased gains in the quality of teaching. This is significant because of TAs' strong involvement in first-year programs and their potential to ultimately impact first-year student retention. By improving the quality of teaching in this way, we may be able to increase retention, a constant problem in engineering.

To address the problem of a lack of information about teaching motivation and identity of GTAs in FYEPs, I employed an exploratory sequential mixed methods design (Creswell & Plano

Clark, 2011) where interviews with GTAs at a variety of different institutions served as the foundation for the development of a national survey targeted at FYEP GTA motivation and identity. Using qualitative and quantitative data, a set of teaching profiles (i.e., GTA characterizations) was created so that future training programs and appointment structures could be developed specifically targeting the factors affecting motivation to teach and identity development as a teacher, thereby enhancing the quality of teaching in higher education and hopefully first-year student retention in engineering.

1.3 Purpose of the Study

The purpose of this study was to examine the factors influencing graduate students' motivation to teach and their identity development as teachers. In the greater context of this work, understanding these factors will help meet the need to improve the quality of teaching in FYEPs through research-based training programs and appointment structures for GTAs that focus on motivation and identity. To accomplish the purpose, the following overarching research questions guided my work: **How do graduate students' motivation to teach and future identities as teachers develop when serving as GTAs in first-year engineering programs?** Through a sequential exploratory mixed methods study (Creswell & Plano Clark, 2011), the following sub questions were answered:

- **RQ 1:** What do GTAs perceive to be the factors that affect their own motivation and teacher identity development as GTAs in first-year engineering programs? (Qualitative)
    - What factors contribute to GTAs' competence, relatedness, and autonomy in the classroom?
    - What factors contribute to how GTAs see themselves as future teachers?
    - What do GTAs report as the relationship between motivation and identity?
- **RQ 2:** How are the factors identified in RQ 1 represented in the larger sample of GTAs, and what are their perceptions of their needs for competence, autonomy, relatedness, and identity? (Quantitative)
- **RQ 3:** Combining the results from RQ 1 and RQ 2, what are the different teaching profiles that can be constructed that distinguish different levels of motivation, identity, and factors, and how do those results inform the proposed theoretical framework? (Mixed Methods)

The study was broadly scoped so that the factors mentioned above could be events, occurrences, people, institutional structures, demographics, etc. that affected the different constructs. This mixed methods approach allowed both a breadth and depth of information to be obtained related to the motivation and identity development of GTAs in FYEPs since little to no research exists examining this space.

The sample for this study includes both Master's and PhD level students who teach or have taught in a FYEP. Graduate students were chosen for the focus because they often have more of a presence and responsibility in first-year engineering courses compared to UTAs who may only serve as graders (Louis & Matusovich, 2012). Both Master's and PhD level students were included because both types of graduate students teach in these types of courses having similar responsibilities and positions regardless of academic rank. They are all in the classroom to teach future engineers so each one should be motivated and in tune with their identity as a teacher. Future development programs created out of this work should be aimed at improving both PhD and Master's level students' teaching regardless of academic rank or perceived future career trajectories such as academia, industry, or the government.

FYEPs were chosen as the environment of this work for two reasons. First, these programs often employ a significant number of TAs which increased the potential participant pool and increased the potential reach of the research outcomes from this study. Second, first year course content tends be less discipline-specific in terms of technical knowledge compared to other courses that may require a very specific knowledge base. Because of this, the findings from this work are more transferrable in that they are not influenced by highly specialized knowledge. Ultimately, the results of this work enable program directors to create research-based programs and appointment structures focused on motivation and identity development aimed at helping GTAs become exceptional teachers and even exceptional future faculty if they choose to enter academia.

1.4 Significance of this Work

As a result of answering the research questions presented above, this research had four distinct outcomes that contribute to the significance of this study. As a result of this research, I:

- Identified and described the factors affecting motivation and identity development while exploring the relationships between the factors through the perspective of GTAs,

- Developed and tested a survey to measure GTA motivation to teach and identity development as a teacher,
- Developed and tested a theoretical model that combines the constructs of motivation and identity with regard to GTAs, and
- Compared relevant motivation and identity factors to create a set of teaching profiles that help categorize GTA experiences.

As a next step, through these outcomes, I believe the quality of teaching in engineering by GTAs can be improved contributing to the overall need of this work.

This research significantly expands current literature. Currently, little research has been done that examines GTAs' perceptions and views specifically in engineering, let alone factors affecting their motivation and identity. Most of the literature available in engineering to date relates to students' perceptions of their GTAs and specific accounts of teaching courses developed for GTAs based on individual program needs (e.g., Crede & Borrego, 2009; Cox, Zhu, Cekic, Chavela, & London, 2010; Cox, Hahn, McNeill, Cekic, Zhu, & London, 2011; Nicklow et al., 2007; Mullin et al., 2006; Matusovich, Cooper, & Winters, 2010). This research filled a gap in the engineering education literature by providing a unique perspective on GTA motivation and identity development through the eyes of the GTAs. It was important to study the GTAs in this way to ensure that future programs will be developed that directly target their specific needs, opposed to the needs expressed by others. Also this approach allowed for a socio-cultural examination of the constructs, motivation and identity, in a specific context. As stated before, I believe that by targeting the factors affecting motivation to teach and identity development as a teacher, we can improve the quality of teaching in engineering thus contributing to advancements in improving retention.

1.5 Worldview

For this study, I took a realist worldview consistent with the mixed methods nature of this work and the constructs researched. Traditionally, a post-positivist view where researchers are concerned with testing hypotheses and focused on a set group of variables is associated with quantitative work, and a constructivist view where researchers are concerned with individuals' views and are open to various findings is associated with qualitative work (Creswell, 2009; Creswell & Plano Clark, 2011). With this is mind, many pair pragmatism, which focuses on the problem or research question and the consequences of actions, with mixed methods research

instead of a post-positivist or constructivist view (Creswell, 2009; Creswell & Plano Clark, 2011). Recently, the pragmatic paradigm's relation to mixed methods research has been questioned.

Maxwell and Mittapalli (2010) argued that realism is a more appropriate paradigm for mixed methods researchers because it concerns both the output and the process. The output relates to the findings of the study (i.e., what you want to know), and the process relates to the methods employed (i.e., the data gathering techniques). Because realism concerns both the output and the process (i.e., you map the methods to the intended findings but also consider additional methods to supplement your intended findings), it leaves more flexibility in the worldview compared to others. In the other worldviews, you traditionally focus on the intended findings and choose a method accordingly. You do not reconsider what additional methods can add to the study. Since realism allows this expansion, it the most appropriate paradigm for this work due to the depth and breadth of information that is needed in an un-researched area such as the motivation and identity develop of GTAs in FYEPs. The need for a realist viewpoint is captured in this work by the use of qualitative, quantitative, and even mixed methods research sub-questions to answer the overarching question. One approach and one type of data were not sufficient to study this topic that so little is known about.

This worldview was also appropriate for the study of motivation and identity, two constructs which encompass many possible perspectives. Both motivation and identity have various dimensions and theories that make research in these fields ever changing and ever more complicated (Eccles & Wigfield, 2002; Vignoles, Schwartz, & Luyckx, 2011). Using a realism worldview allowed me to have flexibility in the study of motivation and identity together allowing one to affect the other and vice versa, permitting the acceptance of the ever evolving nature of the fields. Also in this study, I combined the constructs of motivation and identity through an integrated theoretical framework presented in Chapter 2 which I believe was the most appropriate approach to studying this topic. A realist worldview allows for the unique perspective I took on theory further supporting its use as the worldview for this research.

1.6 Audience

The stakeholders or audience for this work included the university, FYEP administrators and other engineering departments, and GTAs. First, universities were stakeholders because the results of this study have the potential to impact undergraduate education as a whole through

well-trained and motivated GTAs. First-year engineering students may benefit from this study by having GTAs who are both motivated and better prepared to teach, which can enhance the quality of their undergraduate education. Second, FYEP administrators were a key audience because they will benefit by better understanding the factors that affect a GTA's motivation and identity development while teaching. Administrators may also be able to use the survey developed as a tool to identify highly motivated GTAs during the interviewing process to ensure that freshman students are being educated by GTAs who truly care about teaching and learning. Ultimately, all engineering departments could benefit because aspects of the findings are transferable to other courses and settings with additional research. For example, with further testing, the teaching profiles could be adjusted for teaching in traditional engineering disciplines such as mechanical engineering or even other discipline-specific first-year courses such as English. Finally, current GTA participants are an audience because they will benefit by reflecting on their experiences teaching through the qualitative components of this study. They will be able to think about their teaching situations which will hopefully lead to self-guided teaching improvements. Future GTAs will also benefit through research-based changes in training programs and appointment structures. All three of these audiences will directly benefit from this research.

1.7 Study Summary and Chapter Overview

The goal of this study was to examine the factors influencing graduate students' motivation to teach and their identity development as teachers. Specifically, I studied GTAs within FYEPs through a mixed method sequential exploratory study employing interviews developed into a survey. My overall approach to this research is summarized below in Table 1 following the research design approach discussed by Creswell and Plano Clark (2011) and supported by Borrego, Douglas, and Amelink (2009) in engineering education.

Table 1: Research Design

Levels of a Research Study	Approaches for This Research
Paradigm Worldview	Realism
Theoretical Lens	Self-Determination Theory and Possible Selves Theory
Methodological Approach	Sequential Mixed Methods
Methods of Data Collection	Interviews and Surveys

This work filled a gap in the current literature by presenting findings from the GTA perspective in engineering using an integrated motivation and identity approach, and the results included a

survey and set of profiles that could be used in the development of research-based GTA development programs and appointment structures in the future.

Chapter 1 has laid the foundation for the study providing background information about the topic, purpose, research questions, and the significance of the work. Chapter 2 provides a detailed account of the literature available related to the topics of GTA motivation and identity development and provides an in-depth discussion of the theoretical framework being used in this work. Next, Chapter 3 outlines the methods executed in this mixed methods study including a description of the participants, data collection procedures, and analysis techniques. Through an examination of each research question, Chapter 4 presents the qualitative and quantitative findings. Finally, Chapter 5 integrates the results of this work with previous studies providing implications, areas for future work, and major conclusions.

CHAPTER 2: A Review of Literature

To date, there has been little formal research related to the study of TAs in engineering and even less on the factors affecting their motivation to teach and identity development as teachers. Conducting such a study was essential to ensure the future establishment of research-based training programs geared towards enhancing the specific motivational and identity developmental needs of GTAs in FYEPs. In this chapter, I detail the integrated theoretical framework that was employed to guide the research and synthesize past work related to GTAs both in and out of engineering, exploring identity and motivation as constructs.

2.1 The Theoretical Framework for This Study

For this research, Possible Selves Theory (PST) and Self-Determination Theory (SDT) were integrated and employed together to understand the factors affecting GTAs' motivation and identity in FYEPs. PST and SDT are detailed in the following sections. Using both of these theories allowed for a complete picture of GTAs' experiences to be developed that examined the current context and the intended future. Figure 2 depicts the initial relationship between the two theories that was used in this work which is represented through the analogy of a ladder.

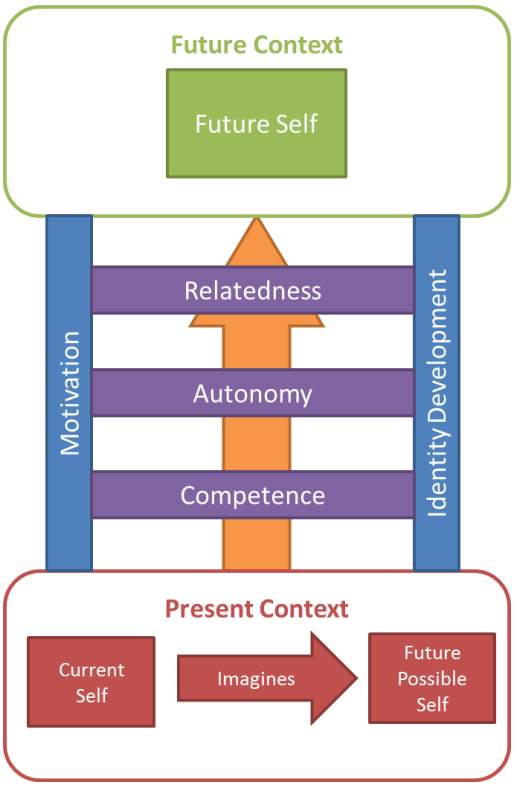

Figure 2: Proposed General Theoretical Framework

In Figure 2, the red items represent the key elements of PST as conceived in the present context. The two blue sides of the ladder represent the main focus areas for this work, motivation and identity development. At the center, the purple rungs of the ladder represent the key components of SDT theory which were used to connect motivation and identity development. Finally, the green items relate to the future while the orange arrow symbolizes a GTA's movement through the process that the theory explains. In the following sections, the details of the framework are explored in reference to past literature.

2.2 Overview of GTA Literature

To begin to understand the relevant literature related to PST and SDT, it is first important to understand the current state of research related to GTAs in FYEPs. Compared to other populations of study (e.g., freshman engineering students who are often research subjects in the field), the literature related to GTAs in engineering is minimal. There are studies that document training programs for GTAs and evaluation approaches for GTAs, but there is little research that aims to understand the experiences of GTAs let alone their motivation or identity teaching in engineering which as shown in Chapter 1 could contribute to quality of teaching. In this section, I review the literature in engineering related to GTAs and then move to a discussion of GTA literature in other fields to provide a landscape of the current GTA literature in higher education along with the holes that my work aims to fill.

2.2.1 GTA Literature in Engineering

Current literature about GTAs in engineering is focused on GTA development programs (e.g., Cho & Predebon, 1996; Crede, Borrego, & McNair, 2010; Csavina, 2002; Lewandowski & Purdy, 2001) or GTA evaluations or assessments (e.g., Cox et al., 2010; Cox et al., 2011; Matusovich, Lee, Janeski, & Winters, 2011). Articles in the first group typically focused on describing specific programs developed for unique departmental or organizational needs. For example, Crede, Borrego, and McNair (2010) examined a GTA development program in engineering framed in communities of practice (Wenger, 1998). In their work, they discussed a program that was implemented to provide supported teaching experiences to engineering GTAs to enhance their teaching abilities. Articles in the second group tended to describe evaluations or assessments of GTAs from the faculty and/or student perspective. For example, Cox, Hahn, McNeill, Cekic, Zhu, and London (2011) documented a program called G-RATE which allowed multiple stakeholders to give feedback to GTAs about their teaching in the class specifically with

regard to pedagogy. Like the prior grouping, these articles tend to be about single programs with specific needs. Therefore, there is a need for research that methodically examines GTAs in engineering across programs.

In addition to typically focusing on one program, very few studies in the engineering literature were conducted from the GTA perspective. Many engineering articles related to GTAs provided faculty or student views of GTAs (e.g., Cox et al., 2010; Cox et al., 2011; Matusovich et al., 2011) or provide programmatic perspectives (e.g., Brannon & Zappe, 2009; Mullin et al., 2006). From this type of research, we learn about students views of GTAs and their strengths and weakness in teaching along with information about specific GTA appointment structures. Research that does examine the GTA perspective (i.e., they interviewed or surveyed the GTAs directly) included the work by Crede and Borrego (2009), Goodlad (1997), Saroyan, Dagenair, and Zhou (2009), and Winters and Matusovich (2011). In these studies, GTAs served as the source of data opposed to outside parties commenting on GTAs. By having this perspective, we are able to better understand the GTA experience, taking a step closer to identifying factors related to motivation and identity. My research specifically fills a gap in the engineering education literature (i.e., the GTA perspective) by using GTA perspectives as the main source of data to better understand the factors, opposed to the typical student or faculty perspective.

2.2.2 GTA Literature in General

Given the limited literature specific to GTAs in engineering, the literature in other fields was considered. Like engineering, many of the studies found in other disciplines related to GTAs also focused on programs developed out of unique departmental or organizational needs. These articles include the works by Gilreath and Slater (1994), Gaia, Corts, Tatum, and Allen (2003), Goepper and Knorre (1980), and Harkness and Rosenberger (2005). However, there were a few relevant studies that did examine GTA perspectives in fields related to engineering such as science and math. For example, Rushin, De Saix, Lumsden, Streubel, Summers, and Bernson (1997) studied GTAs in biology to understand the training being offered in the field. They found that most training programs were brief and provided very little follow-up on teaching practices. There are studies in disciplines more loosely related to engineering such as sociology and language studies that examined the GTA perspective. For example, Korinek, Howard, and Bridges (1999) studied GTAs in sociology, Wright, Bergom, and Brooks (2011) examined GTAs in English literature, Muzaka (2009) studied GTAs in general social science disciplines, and

Young and Bippus (2008) used a case study of GTAs in communication. While the results of these studies were broad, for example Wright et al. (2011) explored the new instructional role GTAs must undertake when executing a specific new method of instruction in the classroom compared to Korinek et al. (1999) who discussed the general usefulness of using a developmental approach and process when designing GTA training programs, they all highlighted that GTA training was being studied in a variety of disciplines at this time. More generally speaking outside of engineering, some studies even examined GTAs regardless of discipline origins. These studies were more holistic in their view of GTAs in higher education. For example, Luo, Grady, and Bellows (2001) developed a survey to understand general GTAs' views on instructional issues by comparing different nationalities, genders, and disciplines. They found that future GTA training programs should focus on approaches to increase student engagement, motivation, and involvement in learning. These types of studies in other disciplines supported the use of GTA perspectives as data in this work because they provided detailed accounts of GTA experiences that can only be gathered through a first-person viewpoint. Obtaining this first-person account of experiences is needed to design future targeted GTA development programs.

The research highlighted above captures the current state of GTA literature where most of the studies focus on a specific program and do not examine GTA motivation or identity in engineering or other fields. There is however a significant body of literature that focuses on how GTAs develop into teachers and more specifically how they learn to teach (e.g., Nyquist & Sprague, 1998; Nyquist & Wulff, 1996). Particularly relevant to my work, the research by Nyquist and Sprague (1998) suggested that there are three developmental stages that GTA progress through as they learn to teach: 1) senior learner, 2) colleague-in-training, and 3) junior colleague. Importantly, these stages were situated in a perspective of teaching as a social system such that they addressed the changing feelings GTAs may have about their students and superiors as they developed. Studies such as this lay the foundation for my research by highlighting the importance of considering GTA teaching experiences as a developmental process. My work extended this body of research by specifically focusing on motivation and identity in teaching, not just how to teach.

2.3 Motivation and Identity Theories

As argued in Chapter 1, motivation and identity should be studied together for a complete understanding of the factors affecting the motivation and identity of GTAs as those constructs are fundamental to who we are and how we act. Understanding the general constructs of motivation and identity separately first lays the foundation for the combination of the two theoretical domains which is discussed later in this chapter. Since GTA literature related to these constructs is not widely available, teacher literature (pre-service teachers, K-12 teachers, and faculty) serve as a source of guidance and inspiration on these topics with regard to definitions and methodology. In the following sections, I describe the constructs of motivation and identity in general terms but also discuss their definition relevant to the specific motivation and identity theories that I employed in my study.

2.3.1 Motivation

According to Eccles and Wigfield (2002), motivation is the study of action. In the case of this work, this would be the action of teaching. While it can be examined in different ways, motivation is commonly split into two main domains: intrinsic, which is self-driven by interest and enjoyment; and extrinsic motivation, which is driven by an outside force (Eccles & Wigfield, 2002). Within these two categories, there are many theories that try to explain how or why someone would be motivated to act (e.g., expectancy value theory (Eccles, 2005; Eccles et al., 1983), self-determination theory (Ryan & Deci, 2000a), flow theory (Csikszentmihalyi & Csikszentmihalyi, 1988), etc.). For my study, self-determination theory (SDT) was used because it has been widely used in the educational context (e.g., Koh et al., 2010; Lavigne, Vallerand, & Miquelon, 2007; Rigby, Deci, Patrick, & Ryan, 1992; Winters & Matusovich, 2011) and specifically to study those in teaching roles (e.g., Fernet, Guay, Senecal, & Austin, 2012; Reeve & Halusic, 2009; Taylor, Ntoumanis, & Smith, 2009). Other possible motivation theories have not been used as extensively in this domain. SDT is also appropriate for my research because it takes into account the context (e.g., a first-year engineering program) in which the action (e.g., teaching) is taking place (Ryan & Deci, 2000a). It does not just consider the individual's beliefs or perceptions as some other theories do. For example, in teaching, someone may be highly positive about their teaching but external circumstances such as institutional structure or departmental policies affect what they are doing. SDT takes into account these external factors or social-contextual conditions as referred to by Ryan and Deci (2000a) while processing them

through a personal perspective. This consideration of both the personal perspective and the outside context make SDT appropriate for this work. In summary, because SDT has been proven useful in a variety of educational settings and because it addresses personal perspectives with specific contexts, it was an appropriate choice for this study compared to other possible motivation theories.

2.3.1.1 Self Determination Theory (SDT)

SDT is a motivation theory incorporating the foundational idea that people act in ways that lead to satisfaction based on basic psychological needs (Ryan & Deci, 2000a). Three psychological needs have emerged as particularly salient including competence (Harter, 1978; White, 1963), autonomy (deCharms, 1968; Deci, 1975), and relatedness (Baumeister & Leary, 1995; Reis, 1994). Generally speaking, competence refers to knowledge, autonomy refers to ownership and control, and relatedness refers to a sense of connection or belonging to a community (Ryan & Deci, 2000a). Ryan and Deci (2000a) state that the three components of SDT (competence, autonomy, and relatedness) "appear to be essential for facilitating optimal functioning of the natural propensities for growth and integration, as well as for constructive social development and personal well-being" (p. 68). This suggests that all three needs are important to personal health. Based on this view, each of the components is needed for optimal function and intrinsically driven motivation which is highly desirable at the core of SDT. While I have chosen to focus on the three basic needs for this study as they are fundamental to SDT, these needs are situated in a larger system of theories.

In general, SDT is made up of five mini-theories that all rely on the basic psychological needs in some way (Vansteenkiste, Niemiec, & Soenens, 2010). Those five theories are:

1. Cognitive Evaluation Theory (CET) which mainly focuses on intrinsic motivation.
2. Organismic Integration Theory (OIT) which mainly focuses on extrinsic motivation.
3. Causality Orientation Theory (COT) which focuses on individuals' dispositions to their environment and their subsequent behaviors.
4. Basic Needs Theory (BNT) which elaborates on the three basic needs.
5. Goal Content Theory (GCT) which provides differences between intrinsic and extrinsic goals including their motivational outcomes.

These mini-theories grew directly out of ongoing research. Each theory is continuing to develop, and through my work I will actively contribute to the BNT. For this research I chose to focus on

the BNT because it builds on the three basic needs that are fundamental for all of the mini-theories (Vansteenkiste et al, 2010). Since this work is exploratory in nature, it is appropriate to start with common elements. The following sections focus on the three basic needs all of which are equally important in BNT and the literature relevant to this study.

2.3.1.1.1 Competence

It is often said that if you can teach something, you have truly mastered it. This notion of mastery at a fundamental level relates to the first component of SDT, competence. The need for competence has been defined as "an attempt to master [your world] and to feel the sense of effectance when [you] do" it (Deci & Vansteenkiste, 2004, p. 25). SDT suggests that people act in ways that satisfy competence needs. Therefore to study teaching, it is important to understand what competence means in teaching (i.e., what elements of teaching must be mastered to feel competent).

Different studies have examined teacher competence and these works informed my study and my definition of competence. For example, in one study teacher competence broadly included content knowledge, pedagogical knowledge, classroom management knowledge, etc. (Lim-Teo, Low, Wong, & Chong, 2008). In another study competence referred to an understanding of subject knowledge, children learning, curriculum, and the educational system (Cubukcu, 2010). From these two studies and others, it is evident that competence may be defined differently (i.e., can include components of content and process knowledge) in different settings.

Beyond identifying the important aspects of competence, competence has been studied in teacher literature with regard to ways of enhancing teacher competence (e.g., Mugaloglu & Saibas, 2010; Orleans, 2010) and assessing teacher's perceptions of their competence (e.g., Admiraal, Hoeksma, Van De Kamp, Van Duin, 2011; Hollins, 1993). This research showed that with interventions curriculum knowledge can be improved through the implementation of better designed lesson plans (i.e., teachers understand the overall curriculum better through improved planning on their part) (Mugaloglu & Saibas, 2010) and that assessments of competence should be context specific to ensure they are accurate (i.e., teaching assessments should be tailored to the teaching environment) (Hollins, 1993). These findings support this research in that this is the first step to developing programs to enhance GTAs' experiences and creating a survey to accurately assess their perceptions of their identity and motivation.

All of these works are relevant to GTAs in engineering because they support the idea that with increased training GTAs can be successful teachers and that their unique teaching context requires a very specific level or definition of competence. For this research, I was specifically interested in GTAs' knowledge or competence related to their teaching. Based on existing literature competence was broadly defined as a self-recognized knowledge of content, pedagogy, and institutional/program structure as these components seemed salient to an engineering GTAs' experience and encompass the overarching concepts covered in past research.

2.3.1.1.2 Autonomy

According to SDT an individual also needs autonomy to be motivated. According to Deci and Vansteenkiste (2004) "the *need for autonomy* concerns people's universal urge to be causal agents, to experience volition, to act in accord with their integrated sense of self (i.e., with their interests and values), and to endorse their actions at the highest level of reflection capacity" (p. 25). Overall, this can be summarized to mean they feel self-regulated in their choices.

Researchers have demonstrated that a sense of autonomy is critical to student success (e.g., Chirkov & Ryan, 2001) and therefore, autonomy is most often studied in educational settings with regard to teachers supporting the autonomy of their students (Reeve, 2002). For example, research has shown that for students, motivation can be increased through autonomous yet supportive environments (Chirkov & Ryan, 2001; Rigby et al., 1992). Also, autonomy has been used in general to examine student motivation in the classroom to simply complete tasks or learn concepts, showing that increased autonomy leads to increased productivity with tasks and increased learning of concepts (Noels, Pelletier, Clement, & Vallerand, 2000; Lavigne et al., 2007; Deci, Vallerand, Pelletier, & Ryan, 1991; Pintrich, 2003). While this is the most common means to study autonomy in education, for this work I was concerned with the autonomy of GTAs, the teachers.

While most research related to autonomy in education focuses on students, some studies have investigated the autonomy of teachers. With regard to teachers, studies related to autonomy show, in general, that more autonomous teaching positions lead to increased motivation (Eyal & Roth, 2011), decreased on-the-job stress (Pearson & Moomaw, 2005), and an increased sense of personal accomplishment (Roth, Assor, Kanat-Maymon, & Kaplan, 2007). They also show that autonomous teachers tend to have autonomous students which increases learning in the classroom (Pelletier, Sequin-Levesque, & Legault, 2002; Roth et al., 2007) similar to the other

studies discuss above. Research also shows that autonomy support from administrators and education systems increases a teacher's motivation as well (Lam, Cheng, & Choy, 2010). Based on these findings, it seems that GTAs would also benefit from autonomous environments since they share similar qualities and responsibilities as any teacher.

Though studies on GTAs' autonomy are rare, Winters and Matusovich (2011) used qualitative techniques to examine GTAs' experiences of autonomy with regard to teaching in engineering. They found that GTAs often have varying degrees of autonomy based on course structures and that those who lack autonomy find it difficult to adjust to classroom challenges in the moment. This study helped to bridge the gap between teacher literature which has studied this construct at length and engineering education which has only begun to investigate it by serving as an example of a GTA motivation study. My research expands on the work of Winters and Matuvosich (2011) by studying autonomy along with the other basic needs in SDT and identity.

It should be noted that all of these studies took a western approach to autonomy where independence is generally valued. Some may argue that autonomy may not be motivating to those who hold an eastern perspective. For example, Zhou, Ma, and Deci (2009) explain this argument when they stated:

> "Western individualist cultures such as the U.S. strongly value autonomy so they raise their children to develop a strong need for autonomy, whereas eastern cultures such as China more strongly value the collective so they raise their children to develop a strong need for belonging to the collective, with little or no need for autonomy. Thus, children from collectivist cultures are expected to act in accord with social norms in order to be accepted by the collective" (p. 492).

Although limited, research from non-western perspectives exists. For example, studies have looked at the autonomy of Chinese students at an age typical to most undergraduate and graduate students to investigate the western vs. eastern perspective on autonomy (e.g., Vansteenkiste, Zhou, Lens, & Soenens, 2005; Zhou, Ma, & Deci, 2009). These studies found that the Chinese students whose age ranged from 18 to 39 years old were motivated by feelings of individuality and independence contradicting what many expected. The authors also stated that more work is needed in this area to truly understand autonomy's impact in eastern vs. western cultures. Deci and Ryan (2008) also commented on this when they stated:

> "Thus, although some cultural relativists have maintained, for example, that the need for autonomy is important only in cultures that value individualism and is essentially irrelevant in cultures that value collectivism, that turns out not to be the case. Feelings of autonomy, like competence and relatedness, are essential for optimal functioning in a broad range of highly varied cultures." (p. 183).

Keeping with the notion that autonomy is one of the three basic psychological needs, this seems true where in eastern cultures the need may be satisfied in different ways, but is still present and required for optimal functioning. For the purposes of this work based on the literature discussed above, autonomy was viewed from a western perspective since the teaching contexts were American universities.

The combined research related to autonomy discussed in this section suggests that studying the autonomy of GTAs is important because their autonomy can have a direct impact on student learning and their teaching motivation. Additionally, autonomy was defined to mean having control or decision making power over your classroom or course in terms of content, activities, and policies.

2.3.1.1.3 Relatedness

Of the three basic needs highlighted in SDT, relatedness seems to be the most under researched. However, a few studies were found that support the use of this component of SDT in this research. According to Deci and Vansteenkiste (2004), who paraphrased Baumeister and Leary (1995), "the *need for relatedness* concerns the universal propensity to interact with, be connected to, and experience caring for other people" (p. 25). GTAs who are charged with educating future engineers are no exception. They are required to interact with students and faculty, often connect to their colleagues in different ways, and share a duty of caring for the education of less experienced students.

The component of relatedness or connectedness in SDT has been used in teacher literature on two levels; relatedness between teachers and students and relatedness between teacher colleagues, where both have been shown to positively impact teacher motivation (Klassen, Perry, & Frenzel, 2012). Most of the literature on teacher-student relationships focuses on student success with regard to connecting with their teachers showing that students who feel connected to their teachers tend to perform better (e.g., Hughes & Chen, 2011; Larose, Tarabulsy, & Cyrenne, 2005). Of the literature that does focus on the teacher perspective with

regard to their own motivation or overall success in general, some studies look at a sense of community instead of using SDT relatedness (e.g., Ciani, Summers, & Easter, 2008; Weathers, 2011). While there are many similarities between community and relatedness, based on my readings relatedness is more of a person or individual view of connection to others while community is more of socially constructed construct. Specifically focusing on community, as it is more often studied than relatedness, one study found that schools that focus significantly on performance have less feelings of community and less adaptive motivational beliefs (Ciani et al., 2008). Another study found that having positive and strong principal leadership leads to a greater sense of community among teachers (Weathers, 2011). All of these articles support the notion that connection is needed for motivation in teaching. Based on these findings, for this study, a GTA would need a strong community both with their supervisors and peers to be motivated and using a more individualized perspective, this would be relatedness.

Moving away from the specific SDT construct of relatedness, the notion of a community of practice which is specifically operationalized to include a joint enterprise (shared mission), shared repertoire (common knowledge), and mutual engagement (person to person interaction) (Wenger, 1998) was also found to also be useful when examining GTAs' teaching. For example, one study formally established communities for graduate students through student organization and activities with the intention of increasing retention and improving experiences (Fentiman & Fisher, 2009). A study by Crede and Borrego (2009) specifically related to GTAs in engineering found that graduate students teaching want peer interaction and a sense of community with their colleagues. These studies support that a strong sense of community can strengthen motivation and foster positive experiences. This idea was applied to this research in that GTAs would benefit from a sense of community or relatedness, making the use of relatedness in SDT important for this study. Based on these studies of relatedness or community, relatedness was broadly defined in this study to mean GTAs' feelings of connection or belonging to both his/her teaching colleagues and students. Chapter 3 contains specific examples of how the dimensions of relatedness were measured in the study.

2.3.1.2 Summary of SDT in Teaching and Learning

Despite considerable research on teachers and learning contexts, little to no work exists that uses SDT to study graduate students. However, the constructs in SDT are very relevant to GTAs since their experiences, while different, are similar in many ways to those of pre-service

teachers and K-12 teachers. The literature used to support the use of SDT to study GTAs was used as a source of inspiration or guidance for this research with regard to definitions, methodologies, and forms of analysis. The same approach used to connect motivation and teacher literature was also applied to identity and teacher literature.

2.3.2 Identity

As previously described, to fully understand a GTA's experience, knowledge about both his/her motivation and identity is needed. For this study, identity is defined as the answer to the question "who are you?" (Vignoles et al., 2011), and it refers to the individual's answer to this question regardless of what others may believe about a person (Sfard & Prusak, 2005). The group or outside influences inform the personal perspective, but it is still an individual response (Sfard & Prusak, 2005). This perspective on identity is different than other approaches to identity that include relational identity, collective identity, or material identity which all define identity from a perspective other than that of the individual (Vignoles et al., 2011). The approach used for this research to study identity is Eriksonian in nature. Erikson (1968) believed "identity helps one to make sense of, and to find one's place in, an almost limitless world with a vast set of possibilities" (Schwartz, 2005, p. 294). He also believed that identity developed over time through multiple stages and that individuals only had one identity that captured who they are opposed to multiple identities (i.e., being a different person in a different setting) (Munley, 1977). Researchers in the fields of psychology and sociology have built on the work of Erikson in many different ways through research projects and theory generation (e.g., Marcia, 1966; Marcia, 1993). For this study, the theory of possible selves (Markus & Nurius, 1986) was used because it specifically targets an individual thinking towards their future roles which in this case may be their future role as a teacher.

2.3.2.1 Possible Selves Theory (PST)

Possible selves theory (PST) is an identity theory in which individuals think to the future and envision who they would like and not like to become (Markus & Nurius, 1986). In addition to simply thinking to a future self, PST also requires that the view of the future self be connected with a current identity, be congruent with other aspects and goals of the current self, and be possible to attain (Oyserman & James, 2011). Since PST considers individuals' personal views of their selves in future positions, it is an appropriate framework for this study that examines GTAs' views of becoming future teachers.

PST has been used as a theoretical framework or lens in a variety of studies related to education including student and teacher perspectives. PST has often been applied to high school settings examining high school student experiences and aspirations for the future (e.g., Oyserman, Bybee, & Terry, 2006; Packard & Nguyen, 2003; Shepard & Marshall 1999; Yowell 2000). For example, Yowell (2000) explored Latino students' views of the future through interviews where she determined that an imbalance between hoped-for possible selves and feared possible selves has the potential to impact academic performance. Oyserman, Bybee, and Terry (2006) also looked at academic performance and its link to future possible selves finding that in order for students to reach their possible academic selves they must have specific strategies to assist them in the process. Additionally, PST has been used to study teachers in the academic setting. A recent study by Hong and Greene (2011) used PST to understand pre-service science teachers' views of the teachers they wanted and did not want to become. Their results indicated that past experiences in teaching and learning played a great role in their views of their future selves compared to their actual education program. PST has also been used in teacher and education literature to examine graduate students' identification with becoming a researcher and future faculty (Benishek & Chessler, 2005) and paths towards becoming professional musicians (Schnare, MacIntyre, & Doucette, 2011). Benishek and Chessler (2005) provided a discussion in their article about the potential impacts of using PST to encourage research among counseling students. They propose that through PST the idea of a research self in the future can be made available to their students. Schnare, MacIntyre, and Doucette (2011) studied music students with PST and determined there were a set of desired and feared selves that were prevalent across a set of musicians that must be in balance for achievement and motivation. While in different fields, these findings are applicable to GTAs in FYEPs in that through this research, I hope to make a teacher self available to GTAs, and GTAs like musicians are balancing various selves or roles (e.g., teacher, students, researcher, etc.) that must be accounted for.

Overall these studies demonstrate connections between possible selves and the academic setting. Understanding this perspective is important as GTAs are a key component to higher education and are students themselves. Despite considerable research on students with regard to PST, both at the high school and undergraduate level, and a few studies on teachers, little to no work currently exists that uses PST to study graduate students in engineering. The use of PST with graduate students is still relevant because while not high school students or undergraduates,

GTA still are developing as individuals in the professional sense and may be still deciding on a career path as they balance their roles as teachers, researchers, and students (Louis & McNair, 2011). The work related to PST that is available in the teacher literature can serve as a guide to work related to GTAs as argued in this study.

2.3.3 Support for the Combination of the Theories

Past work in various research fields has combined the constructs of motivation and identity. In fact, there was a special issue of Educational Psychologist in 2009 titled *Motivation and Identity* that specifically focused on the intersection of identity and motivation that brought light to this emerging and intersecting domain (Chinn, 2009). The articles in this special issue all focus on the educational setting and are theoretical pieces or position papers designed to elicit considerations for the connections between motivation and identity (e.g., Eccles, 2009; La Guardia, 2009; McCaslin, 2009; Roeser & Peck, 2009). These papers support the notion that the combination of motivation and identity can be done in a variety of ways and that it is something to consider when studying these constructs.

In this section, I discuss two main approaches to the combination of motivation and identity that I found in the current literature; the first is using identity as part of a motivation theory and the second is using a traditional identity theory to study motivation or a traditional motivation theory to study identity. Not all of the discussed articles have used PST and SDT as their main frameworks as done in this research, but the connections that have been made through the use of other theories support the idea that the domains of motivation and identity development are indeed linked and can be studied together. More importantly, this supports the view that studying one concept, motivation or identity, is not enough to truly understand an experience. In both of the approaches I have used a research-based article as the first piece of evidence and then I have used a theoretical article similar to the ones discussed in reference to the special issue.

2.3.3.1 Identity as Part of a Motivation Theory

Based on the literature, one way to study motivation and identity is to use a motivational framework that has an identity element. I present two examples below; one demonstrating a motivational theory with a specific identity piece that is a research-based study and one demonstrating the connections between the two constructs in general that is more of a personal perspective piece. I will explain how each case informed my study.

First, Wallgren and Hanse (2011) in their research-based article studied the motivation of information technology consultants and also considered their identities. To situate their work, they used an interactive motivation theory by Alvesson and Karreman (2007) that states that identity is one of three factors that directly affects motivation (norms, reciprocity, and identity) where identity is defined as the response to the question "who are you." Wallgren and Hanse (2011) specifically discuss how social identity and one's place within that social context can have a great effect on motivation due to expectations and responsibilities. From their work, they determined that consultants believe they need to work harder than normal employees because they are paid more than normal employees; they see added value (in this case monetary value) in their position even though they have the same responsibilities (Wallgren & Hanse, 2011). This directly relates to how these individuals view their roles or identity within an organization impacting their motivation to work. They receive more money which leads to greater value leading to greater identification with their jobs. While this research is outside of the engineering classroom, it is still relevant in that GTAs may have stronger work ethics and motivation to teach if they see teaching as a valued part of their identity as the information technology consultants saw the value in their jobs. Wallgren and Hanse's (2011) work also relates to my research because they operationalized identity in a similar way to the way it was defined in my research, the answer to the question "who are you?"

Second, Wigfield and Wagner (2005) also provide general commentary on the connection between motivation and competence to identity with regard to adolescences developing in educational settings in a personal perspective chapter of a book. They stated that "a discussion of competence and motivation in adolescence would be incomplete without consideration of the effects that identity development processes may have on these constructs" (Wigfield & Wagner, 2005, p. 228). They discussed that their research on identity was Eriksonian and was a perception of one's self, which aligns with the views of the research for this study. In their book chapter, they provided a detailed discussion of how identity affects many aspects of the educational experience including topics related to gender, academic performance, and overall motivation, but they also recommended that more work in the field of identity is need to test theories related to identity development. This comment supports the work in this dissertation in that my research aimed to study the connections between motivation and identity in the engineering classroom with regard to GTAs by specifically using PST and SDT. In their book

chapter, they did not directly discuss a particular motivation or identity theory that should be used for this investigation. Their commentary also supports that a study of just motivation or just identity would not be enough to truly understand the factors affecting GTAs which I have also argued for my work.

In the first article discussed above identity was used as a component of motivation (Wallgren & Hanse, 2011) while in the second piece identity was argued to affect motivation (Wigfield & Wagner, 2005). Similar to the Wallgren and Hanse (2011) article, I propose that identity is a construct of equal importance compared to the others in SDT for understanding an experience. Similar to Wigfield and Wagner (2005), I also propose that identity serves as the foundation for understanding motivation. Below another approach to the connections between motivation and identity is explored.

2.3.3.2 Motivation to Study Identity and Identity to Study Motivation

In addition to studying motivation with a consideration of identity, some researchers have linked motivation and identity by using a motivation framework to study identity and an identity framework to study motivation. I present a case for each view showing that in both cases the approach is inadequate. I also explain how the studies relate to the framework used in this research. As with the examples above, the first article is a research-based study and the second is a personal perspective to theoretical piece.

First, a research study by Leondari, Syngollitou, and Kiosseoglou (1998) used PST, traditionally an identity framework, to study motivation (i.e., academic motivation – desire to do well in school) and academic performance. In the article, the authors (Leondari et al., 1998) surveyed 289 high school students to better understand the relationships between possible selves, academic motivation, academic performance, and self-esteem. From their work they determined that those students who envision positive possible selves in the future tended to outperform those students with negative views of their possible selves and those students with more vivid descriptions of their future possible selves had higher levels of academic motivation (measured with the Achievement Motivation Questionnaire), self-esteem (measured with the Rosenberg's Self-esteem Inventory), and persistence (measured with the Task Persistence Questionnaire) (Leondari et al., 1998). While there were different pitfalls to this work including the very limited literature review and discussion because it was a "brief report" in a journal, there were also concerns about the perspective which specifically relate to the strengths of my approach. The

main drawback compared to my research was that they did not take into consideration the current context of these students providing details about their current academic successes and failures. It is possible that these had an effect of their motivation as well which was not captured in their work. In my study, I capture this information directly for GTAs in FYEPs.

In contrast, in the commentary article by La Guardia (2009), SDT, traditionally a motivation framework was used as the foundation to examine identity development. In the article, the author (La Guardia, 2009) argued the strong similarities and connection between SDT and traditional identity theories and concluded that in primary and secondary education, more support for identity exploration and development is needed. She discusses that autonomy, competence, and relatedness not only lead to motivation, but serve as essential elements necessary for identity formation and development. As with the Leondari et al. (1998) article, there are drawbacks to this approach that my study directly addresses. Using SDT to study identity does not account for views or desires of the future. It is a way to measure and assessment current progress, but it does not help us understand an individual's views towards who they would like to become. The proposed framework for my research is based on this view to the future.

While GTAs are different than elementary and high school students as focused on in the two examples above, the use of the theories in both of these works (La Guardia, 2009; Leondari et al., 1998) further support the connection between identity and motivation in my dissertation. The articles show that motivation and identity are indeed linked in some way, but that more work is needed to find a holistic approach to studying the two constructs. Below, I provide a possible solution to studying the holistic experiences of GTAs in FYEPs specifically combining SDT and PST.

2.3.3.3 Why Both Theories Are Needed

The studies discussed above support that motivation and identity can be studied together and that there may be a direct connection between the development of an identity and increased motivation. While no studies could be found that directly link SDT and PST, the articles that do study the general constructs of motivation and identity together demonstrate that these two theories have a strong potential to be connected in a research study given their approaches to the topics and overall views on motivation and identity. Also the basic elements of the theories, SDT and PST, are each missing an element that is filled by the other supporting their linkage.

For SDT, there is not a strong focus on the future (there are brief discussions of aspirations and goals), which is filled by the role of PST. For PST, the current context (e.g., teaching in a first-year engineering program) or social-contextual condition (e.g., the conversations you have, the feedback you get, the role you play, etc.) is not a salient concept (these does need to be connection to the present self, but it is not a driving force in the theory). PST focuses on thoughts to the future. The use of SDT with PST strengthens the importance of the current context because SDT is specifically situated in the present tense and present circumstances. Combining these two theories not only provides a way to examine both motivation and identity, it also helps strengthen the two theories, providing a more complete picture of GTA teaching.

Studying GTAs in this way provided a more complete understanding of their experiences opposed to using one of the two approaches described above for examining both identity and motivation factors. For example, using a main theory with a piece of the other construct presents an imbalance in their importance. For this work, both are equally essential. Also using one theory to study both constructs lends itself to holes in the approach, e.g. SDT does not account for the future. By combining two theories I was able to take a holistic approach to understanding both motivation and identity development and the connections between the two constructs.

2.4 Focused Framework

Above, I have discussed a variety of research related to motivation, identity, PST, and SDT. There are many avenues that could be taken to examine the motivation and identity of GTAs in FYEP, but as I discussed in Section 2.4, I took a specific approach through a proposed theoretical framework that combines PST and SDT. For this study, I only focus on the part of the theory encompassed in the yellow box in Figure 3. Figure 3 is the same as Figure 2 though it is operationalized for this study. By focusing on this section, I was able to study the current experiences of GTAs in FYEPs while accounting for their possible future career trajectories not necessarily their actual future careers. To study the entire figure, a longitudinal research project would have been needed.

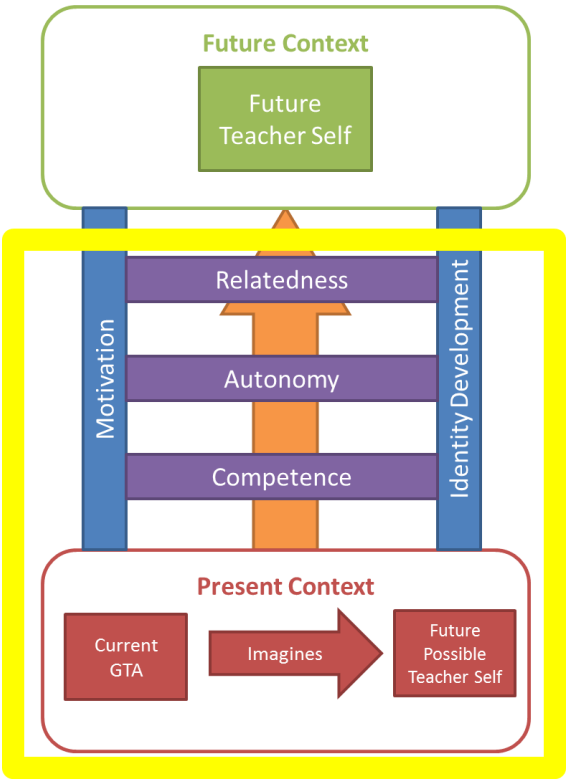

Figure 3: Theory Relevant to This Study

Specifically for this research, the theoretical framework starts with PST at the bottom. In the present context, a GTA imagines their future possible self as a teacher. This served as the base for understanding their motivation and identity development. Once the GTA had their vision established, they then moved forward to reach their future teacher self which could be after graduation or simply some point in their future teaching careers. As they progressed towards their future possible teacher self, competence, autonomy, and relatedness in their teaching context supported or hindered their movement. The rungs of the ladder (competence, autonomy, and relatedness) served as the connection between their motivation and identity development. As proposed by this approach to the framework, all of the rungs were needed to fully connect motivation and identity development, and they were also needed to move a GTA to their future teacher self. It should be noted that at the start of this study, this was a proposed or hypothesized view of the framework. Chapter 5 provides an updated model based on the findings of this research.

As the figure is depicted above, there is an implied understanding that competence must be achieved before autonomy and before relatedness. Currently in the literature, there is support that competence is at the heart of motivation and personal development. As Elliott and Dweck

(2005) stated "competence would seem to represent not only an ideal cornerstone on which to rest the achievement motivation literature but also a foundational building block for any theory of personality, development, and well-being" (p. 8). This statement supports the notion that competence should be achieved before the other components of the theory. Also when discussing the components, competence and autonomy are usually discussed first and together (e.g., Lavigne et al., 2007; Ryan & Deci, 2000a) supporting the placement of them before relatedness. Through the findings developed out of this research, I was able to modify this hierarchical approach which again, is discussed in detail in the final chapter of this dissertation through a framework revision. Based on the figure above, if all of the rungs were present and a strong foundation of a positive future possible teacher self was established, a GTA would have motivation and identity development allowing them to become the positive version of their future possible teacher self in the future context.

For this research, I only focus on GTAs' views of their future possible selves in the present context and their current experiences teaching in FYEPs. To scope the project, the future context has been removed, but provides an area for additional work. Future studies related to this research have the potential to be longitudinal in nature where the future possible self and future self can be examined together looking for similarities and differences. Also it should be noted that while the depiction of the theories is linear, the process is cyclical. Once you reach the future self, that becomes the current self and the process begins again. The notion of motivation and identity development are never ending conceptions. Motivation can continue to change along with identity continuing to develop. These two constructs must be continually updated and evaluated because they are fluid and ever changing. This work studied a snapshot in GTAs' motivation and identity development.

2.5 Literature Summary and Key Definitions

This chapter provided a foundational view of the literature available related to GTAs in engineering, GTAs in general, motivation, and identity. It also presented the theoretical framework that was used in this study to guide the research. Based on my review of the literature, this work fills a gap in the literature in that it focuses on a population that is under researched, GTAs, and combines two theories which have been linked in the past, but not fully combined as proposed in this work. To recap the key elements of this section, the following definitions have been defined with regard to this study:

- **Identity:** a personal view that answers the question "who are you?" – in this case, the question is "who are you as a teacher?"
- **Motivation:** being moved to do something – in this case, the something is teaching
- **Competence:** the self-recognized knowledge and mastery of content, pedagogy, and instructional/program structure
- **Autonomy:** having control or decisions making power over your classroom or course in terms of content, activities, and policies that aligns with personal interests and values
- **Relatedness:** feelings of connection or belonging to both your teaching colleagues and students
- **Future Possible Self:** a view to who you would like and not to be in the future with regard to teaching

After data collection and analysis, the terms were further operationalized based on the results and findings to aid future studies. A discussion of the revised terms based on this research can be found in the final chapter of this dissertation.

CHAPTER 3: Mixed Methods

As shown through my review of current literature, little to no research has been conducted specifically examining the factors affecting teaching motivation and identity development of GTAs within FYEPs. Therefore, both a depth and breadth of knowledge was needed on this subject. To achieve both, I designed an exploratory sequential mixed methods study with priority given to the qualitative strand (Creswell & Plano Clark, 2011). The qualitative portion of this research allowed for an examination of the details of individual GTAs (depth) while the quantitative portion allowed for a more generalized understanding (breadth). The qualitative strand used interviews as the data source and the quantitative strand employed a survey. The sections of this chapter document the methods employed in this study for both the qualitative and quantitative portions.

3.1 Research Design

This research project involved five distinct phases connected in a sequential manner. The overall project was exploratory in nature such that inductive qualitative work led to deductive quantitative research (Creswell & Plano Clark, 2011). Inductive work has been operationalized to mean the particular leading to the general (i.e., the interview data leading to the development of a national survey) while deductive work has been operationalized to mean the general leading the particular (i.e., the framework guiding the analysis of the survey). Approaching the research problem in this manner allowed for a holistic examination of GTAs' motivation and identity.

The distinct phases of the project are depicted below in Figure 4 which includes details about each phase to provide an overview of the research and the phase outcomes. Each phase was linked in some way to the others contributing to the sequential nature of this research. Phases 1 and 2 are mainly inductive in nature leading to Phase 3 which is a development phase. Phase 4 is deductive, and finally, Phase 5 is a mix of both approaches.

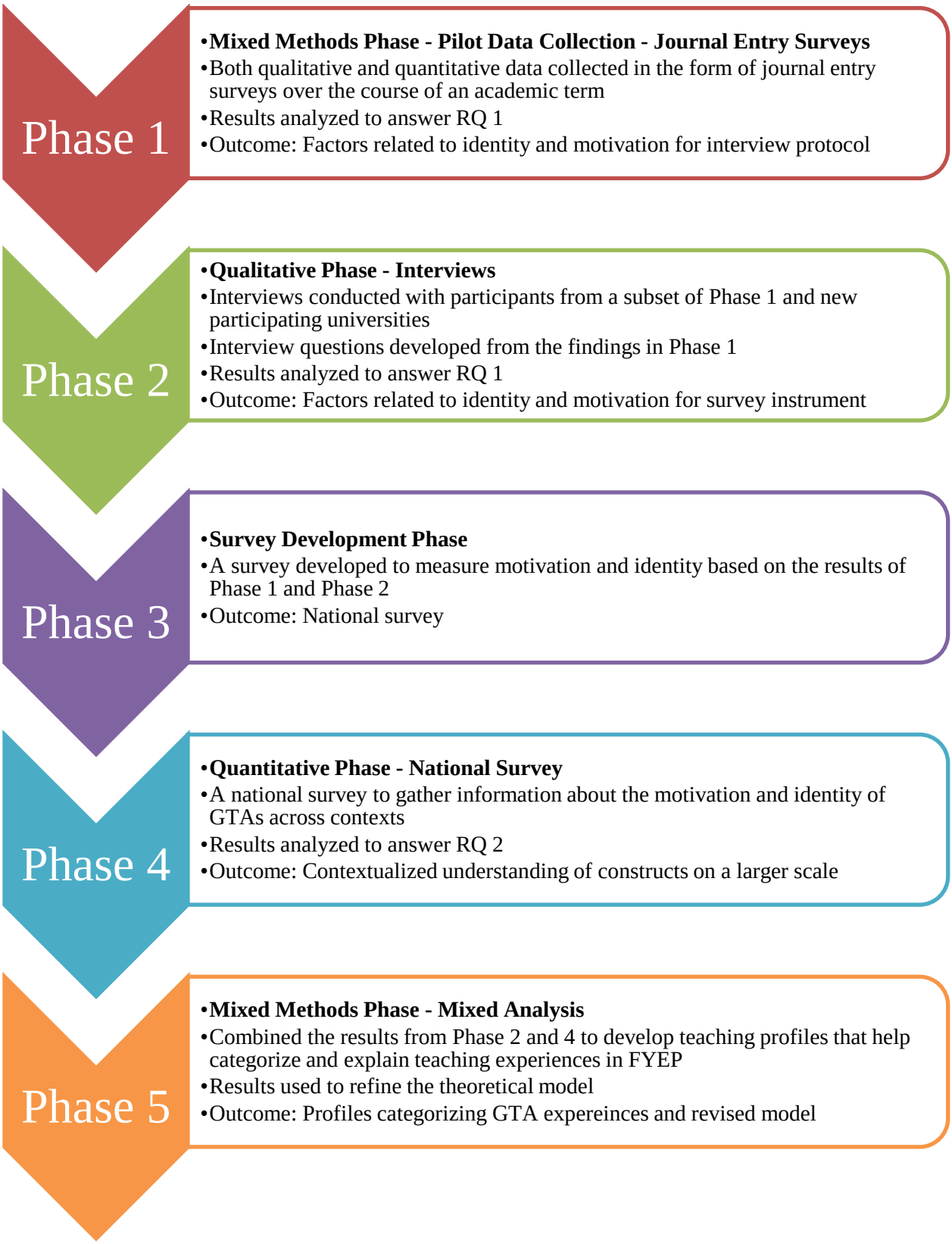

Figure 4: Project Phases

The five distinct yet connected phases resulted in descriptive data regarding GTA experiences, theoretically grounded and contextualized survey data, and set of teaching profiles developed with both the qualitative and quantitative data. The teaching profiles are essentially characterizations of the various types of GTAs who teach in FYEPs as evidenced through this study. They are not meant to categorize every GTA or individual unique experiences, but they can be used to understand the different types of GTAs who are often involved in FYEPs. By using the profiles to consider that GTAs are motivated differently and may have different teaching identities, FYEPs can better design training programs and appointment structures that specifically target GTA motivation and identity needs.

As stated in Chapter 1, the purpose of this study was to examine the factors influencing graduate students' motivation to teach and their identity development as teachers. To address this purpose, this project was designed to answer the following overarching research question "**How do graduate students' motivation to teach and future identities as teachers develop when serving as GTAs in first-year engineering programs?"** The following sub-research questions were also developed which have each been mapped to a phase of the study shown in Figure 4:

- **RQ 1:** What do GTAs perceive to be the factors that affect their own motivation and teacher identity development as GTAs in first-year engineering programs? (Qualitative – Phase 1 and 2)
    - What factors contribute to GTAs' competence, relatedness, and autonomy in the classroom?
    - What factors contribute to how GTAs see themselves as future teachers?
    - What do GTAs report as the relationship between motivation and identity?
- **RQ 2:** How are the factors identified in RQ 1 represented in the larger sample of GTAs, and what are their perceptions of their needs for competence, autonomy, relatedness, and identity? (Quantitative – Phase 4)
- **RQ 3:** Combining the results from RQ 1 and RQ 2, what are the different teaching profiles that can be constructed that distinguish different levels of motivation, identity, and factors, and how do those results inform the proposed theoretical framework? (Mixed Methods – Phase 5)

Again as stated in Chapter 1, the study was conceived broadly such that the factors mentioned above could have been events, occurrences, people, institutional structures, demographics, etc. that affected the different constructs. By answering each of these questions, a detailed understanding of the GTAs' motivation and teaching identity development in FYEPs was developed. As discussed in the future work section of Chapter 5, my plan is to ultimately use the findings from this study to develop research-based training programs and GTA teaching appointments that GTA target motivation and identity needs.

3.2 Data Collection Procedures and Analysis

A variety of data was collected throughout the course of this research, but the primary data sources were the qualitative interviews (Phase 2) and the quantitative national survey (Phase 4). Figure 4 above depicts the various phases of the study in detail, but Figure 5 below provides a graphical and more generalizable depiction of the research project.

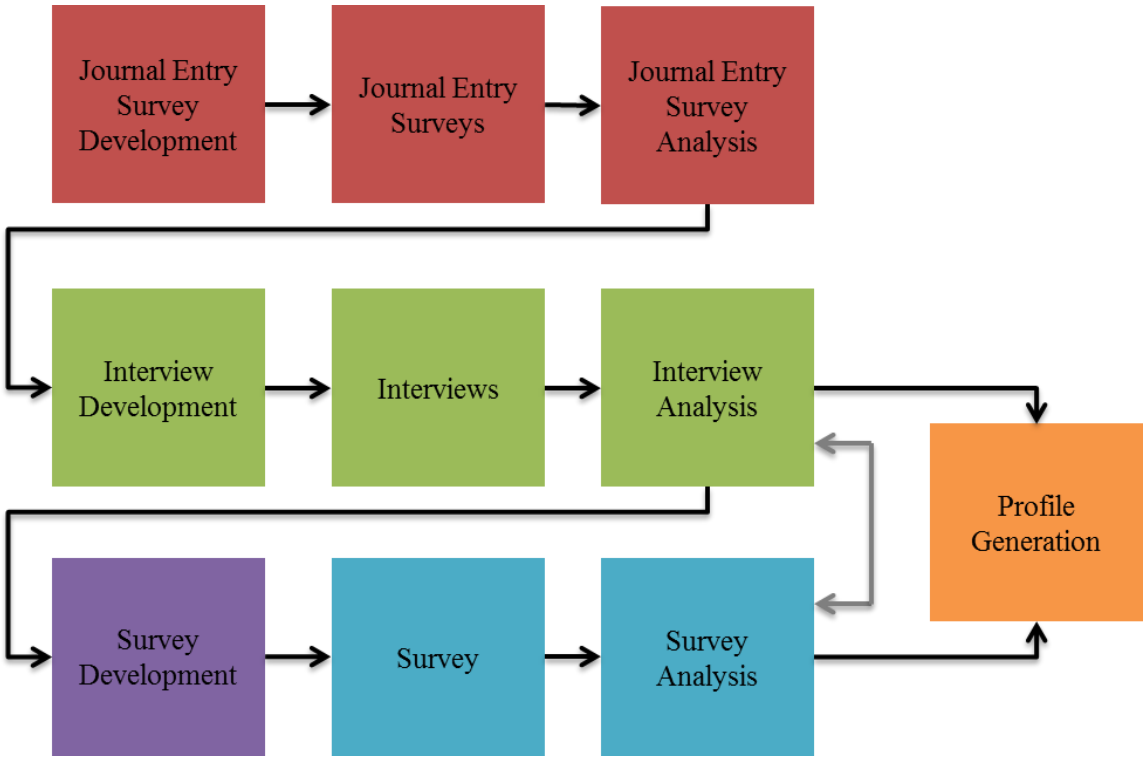

Figure 5: Graphical Depiction of Research

In reference to the different phases shown above which correspond in color to the phases detailed in Figure 4, multiple connected data sources allowed for the development of a more complete and credible understanding of the factors that affect GTAs' motivation to teach and identity development as a teacher where the weaknesses of one data set were offset by the strengths of

the other and vice versa (i.e., a strength of the qualitative data is its depth, but a strength of the quantitative data is its breadth) (Creswell & Plano Clark, 2011). The final products of this research included the individual results of the qualitative and quantitative phases, the national survey, and the set of teaching profiles. As shown in Figure 5 above, the profiles were generated based on the interview and survey data. The analyses of those two items were initially independent, but they also informed each other as shown by the grey arrow. The individual results of the qualitative and quantitative phases and the set of teaching profiles are detailed in Chapter 5, and the survey instrument is available in Appendix E. The remainder of this section will document the data collection and analysis which resulted in the final products.

3.2.1 Participating Universities

Before describing the individual phases of this research, it is necessary to understand the context of this study. The context includes seven universities and their corresponding FYEPs. To protect the identities of the participants and universities, I assigned the pseudonyms U1-U7 to the participating schools. Table 2 provides basic demographic information about the universities and their FYEPs. The general university information was gathered from http://classifications.carnegiefoundation.org/, I determined the region by examining a regional map, and the program information was gathered in the FYEP Directors Study (Louis & Matusovich, 2012). In the FYEP Directors Study, 15 different FYEP directors and supervisors responded to an online survey to gather information related to the size of the FYEP, the program structure, and the responsibilities of both GTAs and UTAs. This information was used to gain a basic understanding of FYEPs in the United States, and the roles and responsibilities of TAs within those programs. Based on the 15 universities who participated in the FYEP Directors Survey, the sample used in this research (seven universities) is representative of the content-based FYEPs in the United States where most FYEPs were established at large public research institutions.

Table 2: Basic University Information

Basic University Info	University	U1	U2	U3	U4	U5	U6	U7
	Public/Private	Public	Public	Public	Public	Private	Public	Public
	Approximate Student Population	40,000	55,000	30,000	20,000	10,000	30,000	30,000
	Region	Mid-West	Mid-West	South	Southeast	Mid-West	Southeast	Southeast
Basic FYEP Info	Program Structure	2 Course Sequence, Honors Track	2 Course Sequence, Honors Track	2 Course Sequence, Honors Track	2 Course Sequence	2 Course Sequence, Honors Track	2 Course Sequence	Unknown
	FYEP Student Enrollment 2011-2012	1800	1600	600	700	460	1400	Unknown
	GTAs or Both GTAs and UTAs	Both	Both	GTAs	GTAs	Both	GTAs	Both

U2-U5 participated in Phase 1, U1-U5 participated in Phase 2, and all of the universities participated in Phase 4. The pseudonyms were given to the universities in Phase 2, a core project phase, based on the number of interview participants who participated in interviews from that university (e.g., U1 had the most interview participants so it is labeled as U1).

While there were similarities across many of the universities as documented in Table 2, there were unique differences which provided a more generalizable picture of FYEPs making this research applicable across different programs. For example in terms of similarities, all but one of the universities were public institutions and all but two had student populations of 30,000 or more. In terms of differences, the size of the FYEPs ranged greatly from 460 students to 1800 students. Also some of the FYEPs employed just GTAs while others employed both GTAs and UTAs. For this research, GTAs were sampled from both standard and honors track courses to increase the potential participant population. The similarities and differences showcase the richness of the sample, but it should be noted that no universities in the East or West regions participated in this research. Based on the preliminary FYEP Directors Study, no institutions with common-content based FYEPs were identified in those regions. Of the FYEPs found in those areas, many were discipline-specific FYEPs which were out of the scope of this research. Additional work is needed to further explore this interesting phenomenon and hopefully widen the sample in the future.

3.2.2 Phase 1: Journal Entry Surveys Development, Data Collection, & Analysis

Phase 1 served as a pilot study to assess the applicability of the newly created theoretical framework and assisted in the development of the interview protocol used in Phase 2. Phase 1 involved collecting three journal entries in the form of online surveys from a total of 30 different

GTAs out of a potential pool of 65 over the course of an academic term. This phase served as a first step to determine if SDT and PST were appropriate for studying GTAs and was also used to determine if there were large changes in attitudes towards teaching over an academic term to support or refute the decision to conduct one interview in Phase 2. Additionally, the data from Phase 1 provided a base for what was asked in the qualitative interviews in Phase 2. Since Phase 1 solely related to the methods of this work, all components of Phase 1 have been included here in Chapter 3 from question creation to results.

3.2.2.1 Journal Entry Surveys

For Phase 1, three journal entries collected in the form of surveys were administered over the Spring 2012 academic term to GTAs teaching in four different FYEPs representing four different universities. Three surveys were chosen so that three data points across the semester could be obtained for comparison in a short longitudinal manner. Three surveys were chosen because they allowed initial thoughts (first survey at the beginning of the term), in process thoughts (second survey after midterms), and full term thoughts (third survey after finals) to be gathered. If only two surveys were given, this level of richness would have not been obtained and if more surveys were administered there would not be clear delineations between the time frameworks. Each survey or journal entry was composed of three unique open-ended questions and a set of common scaled response questions. The open-ended questions were unique because they were different every survey (i.e., Survey 1 and Survey 3 did not have the same questions). Basic demographic questions were also asked which were used to connect response for each person over the three surveys without using an identifying name to allow for anonymity which followed approved IRB protocols.

Each survey was initially sent out to the potential participants via email along with one follow-up reminder email. To increase the response rate for the surveys (Laguilles, Williams, & Saunders, 2010), an incentive was given where each completed survey was voluntarily entered into a drawing for one of four $50 Amazon gift cards. Additionally at U2, a second incentive was added where a $10 Amazon gift card was given to those who completed all three surveys to try to increase the longitudinal response rate. Ideally, I would have liked to give this incentive to all the universities to increase the overall response rate, but this incentive was added after the first survey had already been completed at U3, U4, and U5. U2 was on a quarters system at the time, so this change midway through the phase was possible because of their shifted academic

schedule. In terms of potential sample bias, I believe the participants at U3, U4, and U5 could have had more positive views of teaching than those at U2 since their participation had less of a reward. Regardless, for this pilot phase, the results were still representative enough of GTAs in FYEPs to support Phase 2 of this work because a range of responses were received.

As stated above, each survey contained three unique open-ended survey questions. Table 3 below lists the open-ended questions for each survey along with the topic the question was designed to explore.

Table 3: Pilot Journal Entry Survey Open-Ended Questions

Survey	Questions	Topic
1	What motivated you to become a GTA?	Motivation
	What is the most rewarding part about being a GTA?	Motivation
	What is the most challenging part about being a GTA?	Motivation
2	What motivates you to teach each week?	Motivation
	As of today, do you think you will be a GTA next year? Why or why not?	Future Teaching
	As of today, can you envision yourself in a future job with a teaching role? Please describe what that job would be and how teaching would be involved.	Future Possible Self
3	Looking back on the term, what is one thing you would change about your teaching experience?	Teaching Experince
	Over the course of the semester, did your motivation to teach change? Why or why not, and how?	Motivation
	Overall, do you consider yourself a teacher? Why or why not?	Identity

The questions in this phase of the research were intentionally vague and related to broad topics to allow the GTAs to respond in whatever manner they saw fit without biasing the questions towards the framework. Since Phase 1 was the pilot, I was looking for variation in answers opposed to answer targeting a specific aspect of teaching and elements identified in the literature as relevant to teaching. In the other phases, the questions were specifically targeting the constructs in the theory and explicit aspects of teaching.

Along with the open-ended questions, each of the journals included a set of quantitative questions designed to be compared across the semester to see if GTAs' general feelings of motivation as they relate to SDT or PST changed over the course of an academic term (semester or quarter depending on the university). Those questions were Likert-type questions on a five

point scale from strongly disagree to strongly agree. Guy and Norvell (1977) found that the results of a survey do not statistically differ if a neutral point is available or not (e.g., the results of a five or six point scale, statistically, are the same). To allow the GTAs to choose a neutral option if they felt it appropriate (i.e., if they did not have a positive or negative feeling towards a question and were truly neutral in their reaction), a five point scale was used opposed to a four or six point scale which would have required them to choose a negative or positive disposition. Allowing participants to choose the neutral point was important since they could have had truly neutral feelings towards the questions. Finally, a five point scale was chosen over a three point scale to add variability in responses, but a seven point scale was not used so the choices would be more centralized. The quantitative scaled questions are shown below in Table 4. These questions were created to elicit responses related to the three components of SDT (competence, autonomy, and relatedness) and the GTAs' overall feelings of motivation and identity.

Table 4: Pilot Journal Entry Survey Closed-Ended Questions

Question	Topic
I identify with being a teacher.	Identity
I am motivated to teach.	Motivation
I feel I have control over my teaching.	Autonomy
I feel I am knowledgeable about the content I am teaching.	Competence
I feel connected with my teaching colleagues.	Relatedness

Asking this set of survey questions allowed for comparisons across time and allowed me to gain a general surface level understanding of GTAs since little research has currently been done in this area of engineering education. These questions were intentionally board to allow for a range of responses, but they are consistent with the format of past scales (see Section 3.2.4.1 for examples of past scale questions related to SDT and PST).

3.2.2.2 Journal Entry Survey Participants

In total, 65 GTAs from a total of four institutions (pseudonyms: U2-U5) were asked to participate in Phase 1 and 30 participated in at least one survey. The GTAs were identified by first contacting their program directors via a preliminary study that will be referred to as the FYEP Directors Study (Louis & Matusovich, 2012). For the FYEP Directors Study, potential director and administrator participants were first identified by personal first-year engineering contacts and then snowball sampling was used to expand the potential participant sample. Snowball sampling is a participant recruitment technique were survey participants are asked to

supply the names of other potential contacts to increase the potential sample pool (Goodman, 1961). For the FYEP Directors Study, program directors and administrators were asked to supply the names of two institutions, different from their own, that have FYEPs. Once the names of the institutions were gathered, directors and administrators (along with their contact information) were identified for each program through an internet search. To recruit for Phase 1 of my study (i.e., this dissertation), the directors and administrators from the FYEP Directors Study were asked to supply their email address if they would like their students to be able to participate in follow-up work. The results of the FYEP Directors Study along with recruiting details for directors and administrators were previously published (Louis & Matusovich, 2012).

For Phase 1, four institutions out of the 15 that initially responded to the FYEP Directors Survey indicated they would be interested in having their GTAs participate in follow-up work and supplied email addresses for 65 GTAs. Based on these potential participants, Survey 1 had an overall response rate of 37% (24 participants), Survey 2 had a response rate of 32% (21 participants), and Survey 3 had a response rate of 31% (20 participants) with 23% of the potential participants responding to all three of the surveys (15 participants). The GTAs who participated in Phase 1 were a mix of PhD and Master's level students representing a variety of engineering disciplines. While the sample was relatively small, for the purposes of a pilot study it was adequate to determine which types of questions should be asked Phase 2.

3.2.2.3 Journal Entry Survey Data Analysis and Results

The analysis of the open-ended questions in the Phase 1 data first involved an open coding approach following the recommendations of Rossman and Rallis (2012) who stated that coding is an iterative process where you first start with general large codes and then you break those down those codes into smaller sub-codes collapsing sub-codes as needed to allow the salient trends to emerge from the data. Table 5 below shows the initial major codes that were used on each journal entry survey question.

Table 5: Pilot Journal Entry Survey Major Codes

Survey	Questions	Major Codes
1	Question 1	Competence, Autonomy, Relatedness, Other
	Question 2	Competence, Autonomy, Relatedness, Other
	Question 3	Competence, Autonomy, Relatedness, Other
2	Question 1	Competence, Autonomy, Relatedness, Other
	Question 2	Will be a GTA, Will NOT be a GTA
	Question 3	Teaching Future, Unsure, No Teaching Future
3	Question 1	Competence, Autonomy, Relatedness, Other
	Question 2	Increased, Stayed the Same, Decreased
	Question 3	Teacher, NOT a Teacher

For my analysis, I initially coded Survey 1, Survey 2 question one, and Survey 3 question one using the motivation related constructs of interest in this work (competence, autonomy, and relatedness) along with a major code of "other" that was applied to segments of text that seemed related to GTAs' experiences but were out of the scope of this project. Those segments will be explored in future work. For the other questions, I initially coded those using major codes which paralleled the questions asked in the survey. For example, Survey 2 question two was "As of today, do you think you will be a GTA next year? Why or why not?" so I initially coded that question as "Will be a GTA" and "Will NOT be a GTA." After the initial major coding, I reviewed the individual code segments within the major codes to create sub-codes that captured key trends in the response. This process was iterative where I started sub-coding in Survey 1 looking for common trends, moved to Survey 2, moved to Survey 3, and then revisited the surveys to ensure no sub-codes were missed.

An example of a sub-code that emerged from Survey 1 question 1 was "gaining experience" which was a sub-code for the major code of competence. The sub-code "gaining experience" was applied to the following passage illustrating an example of how a GTA mentioned "graining experience" in their journal survey entry:

> "I had not previous teaching experience and thought through a GTA I might achieve this experience." [Participant 1]

The sub-code of "gaining experience" was related to competence because "gaining experience" was viewed as acquiring knowledge which directly relates to ones' views of competence and SDT in general. See Appendix A for a complete list of the sub-codes, brief definitions,

corresponding major codes, and sample quotes. Figure 6 below, depicts the sub-codes that were created out of the journal entry surveys related to the framework used in this research.

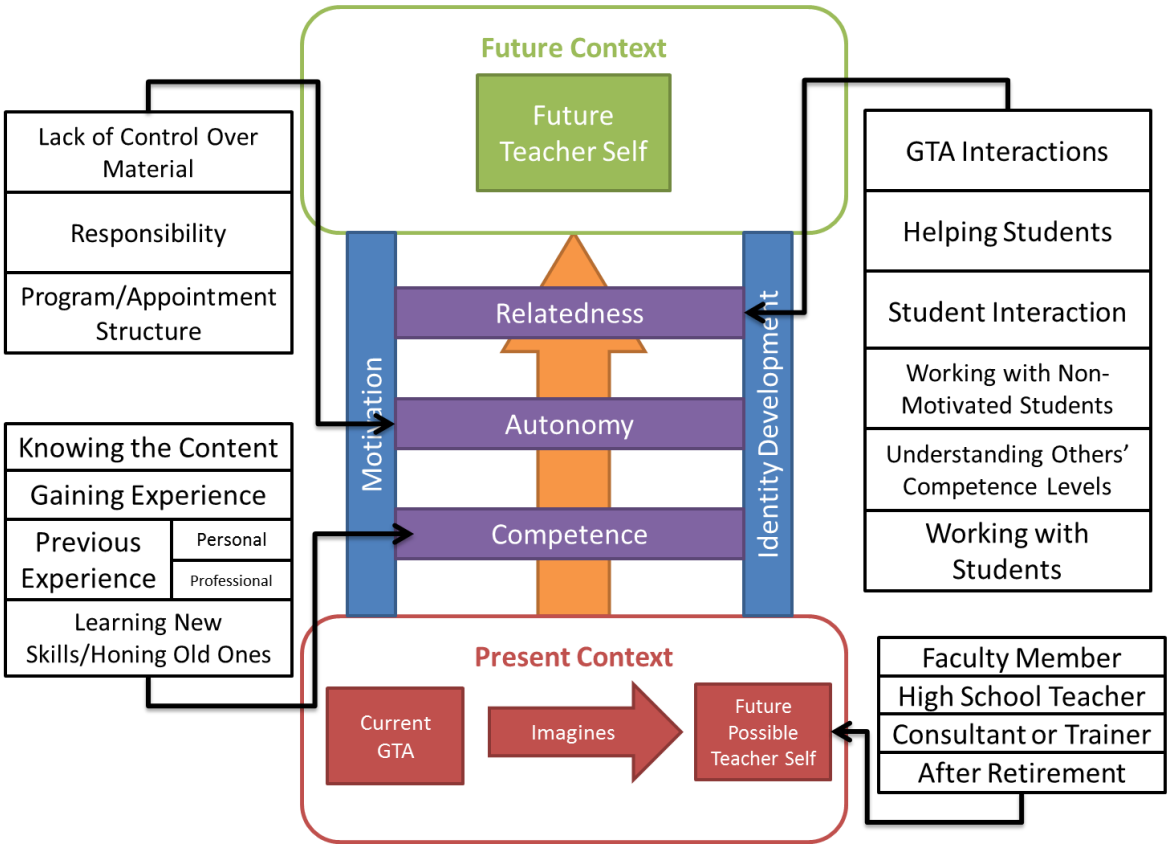

Figure 6: Codes Mapped to Framework

Based on the initial coding and analysis, it seemed that SDT and PST were appropriate theories for this research since many of the sub-codes related directly to the constructs in the proposed framework. For example, when examining the first construct, competence, four sub-codes emerged from the data (knowing the content, gaining experience, previous experience, and learning new skills). These codes contributed to defining competence for GTAs, as past research has not looked at this specific group using SDT or PST. As described in Section 3.2.3.1, the sub-codes from Phase 1 also contributed to the interview protocol developed in Phase 2.

For the scaled questions included with each journal entry surveys, I examined the responses for the 15 participants who completed all three surveys. Their responses were recorded and reviewed for only changes over the course of the three surveys. This was done to see if one interview during an academic term would be sufficient to capture a GTAs' general perspective on teaching. If a change from a positive to negative view or vice versa occurred, the change was noted. For example, if a participant initially responded to the item "I am motivated

to teach" with a two (disagree) and then on the next survey they responded to the same item with a four (agree) their response was flagged. This type of analysis allowed me to understand if GTAs reported changes in their motivation and identity over the course of an academic term or if their responses are relatively consistent. No other analysis beyond flagging the responses was conducted for this data as its purpose was to understand if changes occurred over time. Only four single instances out of 45 possible instances were found where a change from a positive to negative view or vice versa occurred over the course of Phase 1 for a question. Based on this information, over the course of a single academic term feelings towards identity and motivation do not seem to change. This finding supported Phase 2 involving one interview related to being a GTA opposed to a series of interviews over a term.

Phase 1 of this project served as a pilot for the remaining phases. The results of Phase 1 were specifically used to determine whether or not the framework was applicable and what questions should be asked in the interviews. It also guided the decision in Phase 2 to only employ one interview during an academic terms opposed to multiple interviews.

3.2.3 Phase 2: Interviews Development, Data Collection, & Qualitative Analysis

Building on the journal entry surveys, Phase 2 began during the Summer of 2012. The interviews conducted in Phase 2 with 12 GTAs out of a potential 50 focused on identifying factors related to GTA motivation to teach and identity development as a teacher in the context of various FYEPs. The interviews were semi-structured in nature, lasted approximately one hour, and were conducted over the phone. Semi-structured interviews with interview guides or protocols were used because they allowed a common set of questions to be asked in each interview so that comparisons could be made across interviews, but the guides also allowed me to further explore topics by asking participants specific probing questions related to their unique experiences (Patton, 2002). I was the only researcher who conducted the phone interviews allowing for consistency across participants. The interviews were completed according to approved IRB documentation which included audio-recording for later verbatim transcription. The transcription of the interviews was completed by two paid transcribers and me.

3.2.3.1 Interview Protocol Development

The interview protocol used in this phase of the study was developed from the Phase 1 findings and the literature. This approach allowed for the interview protocol to target key aspects of the literature previously found to be important but also allowed for the questions to be

specific to the FYEP context. This approach to interview question development is further explained in the following sections. The complete final interview protocol can be found in Appendix B.

In the protocol, the questions that directly related to the findings gathered in Phase 1 were marked with "Journal Survey Question." The other questions are based on the literature or are demographic related questions. For example, the interview protocol question "Was there anything you knew before being a GTA that you were able to use when teaching?" came directly from the journal entry surveys. In the journal entry surveys, many participants talked about past experiences with teachers and how that influenced their motivation to teach and teaching style in the classroom. For example, participant four from Phase 1 said:

> "I had a bad GTA my first semester and a great one my second semester in two sequential classes [two specific courses listed]. I saw the differences and saw how well having a good GTA can help you in a class."

This quote was coded as a "previous personal experience" which related to "competence" because as a student this particular individual learned the value of being a good GTA which contributed to their knowledge base when they were a GTA. This coding and mapping then lead to the creation of the "Was there anything you knew before being a GTA that you were able to use when teaching?" question allowing this topic to be further explored in the interviews. Some other questions that were developed using a similar approach were:

- What have you learned from being a GTA with regard to teaching?
    - Developed from "Learning New Skills/Honing Old Ones" *(competence)*
- Do you feel you are responsible for your course? If so, how or in what ways?
    - Developed from "Responsibility" *(autonomy)*
- In what ways do you help or assist your students aside from content?
    - Developed from "Helping Students" *(relatedness)*

Other questions that were developed out of the Phase 1 findings can be found in Appendix B.

In the interview protocol, there were also questions that were developed out of the literature review. For example, the question, "In what ways do you feel connected with your teaching colleagues? How do you stay connected?" directly relates to the SDT literature that says that relatedness is comprised of both teacher-student relationships and teacher-teacher

relationships (Klassen et al., 2012). Some other questions that were developed out of the literature were:

- Do you feel you understand how your program fits into the rest of an undergraduate student's engineering education? Why or why not? *(competence)*
- How much control do you have over course policies or classroom management approaches? *(autonomy)*
- In what ways do you relate or connect with your teaching colleagues? *(relatedness)*

Other questions that were developed out of the literature can be found in Appendix B. Creating the interview protocol from the Phase 1 data and the data in the literature allowed for the unique experiences of GTAs in FYEPs to be captured along with the general findings from literature in related fields.

Before the formal interviews were conducted, a draft protocol was piloted with two Virginia Tech Engineering Education GTAs, one male and one female, who taught in a FYEP the term before (Spring 2012). Seidman (2006) stated that pilot testing for interviewing is essential to ensure the instrument is well designed and that researcher will leave the interview having the appropriate data. He commented that there are many things that can be unforeseen before piloting that can be reduce or eliminated if time is take to test the protocols before the actual interview. The students chosen for my piloting were selected because they were not part of the original sample (i.e., do not attend the participating institutions allowing the potential participant pool to be preserved) but belonged to the general population of interest for this research (i.e., GTAs in FYEPs). Engineering Education GTAs were specifically chosen as the pilot group because they could be interviewed as typical participants talking about their experiences teaching in a FYEP, but they could also discuss the questions as a researcher considering wording and timing since they were familiar with educational research methods. This approach ensured that the interview protocol was both accurate and trustworthy (i.e., collected information related to the intended topic) which is further discussed in Section 3.2.3.4. Due to the potential conflict of interest because these GTAs were my colleagues, their responses were only used to assess the questions in the interview, improve the wording of questions, and test the protocol for timing concerns. If used in the actual study their responses could have biased the sample because they knew the detailed background of my study, and we had had

previous conversations about teaching. Their responses to the interview questions were not used as data for the project.

One major revision that resulted from pilot testing the interviews was that pre-interview survey was added to collect basic demographic information about the participants and their role within their FYEP. Upon discussing the interview with the pilot participants, this decision was made to ensure that the same demographic information was collected from each participant and to ensure that the interview remained close to an hour as approved by the IRB. If the survey was not collected ahead of time, the interview could have easily been over an hour based on the pilots. An hour was chosen because GTAs balance many roles and responsibilities aside from teaching so keeping the interview to an hour was needed to try to increase participation. According to Seidman's (2006) interview approach to qualitative research, he recommends that interviews be 90 minutes long, but he also comments that the length of interviews should be adjusted for the population of interest and the questions you are asking. I believe that a longer interview would have decreased participation for this particular population due to their many commitments. Also because a survey was administered before the interview, total participant involvement in this study was actually longer than an hour (approximately one hour and 15 minutes which is close to the 90 minute recommendation). The survey was sent out to the participants a day or two before their interview and was used in the interview to guide the initial discussion. The final version of the interview protocol along with the pre-interview survey can be found in Appendix B. After the interview protocol was piloted and adjusted based on the feedback, it was used to gather the qualitative data in Phase 2 of the project.

3.2.3.2 Interview Participants

Participants for the interviews were identified in one of two ways both of which were approved under IRB; from Phase 1 and from the addition of more universities to the study. First, participants from Phase 1 were identified for interviews through the last journal entry survey where they were asked to supply their name if they were interested in a follow-up interview. If they supplied their email, they were contacted for a potential interview. Other potential participants were identified by contacting all the GTAs that were initially contacted for the journal entry surveys minus those from U2 since U2 already had three interview participants. This was done because the number of participants who initially indicated they would be interested in follow-up work from Universities 3, 4, and 5 was low; by contacting all of the

GTAs the potential participant pool was increased at those universities. In the end, only six participants from Phase 1 participated in Phase 2. Consequently, more potential interview participants were added to the study by including two additional universities in the potential participant pool. This addition was made because the directors or administrators of these FYEPs participated in the FYEP Directors Study discussed in Louis and Matusovich (2012) and decided to give their GTAs an opportunity to participate in the follow-up work after the initial recruiting for Phase 1. Unfortunately, only one of the additional universities yielded participants (U1). In total, recruiting from Phase 1 and the additional institutions yielded 50 potential participants for the interviews.

Each potential participant was initially contacted by email for the interview and then was contacted again with two follow-up reminder emails. In total, 12 semi-structured phone interviews were conducted with GTAs representing five different FYEPs (response rate: 24%). An incentive of a $10 Amazon gift card was advertised and supplied to those who completed an interview to increase the response rate since the response rate in Phase 1 was relatively low. It should be noted that these were all voluntary interviews which had the potential to induce self-selection bias into the study (Sica, 2006). The bias is further discussed in Section 3.3 of this document. Additionally, there were originally 13 volunteers for the interviews, but one volunteer from U2 could not be reached for the interview by phone or follow-up email so she was ultimately not interviewed for this research.

To capture the details of each participant including relevant background characteristics and demographics, I created a participant matrix (Appendix C). In this table, the Carnegie classification of each of the universities has been included along with the data related to that university's FYEP that was gathered from the FYEP Directors Study (Louis & Matusovich, 2012). This information was included to show the range of universities that participated in Phase 2 in this work. In reference to the participants, this matrix was used to capture the unique characteristics of each participant, but it was also used to recruit additional GTAs through purposeful sampling (Patton, 2002). For example, initially I had five interviews scheduled all with males so I purposefully recruited for females for my next interviews by indicating that women were needed in a reminder email for the study. Recruiting in this manner allowed my sample to expand to a wide range of potential GTAs in FYEPs. For example, in the sample there were three females and nine males, five PhD students and seven Master's students, two

international students, and a variety of engineering disciplines including but not limited to engineering education, electrical engineering, and civil engineering. It was essential to obtain a varied sample to ensure that the results of this work were as generalizable as possible and not just specific to one subset of GTAs that teaches in FYEPs.

While the detailed matrix is available in the appendix, Table 6 below summarizes some of the key information related to the 12 interview participants. Table 6 also includes the pseudonym for each participant indicating which institution he/she attended. Pseudonyms were used to protect the identities of the participants in accordance with IRB. It should be noted that the pseudonyms were randomly assigned to the participants using a list of internationally popular names. They are not intended to be ethnically representative but are representative of gender. In this table, I also include their teaching experience to provide a clear perspective on who is new to teaching and who is new to teaching within a FYEP. At the beginning of the study, I thought this would be an important factor in determining the profiles which is why it is highlighted here.

Table 6: Interview Participant Demographics

University	Pseudonym	Gender	Major	Degree	Teaching Experience		
					First Year Teaching or Less in FYEP (9)	Second Year Teaching or More in FYEP (3)	Other Experience Before FYEP (6)
U1	Brent	Male	Aero	Master's		X	
	Ingrid	Female	EngE	PhD	X		X
	Jillian	Female	EngE	PhD	X		
	Sam	Male	ECE	Master's	X		
	Susanne	Female	CSE	Master's	X		X
	Zachary	Male	EngE	PhD	X		X
U2	Dan	Male	ECE	Master's	X		
	Gordon	Male	Civil	Master's		X	
	Wesley	Male	BioMed	PhD	X		
U3	Corey	Male	Civil	Master's	X		X
U4	Roberto	Male	Civil	PhD	X		X
U5	Maurice	Male	ISE	Master's		X	X

From this table, it is obvious that the sample was skewed towards U1 and U2. At first, I thought this would be problematic for my study in that those who were from the same institution may have had the same experiences reducing the range of my findings, but based on the interviews, a range of experiences were captured regardless of program. Since a range of experiences was still captured, the factors found relating to motivation and identity for this work are representative of

GTAs in FYEPs as a whole, not just one or two FYEPs. To learn more about the individual interview participants, see Appendix F where participant summaries are provided. The participant summaries include a bulleted list of information that was approved by the participant (with corrections noted if needed), and a table that summarizes their interview regarding the constructs of interest in this work.

3.2.3.3 Interview Data Qualitative Analysis

The interview data qualitative analysis had four components, (1) initial *a priori* coding, (2) open coding, (3) code categorization, and (4) theme/trend generation. This approach loosely follows the framework analysis approach to coding described in Srivastava and Thomson (2009) and Ritchie and Spencer (1994). Srivastava and Thomson (2009) list five steps to their approach to framework analysis:

1. Familiarization where the researcher explores and reviews the data (i.e., the interviews) to become immersed in the transcripts.
2. Identifying a thematic framework where the researcher explores the trends in the data either allowing the trends to emerge from the data or using *a priori* themes to guide but not limit the data review.
3. Indexing where the researcher codes the data for the trends.
4. Charting where the researcher reorganizes the codes and trends in a meaningful way for presentation.
5. Mapping and Interpretation (Ritchie & Spence, 1994) where the researcher uses the charted data to provide insight into the perspectives of the participants connecting that to work beyond the study.

For my research, I followed a similar path where I became familiar with the data (i.e., the transcripts), coded the data using both an *a priori* and opening coding approach, organized the data into a meaningful format, and discussed the data in reference to the findings of past research. My approach differs from the approach discussed above in that I combined steps 2 and 3, but had two phases (*a prior* then open coding). I did this to allow myself to follow a systemic process for coding that ensured I examined the constructs of interest in this work but also allowed for new findings to emerge from the data. If I followed the steps outlined above in detail, I was afraid I would miss the inductive findings that would have been developed from the transcripts.

To provide more details regarding the actual coding, first, an *a priori* approach to coding was used where the major constructs of the framework served as the codes (competence, autonomy, relatedness, identity). Each transcript was reviewed and coded based on the four constructs. The definitions for the *a priori* codes can be found below in Table 7 along with sample quotes. It should be noted that in Table 7 and throughout this document, the quotes have been cleaned to remove filler words or phrases such as "um" and "you know" where appropriate to improve the readability of the quotes. Additionally, identifying information was removed where appropriate and replaced with general terms to protect the identities of the institutions in this study and the participants. Those locations are denoted with square brackets. The practice of cleaning or editing quotes is something that has been debated in qualitative research. The general consensus seems to be that cleaning quotes is a common practice, and that as long as the editing or cleaning does not change the meaning of the quote or does not misrepresent an attribute of the participant such as dialect, it is acceptable (Corden & Sainsbury, 2006).

Table 7: *A Priori* Code Operationalized and Sample Quotes

A Priori Code	Operationalized Code	Sample Quote
Competence	self-recognized knowledge of content, pedagogy, and instructional/program structure, this would not include simple statements of what they did – it would include a discussion of what they learned or knew or a deep discussion of what they did that showcases knowledge of a topic (a characterization of what they did)	"So for the first quarter, obviously since it was my first time being a GTA and everything, I was kind of nervous I guess. So I was like making sure that I knew everything about everything, I studied a lot, like materials that were going to be covered a month later, like a month beforehand and everything, and made sure that I knew everything." [Dan – U2]
Autonomy	having control or decisions making power over your classroom or course in terms of content, activities, and policies, this also includes a lack of control or decision making power	"I would just like to have more of an atmosphere where I control the curriculum and I control more of the grading rubric and have a little bit more freedom in that." [Corey – U3]
Relatedness	feelings of connection or belonging to your teaching colleagues or students, this also includes connections to the department or university, this does not include a simple discussion of position within a structure – they must mention their feelings in that environment or describe the relationship	"I had a handful of TAs that we like, it was like we're in this together. It was very nice to have them around so I mean there were times we were grading until like 3am or 1am in the morning. I mean it was rough, but it was bearable because we had each other to get through it." [Susanne – U1]
Identity	a personal view that answers the question "who are you?" or "who do you want to be?", ideally will be related to teaching or the role of a teacher, but may include other future possible selves	"I can relate, just, to, you know the teaching aspect of things. So I think it's something I don't know if, it's genetically even possible, but I do feel in a sense that it's there, you know the teaching gene. So I really contribute it to the way you know, I, um, you know as a person, um, I, any time I have any questions as a kid, I never had, you know, a response of, 'Well, I don't know, I don't care.' It was just like, 'Oh, I don't know either. Let's try and go figure it out.'" [Sam - U1]

As a sample, competence was operationalized to the definition above and the sample quote by Dan was coded as competence because Dan was specifically talking about the knowledge he needed to be a GTA. For each of the 12 transcripts, this process was used where the constructs were operationalized into codes and then the transcripts were reviewed for quotes that fit those

code definitions. It should be noted that in some cases, certain interview passages were applicable to multiple *a priori* codes. In those cases, the passages were coded a few times to account for the overlap. This overlap is further discussed in Chapter 4 mainly associated with the construct of relatedness.

Following the *a priori* coding, a round of open coding was conducted to allow for an inductive examination of the interviews. For this round of coding, each transcript was reviewed and coded as items emerged from the transcripts. For this round, I did not constrain myself to the framework developed for this study even though it was used in previous phases to drive the work. I did my best to let the data speak for itself meaning that codes were developed regardless of whether or not they related to a specific construct in the framework. As an example, the code Emotions or Feelings Related to Being a GTA was developed from the interviews because many of the interview participants used strong emotional words in their interviews to describe their experience. This item does not directly tie back to one of the four constructs used in the framework (competence, autonomy, relatedness, or identity), and therefore, demonstrates the inductive approach where developed codes were beyond the confines of the framework. Another example includes the codes related to the individual responsibilities of GTAs (e.g., Follow Course Policy, Office Hours, etc.). During the inductive coding phase, these items did not directly relate to a construct but were prevalent in the interviews and therefore became codes. Strictly coding to the framework would be classified as deductive where the framework would guide the analysis. This type of coding was done in the *a priori* phase described above.

The inductive coding involved an iterative process where the transcripts were reviewed multiple times to ensure each transcript was coded for the open codes as they developed out of the other transcripts as described above. The approach used was guided by the techniques described in Rossman and Rallis (2012) and Patton (2002) where the researcher makes notes about prominent items as they initially review transcripts that they develop into codes that they then group into themes and trends. Again, the process of reviewing the transcripts and creating codes was iterative where the transcripts were read multiple times to ensure that the codes reflected the items in the interviews. Appendix D contains the operationalized open codes developed out of the interviews along with a discussion of what the codes were and what they were not. Table 8 is a listing of just the codes in some general groups to help with organization. The organization is simply to help classify the codes inductively opposed to deductively and

based on the framework. In some cases, the general groupings were codes that were broken down into the sub-codes during the opening coding process (e.g., Past Experiences was broken down into Past Experiences as a Student and Past Experiences as a Teacher) while in other cases the general groups served to organize the data (e.g., Responsibilities was used to organize all of the open codes that related to things the GTAs were required to do). It should be noted that while this phase was inductive, the interview protocol was developed based on the findings of Phase 1 which was directly crafted around the framework. Because of this, the findings, while directly from the data, could still have been influenced by the framework in some way. This is a limitation to this work that should be considered in the interpretation of the findings. For example, the code Past Experiences as a Student emerged from the qualitative interviews in the inductive analysis but directly relates to the construct of competence as discussed in the Phase 1 findings above. This is a possible instance were the framework used to develop the questions in Phase 1 may have carried over into the development of the questions in Phase 2 and then the analysis of the Phase 2 data. Despite the residual effects of the framework throughout the phases, I believe the inductive phase still allowed codes to emerge from the data that were outside of the framework and relevant to the GTA experience. Doing this was important in terms of truly understanding GTAs' experiences in FYEPs.

Table 8: Interview Open Codes

General Grouping	Codes
Teacher Identity	Role Dominance
	View of Being a Teacher
Past Experiences	Past Experiences as a Teacher
	Past Experiences as a Student
	Other Past Experiences
Relationships	Relationships with Students
	Understanding Your Students
	Relationships with Colleagues
Responsibilities	Learn the Content
	Course Logistics
	Lecturing
	Facilitate Student Learning
	Follow Course Policy
	Office Hours/Review Sessions
	Oversee UTA
	Curriculum Development
	Grading
	Other
Other	Knowledge Needed Beyond the Classroom
	Emotions or Feelings Related to Being a GTA
	Things Learned While Being a GTA
	Job After Graduation
	Instructor or Faculty Role
	Training or Ways of Learning

As a detailed example, one open code that was developed out of the interviews was "Training or Ways of Learning." This item emerged from the transcripts as a salient component to being a GTA and was operationalized as:

> the specific training GTAs receive or they ways they learn materials to teach; this is the how of learning; this may include university teacher training, weekly meetings, studying lecture slides, working practice problems, etc.; this is not a statement that they need to know it

An example quote for this code is the following statement by Jillian from U1:

> "[U1] offers a couple of training services. And that's just for learning more about teaching techniques but that's just one service. So I've attended that. A lot of it is just

> from reading on my own and just observing other instructors. So I haven't had any formal training on teaching, you know, for specific techniques."

In this passage, Jillian was talking about a training session she attended related to teaching techniques and that she learned material by reading it and watching others. This related to "Training or Ways of Learning" because she was specifically talking about learning the material needed to be a GTA. This approach was used for all of the transcripts and open codes that were developed. As with the *a priori* codes, certain interview passages were indicative of different codes and were coded multiple times to account for the overlap. This overlap is further discussed in Chapter 4.

Once the open codes were developed and finalized, they were removed from their general groupings and were categorized based on the *a priori* constructs established through the literature review and framework creation (Patton, 2002). For example, the open code of "Training or Ways of Learning" used as an example above was categorized as "Competence" since training contributes to the knowledge you have as a GTA. This process was used for each of the open codes. It should be noted that if an open code could not be categorized to the framework, it was put into the "Other" category as it did not directly fit the constructs but seemed to be of importance for GTAs in FYEPs. The "Other" category serves as a source of data for future work. In many cases, all of the codes from one of the general groups in Table 8 mapped directly to an *a priori* construct (e.g., all of the "Past Experience" codes were mapped to "Competence"), but this did not always hold true (e.g., some of the "Responsibilities" open codes were mapped to "Autonomy" but "Learn the Content" mapped to "Competence"). Table 9 below documents which open codes were categorized to which construct.

Table 9: Open Codes Categorized by Constructs

Constructs	Codes
Identity	Job After Graduation
	Role Dominance
	View of Being a Teacher
Competence	Knowledge Needed Beyond the Classroom
	Things Learned While Being a GTA
	Training or Ways of Learning
	Past Experiences as a Teacher
	Past Experiences as a Student
	Other Past Experiences
	Learn the Content
Autonomy	Course Logistics
	Lecturing
	Facilitate Student Learning
	Follow Course Policy
	Oversee UTA
	Curriculum Development
	Grading
	Office Hours/Review Sessions
Relatedness	Relationships with Students
	Understanding Your Students
	Relationships with Colleagues
	Instructor or Faculty Role
Other	Emotions or Feelings Related to Being a GTA

After multiple passes through the data were completed and the coding was fully established, the codes were reviewed for overarching themes or trends that helped describe a GTA's motivation to teach and identity development as a teacher using the most salient codes that were then established into factors (e.g., the codes under the autonomy constructs were combined into the factor of "appointment structure" which is discussed in detail in Chapter 4). The most salient codes were determined by the codes that were most prevalent in the interviews or the codes that were discussed in great detail by multiple interview participants. The established factors were used to help support unique trends in the teaching profiles. The results of the interviews conducted in Phase 2 along with the teaching profiles can be found in the subsequent chapters of this dissertation.

3.2.3.4 Qualitative Data Trustworthiness

When considering qualitative research, trustworthiness must be established to ensure the qualitative instruments and analysis approaches are rigorous, appropriate, and accurate. Trustworthiness is a term that has been used in qualitative research to define its rigor (Schwandt, Lincoln, & Guba, 2007). Below the trustworthiness of the qualitative phase is discussed in detail in the context of this research breaking trustworthiness down into its respective subcomponents.

In qualitative research, trustworthiness is often used to refer to validity which is to ensure that what was intended to be measured is being measured and that it is being done in an appropriate manner (Creswell, 2009; Rossman & Rallis, 2012). Trustworthiness has also been defined to include credibility (internal validity or how well something is measuring what is intended), transferability (external validity or how well something can be applied to and holds true in a different setting), dependability (reliability or how consistent the measurement is), and conformability (objectivity or how unbiased and truthful the findings are) (Schwandt, et al., 2007). First, credibility was ensured by pilot testing the protocols where pilot testers were asked to discuss their interpretations of the questions. This ensured that the questions were indeed measuring what was intended. Additionally, credibility was established by having the interview participants review a bulleted list of attributes that summarized their experiences following the interview (the list is part of the interview participant summaries in Appendix F). Second, transferability was established by including multiple institutions in the study ensuring that the findings were applicable outside of a single setting. Also purposeful recruiting described also contributed to the transferability to different types of GTAs. Third, dependability was established through discussing the codes with another researcher which is described in more detail in the next paragraph. Finally, conformability was established by developing the questions out of Phase 1 findings and by reviewing all findings with others which is further described in the Section 3.3.1. All of these measures helped to ensure the trustworthiness of this research.

Specifically dependability or intercoder agreement as defined by Creswell (2009) was established to ensure that multiple coders would indeed code the same passages in the same manner in the future and that the code definitions used in this study were clear and reflective of the data. To establish this, I first developed the *a priori* code definitions and gave those to another researcher to use with two of the interview transcripts. We both then coded the

interviews independently using the codes. At that time, the *a priori* codes were defined as the following:

- Autonomy: Anything related to control
- Competence: Anything related to knowledge
- Relatedness: Anything related to relationships with students/colleagues/anyone else
- Identity: Anything related to who they are specifically targeting to become

After the independent coding, we met and went over our coding in detail discussing the codes at length to ensure the definitions captured the information in the interviews and that the definitions were clear. For this round of coding, it became apparent that the codes needed to be further operationalized and defined because the initial definitions were too vague. After that discussion, the codes were operationalized to the definitions in Table 7. Those new definitions were again given to the other researcher, and we each revised our coding on the first two interviews and coded a third interview. After that independent work, we compared our coding, and had relative agreement between our work (i.e., we applied the same codes to many of the passages). Since we had relative agreement, I continued with the *a priori* coding, coding the remaining 9 interviews. Next, for the open coding, I developed a set of open codes and gave those to the other researcher to use with two new interviews. This time the codes were fully operationalized similar to Appendix D. For those codes, we both coded the two new interviews independently. After, we met again and went over our coding in detail discussing the codes at length to ensure the definitions captured the information in the interviews and that the definitions were clear. During that session of coding, our initial open coding had relative agreement (i.e., we coded many of the passages the same) which was because the codes were thoroughly defined to begin with. We did discuss and further define a few of the codes for clarity. One example of a code that was altered after discussing it with another researcher was the code "course logistics." When I first developed the open codes, I called that code "course management" but after discussing it with another researcher, it became clear "course management" was not specific enough as many of the responsibilities of the GTA fell under management. "Course logistics" was a more appropriate term because it did not include the everyday leadership that the GTAs were in charge of, but it did include tasks that were outside of a GTA's defined general responsibilities such as facilitating student learning, holding office hours, etc. After agreeing upon the revised codes, I re-coded all the interviews according to the more defined definitions.

This iterative process of coding, refining, and recoding ensured the codes were dependable increasing the trustworthiness of the qualitative phase.

3.2.4 Phase 3 and 4: National Survey Development, Data Collection, & Quantitative Analysis

Phases 3 and 4 both related to the national survey and therefore have been intentionally grouped together in this methods description. Phase 3 involved the development of the survey, and Phase 4 involved the survey administration and quantitative analysis. The survey was developed during the end of Summer 2012 and the first part of the Fall 2012 academic term. It was deployed at the end of the Fall 2012 academic term. In total, 134 GTAs were contacted for the study and 33 responded. Additional details related the survey, the participants, and the analysis is provided below.

3.2.4.1 Survey Development

Based on the items observed in the interviews, a GTA motivation and identity survey was developed to expand the findings in the interviews to a broader sample. The results of the survey were also used in the development of the profiles which is discussed in detail in Chapter 4. The development of the survey was informed by the work of Rea and Parker (2005) where the survey was created through multiple iterations to ensure that the questions map to the items identified in the interviews and previous surveys and that the survey questions were asked properly targeting the topic of interest (e.g., clearly worded questions, no double barreled questions, etc.). To do this, a systematic approach to question development was taken which is described in detail below along with pilot testing which is also described in the remained of this section.

The survey was developed by taking the codes generated in Phase 2 and creating survey questions out of those codes that were targeted at the unique experiences of GTAs in FYEPs. There were three types of questions in the survey:

1. Scaled questions that contributed to the development of the constructs,
2. Open-ended questions designed to capture a range of information in the participants words, and
3. Uniquely formatted questions directly related to items found in the interviews.

An example of a scaled question developed from the interviews was “I feel connected to my university.” This question was evaluated on the five-point Likert-type scale and was included in the survey because during the interviews GTAs mentioned items related to feeling a connection

with their university beyond their FYEP. An example open-ended question from the interviews was "In general, what does being a teacher mean to you?" This question was added because during the interviews it became clear that the GTAs had a wide perspective on what it meant to be a teacher. Finally an example of the third type of question (i.e., the uniquely formatted questions) would be the following:

> When thinking about your position as a TA, how do you feel? I feel…
>
> Confident +, Stressed –, Overwhelmed –, Passionate +, Scared –, Excited +, Prepared +, Anxious –, Enjoyment +, Unprepared –, Motivated +, Nervous –

For this question, survey participants were asked to select all the words that applied to their feelings about their appointment. Many of the words, such as overwhelmed and enjoyment, came directly from the interviews because after coding the interviews it was clear that GTAs associate a variety of feelings with being a GTA. In the example above, the "+" indicates a positive emotion, while "–" indicates a negative emotion. This type of question was asked to allow the participants to select all of the emotions they felt relative to their teaching, but it scoped their responses. The other two question types would not have been appropriate for this question because I wanted to ensure that the responses related to the interviews (why I did not leave it as open-ended) but were simple to answer not contributing to the length of the survey (why I did not scale each emotion). Formatting the question in this way allowed the most information to be gathered related to this topic in an efficient manner.

In addition to using the interview results to develop questions, existing SDT and PST scales from the literature were also used to inform the survey development. For PST, the Next Year Possible Selves interview questionnaire (Oyserman, Bybee, Terry, & Hart-Johnson, 2004) was adapted and used in the survey by changing the question format. As an example, the original Next Year Possible Selves interview questionnaire included the following question:

> Who will you be next year? Each of us has some image or picture of what we will be like and what we want to avoid being like in the future. Think about next year -- imagine what you'll be like, and what you'll be doing next year.
>
> - In the lines below, write what you expect you will be like and what you expect to be doing next year.

- In the space next to each expected goal, mark NO (X) if you are not currently working on that goal or doing something about that expectation and mark YES (X) if you are currently doing something to get to that expectation or goal.
- For each expected goal that you marked YES, use the space to the right to write what you are doing this year to attain that goal. Use the first space for the first expected goal, the second space for the second expected goal and so on.

This question is also accompanied by a table as it is usually asked in an interview that provides space for the participants to write out their answers. Due to the electronic format of the national survey developed for this work, this format was unrealistic; so for the survey developed in Phase 3, the question was adapted to the following two part question:

1. Think about your life after graduation -- imagine what you will be like, and what you will be doing. Each of us has some image or picture of what we will be like and what we want to avoid being like in the future. In the text boxes below, write what you expect you will be like and/or what you expect to be doing after you graduate. Please list up to 5 goals.
2. On the previous page, you identified goals for after graduate (repopulated below). In the small text box to the left of each expected goal, mark NO (0) if you are not currently working on that goal or doing something about that expectation, and mark YES (1) if you are currently doing something to get to that expectation or goal. For each expected goal that you marked YES (1), also write what you are doing now to attain that goal with the goal in the corresponding larger text box.

Similar to the original version, the version used for this survey also had a table-like structure that allowed participants to enter in their results, but it also self-populated their responses so they could answer all the parts of the question marking yes and no and commenting next to their original responses when needed. By formatting the question in this manner, it allowed for an exploratory perspective on future selves where the participants were allowed to enter any answer they saw fit. Another approach would have been to provide them with choices, but this would have been limiting and not in the open-ended spirit of the Year Possible Selves interview questionnaire.

For SDT, the Basic Psychological Needs Scale and the Perceived Competence Scale (available at http://www.selfdeterminationtheory.org/) were adapted and used. The changes

made to these questions were simpler than the changes made to the PST scales. For example the Basic Psychological Needs Scale question "I get along with people I come into contact with" was changed to "I get along with the people I teach with" for use in the survey. Also as another example, the Perceived Competence Scale question "I feel able to meet the challenge of performing well in this course" was changed to "I feel able to meet the challenges of performing well as a teacher." By incorporating pre-existing scales into my survey, I was able to ensure that my new instrument aligned with previous work using question formats that had been previously used and tested. The final survey protocol can be found in Appendix E. In that document, the questions that were developed out of the literature, interviews, and existing scales have been marked accordingly.

After a draft of the survey was complete, pilot testing or a pretest was conducted to ensure a well-crafted survey (Rea & Parker, 2005). Pilot testing of the survey was again completed with a subset of GTAs in Engineering Education at Virginia Tech. As with the pilot testing of the interview protocol, testing the survey with these individuals allowed the questions to be tested as if an actual participant was taking the survey, but testing with those out of the sample and versed in educational research also allowed for a discussion about the survey questions in more detail. For the pilot, two individuals completed the survey as a think-aloud with me where we walked through the survey taking it like an actual participant, but I asked them to comment on what they thought each question meant including any sources of confusion (Collins, 2003). As a source of additional information, one of the pilot testers was a female who does not really enjoy teaching and the other was a male who is passionate about teaching. These individuals were chosen to provide both the male and female perspective on teaching in addition to testing the survey with those who have positive and negative views on teaching in general. Based on that first round of piloting, the PST question was reformatted breaking up the question into multiple sub questions to improve the usability of the survey. Two additional individuals took the survey independently online as if they were participants and provided feedback regarding timing and question wording after the think-aloud testing. Again, one was male and the other female. This additional form of piloting allowed for any issues regarding the format of the survey in the online system, Qualtrics, to be eliminated. Based on that second round of piloting, a few typos were fixed, and it was determined that the survey should take no longer than 20 minutes to complete. As with the interviews, the results of the survey pilot testing were

only used to improve the survey (formatting, timing, wording, etc.). The results of the pilot were not used as part of the data set due to the potential conflict of interest regarding surveying my peers. As with the interview protocol, if the pilot results were used in the actual study, their responses could have biased the sample because the individuals who pilot tested the survey knew the detailed background of my study, and we had previous conversations about teaching. The final survey questions can be found in Appendix E.

3.2.4.2 Survey Participants

The survey was sent to potential participants at seven universities. The potential participants (i.e., the FYEP GTAs) were identified by first contacting their program directors via the FYEP Directors Study (Louis & Matusovich, 2012). As previously mentioned, for the FYEP Directors Study, potential director and administrator participants were identified by personal first-year engineering contacts and snowball sampling. Once the names of the institutions were gathered, directors and administrators (along with their contact information) were identified for each program through an internet search. To recruit for the national survey used in this dissertation, the directors and administrators from the FYEP Directors Study were asked to supply their email address if they would like their TAs to be able to participate in follow-up work (i.e., this dissertation). In total, 134 GTAs were sent the survey as potential respondents and 33 completed it resulting in a response rate of 25%. While this is a relatively low response rate, it is consistent with the response rates I received for the other phases of the study indicting it is normal for this particular population. Additionally, while the sample is small which limits the types of analyses that can be conducted, it is sufficient to facilitate the generalizability of the qualitative results to a slightly wider sample. Finally with regard to the response rate, the percentage received is consistent with the work of Nutty (2008) who reported on teaching evaluation surveys and the comparison between paper-based and on-line surveys in general. In Nutty's (2008) work, the response rates for online surveys were most often in the range of 20-40% which is where the response rate for this dissertation fell. Additionally in the article, Nutty (2008) comments that the most common ways used to boost response rates include:

1. Repeat reminder emails to students and administrators
2. Incentives to students for completing the surveys

These tactics were used to increase the response rate for this survey so I am confident that this is a typical response rate for this population. For the national survey, two reminder emails were

sent out and an incentive of a chance to win one of four $25 Amazon gift cards was used. To increase the number of institutions involved, an incentive of a $20 Amazon gift card was also provided to those directors and administrators who supplied email addresses of their GTAs.

Table 10 below depicts demographic information about the participants who completed the survey. I have included general demographic information related to gender, age, and race as these are typical demographics presented in survey data, but I have also included engineering demographics and teaching demographics which are specific to my study. It is important to include all of these various demographics to ensure that the spectrum of survey participants is accurately understood. It should be noted that "No Response" includes those who selected "Prefer Not to Answer" and those who simply did not select an option. The items where there is no "No Response" are items where all of the 33 participants answered the question.

Table 10: Survey Participant Demographics

Demographic Type	Item	Response	Percentage	Number Out of 33
General Demographics	Gender	Male	58%	19
		Female	30%	10
		No Response	12%	4
	Age	30 or Younger	70%	23
		31 to 40	15%	5
		41 or Older	3%	1
		No Response	12%	4
	Race	White	52%	17
		Asian	12%	4
		Black/African American	6%	2
		Hispanic/Latino	9%	3
		Other	6%	2
		No Response	15%	5
Engineering Demographic	Degree	PhD	67%	22
		Master's	33%	11
	Discipline	Traditional Discipline	48%	16
		Engineering Education	27%	9
		Other	9%	3
		No Response	15%	5
Teaching Demographics	General Experience	Prior Experience	82%	27
		No Prior Experience	18%	6
	FYEP Experience	First-Term in FYEP	42%	14
		Not First-Term in FYEP	58%	19

Most of the items above are self-explanatory, but it should be noted that "Traditional Discipline" includes engineering majors such as civil, mechanical, aerospace, etc. and "Other" includes disciplines that were not provided on the list. Unfortunately a space was not provided for participants to indicate what their "Other" choice was. As with the previous phases, this phase was advertised following IRB approved protocols. It should be noted that I contacted all participants directly except at one institution. U1 opted to contact their GTAs directly, but they followed the same survey advertisement procedures using the same email protocols as I used to contact the other institutions. For both recruitment procedures, the survey was administered using Qualtrics.

3.2.4.3 Survey Data Analysis

The survey data quantitative analysis involved a few key steps that contributed to the rigor of the analysis through a systemic process that removed incomplete cases, reverse coded response, and analyzed the data based on the given sample. First, the survey quantitative analysis began with basic data cleaning where incomplete cases were removed from the data set when appropriate according to the recommendation of Rea and Parker (2005). Cases were removed if a participant only answered the first few demographic questions or if an individual did not fully answer a set of questions related to a construct. If they answered all of the questions related to one construct, but not others, they remained in the sample. Also reverse coded questions were rescored for alignment. Once the data was clean, the analysis of the quantitative results included basic quantitative statistical techniques that provided descriptive information such as general response to the constructs, standard deviation of responses, and common trends.

To determine the general response to the constructs (competence, autonomy, relatedness, and identity), the questions related to each construct were averaged to create a construct score. For competence nine individual questions were averaged, for autonomy nine questions were averaged, for relatedness 11 questions were averaged, and for identity six questions were averaged. To see the exact questions, see the full survey which is available in Appendix E. Once the construct scores were created, they were tested for normality by creating histograms of the response. None of the constructs displayed normal distributions so the analyses that followed only looked at means, standard deviations, percentages, etc. that helped to describe the results opposed to proving any relationship between the constructs or groups. A larger more normal

data set would be needed to conduct additional statistical analyses. The quantitative results are discussed in detail in the following chapter.

The survey results were also triangulated with the qualitative findings where appropriate in the discussion. This was done to check if the findings from both phases aligned and to identify any major differences (Mathison, 1988). Further data triangulation was not completed since the quantitative data sample was relatively small and could only provide descriptive statistical information.

3.2.4.4 Quantitative Data Validity and Reliability

For quantitative research, assuring that a survey instrument is both valid and reliable is essential. Validity refers to the accuracy of a measurement while reliability refers to the consistency of a measurement (Creswell, 2009). Below both items are discussed in detail in relation to this study.

There are many different types of validity that can be assessed in a research study. For this work I addressed traditional forms of validity discussed by Creswell (2009). Those types are content, predictive or concurrent, and construct validity. Content validity is assessed by asking the question "do the items measure the content they intended to measure?" (Creswell, 2009, p. 149). To ensure content validity in this research, the survey was pilot tested with individuals who explained what they believed the questions were asking and discussed any confusion with the survey (Suskie, 1996). By having the participants take this survey in this manner, I was able to ensure that their interpretations of the questions matched the intention of the questions and that the questions allowed for a range of targeted responses contributing to the surveys content validity. Next, predictive or concurrent validity is assessed by asking the questions "do the scores predict a criterion measure?" and "do results correlate with other results?" (Creswell, 2009, p. 149). Normally, this would be evaluated by examining how well the survey measured items in reference to similar surveys. Since this survey is the first of its kind in this context, this type of validity was not directly established. However, by using some questions from previously validated and reliable instruments, I was able to step a step towards achieving this. Future work will be needed to fully test this type of validity. Finally, construct validity is evaluated by asking the question "do items measure hypothetical constructs or concepts?" (Creswell, 2009, p. 149). Since the survey was developed out of the literature, interviews, and preexisting survey instruments all of which focused on either motivation and identity construct validity was

achieved. Overall, the in-depth pilot testing and systemic development of the survey ensured that the survey was measuring what it is intended to measure, validity.

The reliability of the survey was addressed by asking multiple questions related to the same topic in different ways and running an internal consistency test using a Cronbach's Alpha approach on the questions (Rea & Parker, 2005). This type of analysis ensured that the questions intended to measure the same thing were indeed being answered in the same ways. The Cronbach's Alphas for the four constructs measured in the survey can be found below in Table 11. In Table 11, I have also listed the number of questions or scales that were compared for each constructs.

Table 11: Cronbach's Alphas for Constructs

Construct	Alpha	Number of Questions
Competence	0.78	9
Autonomy	0.73	9
Relatedness	0.84	11
Identity	0.89	6

All of these Cronbach's Alpha scores are over 0.7 which is an acceptable measure of internal consistency confirming the reliability of the instrument (DeVellis, 1991). It should be noted that another popular way to determine the reliability of an instrument is through factor analysis (e.g., Gerbing & Anderson, 1988). For this particular study, this type of analysis could not be executed because of the small sample size. In the future, confirmatory factor analysis could be used to further test the reliability of the instrument, or exploratory factor analysis could be used to see if the individual questions could be linked in ways other than the way they were intended (i.e., linked by constructs). Since the Cronbach's Alpha levels for the questions related to the constructs where above the acceptable threshold, this allowed the questions to be averaged in to the construct scores discussed in Section 3.2.4.3.

3.2.5 Phase 5: Mixed Methods Analysis

Phase 5 of this research involved the mixed methods analysis. Before this time, the qualitative and quantitative strands were analyzed independently, but this phase allowed the results to be connected. The main product of this final phase was the teaching profiles.

3.2.5.1 General Mixing in the Study

The combination of qualitative and quantitative strands in a mixed methods study is referred to as "mixing." Creswell and Plano Clark (2011) define mixing as "the explicit

interrelating of the study's quantitative and qualitative strands and has been referred to as combining and integrating" (p. 66). Some studies use the term triangulation for mixing (Mathison, 1988) or integration. Mixing can occur during the design, collection, analysis, and discussion phases of a research study, and some argue that the extent of mixing directly relates to the quality of the study (Bryman, 2007; Yin, 2006). Yin (2006) in particular is a proponent of mixing at all stages believing that for a study to be truly classified as mixed methods, mixing needs to be included in all phases of a research. Mixing within the data analysis occurred in Phase 5, but mixing also occurred throughout all the phases of the research study.

To ensure a rigorous and well-crafted study by mixed methods standards (e.g., Bryman, 2007; Yin, 2006) mixing occurred in all phases of my study, starting with the initial design moving through the study discussion. Below, a discussion of the mixing in the various phases has been provided.

- *Design Phase:* Mixing at the design phase was achieved by the study layout provided earlier in this chapter where both a quantitative and qualitative component to this work was planned from the beginning and was intentionally kept in mind through all phases of the study.
- *Data Collection:* Mixing in the data collection phase occurred because both qualitative and quantitative data was collected in both major phases. For example, in Phase 2 each interview was mostly qualitative with open-ended questions, but a set of quantitative questions was included as well such as years of experience teaching and rating levels of the major constructs. For the national survey disseminated in Phase 4, open-ended questions were included with the close ended questions to gather additional qualitative data in the survey phase that could be used for survey studies.
- *Analysis:* While the two data strands were initially analyzed separately, mixing in the analysis occurred in the form of connecting where the results of quantitative phase guided the analysis of the qualitative data (i.e., the finding of identity being the most salient construct guided the profile development – see the next section for more information).
- *Discussion:* Mixing in the discussion took the form of triangulation where both the qualitative and quantitative findings were compared to the literature together

identifying similarities and differences between the data sets when appropriate regarding the factors.

Including mixing in all phases of this research ensured a rigorous mixed methods study that provided a holistic view of the factors affecting GTA motivation and identity in FYEPs.

3.2.5.2 Profile Development Using Mixing

One of the main locations for mixing in this study was conducted in Phase 5, the mixed methods analysis phase, where the profiles were developed. Again, the profiles are characterization of the GTAs who teach in FYEP regarding their identity and motivation. It should also be noted that this section refers to the mixed methods analysis and that both the qualitative and quantitative pieces of this work were each analyzed separately before this phase (Phase 2 – Interviews – Qualitative Analysis and Phase 4 – National Survey – Quantitative Analysis). This phase brought together the two data sets directly. The overall profile development included first clustering the quantitative response, applying the salient cluster components to the qualitative data, and reviewing the qualitative data for trends by clusters. Each step has been explained in detail below.

The profiles were developed by first analyzing the quantitative data through the clustering of survey participant responses. A cluster analysis was performed using the four overarching constructs created by the survey results (competence, autonomy, relatedness, and identity) to develop groupings of participants. In a cluster analysis, the large data set is organized into subgroups or clusters to achieve the greatest difference or distance between groupings and the most similarity within groupings (Kachigan, 1991). For this particular analysis, a two-step clustering technique was used in SPSS following the procedures and recommendations of Norušis (2011). Using this analysis resulted in three distinct clusters where the strongest contributing construct to the clusters was identity. Table 12 below summarizes the mean scores for each construct by cluster.

Table 12: Results from Survey Data Cluster Analysis

Cluster	Teacher Identity		Teaching Motivation		
			Competence	Autonomy	Relatedness
Cluster 1	4.7		4.4	3.4	4.1
Cluster 2	4.1		3.8	2.4	3.3
Cluster 3	3.4		3.4	3.1	3.6
Response Range	(2.8 to 5.0)		(3.0 to 5.0)	(2.0 to 4.1)	(3.0 to 4.8)

In Table 12, the colors correspond to a high (green), low (red), or medium (yellow) raking and have been use to simply capture visual trends in the data. The ranking was determined by taking the highest and lowest individual scores for each construct and splitting that range into three equal segments. For example for identity, the highest rating was a five and the lowest a 2.8. The difference between these is 2.2 so those who ranked 2.8 to 3.5 were low, 3.6 to 4.2 were medium, and 4.3 to five were considered high. This same methodology was applied to all of the constructs. This methodology was applied to determine how the averages for each cluster and each construct related to the rest of the sample responses opposed to how they compared to each other. For example, when relatedness is examined you will notice that two groups fall into the medium category. This is because compared to the large sample the averages for both Cluster 1 and Cluster 3 fell into the medium ranking even though compared to each other Cluster 1 had a higher relatedness score than Cluster 3. This was done to ensure that that clusters were compared to the entire sample, not just the clusters that were determined from the analysis.

Since identity was the most salient construct for determining the clusters in the quantitative analysis, identity was used to group the interview participants in the qualitative data. It should be noted that the interview participants were not necessarily the same participants who took the survey. It is possible that an interview participant took the survey, but there is no way to know for sure. The one known connection is that they are all part of the target population, GTAs who teach in FYEPs. Looking at the qualitative data, the interview participants were grouped based on a high, low, or medium self-reported rating of their identity as a teacher. As mentioned above, during the interviews the participants were asked to score themselves in relation to the constructs. The four constructs questions that were asked in the interviews were:

- On a scale from 1 to 10, where 10 is you are expert with regard to content and teaching practices, what is your level of competence?
- On a scale from 1 to 10, where 10 is you are in complete control of your class, what is your level of autonomy?
- On a scale from 1 to 10, where 10 is you feel like you are extremely connected to your students and colleagues, what is your level of relatedness?
- On a scale from 1 to 10, where 10 is you are a teacher, how much is being a teacher part of your identity?

The answers to these questions were used to determine whether or not the participant had a high, medium, or low ranking in relation to the other participants for each construct following the same ideas discussed for the quantitative data. It should be noted that both SDT and PST are from the perspective of the individual so using self-reports for this analysis was important in keeping with the traditions of the theories. For the interview participants, their category was determined by taking the highest and lowest scores for each construct and splitting that range into three equal segments as was done with the quantitative data. Those individuals who fell into each of the segments served as the groupings to examine the construct more in-depth. For example for identity, the highest rating was a ten and the lowest a four. The difference between these is six so those who ranked four to 5.9 were low, six to 7.9 were medium, and eight to 10 were considered high. This same methodology was applied to all of the constructs. It should be noted that both the scoring for the quantitative data and the qualitative data was not normalized (i.e., scaled from zero to one) because the analysis of this data was simply to show clusters and general trends opposed to prove statistical findings. If higher level statistical analyses were to be performed, normalizing the data may be needed. For example, if this data were to be combined and used for ANOVAs or even factor analysis, normalizing the scales so they matched would be essential to ensure agreement between the two data sets.

Table 13 below shows the scores reported for each construct by the interview participants where the color coding depicts which category they fell into for each construct to again help with observing visual trends (high – green, red – low, yellow – medium).

Table 13: Interview Participant Self-Reported Construct Score

Participant	Teacher Identity	Teaching Motivation		
		Competence	Autonomy	Relatedness
Dan	9	7.5	6.5	10
Maurice	9	7	4	8
Sam	10	9	4	8
Susanne	10	6	4	8
Wesley	9	7	7	5.5
Gordon	6.5	8	7.5	10
Roberto	6	7	5	9
Ingrid	7	6	1	5
Jillian	7	7	2	6
Zachary	8	7.5	2	4
Brent	5.5	8	7	6
Corey	4	8.5	6	7.5

Examining Table 12 and Table 13, you will notice that the color trends between the construct do not match (i.e., those with high identity do not always have high competence, high autonomy, and high relatedness). Also between Table 12 and Table 13, the trends do not match (i.e., the pattern observed in Table 12 of high identity, high competence, high autonomy, and middle relatedness does not match the trend observed in Table 13 of high identity, middle competence, middle autonomy, and high relatedness). These disagreements suggest that identity can be used to classify participants but that the motivational constructs are individual dependent. This is further discussed below.

Once the groups were established, the transcripts and codes were re-reviewed to identify trends among the groups (i.e., the interviews were already coded but the codes were re-reviewed for specific trends within each grouping). Based on the re-review, there were distinct differences between the groups which will be discussed further in Chapter 4. It should be noted that identity was the most salient construct and therefore served as the profiles, but the motivation constructs (competence, autonomy, relatedness) differed across the clusters and profiles. Due to this breakdown in findings, each motivation construct was explored independently, again based on the self-reported responses to a question developed for each construct where a high, medium, and low categorization was applied. Additionally based on the review of the qualitative data, in some instances the high, medium, and low categories were renames to better align with the findings in the data. Even if the names changed, the pattern still remained of high, medium, and low. Finally, as a reminder, please see Appendix F for the interview participant summaries to learn more about each individual. By combing the qualitative and quantitative results in this manner, a holistic view of GTAs was observed.

3.3 Bias

Bias can occur in any research study both for the researcher and the participants. In this section, I have addressed my own possible biases along with the participant bias that may have affected this work.

3.3.1 Researcher Bias

At the time of this research, I had been a teaching assistant in some capacity for over five years and had been directly involved in efforts to improve the quality of teaching of GTAs in FYEPs. I had taught as an assistant in the classroom, a lab instructor, and even a lecturer. I also developed training modules for GTAs to assist with pedagogy development and co-taught a

graduate level teaching practicum course. I sought out all of these experiences because I truly had a passion for teaching first-year engineering and helping others improve their teaching. This allowed me to bring both experience and passion to my research with a critical perspective focused on improving FYEPs through GTAs. Along with these things, there also came the potential for bias in my research that could not be ignored. Based on my past experiences, my bias is that I have a drive to improve the quality of education in engineering and because of that I may be overly critical of current practices looking for faults within programs and structures as I believe they can all be improved in some way to enhance education.

Grimes and Schultz (2002) stated that "bias in research denotes deviation from the truth" (p. 248). Having bias is something that every researcher brings to their work, but acknowledging one's bias honestly and working to minimize bias is essential to any high quality research piece increasing the validity and reliability of a study (Rossman & Rallis, 2012; Sica, 2006). Mehra (2002) stated "a researcher's personal beliefs and values are reflected not only in the choice of methodology and interpretation of findings, but also in the choice of a research topic. In other words, what we believe in determines what we want to study" (Deciding What to do Research on - Beginnings of Bias section, para. 2). This quote truly encompassed how I chose this research area. As a GTA in a FYEP, I felt directly tied to this area of study, perceived shortcomings in FYEPs, and had a desire to improve teaching in FYEPs. After reviewing the literature and finding that very little work in engineering education had been done on this population of students (graduate students and GTAs in general and more specifically GTAs in FYEP), my interests only increased. While having a strong passion for your research can help drive your work and increase your motivation, it can also produce bias in your results if active steps are not taken to acknowledge and reduce it.

I took two main approaches to reducing my bias. First, I was reflexive throughout every step of my project. Reflexivity refers to the act of the researcher actively thinking about and evaluating their impact on a study (Rossman & Rallis, 2012). For my work, this was essential as I had the potential to possess many predetermined opinions about my findings that I may or may not have been aware of through my critical eye. As I worked through my research, I constantly had to check that the findings of the work were neutral and that I had not introduced only my own thoughts on the results based on my personal feelings to ensure the quality of my study. Another method I employed to reduce my biases was through the use of a "critical friend" or

"debriefer" who double-checked the changes I made to the study to ensure continuity and ensured that the findings were reflective of the data and the situation I was studying, not my own personal views (Rossman & Rallis, 2012). For my work, my critical friends included my chair, my committee, and my research group. While these individuals did not have direct access to my data, they helped provide another possible perspective on my work helping to reduce my own personal bias that may have been unknowingly introduced into my findings. Conferring with these individuals also helped with the dependability of my study as discussed in Section 3.2.3.4 where findings were discussed with other researchers to ensure that they were clear and representative of the data. Personal biases towards a topic can help keep a researcher interested in the study, but they can also skew results if they are not critically addressed. Above, I have discussed two ways I mediated the effect of my bias on this research which again was potentially being overly critical of current practices looking for faults within programs and structures to help enhance education in engineering.

3.3.2 Participant Bias

Within a research project there are other types of biases aside from personal bias that may develop over the course of a study. Two forms of bias in both qualitative and quantitative research relative to my study include sample bias and self-selection bias (Sica, 2006). Each of these biases has been further explained below as they relate to this research.

Sample bias refers to the misalignment between a sample of participants and the specific target population they are meant to represent (Sica, 2006). In this project, the target population was GTAs who teach in FYEP. In order to study a sample that accurately reflected the qualities of the targeted population and to not introduce sample bias into my work, I selected institutions for my study that represent a range of universities that have FYEP (see Table 2). In a way, this was purposeful sampling, where the targeted institutions were chosen not only for their willingness to participate but also because of their characteristics (Rossman & Rallis, 2012). For example, it was important to have participants from both large and small institutions, public and private universities, and even geographically dispersed schools. As shown in Table 2 in Section 3.2.1, this was achieved. This diversity in program was important for the qualitative portion so that I could learn about GTA experiences in a range of settings, but it was also essential in the quantitative portion so that the results could be generalized to FYEP GTAs across the country. Other types of bias that may have occurred because of my sample are gender, race, or even age

biases, but these biases were actively reduced through the use of descriptions of the participants, and proper terminology for the generalization of the sample that is both professionally and socially accepted and agreed upon (*Publication Manual*, 2010). In other words, by providing rich detail about the participants, I was able to scope the findings in relation to my study participants opposed to making statements without the context of who my participants were. Through a rigorously designed study, purposeful sample, and thorough description of participants, the sample bias in this research has been minimized.

Another type of bias that occurred during my study was self-selection bias. For the various parts of my study, both the qualitative and quantitative segments, participants chose whether or not they participated in the research. When participants are allowed to directly choose their participation, volunteers and non-volunteers may have different characteristics. For example, for the survey, it seems that most of the participants had positive views of teaching and therefore wanted to share their experiences. Those with negative views may not have volunteered meaning their views may have been missed in the study even though their perspectives on teaching are also essential to this work. One way to account for this bias was to fully describe the sample so that those who review my findings are aware of the types of participants the responses are coming from (Rossman & Rallis, 2012). If this was not done, it is possible that the findings could be misinterpreted. Additionally, both positive and negative views towards teaching in a FYEP were obtained in the interviews providing a wide scope of experience in that strand. It should be noted that the sample tended towards positive views of teaching opposed to negative. Despite this influence, the findings discussed in Chapter 4 represent the opinions of all the GTAs in this sample regarding the items of interest in this study (i.e., the factors affecting motivation and identity and the profiles). While the negative views did provide a different overall outlook on the FYEP teaching experience, they did not provide different results (i.e., the factors identified to affect GTAs were prevalent regardless of general orientation (positive or negative) to their appointment). In future phases of this research, I hope to address this bias directly by providing higher incentive for participation to encourage more people to participate and to possibly oversample for participants who may have negative views on teaching to ensure their experiences are more fully captured and the sample is more balanced. Despite the unbalanced nature in the GTAs' general orientation to teaching, the passages presented in Chapter 4 are still representative of the findings.

While there are many types of biases that may occur in research, there are specific steps that can be taken before, during, and after a project to reduce the biases to a manageable and accepted level. As Sica (2006) stated "it is difficult or even impossible to completely eliminate bias. In the process of attempting to do so, new bias may be introduced" (p. 780). This notion of biases being inherent to research is something that every researcher must be aware of and actively seek to reduce with a keen awareness of consequences and the potential effect on results. In this study, while there may have been sources of bias, I was able to reduce them to the best of my ability using the tactics discussed above.

3.4 Limitations

Limitations are present in all forms of research. For this particular study there are limitations regarding three key components: the sample, the scope, and the perspective. The sample and the perspective have been discussed independently below with the scope woven in. These limitations do not negate or invalidate the quality of this research or the findings; they simply bound the use of the findings to appropriate contexts.

One of the main limitations of this study relates to the sample. In all phases of this work, the response rates were between 20% and 40%. While I would have liked to receive higher responses, the response rates were consistent across phases demonstrating the typical response rate for this population, and they still provide a meaningful sample of participants for the study because they represent a spectrum of responses (positive to negative even though the responses tended to favor the positive perspective), especially in the interviews (Rea & Parker, 2005). The spectrum in the surveys was limited (i.e., they also tended towards the positive or neutral perspective), but there was still variation in experiences, demographics, and views within the sample. While slightly limited, I argue that these results are reflective of the GTA experience and have used quotes in Chapter 4 to represent the responses of GTAs regardless of positive or negative orientation. Again, based on my analysis the major findings from this research are applicable to both the positive and negative perspective. However, the results should be viewed cautiously as the results obtained in the study are not applicable to all teaching contexts using GTAs (i.e., a GTA who is instructor of record and completely in charge of their own course would have a different experience than these GTAs), which relates to the scope of the work. If the context is significantly different than the one discussed in this work, future studies should use the results of this research to inform their work and test the findings in their own setting. Also

the small sample size limited the types of analysis conducted on the data again affecting the generalizability of the findings.

Another limitation is that my data is strictly GTA perceptions so it should not be taken as absolute truth, but truth from a GTA viewpoint. This means that while the GTAs report certain experiences, responsibilities, and viewpoints, others may report on these same issues differently. This was consistent with my theoretical frameworks that focus on understanding an individual's perspective and his/her experience in an event, not necessarily others' views. In the future, this work could be expanded through the use of observations and additional interviews to see if the expressed perceptions of the GTAs align with what is happening in the classroom. Doing this type of examination and analysis would allow a more holistic improvement in the quality of teaching in higher education in general by not only understanding what GTAs experience, but how that translates to their teaching. This approach was beyond the scope of the study due to the bounding needed but would be consistent with my realism worldview. Realism suggests that a topic can be explored in many different ways leading to many different outcomes (Maxwell & Mittapalli, 2010). Using GTA perceptions is one path to understanding experience and future work will expand the paths.

While there are limitations to this work, the results are still rigorous because of the careful planning and execution that took place throughout all phases of the work. The steps discussed Chapter 3 ensured that regardless of limitations this work provided a valuable contribution to engineering education and general educational research.

3.5 Methods Summary and Following Chapters

Chapter 3 outlined the exploratory mixed methods research study employed for my dissertation. Through the use of journal entry surveys and reflective interviews with a small sample of GTAs who teach in FYEPs, I developed a national survey that could be used to measure GTA motivation to teach and identity development as a teacher. I also developed a set of teaching profiles that could be used to understand various teaching experiences that GTAs can have. In the following chapter, the results of these phases will be discussed in detail and then the findings will be explored within the context of past research in Chapter 5 providing major conclusions and areas for future work.

CHAPTER 4: Results

The purpose of this study was to examine the factors influencing graduate students' motivation to teach and their identity development as teachers. The overarching research question that guided this work was: *How do graduate students' motivation to teach and future identities as teachers develop when serving as GTAs in first-year engineering programs?* To address the purpose and answer the research question, I designed a sequential exploratory mixed methods study that employed both interviews and a survey. Below the results of the research are presented and organized in relation to the three phase research questions used to answer the overarching question.

As a point of clarification, it should be noted that throughout this chapter and Chapter 5 when I state that a GTA reports feeling competent, autonomous, or related that implies that their need is being met within the FYEP which is the foundation of SDT. In both the interviews and the survey, I did not specifically ask if their need was being met, but if they reported feeling competent, autonomous, and/or related, we can infer that the need is being met or in SDT words, the need is being supported (Deci & Ryan, 2008). If they do not report feeling competent, autonomous, or related, then their need is being thwarted in SDT language (Deci & Ryan, 2008). I did not specially measure if the need was being met because that can be defined differently for every person and may be unclear, but overall, people can report whether they feel competent, autonomous, or related and can discuss items that may be affecting those feelings. These feelings all related to GTAs' perceptions of the three needs and identity.

4.1 Factors GTAs Perceive to Affect Motivation and Teacher Identity

To answer the overarching research question, the first phase research question was: *What do GTAs perceive to be the factors that affect their own motivation and teacher identity development as GTAs in first-year engineering programs?* To answer that question, three sub-research questions were developed that targeted (1) motivation, (2) identity, and (3) the intersection of motivation and identity. The factors affecting motivation and identity, organized by construct and based on the data from Phase 2, are summarized below in Table 14:

Table 14: Motivation and Identity Factors

Construct	Factors	Sub Factor
Competence	Training	
	Previous Experiences	As a Student
		As a Teacher or Mentor
Autonomy	Appointment Structure	
Relatedness	Students	
	Teaching Colleagues	Fellow GTAs
		Faculty
Identity	Future Careers	
	Role Dominance	

The factors were determined by reviewing the open coding summarized in Table 8 to determine salient themes. Not all of the open codes are reflected in the factors above because analysis revealed some codes to be less salient to motivation and identity than the factors listed in Table 14. Only the salient factors (as listed above) have been presented here in Chapter 4 which were the factors that appeared frequently in the interviews or were talked about extensively by different participants. Analyzing the remaining codes is outside the scope of this present study, but the analysis may be conducted in future work.

4.1.1 Factors Affecting Motivation Constructs

The first sub-research question was: *What factors contribute to GTAs' competence, relatedness, and autonomy in the classroom?* Based on the interviews, different factors (events, occurrences, people, institutional structures, demographics, etc.) were identified as affecting each of the basic needs of SDT. Each need or component of SDT has been detailed below with regard to the factors. While the factors described are in the context of the main need they affected, it should be noted that some of the factors crossed need boundaries. This is further explored in Chapter 5 through the discussion of the findings.

4.1.1.1 Factors Affecting Competence

The main factors observed in this research that contributed to competence were training and previous experiences both as a student and teacher or mentor. These can be classified as events and occurrences. As defined in Chapter 2, GTA competence is the self-recognized knowledge of content, pedagogy, and instructional/program structure. Through training, GTAs were given opportunities to learn new material related to GTA competence while previous

experiences provided information they already knew related to being a GTA, both of which supported their need of competence. These two factors are discussed in detail below.

All of the GTAs who were interviewed discussed a variety of training offered by their FYEPs as something that supported their need of competence. To summarize the various types of training, Table 15 below categorizes the training by university as most of the GTAs from the same institution talked about the same kinds of training. For those GTAs at an institution who did not mention a specific training in their interview, that indicates that that training was not a salient component affecting their competence.

Table 15: Types of Training

Type of Training	Facilitator	Topic	U1	U2	U3	U4	U5
Weekly Content Training/Overview	typically facilitated by FYEP and ran by faculty and senior GTAs	often about content and sometimes pedagogy	X	X	X	X	X
One-time Beginning of Year Training Provided By Group Outside of the FYEP	typically facilitated by a teaching and learning center or another academic entity	often about pedagogy and GTA resources on campus related to teaching	X	X	X	X	
Informal Training through Faculty/Peer Interactions	typically occurs outside of normal class times through conversations with teaching colleagues	often about pedagogy but could include content	X	X	X		X
Required to Attend Lecture	typically lecture is given by someone more experienced than the GTA	often used to learn content and observe pedagogy	X	X	X		
One-time Beginning of Year Training Provided By the FYEP	typically facilitated by those who run the FYEP	often covers the mechanics of the FYEP, first week's content, and possibly pedagogy	X	X			X
Workshops Throughout Year/Monthly Discussions	facilitated by a variety of entities including but not limited to teaching and learning centers and the FYEP	often covers pedagogy or professional development		X		X	

The training offered to GTAs in FYEPs varied including both content (i.e., what to teach) and pedagogy (i.e., how to teach) training, but the most common trainings included FYEP weekly training, one-time university-wide training, and informal training through faculty or peer interactions.

With regard to the weekly training, most GTAs reported participating in the training where it was led by a faculty member or administrator. In these typical cases, the GTAs commented that in these trainings they were learning about the things they would be teaching the following week. Gordon from U2 was a non-typical case where he actually got to run the

training opposed to just sitting in on it as the other GTAs did. With regard to that opportunity and his competence, Gordon said:

> "I held a leadership position within that, for the first year engineering program. And I had to lead the training, or the weekly training, so, not only I was reviewing that stuff, on my own, but I was reviewing it, I had to present it to the rest of the TAs and faculty, and I had to get ready for the actual presentation in class. So I had time to preview the material, like 3 or 4 times, before I get to see the students, so by that time I felt very comfortable with the material that I had to cover."

Through this training and ultimately running the training, Gordon's need for competence was satisfied because he had to learn the material before leading the meeting. The other GTAs, whose competence needs were also met, discussed these meetings as the main mechanism for learning what they needed to teach each week by listening to presentations and demonstrations and participating in activities, but Gordon talked about it in terms of learning content and taking a leadership position.

In reference to the university-wide training, most of the GTAs mentioned this type of training stating they learned about general ethics regarding teaching, resources on campus, etc. Based on the interviews, it seemed that typically these trainings were sessions that the GTAs attended to get general information about teaching at their university. In addition to the general information, the GTAs at U1 got to do some practice teaching in this training in the form of micro-teaching. Sam commented on this experience saying:

> "There was a micro-teaching session, which involved preparing on a topic, talking about it for ten minutes, you were video recorded, we went through and announced that it was, because you were presenting in front of a group, some of them are your peers, they were able to accept you, later on, you could meet later on in the week, so that you could talk about certain things."

This experience of micro-teaching contributed to the competence of these GTAs by giving them a chance to practice teaching and to get feedback before they began teaching their own class. At the other universities where micro-teaching was not part of the training, they seemed to be indifferent about the training often forgetting what they actual did during the training suggesting it did not contribute to competence as strongly as it did at the other institution.

Aside from the formal training programs and mechanisms the GTAs were required to participate in, they also mentioned informal training which took the form of asking their teaching colleagues questions. Brent from U1 sums this up best when he said:

> "And then a lot of the other stuff is just talking to professors, talking to the other grad students and seeing what worked on their end and kind of doing that and seeing how it works for yourself."

Here Brent recognizes the training but commented that there are a lot of other ways to gain information that contribute to his competence. It should be noted that this type of training is more than simply asking questions related to content. Here the participants were asking questions to gain knowledge about teaching including how best to teach. Brent represents a typical perspective the GTAs had regarding informal training.

With regard to previous experiences the most common influential experiences related to those as a teacher (e.g., UTA, tutor, etc.) or as a student. Table 16 below summarizes the main past experiences the interview participants cited as contributing to their competence. These experiences contribute to competence in that the GTA cited these experiences as contributing to the things they knew before becoming a GTA that they were able to use to help them with their teaching.

Table 16: Past Experiences

Participant	Past Experiences
Sam	past student in current FYEP, advisor
Brent	past student in current FYEP, UTA
Gordon	past student in current FYEP, UTA
Jillian	past student in current FYEP
Dan	past student in general
Corey	past student in general
Zachary	guitar tutor
Wesley	mentor
Ingrid	mentor
Maurice	mentor
Roberto	industry
Susanne	bible study teacher, industry

Based on Table 16, it is apparent that experiences as a student and as a teacher or mentor (based on the interviews mentor was a more informal teaching experience while teacher was a formal teaching experience) contributed to competence most often. Most often the GTAs stated that

because they were a UTA or mentor, they had some experience teaching others and were able to apply that information to their current teaching appointment. Conversely, Zachary who was a GTA at another university before taking on his current GTA position, did not cite that job as contributing to his competence. In fact, Zachary said in reference to the skills he learned while being a GTA:

> "So those skills did carry over but I felt like I wasn't able to use them...I wasn't given the opportunity to use them as often."

Here we see that Zachary could have used his previous teaching knowledge to assist him as a GTA contributing to his need for competence being satisfied, but instead, he was not able to execute that information. The other GTAs who had past experiences stated they were able to apply at least some of what they knew from their past teaching.

Dan represents a typical GTA where he was able to draw from his previous knowledge that he gained as a student. Dan said:

> "I have been a student, learned MATLAB in my own way, I never had anybody actually teach me MATLAB, I just kind of learned it, through the online documentation and everything but I have read a few things which I have felt that could have been explained a little bit better, and in a slightly different way."

While Dan had not taught before joining his FYEP, he still had a knowledge base that contributed to his competence. The other GTAs who cited past experiences as a student had very similar views.

In summary, the factors found to satisfy the need of GTA competence included training and previous experiences. While the training and past experiences were varied, they all seemed to have a meaningful impact on the GTAs' competence.

4.1.1.2 Factors Affecting Autonomy

The main contributing factor that affected autonomy in the interviews in terms of both supporting and thwarting the need was the idea of appointment structure for the GTAs. Appointment structure means the assigned job of the GTAs which is related to institutional structures. Looking back at Table 9, the open codes mapped to autonomy all related to duties or responsibilities of the GTAs which is their appointment structure (i.e., what they have to do). This is further supported by Table 17 below that summarizes which responsibilities each GTA discussed in their interview as parts of their job. It should be noted that just because a GTA did

not talk about a specific responsibility it does not mean it is not part of their duties. Rather, it was perhaps not something that they thought was salient in answering the interview questions.

Table 17: GTAs' Responsibilities

Participant	Grading	Facilitate Student Learning	Curriculum Development	Lecturing	Course Logistics	Follow Course Policy	Oversee UTA	Office Hours/Review Sessions
Brent	X	X	X	X	X	X	X	
Corey	X	X	X	X	X			X
Dan	X	X	X	X	X	X		
Gordon	X	X	X			X		
Ingrid	X	X	X		X	X	X	
Jillian	X	X	X	X	X		X	
Maurice	X	X	X		X			X
Roberto		X	X	X		X		
Sam	X	X	X	X		X	X	X
Susanne	X	X		X	X	X	X	
Wesley	X		X	X		X		
Zachary	X	X	X	X	X		X	X

These items are discussed in more detail below. As stated in Chapter 2, autonomy for this research has been defined as perceived control or decision making power over your classroom or course in terms of content, activities, and policies. Based on the findings of this research, GTAs reported very little to no control over the content, activities, or policies in their classroom which could thwart their need for autonomy, but other responsibilities and interactions with faculty that were inherent to their appointment structure seemed to support the need directly.

Relative to appointment structure, GTA responsibilities found to support autonomy included lecturing, grading, facilitating student learning, curriculum development, holding office hours or reviews sessions and overseeing UTAs. In all of these types of activities, the GTAs were responsible for and had control over someone or something else which contributed to their autonomy and ultimately their motivation to teach. For example, Roberto, a GTA new to teaching but with past industry experience, stated:

> "And then, most of the course content is already, has already been developed, but during the year or unit you help to make the exams, like everyone write questions for the midterm and final exams. And then also the lecture that you gave is normally something that you create on your own as well."

Here Roberto directly comments that most things are fixed and pre-set, but that he can be involved in other aspects of the program satisfying his need for autonomy. This was a sentiment echoed by many of the GTAs interviewed. The programs were very structured, but they had

specific outlets that allowed their need for autonomy to be met whether it was leading a class lecture, being in charge of grading, overseeing UTAs, etc.

Another structural factor affecting autonomy was a GTA's relationship with faculty (it should be noted that this factor also intersects with relatedness which is further discussed in Section 4.3.5). GTAs in this study commented on situations where they were encouraged by faculty to make changes or take on increased roles in their classrooms. These GTAs generally had a stronger sense of their autonomy need being met which was directly impacted by faculty. Ingrid, who was a new GTA, had an opportunity to take on more responsibility, but chose not to due to her poor experience in the program before that time. She represents a non-typical case. Ingrid stated:

> "The only thing I could have participated in was at the end of the semester they have a project after their last [extensive problem] activity. But like I said, I think I made it clear to the professors I was working for by then I was not interested in, haha, so they could design the project. I didn't want to be a part of designing it."

By this stage, Ingrid's need for autonomy had not been met therefore she was discouraged and completely uninterested in teaching in a new capacity. Conversely, Dan at U2 who was also a new GTA had a different experience when given the opportunity to do something new which was typical of the other GTAs. Dan stated:

> "The last [term] I got an opportunity to actually lecture class when the professor was in the class. So then basically I talked to him beforehand and I was like, Do you think it would be okay if I could lecture one of these classes? And he was cool with that, so I kind of, you know, tried something kind of new."

Here Dan's autonomy need is being supported by the faculty member he works with. While the GTAs in this study were not found to have direct control over classroom content, activities, or policies, they were still relatively autonomous in their teaching finding different ways to make their class their own. The two major contributing factors to this were the responsibilities they were assigned and the faculty they interacted with.

4.1.1.3 Factors Affecting Relatedness

As defined in Chapter 2, relatedness was defined as feelings of connection or belonging to both teaching colleagues and students. Through this work, both groups were found to be extremely instrumental in terms of relatedness, but teaching colleagues were divided into fellow

GTAs and faculty which directly resulted from the interviews. Another population mentioned to affect relatedness was the institutional population as a whole, but this group was not as salient as the others so it was not further explored in the study. For this construct, the two salient groups are the people they interact with, but they are also a factor influencing the satisfaction of the need. For example, if there was no connection to faculty, the lack of that group relationship became a factor. Table 18 below provides a participant summary related to their connections with their students and colleagues. See Appendix F additional information about participants' views on relatedness.

Table 18: Relatedness Summaries for Interview Participants

Participant	Students	Fellow GTAs	Faculty
Sam	High	High	Middle
Gordon	High	High	Low
Jillian	High	High	Low
Brent	High	Middle	Low
Maurice	High	Low	Low
Dan	Middle	High	Low
Ingrid	Middle	High	Low
Wesley	Middle	Middle	Middle
Susanne	Middle	Middle	Low
Corey	Middle	Middle	Low
Roberto	Middle	Low	Low
Zachary	Low	Middle	Low

In this table, a high relationship was one where the individual extensively talked about connections with that group and mentioned in multiple instances the deep level of connection they had with that group. A middle relationship was one that was mentioned as important and that interactions occurred but did not appear to be particularly salient for the GTA. Finally, a low relationship was one where the participant acknowledged the other group existence in the FYEP and their interaction with that group but left the relationship at that. There really was not a mention of interaction in the low relationships. It was a very surface level relationship which is surprising given that for the faculty especially, they actually interacted with them on a regular basis.

The relationship a GTA has with their students greatly impacted their experience teaching in a FYEP. Many of the GTAs discussed how helping their students and seeing them succeed

was something that impacted their view of teaching. This high connection to students which was typical of 5 out of the 12 participants is demonstrated by Jillian who said:

> "I love teaching. I love helping students... I like seeing them grow confident in their beliefs they can get through the course and they know the material and the content. I don't know, I like teaching."

Here we see that having her students learn and supporting them actively contributes to her passion for teaching and subsequently her relatedness. This was a common view of the GTAs in this study.

With regard to teaching colleagues, GTAs generally talked about their relationship with their fellow GTAs and their relationships with faculty, and in many instances, these relationships were not the same. In this study, there were instances where a GTA had a very strong connection to their fellow GTAs and a weak connection with the faculty. For example, Sam who was a Master's student as U1 showed this mix of relationships. With regard to his fellow GTAs Sam said:

> "I also worked with my peers a lot. I really rely on them and they also rely on me to kind of exchange any information or anything that could have been taught differently or make a concept more simpler for students to understand, that's what we did. We had a lot of time that we met outside of the classroom, outside of meeting times, you know, just in casual settings, so that we could get a sense for what everyone else was doing."

Even though Sam had a positive relationship with the faculty he worked with, he said:

> "Sometimes, it's difficult working with a faculty member, because if they have got a very specific idea of how the class has to go, and you don't, agree with that, it is very hard to kind of reach a common consensus. Now, I have been pretty fortunate with the faculty members that I have worked with who are just great and who are just similar to my personality, we had a good understanding of how to deal with things. Dealing with faculty members is a challenge."

We see here that even those who have overall highly related interactions see a difference between the relationships they hold with fellow GTAs and faculty. All of the GTAs in this study reported slightly different relationships with fellow GTAs and faculty. This finding contributes to the understanding of relatedness for this population.

The construct of relatedness is complex involving students, fellow GTAs, and faculty. Through this work, students, fellow GTAs, and faculty had greatest impact on GTAs' need of relatedness each contributing to the need in different ways.

4.1.2 Factors Affecting Identity Construct

The second sub-research question was: *What factors contribute to how GTAs see themselves as future teachers?* The main factors (events, occurrences, people, institutional structures, demographics, etc.) that contributed to GTAs' views of themselves as future teachers related to future careers and role dominance.

Based on this research, future careers, which could also be thought of as future aspirations which is a component of future possible selves, seemed to limit a GTA's views of himself/herself as a teacher in the future (i.e., there are some jobs that are teaching related and some that are not opposed to teaching being integrated into many positions). Many of the future careers cited by the GTAs involved teaching directly such as being a faculty member. The other future jobs cited by the GTAs did not involve teaching at all. When GTAs initially did not list a teaching future career, they were prompted about teaching and then mentioned other possible future careers they could be classified as teaching related. In those cases, teaching was often seen as a fall back career. Table 19 below summarizes the future possible careers cited by the interviewed GTAs both related and not related to teaching.

Table 19: Future Possible Careers

Participant	Future Career
Dan	Faculty Position with Research and Teaching
Maurice	Research for Government or Teaching
Sam	Electrical Engineering Consulting or Teaching
Susanne	Direct a First-Year Engineering Program, Support Programs, Educational Technology Industry
Wesley	Faculty Position with Research and Teaching
Gordon	Construction Manager, Teaching after Retirement
Roberto	Teaching Faculty Position
Ingrid	Developing Outreach Programs
Jillian	Educational Technology Industry
Zachary	Faculty Position Possibly at a Teaching College
Brent	Product Development Industry, Teaching Software in Industry
Corey	Design Engineering, Possibly High School Teacher But Very Unlikely

For those who cited teaching as a secondary job above, there seemed to be a conflict between various aspects of their identity which is best summarized as role dominance (the final factor

related identity) which is explained in more detail below both with regard to the present and future contexts.

With regard to role dominance, Susanne serves as an example. While she cited a future career related to teaching, she also said:

> "The only thing I ever really identify as is an engineer, and I don't even know where that came from. It was just, I wanted to be an engineer, and I just started calling myself an engineer. Now teacher, I just identify with that because I feel comfortable with my skill sets to do it."

This idea of her engineering identity being extremely salient seemed to be a factor that resulted in Susanne questioning her teacher identity. Here her identity as an engineer is dominating over her identity as a teacher in that she believes that she is an engineer (i.e., it was the only thing she identified with and therefore it is her dominant role) while she is just doing teaching (i.e., it is her subordinate role). This idea is also echoed by Corey in the present context who stated:

> "I'm teaching but I wouldn't, in my psyche I don't see myself as being, 'oh yeah I'm a teacher.' Sometimes I have to remind myself that's really what I am doing but I'm at the University all of the time. Part of the time I'm teaching, a lot of the time I'm taking classes, doing homework so it's an integrated thing. I don't go there to teach. I go there to go to school, even though at the same time, I am teaching."

In this quote, we see the role dominance between being a student and a teacher. Corey mentions that he teaches, but most of the time he is at his university to complete activities related to being a student. In this instance, his role of a student is dominating over his role as a teacher. Gordon from U2 also commented on this balance by saying:

> "While it was important for me to be a good teacher, and give 100%, or 110%, I had to remember that I was a student first. I wasn't a student first, I was also a student. So, there were times when I would like, I would have to give more time to my studies, as my own studies than being a TA, but there were times when like, you know, any free time that I had, would be devoted to doing TA uh work."

As seen above, Gordon too struggles with the balance between the role of a student and teacher. Thinking towards the future, again Corey has similar role balance concerns that are affected by outside expectations. When asked if teaching would be part of his future career he said:

> "My wife would kill me if I did this, but I would almost like to try to teach high school math, maybe at like a private school or something where it would be a part time thing. I do enjoy teaching; I would just like to have more of an atmosphere where I control the curriculum and I control more of the grading rubric and have a little bit more freedom in that. I do enjoy teaching and wouldn't mind doing something like that but that wouldn't necessarily be my ideal full-time job."

Here we see that Corey's future possible career as a teacher is competing with other aspects of his life (i.e., his relationship with his wife and his desire to have the role as a design engineer – this was his cited as his ideal future career in Table 19). He is passionate about teaching and likes doing it, but his wife or the expectations of his wife are holding him back pushing him towards a career in engineering. His possible future role as a teacher is being dominated by his future role as an engineer.

Related to identity and the factors that affect a GTA's view of themself as a future teacher, two major factors were found to contribute to the construct. First, the future careers of GTAs had a great influence in that GTAs often saw themselves in careers that were or were not teaching focused. Second, role dominance has an effect both in the present and future. This dominance was often between being an engineer and a teacher and between being a student and an engineer. In either instance, the participants were struggling to understand and balance their different roles.

4.1.3 Relationship between Motivation and Identity

The third sub-research question was: *What do GTAs report as the relationship between motivation and identity?* This sub-question was included in this research to begin to understand the connection between motivation and identity directly. Based on the findings of this work, GTAs see motivation and identity as linked and directly contributing to one another. When directly asked about the connection between identity and motivation, GTAs mainly saw two paths, identity dictating your motivation or motivation dictating your identity. Table 20 below summarizes this finding.

Table 20: Links Between M(motivation) and I(identity)

Participant	M to I	I to M	Other
Jillian	X		
Brent	X		
Ingrid	X		
Roberto	X		
Sam		X	
Zachary		X	
Wesley		X	
Dan		X	
Corey			X
Susanne			X
Gordon			X
Maurice			X

It should be noted that those marked as "other" either did not provide a clear perspective on this topic or chose not to answer the question by talking about something else in their interview that was of more interest to them. For these participants, they did not have a clear understanding of motivation and identity as specific constructs and chose to not engage in the connection discussion. For example, Gordon responded to the identity and motivation question by saying:

> "Um, yeah. I think they are in the sense […] I wanted to be a better TA, I wanted to continue doing that, because I know, like I said, in the future I want to get back into industry. So if I have the best memories of being a TA, it would be, I would be more willing to want to do that in the future. But if I have a really horrible experience as a TA, why would I ever want to go back to the industry?"

In this quote, Gordon seems to be struggling with the question which is why it was marked as "other." To exemplify the motivation to identity perspective, Brent said:

> "I just think that the motivation kind of drives how you see yourself as a teacher because if you're not getting much motivation from it and if you're not, not enjoying it you're not going to.... you're not going to identify with being a teacher."

Similarly, Ingrid said:

> "Yeah...well I think my motivation carves out my identity because I mean...so for example, before I got all of these positions, I was volunteering and that's how I ended up getting into this whole engineering...different teaching assistantships for engineering anyway. I was volunteering from the civil engineering school because I was still a civil

> engineering doctoral student so much that I was offered a position as a TA. They were like, 'you gotta get on board.' That's how I got interested in women in engineering because I was just volunteering so much they were just like we might as well just employ you. So um, it's kind of...I guess my motivation etched out my identity. They already had in their mind, 'this lady loves to do outreach, she loves to teach, she loves to give back, it really makes her happy. She really gives it 150%.' So it was yeah, I would say my motivation kind of etched out the identity."

Demonstrating the other path of identity to motivation, Zachary said:

> "My identity forms who I am and sort of determines what sort of activities I can do to keep that identity or to improve that identity. The fact that I have this certain identity as a teacher, for instance, I'm motivated to do things that help me keep that identity and also improve my teaching ability and things like that."

These documented responses about identity and motivation support the idea that the two constructs are connected in the eyes of the GTAs.

4.1.4 Summary of Sub-Research Questions

Based on the results presented above, seven factors were found to affect motivation and identity that mainly related to events, occurrences, people and institutional structures. Competence was affected by training and previous experiences. Autonomy was affected by appointment structure. Relatedness was affected by relationships with students and teaching colleagues (fellow GTAs and faculty). Finally, identity was affected by future careers and role dominance. In terms of affecting these various constructs, depending on the GTA these items either supported or thwarted their needs which would affect their motivation to teach and identity development as a teacher.

4.2 Expanding the Findings to a Larger Data Set

To understand how the factors identified in the qualitative phase might generalize, I asked *How are the factors identified in RQ 1 represented in the larger sample of GTAs, and what are their perceptions of their needs for competence, autonomy, relatedness, and identity?* Below the factors identified as salient in Phase 2 to answer Research Question 1 are discussed in detail with regard to the larger survey sample. I chose to specifically focus on these items to build direct parallels between the qualitative and quantitative findings. In the future, the quantitative data may be reexamined for additional trends, but this is beyond the scope of this dissertation.

To answer the second part of the research question, the statistical results for the four constructs (competence, autonomy, relatedness, and identity) are provided to understand GTAs' perceptions of these items in a wider sample. As mentioned in Chapter 3, basic descriptive information is presented below from the survey data due to the limited sample and non-normal results. In future work, I hope to expand the data set to be able to conduct higher level statistical analyses, but at this stage that is out of the scope of this research.

The factors identified in Phase 2 are summarized above in Table 14. When examining the results of Phase 4 (the quantitative survey) in terms of the factors, unique findings related to training, previous experience, appointment structure, relatedness groups, and future careers were observed. The factor of role dominance was not directly observed in the Phase 4 data due to the complex nature of that factor (i.e., it can be in the present or the future and it can be between a variety of different roles) and because the factor was not completely vetted until the profiles were developed. The depth of the qualitative interviews was needed to explore that item fully. In future work, I hope to further explore the factor of role dominance possibly building on the work in Louis and McNair (2011) where the roles of teacher, research, and lifelong learner/student were measured.

With regard to training, the most common type of training the GTAs received was one-time university-wide training (20 GTAs out of 33). The second most common trainings were weekly content training and one-time pedagogy training (14 GTAs out of 33 for both). This finding supports the trends observed in the qualitative interviews where one-time university-wide training and weekly training were the most prevalent. It should be noted that in the national survey a variety of training options were listed and an "other" option was also supplied so to still see university-wide training and weekly training as the most cited training demonstrates direct links between the phase findings.

In terms of previous experience, 58% of the GTAs who participated in the survey had taught in their FYEP before their current GTA appointment. In the survey sample, 82% of the participants had taught in some other setting before teaching in their current FYEP (e.g., tutor, UTA, GTA for another course, etc.). This finding also supports the trend observed in the qualitative data where many GTAs reported some other experience that contributed to satisfying their competence need.

With regard to appointment structure, this factor can be best observed in the quantitative data related to the hours GTAs spend on activities (i.e., the activities make up the appointment structure to some extent). The list provided below in Table 21 is larger than the list of activities discussed in the appointment structure factor section because in the survey I tried to account for a variety of possible responsibilities, not just the ones mentioned in the interviews. This approach lends credibility to the study in that I did not just survey about items found in the interviews; I intentionally tried to broaden the perspective when possible. Based on the survey data, on average GTAs spend the most amount of their teaching time on grading homework and in office hours (an average of three hours per week on each activity). Table 21 below documents the average hours spent of GTA related activity for the 33 participants.

Table 21: Average Hours Per Week on Teaching Activities

Activity	Average Hours
Grading HW	**3.0**
Office Hours	**3.0**
Leading Lab	2.4
Attending Lecture	2.0
Emails	1.9
Preparing Materials	1.7
Grading In Class Work	1.5
Learning Content	1.0
Curriculum Development	1.0
Grading Writing	0.9
Lecturing	0.3
Total Hours Spent	18.8

The next highest activity related to time was leading a lab section. This aligns with the qualitative findings in that in the interviews grading was one of the most frequently cited responsibilities. This differs slightly from the qualitative data in that curriculum development was also frequently cited in the interviews but did not receive a high average hours value in the quantitative data. This suggests that this is an activity GTAs are involved in frequently, but they do not spend a great deal of time on it.

In terms of the different groups of individuals that GTAs interact with, slight differences were noted in GTAs' feelings of relatedness to the various groups which becomes a factor affecting relatedness. To capture the differences, the following three survey questions were analyzed.

- I feel connected to my students.
- I feel connected to my fellow TAs.
- I feel connected to the instructors and faculty I teach with.

The means and standard deviations shown in Table 22 were captured for these questions. As a reminder the scale of these questions was a five-point Likert-type scale that ranged from strongly disagree (1) to strongly agree (5).

Table 22: Relatedness Group Scores

Relatedness Groups	Mean	Std. Dev.
Students	3.94	0.70
Fellow GTAs	3.73	0.94
Faculty and Instructors	3.52	0.91

Based on this information, the perceptions of relatedness specifically related to each group are similar in that the GTAs were neutral or somewhat agreed that they felt connected to these groups. They did report the strongest feelings on connection to their students which supports a common finding the qualitative phase.

Finally, with regard to future careers, in the quantitative data the GTAs in the sample listed faculty as an option for a future career, but they also equally listed jobs in industry or related to research. When asked about the future in the PST questions, they also listed more immediate goals such as get a PhD and personal goals such as becoming a mother. These findings suggest, like the qualitative findings, that the roles of GTAs are multi-faceted and need to be balanced to account for all that they do and want to become.

Aside from the specific factors targeted in the survey discussed above, the general constructs related to this research were also explored (competence, autonomy, relatedness, and identity). In terms of the general perceptions of the constructs which is a key component to the second research question, Table 23 summarizes the findings.

Table 23: Construct Means and Standard Deviation

Construct	Mean	Std. Dev.
Competence	4.03	0.54
Autonomy	3.18	0.57
Relatedness	3.82	0.54
Identity	4.24	0.68

Based on these results, GTAs "agree to somewhat agree" that they feel competent, autonomous, related, and have a teacher identity. As a reminder, these constructs were developed by averaging a set of questions on a five point Likert-type scale related to the various dimensions of the constructs defined by Phase 2 and the literature. Due to the small sample size, the centralized responses in terms of the means and the small standard deviations suggest that the GTAs who participated in the survey may have induced positive sample bias into the study. For that reason, the quantitative data was only used to supplement the qualitative findings. In future studies with more participants, I would expect the responses to normalize.

The quantitative findings used to answer Research Question 2 parallel the general findings of Research Question 1 supporting that the factors identified in Phase 2 are salient to GTAs' motivation to teach and identity development as teachers in a wider sample. The small sample size limits the transferability of the findings, but that the results still add value to the major results of this research.

4.3 Profile Development

To bring the phases together, the final research question was: *Combining the results from RQ 1 and RQ 2, what are the different teaching profiles that can be constructed that distinguish different levels of motivation, identity, and factors, and how do those results inform the proposed theoretical framework?* Based on the results of this work, three distinct teaching identity profiles were constructed along with a competence lens, autonomy lens, and relatedness filter. The findings from this study suggest that identity is the most salient construct for determining the profiles and that the other constructs related to motivation contribute to the understanding of those profiles but are not distinct characteristics of profiles by themselves. The factors identified in Phase 2 and expanded in Phase 4 contribute to the profiles holistically, serving as a source of explanation for distinctions between the profiles and various levels of the lenses and filter. By developing the profiles, lenses, and filter, a better understanding of the theoretical framework was established, which is discussed in detail at the very end of this section and in Chapter 5. The qualitative interview data serves as the main source of data for profiles, lenses, and filter.

4.3.1 Identity Profiles vs. Motivation Lens

As stated in Chapter 3, the results of this research were examined using a mixed approach where the quantitative data served as the foundation for the qualitative data exploration. To summarize the detailed steps presented in Chapter 3, a clustering technique was used on the

quantitative data which revealed identity as the most salient construct for determining group differences among GTAs. Next that idea of differentiation by identity was applied to the qualitative data, where the participants were grouped based on their self-reported answer to the question "On a scale from 1 to 10, where 10 is you are a teacher, how much is being a teacher part of your identity?" into weak, strong, and transitional identity groups. After grouping, the individual interviews were re-reviewed to determine general trends among the groups based on the coding that was initially completed before the groupings. The trends observed supported the notion that there were indeed three distinct identity categorizations each with unique trends, but that the motivation constructs differ individually, not by profile.

After the creation of the profiles, it was determined that specific identity profiles do not have a typical landscape related to the motivation constructs. This led to the development of the motivation construct lenses which serve to further explain a specific individuals' experience with relation to his/her profile. The lenses were developed by again grouping individuals, regardless of identity profile, into high, medium, and low categories based on their self-reported answers to interview questions designed to target each of the specific SDT constructs. The groups, high, medium, and low, were then reviewed independently, regardless of identity profile, to observe common themes and trends across the groupings. This review was also supplemented with my own classification of the individuals where appropriate which is explained in detail in Section 4.3.6. It should be noted that while relatedness was initially reviewed using the high, medium, and low approach, there were also unique connections between relatedness and competence and relatedness and autonomy that could not be ignored. These unique interactions led to an additional examination of relatedness with regard to the other two constructs which is further discussed in Sections 4.3.5.4 and 4.3.5.5. This interaction resulted in the relatedness construct being referred to as a filter opposed to a lens because it can be used with the profile and the lenses. In terms of SDT, the consequences of using profiles, lenses, and filters have been discussed in Section 5.1.4.

In summary, the relationship between the profiles, lenses, and filter can best be understood by the analogy of transition bi-focal glasses. When you look at something without glasses (and you have poor eyesight), you see an image (i.e., the profiles) that you often can make out but you cannot discern the details of (i.e., the motivation). If you applied glasses designed to aid in seeing distance, parts of the image would become clear, but others would still

be out of focus (i.e., just using the competence lens). If you applied glasses designed to aid in seeing close up, again parts of the image would become clear, but the far away details would still be out of focus (i.e., just using the autonomy lens). By looking at something using bi-focal glasses you are able to view both the close and distant features of an image (i.e., using the profiles with both the competence and autonomy lenses). If you then apply the transition filter to the glasses (i.e., the relatedness filter), the various lenses interact providing the clearest possible picture of what you are looking at. To truly understand the experiences of GTAs in FYEPs the profiles, lenses, and filters are all needed.

4.3.2 Identity Profiles

After determining the groupings for the identity profiles based on the process described in Section 3.2.5.2, unique findings were gathered related to each profile regarding general trends and themes of identity and future possible careers (which directly related to the future careers factor). The details for each identity profile have been provided below with sample quotations from interview participants to help contextual the findings. A summary of the findings regarding the profiles is provided below in Table 24.

Table 24: Profile Summaries

Teacher Identity Profile	General Trends	Future Careers
Strong	teaching is something they were meant to do	teaching is a direct component of their future career
Transitional	teaching is something they are just considering as part of who they are	teaching is something they will consider for the future but they are also considering other options
Weak	teaching is something they enjoy doing but it does not define them	teaching is not something they see themselves doing in the future

4.3.2.1 Strong Teacher Identity

This profile categorizes GTAs who self-identify as having a strong identity as a teacher. From the qualitative phase of this work, Dan, Maurice, Sam, Susanne, and Wesley exemplify this profile. Their interviews were used to further explore the various dimensions of the strong identity profile. In general, these individuals believed that teaching was integral to who they are and have a drive to have a future career that involves teaching.

4.3.2.1.1 Strong Identity General Trends and Themes

In this profile, GTAs believed that teaching was something you do beyond the confines of a classroom integrating teaching into various aspects of their lives. They also believed that there is some kind of natural fit to teaching. As stated by Sam, a new GTA to U1 but a past student of the program:

> "I can relate to the teaching aspect of things. So I think it's something I don't know if, it's genetically even possible, but I do feel in a sense that it's there, you know the teaching gene."

For this group, teaching was a natural fit as shown above and was something they were meant to do. As Dan from U2 stated:

> "The thing is, I generally like teaching, and I feel, it feels natural to me, standing in front of a class… I like the feeling of trying to help students out, and all of that."

Echoing Dan's statement of teaching being a natural fit, Wesley who was also a new GTA to U2 stated:

> "It goes along with the fact that it's part of who I am. And it was, it was interesting that I discovered this experience, which it kind of helped me know, part of me that I was unfamiliar with. I always knew I had to you know, teach in order to be happy, but I did not know it was that much."

These quotes demonstrate that people in the strong identity profile see teaching as a key aspect to who they are and what they do. It truly is part of their identity. As Dan stated he always knew he had to teach in order to be happy opposed to those in the transitional profile who recently are considering teaching. This idea of just considering teaching is further discussed below in Section 4.3.2.2.

4.3.2.1.2 Strong Identity Future Possible Careers

In terms of possible future careers, these individuals explicitly mentioned their future careers involving teaching to some degree or are directly considering it as a long term option comparing it to other careers. For example, some individuals want to directly pursue academic careers. As Susanne, a Master's student in a traditional engineering major, stated with regard to a future possible career:

> "I think I would like maybe to direct a first-year program or something like that. I really like the idea of having students work on problems such as open-ended problems, design problems."

Additionally, some individuals in the strong identity profile want research-based faculty jobs, but want teaching to be a part of that. For example Dan, who is also a master's student in a traditional engineering discipline, stated when asked what kind of balance he would like between research and teaching in a faculty position:

> "So from a student's point of view, like right now, when I see my professors, I would hope that they would have 50-50 percentage. And yes, that would be ideal, to have 50-50, because then when I teach, I profess, I have come across professors who prioritize their research over academia, you know teaching, and that's, that doesn't seem very fair to the students, from my point of view, anyway. So I would definitely try to make it as close to 50-50 as possible, if I had the opportunity, that is."

Here Dan discusses the importance of teaching to a faculty role. These individuals, while not all wanting to be faculty members, do see teaching as a viable option in their future careers. The only participant who did not fit this directly was Sam. When asked about his future career Sam first mentioned that he wanted to go into electrical engineering consulting, but when specifically asked about teaching, he saw that as a possible option for his future. This suggests that for this profile, teaching is a viable option for these individuals even if it is not the first ideal job they think of.

4.3.2.2 Transitional Teacher Identity

This profile categorizes GTAs that self-identify as having a transitional identity as a teacher whose self-reported rating fell between the strong and weak identity profiles. Originally this profile was called the medium profile to align with the way the profile was developed, but later the title was changed to transitional as the participants were clearly in a transformational phase transitioning to or away from a teacher identity. From the qualitative phase of this work, Gordon, Roberto, Ingrid, Jillian, and Zachary exemplify this profile. Their interviews were used to further explore the various dimensions of the transitional identity profile, providing information about possible causes for the transitional identification.

4.2.2.2.1 Transitional Identity General Trends and Themes

Participants categorized as "transitional" have recently considered or reconsidered teaching or being a teacher as part of their identity. Something recent happened that made them consider it to be a salient part of who they are or are not and they clearly articulated that change. This transition is directly related to role dominance in that there are negotiations between various roles and perspectives. For these individuals there was a transition opposed to those in the strong and weak profiles whose discussion of identity was fixed. The transition happened at different times for different people. For example, the segment of the interview with Roberto below exemplifies an identity transition currently taking place.

> "*Interviewer:* So then, thinking about everything that you want to do in the future and everything that you have done in the past, um, would you say being a teacher is part of your identity?
>
> *Roberto:* Uh I think it is becoming part.
>
> *Interviewer:* It's becoming part? So could you talk a little bit more about that? Kind of in that evolution it sounds like you are going through?
>
> *Roberto:* Well, it's just, I've transitioned from like student to the faculty, I think it's sort of, I don't know, I think I'll be able to identify less with being a student and eventually more with being a teacher."

Here Roberto, a PhD student at U4, stated that in his role he is now transitioning to that teacher identity and that in the future he will be even less connected to his own student identity. Jillian, a new GTA to U1 and an engineering education PhD student, went through a similar transition that actually took place in the interview. When asked about her teacher identity, Jillian said:

> "I'm not sure actually. I haven't really thought about this. I would think so. Um, just because it's a role I was proud to take on and one that I still continue whenever I run into students and they have problems and, you know, if they have questions about any content I definitely still can help them out. So yeah I would consider it, um, a significant portion of my identity now that I think about it."

In this quote, Jillian goes from not thinking of teacher as part of her identity to seeing it as a "significant portion" of who she is. She experienced the transition milestone in the interview. Jillian, like many of the other members of this group, consider teaching an important part to their identity now that they have actual been a GTA and taught.

4.3.2.2.2 Transitional Identity Future Possible Careers

Participants in this group have a mix of future careers but teaching was mentioned in some way. They range from Roberto who is currently has a full-time job teaching (the strong end of the spectrum) to Gordon who is now working in industry but sees teaching as a possible career for himself in 20+ years after he retires from industry (weak end of the spectrum). Further exemplifying the transitional aspects of this profile, when asked what job he would like to hold in the future, Zachary stated:

> "Ok, it keeps changing. So I came in with, I came from an electrical engineering background and my goal was to be an electrical engineering faculty member, who did engineering education research and you know, tenure track, that kind of thing. But the more I spend teaching and the more I spend doing educational research, the more I want to be able to have opportunities to teach in a classroom environment. So right now I'm leaning towards something more at a teaching college, where I still have the opportunity to do research and mentor students but definitely more classroom and those types of experiences."

Even with regard to his future job, Zachary, a PhD engineering education student, demonstrates a transitional mentality where his connection or even interest to teaching is shifting. The other GTAs in this profile had more solid views of their future careers which all had an educational focus.

4.3.2.3 Weak Teacher Identity

This profile categorizes GTAs who self-identified as having a weak identity as a teacher. From the qualitative phase of this work, only Brent and Cory belong to this profile. Their interviews were used to further explore the various dimensions of the weak identity profile providing information about possible causes for the weak identification. In general, these individuals have a strong drive to go into something other than teaching and often see being a teacher as something they just to do.

4.3.2.3.1 Weak Identity General Trends and Themes

The two participants in this identity profile saw their GTA responsibilities as simply work. When asked about their identity as a teacher, they often hesitated and said that other areas of their identity were more salient. This is exemplified by Brent from U1 who was both a past

student and UTA in his FYEP. When asked why he did not score himself higher with regard to his teacher identity, Brent said:

> "I think there's more [to who I am]. There's more to just being a teacher. So I think in addition to that I kind of like being a designer and that kind of thing."

Brent is a Master's student in a traditional engineering discipline which explains his drive to be a designer. In this quote he sees himself as a teacher, but he believes it is only a part of who he is. He also sees himself as a designer or more generally an engineer. Corey, who is also a Master's level student in a traditional engineering discipline said with regard to his teacher identity:

> "Because I guess I am a teacher. I'm teaching but I wouldn't, in my psyche I don't see myself as being, 'oh yeah I'm a teacher.' Sometimes I have to remind myself that's really what I am doing but I'm at the University all of the time. Part of the time I'm teaching, a lot of the time I'm taking classes, doing homework so it's an integrated thing. I don't go there to teach. I go there to go to school, even though at the same time, I am teaching."

His response exemplifies that GTAs are not only teachers, they are also students, researchers, husbands, parents, etc. Corey's views on teaching and being a teacher are also highly influenced by his wife who has been educated as a K-12 teacher. In Corey's mind being a "teacher" means educating children and even though he is a Graduate "Teaching" Assistant, he does not see being a teacher as a strong part of who he is. It is something that he does.

4.3.2.3.2 Weak Identity Future Possible Careers

Considering PST theory in the context of this identity profile, these individuals wanted their future careers to involve working in industry. When specifically asked about a job teaching, they saw it as something to fall back on, but it was not what they wanted to do for a career. Also in this profile, the fallback teaching appointments were not in higher education. With regard to what he wanted to do after graduation, Brent initially said:

> "I'm still trying to figure that out. I'm not really sure yet. I kind of want to into product development, see if I can do that. Still trying to figure that out actually, right now."

When specifically asked "do you see teaching being part of your future career at any point," he said:

> "Possibly. Possibly, yeah. That might be something I look into too as well, like teaching software at an industrial level."

These quotes demonstrate that Brent is very unsure about his future career in general, but that teaching is not going to take a primary role. Similarly, when asked about his future career, Corey said:

> "My ideal job right now would be to get a job at an engineering firm and to be a design engineer."

When specifically asked if saw teaching as part of a future career, he said:

> "My wife would kill me if I did this, but I would almost like to try to teach high school math, maybe at like a private school or something where it would be a part time thing. I do enjoy teaching; I would just like to have more of an atmosphere where I control the curriculum, and I control more of the grading rubric and have a little bit more freedom in that. I do enjoy teaching and wouldn't mind doing something like that but that wouldn't necessarily be my ideal full-time job."

From this quote it is clear that while Corey enjoys teaching, it is not part of his future plans. He plans to pursue a career in industry. The experiences of Brent and Corey help explain possible future careers for those who have a self-reported weak identity as teachers where they often see themselves going into something other than teacher for their long term career.

4.3.2.4 Identity Profile Summary

The three identity profiles presented above are each distinct and capture a range of identity related perspectives GTAs may experience. The main feature defining the identity profiles were future careers and connections to teaching as part of one's identity. Not every GTA will fit exactly into one of these profiles, but they can be used to better understand the range of GTAs' identities in FYEP. While the identity profiles serve as a foundation for understanding a GTA, more information is needed regarding their competence, autonomy, and relatedness needs. The sections below discuss these constructs as lenses and filters to further explore GTAs' experiences in FYEP with regard to identity and motivation.

4.3.3 Competence Lens

Competence relates to the knowledge required to teach in an FYEP that includes both content knowledge and pedagogical knowledge. While the definition of knowledge may be universal to GTAs in FYEPS, the ways in which GTAs learn and meet the need of competence in these areas differs. Again as with the identity profiles, the data below is based on the self-reported scores of the individuals using the qualitative interviews as the main data set. The

construct of competence is referred to as a lens because it was not the salient factor for determining the profiles but it contributes to understanding the individual stories with the profiles.

4.3.3.1 High Competence

GTAs with high levels of satisfaction regarding their competence are knowledgeable about many aspects of teaching including the content and pedagogical approaches. Importantly, not only do they have the knowledge, they recognize their abilities. Four interview participants demonstrated high levels of GTA competence. Those individuals were Brent, Sam, Gordon, and Corey.

One unique and defining characteristic of this group was that all but one of them had previous connections to their FYEP before becoming a GTA. These experiences seemed to directly impact their competence views aligning with the factor of previous experience. For example, Brent, an experienced GTA at U1, said:

> "A lot of the content I actually went through this course years ago so I already knew that stuff. The content hasn't really changed in a few years so once you get it once you kind of got it."

This notion of already learning the material and then applying was also echoed by Sam at U1 who said:

> "More than anything, I really relied on the fact that I was an undergraduate student here. The, the course content was mostly derived from what I had done in that past."

These two quotes demonstrate that high competence GTAs often have past experience to pull from that contributes to their knowledge base. They are not seeing the material for the first time and therefore have an advantage over other GTAs. In these cases they have direct experience from the same course that they are teaching which supports their need of competence.

Another defining characteristic of this group is that often they had advanced teaching responsibilities. While the appointment structure factor above related to autonomy, here we see that those responsibilities can also affect competence in unique ways. Brent talked about this when discussing the training (which was discussed as a factor directly affecting competence) he received where he talks about the training broadly, but then talks about an advanced responsibility.

> "Anything that's new is covered through the weekly meetings. If there's any kind of more in-depth topic we provide training on it. So the first time you'll go through [a more in-depth topic], you'll go to like training at night or something to get a better understanding of it. And then hopefully you [understand the topic] and then you become the trainer."

This idea of taking a leadership role or in Brent's example "becoming the trainer" in the FYEP was also demonstrated by Gordon who served on a GTA leadership team in his FYEP at U2. Part of his responsibilities included leading weekly training sessions. When asked how his experience differed from his fellow GTAs, he stated:

> "Well I just felt better prepared when I compare myself to a first year TA that was leading his own lab section, for example, I think having seen the material that many times, I could, five times recite everything, like forward and backward, without even looking at my notes. So, I think I was just fortunate that I had that position, because if I probably wouldn't have done that much work had I not had that leadership position. You know, like I probably would have just like reviewed once on my own, and reviewed once during the weekly meetings. And though that might be enough, I think that you can never be too prepared for um, teaching."

His leadership position in this case contributed to his competence. He was required to learn the material in-depth and multiple times to teach it to others. This repetition helped to strengthen and support his competence.

4.3.3.2 Middle Competence

GTAs who report middle or average levels of competence are knowledgeable about teaching, but are not confident in their abilities even though they have taken steps to gain competence such as participating in training or reviewing course materials. Six interview participants demonstrated middle or average levels of GTA competence. Those individuals were Dan, Maurice, Wesley, Roberto, Jillian, and Zachary.

A defining characteristic for this group was that all but one (Maurice) of these GTAs were teaching in their FYEP for the first time. This again relates back to the factor of previous experience. These GTAs were lacking that experience so their need was being thwarted. This inexperience could have contributed to their lack of confidence in their ability and views of their competence. This was demonstrated by Jillian from U1 who said:

> "I don't know. I just feel like I need more experience. And then there's always that...I always hesitate because I've only done being a TA for one semester and I mean, I think I did a great job at it and I helped a lot of students. But I think with more experience I would be able to help more."

Here we see Jillian's insecurity in her ability even though she believes she did a great job her first semester as a GTA. This feeling of not being fully competent is echoed by Wesley, a new GTA at U2, who said the following after giving himself a competence score of 7:

> "Because (exhales loudly) I didn't have nearly as much experience as I would have liked to. […] Just because a lack of experience, I say I am a 7. But that doesn't, that is from my perspective. I think that with more experience, without, I mean without changing anything, but just with more experience, I would give myself a higher rating."

This quote exemplifies that this group of GTAs is often critical of their abilities regarding competence even though they know the material and had the same training (another factor identified in Phase 2) as their colleagues in the high competence group. This finding sets them apart from the high competence group who has extensive experience with FYEP material which contributes to their competence gained from training.

The other experiences of this group were very mixed in that some of them had taught outside of their FYEP, some had attended the university they were teaching at as an undergraduate, and they came from a different of majors. This variety suggests that this middle competence group, much like the transitional identity group, is made of individuals with very unique experiences that dictate their views of themselves and therefore their self-reported scores.

4.3.3.3 Low Competence

GTAs with low levels of competence, like the middle competence group, often feel they are not prepared for teaching, but these individuals reported lower competence rating than the previous group making their view different. Essentially, they had a lower self-efficacy perspective than those in the middle group. Two interview participants demonstrated low levels of GTA competence. Those individuals were Susanne and Ingrid. These two women were both teaching in the FYEP for the first time and had other teaching or mentoring experience outside of the FYEP.

The detailed reasons given by Susanne and Ingrid for this level differed, but they both seemed to cite the structure of their program as contributing to their inability to learn material. It

should be noted that these two individuals were from the same FYEP, but differed in their major and academic level. In terms of the structure (which relates to the factor of appointment structure and autonomy) of the FYEP and how it affected her competence and ability to learn, Ingrid, a PhD student in engineering education, said:

> "So I would say...there were two key things: one was that I was a novice in this area so I'm actually not a programmer, I am a civil engineer…my discipline. I've never had to use MATLAB a day in my life for any modeling. So the expectation, and I said this at the interview, the expectation was that I would have time to, you know, at least stay two weeks ahead of the students, um which, in a course which was run in a different manner would be reasonable. In this course however, no. So that's one of the areas I was not as experienced as other TAs, which for most of them, come from an electrical or computer engineering background."

There are two key points to this quote. First, Ingrid felt she was not competent in the area of programming because of her undergraduate major (civil engineering) where she never had to program (this directly relates to the factor of previous experience), and she felt that the structure of the program did not allow her to fully learn the materials before she had to teach it to her students despite the fact that she attended training sessions. In contrast, Susanne, who is a computer science major, does not attribute her lack of competence to her background, but she does discuss the program structure and how it affected her competence. Susanne said:

> "Umm... [Pause] Oh boy. Sometimes I would cheat depending on how much time I had, if I'm allowed to say this. And just go based on what the presentation was […] Ok, so there are 2 semesters that I taught. The very first semester I cheated because [my instructor] was teaching earlier in the morning so I would just sit in on his lectures and pretty absorb as much as I could and if I had to teach in the afternoon I could pretty much regurgitate it because they were easy to understand after hearing if from him. […] The second semester my professor was kind of like, liked to teach as well. He was a pretty good instructor so whatever ya know he taught, the instructor, lecturer I would just listen and, and if I needed to help the students I would just apply it and in some cases it took me a while, to umm, to catch up with MATLAB in the beginning. So I just found out which one of my [UTA]s was the expert and follow them around and try to learn as much as possible, as fast as possible."

Susanne's approach to gaining and establishing competence was to rely on others which the program structure allowed her to do, but this approach was not fruitful as she rated herself having a lower competence rating.

Despite feeling that their competence need was not being satisfied and therefore not supported relative to the other GTAs, both of these individuals did seem to learn a lot during their teaching experience which contributed to their competence in a unique way. First, Susanne said:

> **"**Oh I learned a lot. Let's see... Well, it took me a while to finally pick something that I learned that I was going to pursue further, but one of things I'm pursuing now with my research is about computational thinking in engineering."

From this quote we see that while Susanne's competence as a GTA was low, she was able to use what she learned in that setting to inform her research interests. Similarly, Ingrid said the following with regard to what she learned:

> "Oh yeah, I learned a lot. I just learned, let's see, what did I learn? I think I learned more life lessons than technical things, as far as the course."

Ingrid goes on to discuss that one of the main things she learned related to leadership. Through her experience, she was able to build a solid foundation for the type of leader she would and would not like to be in the future. While the two women in this grouping demonstrated low levels of competence with regard to their GTA role, they both learned a great deal from the experience that they will be able to apply to other settings.

4.3.3.4 Competence Lens Summary

The main item found to distinguish between degrees of competence was past experiences (training did not seem to play a key role since they all had approximately the same training) which were previously identified as a critical factor affecting competence development. Those in the high competence lens had extensive past experiences as students in their FYEPs that contributed to their knowledge base. Those in the medium lens had the knowledge to teach, but due to their lack of experience, they often questioned themselves and were unsure about their abilities. Finally, the two GTAs in the low competence lens had past experiences to pull from to help them met their competence need, but they were in settings other than FYEPs. This finding supports the importance of past experience which will be further examined in Chapter 5. Finally,

while the competence lenses can be used to better understand the profiles, an autonomy lens is also needed to understand the individual experiences in more detail.

4.3.4 Autonomy Lens

Autonomy, or one's sense of control and decision making power, was experienced by the participants in different ways as well. Despite that the fact that some of the participants came from the same institution and taught within the same FYEP with the same appointment structure, they still experienced autonomy in different ways.

4.3.4.1 High Autonomy

GTAs with high levels of autonomy feel they have decision making power over some aspect of their class (i.e., their appointment structure, a factor identified above, contributes to their need being supported). This often includes, but is not limited to, the ability to change the presentation style, activities in the class, and the classroom management approaches. This does not include the content taught in the course as for all of these FYEPs the content is fixed and set by faculty. Despite the lack of control over content (i.e., it is not their responsibility), all of these GTAs have a sense of responsibility for their sections. Five interview participants demonstrated high levels of autonomy. Those individuals were Dan, Wesley, Brent, Corey, and Gordon.

As stated above to have a high level of autonomy, a GTA must feel that they have decision making power over some aspect of the course. For some GTAs, this control was obvious as it was built into their appointment, again this relates to the appointment structure factor. For example, Gordon was part of a leadership team in his FYEP so he had authority over other GTAs and was in charge of running some weekly training sessions. For other GTAs, the sense of control was not as distinct but still very present. For example, Brent both a past student in his FYEP and UTA said:

> "Maybe not so much for the course but for the section you're in charge of you're definitely responsible. You're kind of the go-to person, you're in charge of grades 100 percent. A lot of the professors I've worked with, and this isn't across the board but just in my experience, they've kind of weighed heavily on me. So they kind of just wanted to be there to provide the material and handle that but everything else that comes outside of lecturing, I guess, kind of falls on the grad TA."

Here we see that while Brent is not in charge of the class content, activities, or even the lecture, he still feels responsible for the course in every other way contributing to his sense of autonomy.

The two examples above are built-in structure characteristics that contribute to autonomy. Not all GTAs had this built into their appointments, so these individuals sought autonomy in other ways. For example Wesley, who did not have any formal teaching experiences before joining his FYEP, said:

> "Well, we have full liberty providing the lectures the way we wanted. Like I said, I mean we could have changed, maybe, the in-between slides, not change the content of the presentation, but maybe add a funny joke or something."

Here just being able to change up the lecture is enough autonomy for Wesley. By being able to add in joke, he is able to take ownership over his section. While there was not one defining feature that dictated why a GTA would have a high sense of autonomy, the common trend was that they all felt responsible for their sections and found some way to have decision making power in their class.

4.3.4.2 Middle Autonomy

GTAs with middle or average autonomy felt they had some control over the course, similar to those with high autonomy, but these individuals often sought to justify their lack of autonomy. This means that they recognized it was low and determined that it was acceptable given the structure of the FYEPs or the individual instructor they were working for. Four interview participants demonstrated middle or average levels of GTA autonomy. Those individuals were Maurice, Sam, Susanne, and Roberto. It should be noted that compared to the competence lens, this middle group was more spread in their self-reported data. With that there are not general trends that describe this group, but there are some interesting features that will be discussed below.

Maurice exemplifies a mixed view towards autonomy. For example he stated in response to the control he had over the content in the course:

> "Uh, none...-ish. Sorry, I had to think about it. So as far as the actual content, we didn't have very much but we did get to work with the instructors on building the lesson plans. They had final veto power and got to decide what they wanted to teach in the end but they did give us the opportunity for…for instance I've done a lot of Excel work and so I got to structure what the Excel PowerPoint and what the Excel lecture would look like, with a lot of input from the instructors."

Here we see that he does have input into the course, but that the faculty ultimately have decision making power. Susanne also has an interesting mixed view related to autonomy that is most explained by her extroverted personality. In her interview, she specifically talked about not having control over any aspect of the course, but she did mention that she would provide her thoughts and insight during weekly meetings regularly. With this we see that she does not have control, but has found a way to regain a sense of it allowing her to partially meet her need for autonomy.

Sam also provides a different perspective on mixed view of autonomy by attributing the changes to autonomy or the control he had over course material to the various instructors he had worked with. Sam who had past experiences as an academic advisor said:

> "I think it is almost, it depends on who is going to be the, I guess the particular professor who is in charge of that particular course. [A: Mhm] I have worked on semester where is was left very flexible to each and every faculty member and GTA could work together and devise things that were, would be taught differently, try it out and ex, and share it with other people and during the meetings, but I have also taught where it, during last semester, where it was taught by a faculty member who refused for any other way to be taught, and would try to enforce the idea of consistency amongst all sections."

Here we see how autonomy can be directly affected by the supervisor. This will be further explored in the relatedness section.

Overall, this group of GTAs has a variety of views concerning autonomy. They all have a feeling of autonomy in some way, but it is highly influenced by the environment around them and their individual personalities. The factor of appointment structure is salient here and mixed for this group.

4.3.4.3 Low Autonomy

GTAs with low autonomy felt they had no decision making power or control over any aspect of their class. Three interview participants demonstrated low levels of GTA autonomy. Those individuals were Ingrid, Jillian, and Zachary, and they all came from the same FYEP. They are also all PhD students studying engineering education.

In this study, only three participants were PhD students studying engineering education and those three individuals make up the low autonomy lens. Unlike their teaching colleagues,

these students have chosen to focus their studies on education opposed to technical engineering. Below Jillian addressed the responsibility she feels for the course by saying:

> "I feel a little bit responsible in a sense that I feel responsible in helping the students learn; in making sure the questions they have are addressed. But, I'm not...I don't feel that I had that much control over the course content or the pace or anything like that."

This quote exemplifies the dichotomous view she has towards her appointment. She believes she is responsible for helping students learn, but she's doing that within a very fixed structure. Her feelings towards her lack of input in the course are reiterated when she said:

> "As the job was explained to me, it became more clear that it was going to be more of a supporting role. I think title the of graduate teaching assistant, the teaching part can be a little misleading but I mean occasionally you had the opportunity to teach should the instructor not be able to. But it's very minimal teaching that a graduate teaching assistant does."

This feeling of frustration and lack of control is echoed by Zachary, a former GTA at a different institution, who said:

> "It was frustrating at first. You know you get frustrated in terms of, I would make, or if I were preparing the course I might have done these things differently and dealing with the fact that, ok well this is a system I'm working in and even if I don't think this is best for the students, this is what I have to work within. So I just sort of had to take it on the chin and you know, say it would be better for me to do it this way than to...you can do a certain amount of suggesting."

Zachary, while frustrated by his appointment, tried to make up for his low autonomy by making suggestions in weekly meetings, but he still felt a low sense of autonomy.

Another defining feature of this group is that all three of these individuals will not be GTAs in the FYEP next year. They will still be graduate students, but have taken appointments with other responsibilities. Zachary will be focusing on his research, Ingrid took a graduate professional assistantship, and Jillian decided to remain in the FYEP, but only in curriculum development capacity. Their GTA appointments and perhaps their lack of autonomy contributed to their decisions.

4.3.4.4 Autonomy Lens Summary

The main item found to affect levels of autonomy was appointment structure which was a factor previously discussed as a critical to feelings of autonomy. In the high autonomy lens, the participants discussed concrete ways they meet their autonomy meet through responsibilities in their appointment. Those in the middle lens struggled to have their need met and had mixed views of their responsibilities. Finally, those in the low autonomy lens had a strong disposition that their need for autonomy was not being met which was directly a function of their appointment structure and responsibilities. This finding supports the importance of appointment structure which will be further examined in Chapter 5. Finally, while the competence and autonomy lenses can be used to better understand the profiles, a relatedness filter is needed to fully understand the individual experience regarding motivation.

4.3.5 Relatedness Filter

Relatedness relates to the feelings you have to the community around you. For GTAs this community includes faculty, students, and fellow GTAs all of which were previously discussed as factors affecting relatedness. As mentioned earlier, these are the groups that the GTAs interact with, but based on their relationships that a GTA has with these various groups, they become factors affecting their relatedness. Based on my data, relatedness is different from competence and autonomy in that it interacts with those two constructs. Because of this, relatedness has been described as a filter where it too has high, middle, and low levels, but also has interactions with the other two motivation constructs. Figure 7 below was generated from the quantitative data and also supports the interaction between relatedness and the other two constructs. This figure was created from the survey question that asked participants to rank order the questions in terms of importance when considering being a GTA.

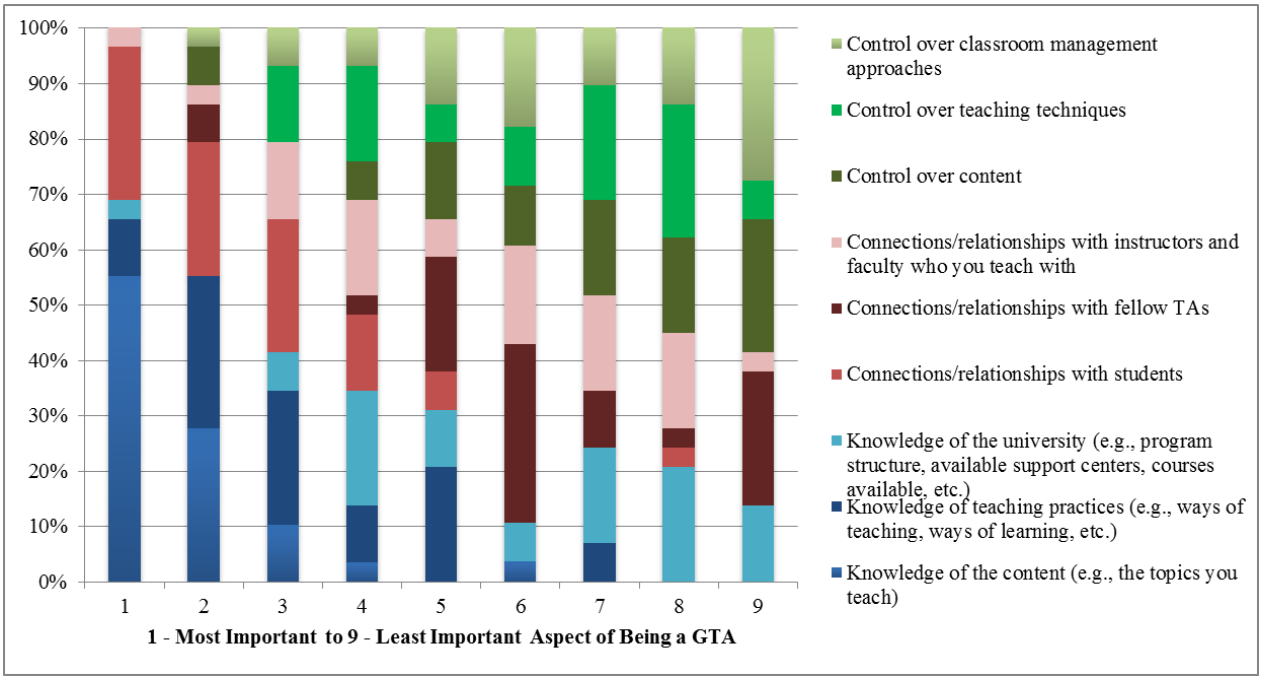

Figure 7: Survey Data about Construct Relationships

In this figure, the items listed on the right each correspond to a construct related to SDT (and three items were included related to reach construct). If you examine the bar graph, you will notice that the three questions related to competence (the last three in the list - blue) are mostly concentrated on the left indicated that participants ranked those as the most important constructs related to being a GTA. If you examine the three questions related to autonomy (the first three in the list - green), you will notice they are all concentrated to the right indicating they are not as important as the other items. The three items related to relatedness (the middle three in the list - red) are scattered throughout the figure indicating their importance is interconnected with the other two constructs. This finding further supports relatedness as a filter. Below are the classifications of the levels of relatedness GTAs were found to have in this study and a discussion of the interactions between relatedness and competence and autonomy in more detail based on the qualitative data.

4.3.5.1 High Relatedness

GTAs with high levels of relatedness have strong connections to all those involved in FYEPs. They truly see their FYEP as a community. Six interview participants demonstrated high levels of GTA relatedness. Those individuals were Sam, Susanne, Gordon, Dan, Roberto, and Maurice.

One unique and defining characteristic of this group was that they incorporated mentorship into their view of relatedness of community which was not observed in the data during the initial Phase 2 factor analysis which is why it was not listed as a specific factor. The mentorship took different forms but the type of mentorship was them being mentored by faculty or senior level GTAs. These pairings support that faculty and GTA relationship that are strong help support the need for relatedness. Dan talked about a formal mentoring experience in his FYEP where they are actually paired with senior level GTAs. Dan, a Master's level student from U2, said:

> "And, like for example, so for each GTA is assigned a mentor, so I had like this one GTA who was responsible, I mean, not responsible, but she was responsible to answer questions which I have, and, and I have a lot of questions, in general […]"

This assigned mentor contributed to Dan's sense of relatedness and connection to his colleagues. He also discussed that while he was assigned a mentor, he also received support from other GTAs involved in the FYEP. Dan said in relation to the other people has asked questions of (i.e., not his mentor):

> "The thing is like although these people I ask questions to weren't my mentor, or whatever, that didn't stop them from answering the questions. […] They answered it perfectly and I think without that it would have been like immensely hard for me, because obviously I was, in my first [academic term], I was taking three courses, I was teaching, and I was doing my research, and yes so it was kind of chaos, so like if it wasn't for these people it would have been so hard."

Having these fellow GTAs there to simply answer his questions contributed to his relatedness. Similarly, Maurice, also a Master's student but from U5, said in reference to the faculty he worked with:

> "There were definitely many....which all of the TAs had a pretty good relationship with the instructors so there were definitely informal training sessions in the afternoons. If you had a bad day you could just go in and talk and be like, 'I don't know what to do' and they would help talk you through it and figure something out."

For these GTAs mentorship and guidance from those more senior to them contributed to their relatedness.

These GTAs also had high feelings of relatedness or connection to their freshman engineering students again contributing to the factor previously discussed. GTAs in this category often mentioned connecting to their students because they had been through the experience of their students. For example, Sam from U1 said:

> "As far as students, I can relate to them 1, because I was in the same university. 2, you know, I was in engineering. I am also still in engineering. 3, I know some of the challenges that were there for me, learning the course, not just understanding the content, but understanding that it is a huge transition from high school where you could, you know ask your teacher, or the content was easier, and college is going to be a lot more different."

Similarly Gordon from U2 said:

> "Well, I definitely relate to them in the sense that I was in their shoes. Literally in their shoes because I was in the engineering program. So I went through the program, and I knew how tough it can be at times, and how like, all-consuming it can be."

Having been in the same place as their students, there GTAs have built strong bonds and connections with their students contributing to their high view of relatedness.

4.3.5.2 Middle Relatedness

GTAs with middle levels of relatedness have strong connections with some people involved in FYEPs and weak connections with others. The things they talked about in their interviews echoed trends in the high relatedness group, but they did not score themselves as such. Three interview participants demonstrated this middle level of GTA relatedness. Those individuals were Brent, Corey, and Jillian. It should be noted that these individuals were those who also had relatively short interviews and did not seem as engaged in discussing their experience as others. With this in mind, I have used Brent as an example of the middle relatedness group.

Paralleling the high relatedness filter, Brent said the following with regard to his relationships with his students:

> "It's more of a mentorship role kind of. They know...they know what they're there to do and some are more inclined to do it than others but it's more just mentoring, kind of getting them...teaching them the way you want them to act and that kind of thing. And they already know the material pretty well so that's not much of a concern."

Brent, like those in the high relatedness group, saw mentorship as a key component to this relatedness, but Brent feels he was mentoring his students opposed to being mentored. Also Brent said:

> "I relate and connect pretty well because I've been through their shoes. I did the undergrad engineering thing at [U1] so I kind of know what they're going through, I know where they're headed."

Here again we see him commenting on his experience in a similar manner to those in the high group where he connects to his students because he experienced the program they are in when he was an undergraduate, however, he rated himself had having average relatedness (self-reported 6). I attribute this to his weaker connection with faculty. With regard to faculty Brent said:

> "I haven't...well occasionally I just go and talk to them or whatever. I worked over the summer with a few faculty members and got to know them a little bit better. So within the course setting it's kind of hard I guess but when you get down to course development and that kind of thing there was a lot more opportunity to meet instructors and kind of get to know their background and what they're all about."

Here we see that Brent does not believe that in his GTA role he was able to connect with the faculty. It was not until he became involved with curriculum development that a relationship was built.

4.3.5.3 Low Relatedness

GTAs with low levels of relatedness have weak or minimal connections to those involved in FYEPs mainly the students and the faculty. These GTAs seem to have average connections with their fellow GTAs, but they often discussed their student relationships in a very professional sense. Three interview participants demonstrated low levels of GTA relatedness. Those individuals were Wesley, Ingrid, and Zachary.

With regard to their students, these GTAs did not have strong personal connections. They often kept the relationships focused on the course. For example when asked about the relationship she had with her students, Ingrid said:

> "It's pretty much class-driven. Yeah because I said we didn't really get to... [Pause]...let's see, no I don't really think they asked me anything. It was all really class-driven and if it had to deal with personalities of people it was team affiliated, which was a part of that class."

Zachary also said the following with regard to the relationship he had with his students:

> "Yeah it was harder this time than it was earlier. I had mentioned previously, I didn't have as much direct interaction with students compared to the [UTAs]. So it was harder to relate to them. Also, it's interesting because I'm getting older and the age difference between...I'm 26...the age difference between me and 18 year-olds had become more noticeable in terms of, I don't know, cultural references and even how students are acting in a class. So I didn't feel entirely connected with students. So another part of the problem is that there were 120 students so you can learn their names but it's really hard to get to know 120 students. I might have gotten to know 5 students in the course whereas when I taught a course of 25 students I got to know all of their names, a little bit about everyone. I wouldn't say I developed friendships but I would see students and maybe chat with them if I saw them on the street or in one of the academic buildings; maybe stop and chat with them for five minutes. And I didn't ...not really have that here."

Zachary had a previous teaching appointment at another university where he had more direct interaction with his students. His expanded view of relatedness to students manifests in the quote above because he has another experience that serves as the comparison to his current teaching appointment.

4.3.5.4 Interaction with Competence

While competence and relatedness are unique and different constructs in this study, from the qualitative interviews unique occurrences were observed where relatedness seemed to impact competence. While not all of the GTAs in the study reported this interaction, a few examples from four participants who directly talked about it have been provided below to illustrate this finding. Mainly these interactions were observed when participants discussed their relationships with faculty and their fellow GTAs.

With regard to faculty, they seemed to impact competence in that they serve as a source of pedagogy information (i.e., they can help GTA learn about teaching approaches and skills) opposed to just a source of information about course logistics, university policy, etc. For example, when Jillian who was a first-time GTA at U1 was asked about how she learns about teaching techniques she said:

> "A lot of it is just from reading on my own and just observing other instructors."

Here the faculty are serving as a source of knowledge about teaching. There is a connection here that the relationship she has with the faculty member is supporting her need for pedagogy competence. Zachary, who also taught at U1, but taught at another university prior to his current appointment said with regard to learning the content:

> "And if I had questions, which was fairly rare, just because I mean the material was pretty straightforward, I would ask my, the faculty instructor for the section I was doing. It was actually helpful that I had a good relationship with her because she's also my academic advisor."

Here we see that the relationship with the faculty contributes to competence, but it also may extend beyond the FYEP adding another layer to relatedness. This is deeper than a faculty member simply providing facts. These quotes demonstrate that faculty interact with their GTAs contributing to their sense of relatedness, but they also serve as a source of information contributing to their competence as GTAs. This may also be seen as a type of informal training, but the relationships discussed above seem to be deeper than that of just a trainer and trainee.

When discussing fellow GTAs, they seemed to support the gaining of competence as well by answering questions and supporting each other in the FYEP. For example, Wesley from U2 said:

> "Well, in my case, it was more of a community based approach. I would go to other people and kind of ask how they were doing if I had a problem or something."

Here we see Wesley's fellow GTAs serving as a source of knowledge for him in a similar way to how the faculty served as a source of information above. Contributing to this idea of GTAs sharing knowledge, Susanne from U1 stated:

> "Actually so [another GTA] I met because his section was directly after mine so I would debrief with him after mines was done. He would tell me pointers on things and it became a relationship that way of just having someone to debrief and kind of have a sounding board on how to do things."

Having this other GTA there to share ideas and tips directly contributed to both Susanne's competence and her feeling of relatedness.

GTAs in FYEP have a lot to learn regarding content and pedagogy, but the people they interact with often support their development. Many times those people include fellow GTAs and faculty contributing to the interaction between competence and relatedness.

4.3.5.5 Interaction with Autonomy

Relatedness directly interacted with autonomy with regard to GTAs' experiences with faculty. In many cases, the faculty member and a GTA were paired in a classroom which dictated their autonomy in the class (i.e., they taught a class together where the faculty member was the instructor of record and the GTA was there to support the faculty). For example, Dan from U2 said:

> The last [term] I got an opportunity to actually lecture class when the professor was in the class. So then basically I talked to him beforehand and I was like, Do you think it would be okay if I could lecture one of these classes? And he was cool with that, so I kind of, tried something kind of new, in the sense that I, like it was a MATLAB class, I think it was handling in MATLAB or something like that."

This quote from Dan was previously used to demonstrate him taking ownership of this own autonomy, but it also exemplifies how the faculty member was the gatekeeper for this experience. Dan needed to have a good relationship with this faculty member for this activity to happen. On the other side of the coin, Corey from U3 said in reference to his autonomy:

> "In the lab we have freedom because I guess, the professor's not there breathing down our necks."

From this quote we again see that in a classroom when the instructor or faculty member is there, they often control the environment and the autonomy of the GTA is removed. This also relates to the appointment structure factor found to affect autonomy in that if a faculty member is not in the lab the dynamics and feelings of the GTA may be altered. Susanne from U1 summarizes how this can change from faculty to faculty though which makes this related to relatedness not just appointment structure. Susanne said in reference to her role in the classroom:

> "It depends on your instructor. So, in the beginning for my first sections, my instructor was new and I was new so were kind of like, more co-collaborative instructors in a sense. And I was always going in so she would always kind of like rely on me to help her with some of the content material sometimes. The second time around, my professor was, this was like his fourth time teaching so he was more like, "I just need you to help me with the grading and do the umm, [extensive problem]s" and that's pretty much it. So... It really depends, but it's more of a professional relationship, I guess."

From just Susanne, we see that the faculty member and the relationship with that faculty member can directly interact with autonomy. One term Susanne had autonomy getting to help with content and serving as a co-collaborator. The second term, Susanne did not have autonomy. She just did what she was told. These examples support the idea that relatedness with regard to faculty has a great impact on an experience, but it also interacts with autonomy.

4.3.5.6 Relatedness Filters Summary

Relatedness was a unique construct in that it interacted with both competence and autonomy. The main items found to affect relatedness were connections with student and the sense of community with teaching colleagues including faculty. In the high relatedness filter, the participants had strong connections with their students and colleagues. Those in the middle filter had differing experiences regarding relatedness that showed no universal trends. Finally, those in the low relatedness filter had limited connections with any group related to the FYEP. These finding supports the importance of community in a FYEP which will be further examined in Chapter 5. In terms of the interactions between relatedness and competence and relatedness and autonomy, it should be noted that competence and autonomy could interact as well, but based on the data gathered for this study any possible interactions were not prevalent. In future studies, I hope to explore the interactions more thoroughly considering the possible interaction between competence and autonomy.

4.3.6 Variations from Self-Report

The information presented above is based on self-reported data which is an approach that is consistent with, and appropriate for, the theories used to guide this work. To further explore the self-reported nature of the results, the interview participants were initially classified based on their self-reported scoring, but I also classified them relative to each other looking for distinct patterns related to the constructs to see if their self-report differed from an expert categorization. To categorize the experiences in reference to the four constructs, I operationalized my ranking to the following which is shown below in Table 25:

Table 25: Classification Definitions

	Identity	Competence	Autonomy	Relatedness
High	Teaching is a clear part of who the participant is. The participant really enjoys teaching and sees themself doing it in the future. The participant often says that teaching is something they were meant to do.	The participant is knowledgeable about teaching. Often the participant has past experiences that have prepared them for teaching such as other teaching appointments, completing the program they teach, etc.	The participant has control over their class which includes decision making authority when it comes to course material, presentations, policies, etc.	The participant has a strong connection to their students, fellow GTAs, and faculty. The participant sees their program as a community.
Middle	Teaching is something the participant enjoys doing, but does not necessarily want to be doing it for a future career. The participant sees being a teacher as important to who they are, but it does not define who they are.	The participant is knowledgeable about teaching, but often doubts themself. While the participant knows the material through studying it or through other means, the participant often questions their knowledge and do not always feel comfortable.	The participant often has little control over the actual details of the course, but justifies why that lack of autonomy is acceptable given outside constraints. The participant may have control over one aspect of the course.	The participant has a strong connection to one or two of their main contact groups, but does not have a strong relationship with all parties involved in a FYEP.
Low	Teaching is something the participant is just doing. The participant does enjoy teaching, but does not see it as part of their future career.	The participant is ill prepared for teaching or does not believe they are prepared. The participant's actions indicate they do not learn the necessary information needed to be a successful GTA.	The participant has little control over their course and is unhappy with their situation. The participant desires more control and often complains about their responsibilities.	The participant does not have a strong connection with their colleagues or their students. The participant often views teaching just as a job and keep all relationships very professional.

This table highlights the various experiences that were represented in the data. For the most part the rankings I gave the participants mapped back to the rankings they gave themselves allowing for slight adjustments. For example, I may have ranked their identity as transitional, but they ranked themselves as high. Due to the subjectivity of this analysis these slight differences were overlooked. All of the self-reported rankings aligned with my rankings except for two individuals in two different constructs. Those cases have been discussed in detail below to provide further information about why my ranking may not have aligned with their self-reported

ranking. It should be noted that while this comparison provided additional information about the participants, this work was ultimately guided by self-perceptions.

4.3.6.1 Sam

Sam was a first time GTA at U1 working on his Master's in electrical and computer engineering. His self-reported identity score put him into the strong identity category, but I would have rated him as having weak identity. I chose to rank him as having a weak identity because he enjoyed teaching, but he did not mention as it as something he would like to do in the future. For a future job, he stated consulting as something he would like to do. I believe that the difference between his self-report and my classification can be attributed to his passion for teaching, but minimal experience in it. Being a first time GTA, I believe that he likes what he is doing, but really does not know what he wants to do in the future.

4.3.6.2 Roberto

Roberto is also a first time GTA in a FYEP, but he had previous teaching experiences. He was working on his PhD in civil engineering at U4. The mismatch between his self-reported ranking and my ranking was in reference to the relatedness construct. He rated himself as having high relatedness, but I would have ranked his relatedness as low. I believe this is mostly attributed to his personality. Based on his interview, Roberto seemed to be a quiet and introverted person. For him, the relationships he has with his students and his colleagues may indeed be strong compared to other relationships he has. Compared to other individuals though, his views on relatedness and interactions with those involved in FYEPs are weak.

4.4 Summary of Results

The results presented in this chapter capture the complex interaction between identity and motivation for GTAs. Based on the qualitative data, there are seven unique factors that affect GTA motivation and identity. While each factor is concentrated into affecting one of the four constructs of this research there is overlap especially in the area of relatedness. From the quantitative data it is clear that the needs of GTAs as a large group are being supported in FYEPs, but when those findings are explored in detail in the interviews, we see that the needs are supported in different ways for each GTA and that in some cases the needs are not being supported. This was best summarized by the use of profiles, lenses and filters. The findings suggest that to truly understand the experience of a GTA, you must examine the individual story and understand the nuances of the experience as each GTA is different. Even within the same

FYEPs, the GTAs who participated in this project had different experiences and expectations in terms of identity, competence, autonomy, and relatedness. The next chapter discusses these findings in relation to existing literature and provides recommendations for implementing the results.

CHAPTER 5: Discussion, Implications, Future Work, Conclusions

Based on the findings presented in Chapter 4, this dissertation study allowed me to answer the research question: *How do graduate students' motivation to teach and future identities as teachers develop when serving as GTAs in first-year engineering programs?* Through mixed methods analyses, I was able to identify the factors affecting the motivation to teach and teacher identity development of GTAs in FYEPs. In this chapter, I discuss the findings presented in Chapter 4 relative to the current literature and specifically with regard to PST and SDT. This chapter is organized around the four primary outcomes from this study as listed in Chapter 1 but detailed in Chapter 4 through the results. After a discussion of the outcomes, I explore the implications of the profiles, lens, and filters with regard to practice and theory. Finally, I present the conclusions from this research concerning GTAs in FYEPs and describe avenues for future work.

5.1 Discussion of the Outcomes from this Study

As identified in Chapter 1, there were four main outcomes for this research that stemmed from the different phases of the study. These outcomes contribute to both engineering education research and practice. Through this study, I:

- Identified and described seven factors affecting motivation and identity development while exploring the relationships between the factors through the perspective of GTAs,
- Developed and tested a survey to measure GTA motivation to teach and identity development as a teacher,
- Developed and tested a theoretical model that combines the constructs of motivation and identity with regard to GTAs, and
- Compared relevant motivation and identity factors to create a set of teaching profiles that help categorize GTA experiences.

The following sections are organized around these four outcomes where a discussion is provided about how the outcomes are consistent and/or expand current information available in the literature.

5.1.1 The 7 Factors Affecting Motivation and Identity Development

Through the analysis of the qualitative data and supplemental analysis of the quantitative data, seven factors (including four sub-factors) were found to affect GTA motivation to teach

and identity development as a teacher. Those factors, listed, in Table 14 Chapter 4, included training, previous experiences (as a student and teacher or mentor), appointment structure, students, teaching colleagues (fellow GTAs and faculty), future careers, and role dominance. The factors were each found to have a different impact related to one or more of the four main constructs of this research (competence, autonomy, relatedness, and identity). In the following sections I interpret these factors separately, but within the context of the current literature available related to SDT, PST, GTAs in engineering, and teaching in general.

5.1.1.1 Training

All of the GTAs who participated in this study, both through the qualitative interviews and quantitative survey, discussed different types of training available and required in their FYEPs. The most common type of trainings, looking at both data sets, were university-wide one-time training for GTAs typically administered through a teaching and learning center and weekly trainings facilitated by FYEP staff. As shown in Chapter 4, training mattered to GTAs in FYEP because it served as a means for gaining knowledge about teaching contributing to their perceptions of competence. My research findings are consistent and expand current literature.

University-wide GTA training has been identified as a common approach to training GTAs in higher education and I argue this can be likened to a form of competence support. In Chapter 2, I discussed the need for GTA training in the engineering education context, but this need for GTA training is also prevalent in higher education in general further demonstrating how the findings from this research are consistent with current literature. For example, Kenny (1998), on behalf of the Boyer Commission, wrote a call to action to improve higher education that included increased GTA development and training in general. In the follow-up to the first report, it was noted that 70% of research universities provided mandatory initial training for their GTAs (Kenny, Thomas, Katkin, Lemming, Smith, Glaser, & Gross, 2001). However, my study also extends this trend to 2012 by demonstrating that almost all of the GTAs interviewed and surveyed mentioned university-level GTA training. Moreover, my study expands the literature by showing that this type of training is not only popular but is beneficial to teacher motivation because it supports the need for GTA competence. While no studies could be found that directly link training to supporting the need for competence with SDT or teacher literature, it seems appropriate to view the two as linked in that training can support knowledge acquisition and having knowledge is an aspect of teacher competence. Through my research, the two were

found to be directly linked. The connection between training and competence is therefore an additional contribution to the literature.

Beyond one-time university-training, a unique finding for my study compared to the literature was that weekly training within the FYEP was something almost all of the GTAs reported as supporting their competence. A nearly 20-year old study by Torvi (1994), attempted to describe the GTA training in engineering. His work revealed that little to no training existed for GTAs in engineering. My study demonstrates a significant shift in training frequency by demonstrating that most GTAs receive weekly training. Moreover, combined with more recent studies which document specific training programs developed for GTAs (opposed to the broad survey of the field conducted by Torvi (1994)), my study suggests a higher quality of training focused on content and pedagogy. For example, the work by Mullin, Lohani, and Lo (2006) documented a training program in a FYEP that included a weekly training meeting that was similar to the training discussed by my interview participants. In the work described by Mullin et al. (2006), GTAs met weekly to discuss upcoming lectures, lab or workshop materials, and general course issues. Additionally, Nicklow, Marikunte, and Chevalier (2007) documented a reoccurring training in civil engineering that was more focused on pedagogy and professional development. In that weekly seminar series, "the program focused on those unique skills that are especially important for engineers and engineering educators" (Nicklow et al., 2007, p. 90), and included topics such as ethics, grading, teaching a lab, and PowerPoint. The two programs discussed above serve as examples of supplemental weekly training beyond the typically one-time university level training required by many GTA appointments. In addition to describing the training programs, the two studies discussed above (Mullin et al., 2006; Nicklow et al., 2007) assessed students' perceived usefulness of the various trainings. However, research was not conducted to better understand the long term impacts for the GTAs or their students. Also because the studies focused on a single program they did not offer insight into widespread adoption of training. In fact, no current studies could be found that measured the longer-term impact or adoption of weekly trainings. My research takes a step towards filling that gap by understanding the experience of GTAs in a variety of programs and how training is impactful with regard to motivation and identity. In future work, a truly longitudinal study will provide more insight into this area of research.

My research is consistent with studies that show university wide training is a staple in GTA preparation and with studies that describe weekly training that includes both content and pedagogy. My work expands the literature by extending the trend to increased frequency of university-wide training and documenting the widespread nature of weekly training in FYEPs. This is also directly linked to motivation which as a whole has been under researched for GTAs.

5.1.1.2 Previous Experience

In this study, past experiences both as a student and as a teacher impacted competence. Those participants with past experiences seemed to have greater satisfaction of their need for competence than those without prior experiences to draw upon. The importance of past experience was observed in the qualitative data, but many of the survey participants also reported past experiences specifically related to being a teacher. This finding supplements past studies related to previous experiences and competence.

Directly related to competence and past experiences, the work by Prieto and Altmaier (1994) found that for GTAs from a variety of disciplines previous teaching experiences had a significant positive correlation to self-efficacy which is directly connected to competence. Expanding on the discussion of competence in Chapter 2 that aimed to define and operationalize the construct, I expanded by review of the literature in this discussion to include the idea of self-efficacy. Ryan and Deci (2000a) use the terms competence and self-efficacy together in their discussion of SDT. Generally speaking, self-efficacy is the belief in one's ability to apply knowledge while competence is more focused on having the knowledge base. Since Ryan and Deci (2000a) connect the two terms, it is appropriate to say that Prieto and Altmaier's (1994) work regarding past experiences and self-efficacy can be interpreted to mean that past experiences also affect competence. My research echoes the findings of Prieto and Altmaier's (1994) in that I found past experiences to be a factor affecting competence. Also, moving beyond the factor to the lenses, the GTAs in the middle competence lens who often had little to no past teaching experiences had low feelings of self-efficacy reporting that they had the knowledge needed to be a GTA but were unsure about their abilities. This directly matches the findings of Prieto and Altmaier (1994) where past experience affects self-efficacy and therefore competence. Overall, these findings are consistent with the findings in the current literature, but expand the findings in that previous experience has now been found to directly affect competence.

The importance of past experiences was also present in the work by Hong and Greene (2011) that used PST to understand the views of pre-service teachers as they examined the pre-service teachers' future possible teacher selves. Their work revealed that past experiences teaching and being a student (both of which were found to be factors in this dissertation study as well) greatly impacted the view of the pre-service teachers' future selves when compared to their teacher preparation programs (i.e., their past experiences had a greater impact than the training program in terms of considering their future teacher selves). While the program taught the teachers about teaching, their views of teaching and who they wanted and did not want to become were directly influenced by past experiences rather than the training they were receiving. While this does not directly relate to competence and past experience as that was a major finding in my research, it does point to the importance and power of past experiences for GTAs and even the strength of past experience on identity which was not directly observed in my work. For future research, I hope to further explore past experiences supporting competence but to also examine the connection between those items and identity. In summary, my research expands the work by Hong and Greene (2011) by supporting their finding that past experience is important, but my research also expands their work in that I found past experiences to contribute to competence as well.

Based on the two studies above and the findings in this research, past experiences both as a student and as a teacher can impact GTA competence and even identity (e.g., future possible teacher selves) although that element was not directly observed in my research. The results of my research support and expand past studies that document the impact of past experiences and their connection to competence.

5.1.1.3 Appointment Structure

Whereas the first two factors related to competence, the third factor, appointment structure, was the most important factor identified in this research for determining whether or not the need for autonomy was being supported. Appointment structure means the requirements of the GTAs teaching appointment or, in other words, the responsibilities given to the GTAs for their job as perceived by the GTAs. This included the activities they were assigned to do (e.g., grading, curriculum development, office hours, etc.), but it also included the overall structure of the FYEP (e.g., mentoring UTAs in the class or working under the direct supervision of a faculty member). Based on the participants involved in this research, those who had some type of

autonomous responsibilities (i.e., where they were in charge of something ranging from grading to delivering lecture) reported higher perceptions of autonomy where those lacking responsibility did not report their autonomy needs as being met. This finding is reinforced when situated against the broader SDT literature.

Beyond the previously described literature demonstrating positive outcomes from perceived autonomy in Chapter 2, my study highlights the dual nature of GTA autonomy as GTAs are simultaneously both students and teachers. For the student perspective (i.e., GTAs are students themselves), past research has found that students who have autonomy supportive classroom environments where they are permitted and encouraged to make choices about their learning tend to be more motivated (Chirkov & Ryan, 2001; Rigby et al., 1992). For example, Roth, Assor, Kanat-Maymon, and Kaplan (2007) found that teachers who exhibit autonomous behaviors give rise to students who also exhibit autonomous behaviors. They found this to be directly related to increased motivation which connects to student learning. Specifically Roth et al. (2007) state that in their quantitative data "autonomous motivation for teaching was associated positively with teachers' sense of personal accomplishment" and that "autonomous motivation for teaching was positively related to students' perceptions of teachers as autonomy supportive and to students' autonomous motivation for learning" (p. 769). Thinking about GTAs as students, the findings from my dissertation parallel these results in that those GTAs who were given autonomous appointments had generally more positive views about teaching compared to their peers with less autonomy. This suggests that we should consider GTAs as students providing them with autonomous environments that will allow them to excel in teaching. Additionally, expanding the idea of GTAs as students to their impact on their own students, I suspect that increased GTA motivation would ultimately lead to increased freshman student motivation and hopefully learning. Additional work is needed to understand this phenomenon, as it is beyond the scope of this study, but it is an interesting point to make while connecting my research to the existing literature.

In terms of GTAs being viewed from the teacher perspective, autonomy was also found to be directly impacted by supervisors' (i.e., for this research faculty) support or lack of support (this also relates to interaction between autonomy and relatedness described in Chapter 4). This idea of administration affecting the autonomy of teachers directly matches the work of Lam, Cheng, and Choy (2010) who found that K-12 teachers' motivation is increased in environments

where their autonomy is supported by administration and the educational system in general. This also parallels the findings of Winters and Matusovich (2011) who studied engineering GTAs. They too found that faculty play a great role in GTAs' views of their autonomy and can encourage or discourage autonomous behaviors. With these findings and past findings from other research studies, it is then important to not only provide GTAs with outlets for their own autonomous activities but to also consider faculty working with GTAs and their impact on GTA motivation and identity. Again, for my research I did not directly measure motivation, but I did examine the need for autonomy which, based on the studies above, has been found to directly impact teacher motivation where administrators or faculty are key players in the interaction.

In summary, the findings from my research are consistent with past studies related to both student and teacher autonomy and motivation. In both this study and in the literature, autonomy supportive environments were found to play a key role in both individual motivations from the student and teacher perspectives. Matching past studies, my research also found that faculty or administrators play a key role in GTA autonomy. All of these factors should be considered when examining the GTA teaching experience. My study expands current literature by identifying the dual aspects of autonomy where GTAs are both students and teachers.

5.1.1.4 Relationships with Students and Colleagues

The qualitative and quantitative data in my study show that the people with whom GTAs interact and the types of relationships they have with those individuals have a direct effect on relatedness. Important relationships were found to exist with both students and teaching colleagues (both faculty and fellow GTAs) for GTAs. As discussed in the Chapter 4 findings concerning relatedness, these groups are the people who GTAs have relationships with, but these relationships move to factors because the nature of the relationship directly affects relatedness. While students and teaching colleagues had a distinct impact on GTAs, which have each been discussed independently below, the idea of a community also seemed to impact GTAs in FYEPs.

In the literature related to education and motivation, studies have found that being connected to the teacher helps a student be motivated (e.g., Hughes & Chen, 2011; Larose et al., 2005). The findings from my research expand those past studies by showing that when the teacher-student relationship is strong, the GTAs' need for relatedness is also supported which suggests they would be more motivated as well. As discussed in Chapter 2, there are not many studies that explore teachers' perceptions of relatedness. Because of that, the following example

is broad in that it examines the teacher-student relationship from the teacher perspective in general opposed to focusing on SDT. Demonstrating the impact of students on K-12 teachers, Martin (2006) surveyed over 1,000 teachers showing that student persistence and student planning directly correlated to teacher confidence in teaching. His work also indicated that student mastery orientation was strongly correlated to teacher enjoyment in teaching. While his work was not related to GTAs and focuses on confidence and enjoyment, it does demonstrate that the relationship between students and teachers is mutually affective where both parties react to the actions of the other. In my research, the relationship between GTAs and their students was a key factor directly affecting relatedness. This expands Martin's (2006) work that also showed that student relationships affect teachers (even though he did not examine relatedness specifically) opposed to teachers just affecting students.

In addition to the student-teacher relationship, there is also literature related to the impact teacher colleagues can have regarding relatedness. In general terms, these studies often find that stronger connections to colleagues lead to increased motivation (e.g., Klassen et al., 2011). Again, I did not measure motivation directly, but I did study the need of relatedness which is directly connected to interactions with teaching colleagues. For my research, the relationships with teaching colleagues include both fellow GTAs and faculty or instructors. Despite both being collegial, relationships between GTA peers and GTA faculty colleagues are different for GTAs. The current literature regarding teacher relatedness does not parse out these different relationships for GTAs so the findings from my dissertation expand the current literature related to teaching colleague relatedness. GTAs being both teachers and students have unique relationships that need to be managed.

While the individual relationships GTAs have with students, faculty, and fellow GTAs discussed above differ, they all impact the overall sense of a community in a FYEP which was discussed to some extent in Chapter 2 but is expanded upon here. While not directly examined in this research, one approach to further understanding these interactions would be to use a community of practice (Wenger, 1998) to view a FYEP. In a community of practice, according to Wenger (1998), members share in a joint mission, shared knowledge, and engage with one another. This idea of a community of practice was demonstrated by the work of Crede et al. (2010) with GTAs in engineering. While their work was situated in the community of practice literature opposed to the SDT literature as my dissertation was, it demonstrated the community

and support that can be built specifically with GTAs in engineering through this model. Again, while this was not directly researched in my study, my findings complement the importance of community or relationships for GTAs in engineering. For my research I chose to take the relatedness perspective, but a community of practice would be used in future research.

The relationships GTAs have in FYEP are multi-faceted. They involve students, fellow GTAs, and faculty or instructors that all support or thwart the need for relatedness. With this in mind, it is important for FYEPs to focus on bringing these various groups together to build a sense of community to not only support their GTAs' needs, but also the needs of faculty and students.

5.1.1.5 Future Careers

For the GTAs in this study, a range of future careers were listed both involving and not involving teaching that directly related to the identity construct. The notion of future careers is something that has been explored in PST literature, but it usually relates to K-12 students' views to the future in the literature (e.g., Kerpelman, Shoffner, & Ross-Griffin, 2002; Packard, & Nguyen, 2003). Moving out of the K-12 scope, Hong and Greene (2011) explored the details of a future career for science teachers because there was a high attrition rate in this field. They hoped to better understand pre-service science teachers' hoped and feared selves in the workplace to better prepare them for their upcoming careers. While their research focused on one future career, through my research and understanding of what the future selves of GTAs are with regard to teaching, I too hope to better prepare GTAs for their future careers in teaching or other fields. This idea shows that my findings expand the current literature by examining the future careers of GTAs in engineering which has been under researched.

The idea of future careers was also a key point in the dissertation work by Winters (2012) who examined the early career choices of undergraduate engineering students. Initially upon identifying the factor of future careers, I searched the literature for studies directly related to GTAs in engineering. Due to the limited nature of research available about GTAs in engineering, I widened my scope to review past studies related to career choice in engineering in general. Upon doing that, I came across Winters (2012) work, and while her research specifically looked at those who completed an undergraduate degree in engineering, opposed to GTAs, her research revealed that there are variety of future career options to engineering students and that many factors influence their career choices and goals (e.g., economy, family,

interests, etc.) which related to my findings. Winters' (2012) findings matched the finding from my dissertation work related to future careers (i.e., there are a variety of future careers for engineers) even though we studied different populations (i.e., this expands the results with a new population). Based on these results, participating in teaching as a graduate student can open additional future careers for GTAs that may involve teaching.

The idea of a future career was a factor that directly related to identity. In my data there was a mix of future careers which has also been seen in other research. Also similar to other research, I hope to use findings related to future careers to better prepare GTAs for their future careers both within and outside teaching.

5.1.1.6 Role Dominance

All graduate students, whether they are GTAs or not, balance a variety of roles in their everyday lives that directly contributes to their identity. These range from student to researcher to, in the case of GTAs, teacher. All of these roles are important to a successful graduate career. A key feature of my research is the demonstration that these roles can often be competing where one role dominates over another. Specifically, I found that the roles of student and teacher were often at odds and that the roles of teacher and engineer were often competing. This result itself is not surprising as PST suggests that people have both desired and feared future selves. However, the interaction between roles and identities is less well-understood specifically with regard to GTAs. Looking outside PST literature to make sense of this finding, I found that others have examined the balance and shift between various roles in higher education (e.g., Harrison 2008; Louis & McNair, 2011; Winberg, 2008).

Though the specific roles are unique to engineering education, the idea of role dominance is supported in existing literature. Harrison (2008) studied his own development from student to researcher in the field of counseling through self-reflection. In his narrative analysis, he discovered the key role that a research superior plays in mentorships and preparation for identity development as a researcher and scholar in that they can help facilitate and support the transition. Shifting roles or transition is an important part of being a GTA; GTAs are constantly in a transitional stage balancing both their role as a student and a teacher. To complicate the matter, GTAs are also balancing their researcher role which in many cases occurs independently of their teaching role. With this variety in responsibilities, it is not surprising that the GTAs in my research reported one role dominating over the others in difference situations. The work by

Harrison (2008) and the findings from my study parallel each other showing consistencies between the findings in that graduate students experience role shifts that must be managed for success.

In work that is similar to my research, Winberg (2008) studied Master's level student lecturers in engineering pursuing a degree in engineering education. Her work revealed that the identities of these individuals are multi-faceted and that the process of shifting from an engineer to an engineering educator is different for each person, but that they share common stages of development. Through this shift it is expected that GTAs would question and struggle with their engineering identity and their teacher identity. I also saw this in my research especially in the transitional teacher identity profile. My work complements Winberg's (2008) by providing insight into the shifting roles and identities of students teaching in engineering.

Due to the various roles that GTAs, or any graduate student for that matter, are required to balance, it is no surprise that some roles dominate over others directly affecting their identity. To ensure that GTAs manage these roles effectively, supervisors and trainers must be aware of the roles and support GTAs in their professional development. This is future discussed in the implications section of this chapter.

5.1.1.7 Summary of Discussed Factors

Through my research I identified seven factors that affect the motivation to teach and identity development of GTAs. It should be noted that, for the most part, my findings are either consistent with the current literature (i.e., my findings parallel those of other researchers) or expand the current literature (i.e., relate to past findings but provide additional information). None of my findings contradicted current literature which is expected given the limited information available related to GTAs in engineering. Table 26 below summarizes how the factors contributions to the existing literature.

Table 26: Summary of Factors Related to Literature

Factor	Contribution to Literature	Topic in Literature
Training	Consistent With and Expands	GTA training is commonly onetime university-wide training, but it is increasing
	Expands	Training directly affects GTAs' competence
	Consistent With	FYEPs have weekly training
	Expands	This research is the first step towards longitudinal broad impacts of training including widespread adoption of weekly training
Previous Experience	Consistent With and Expands	Past experiences relate directly to self-efficacy and therefore competence
	Area for Future Work	Previous experiences can affect identity
Appointment Structure	Consistent With	This research is the first step towards linking GTA motivation and student learning
	Consistent With	Supervisors' support of autonomy can lead to increased motivation
Relationships with Students and Colleagues	Expands	Students also affect teacher relatedness and motivation
	Expands	Relationships with fellow GTAs and faculty are different
	Consistent With	A sense of community is important
Future Careers	Expands	This research helped in understating the future careers of teachers
	Consistent With	Engineers have a variety of future careers
	Expands	This research helped in better understanding GTAs in engineering
Role Dominance	Consistent With	Graduate student have a variety of roles that often compete

While the context of GTAs in FYEP might be new, there are programs that have been developed that we can look to, to help guide FYEP improvement that target GTAs. The points made above related to the factors are expanded upon in subsequent sections as implications. The implications have been organized relative to the profiles, lenses, and filters as those were the main products of this research.

5.1.2 The Survey

The second important outcome from this research was a survey instrument that could be used to measure factors relative to GTA motivation for teaching and teacher identity

development. The survey was designed based on the Phase 2 interviews and past SDT and PST scales. It included both open ended and closed ended questions designed to elicit a variety of responses from GTAs about their teaching. Since this survey is the first of its kind regarding GTA motivation and identity, the discussion below focuses on applications instead of direct connections to findings from other instruments. Specially, the survey will be beneficial to (1) those involved in hiring and training GTAs and (2) researchers using SDT and PST to study teachers.

First, in terms of a practical discussion of the use of the survey, the survey developed out of this research could be used to evaluate GTAs' perceptions of competence, autonomy, relatedness, and identity. Currently, no such survey could be found in the literature so creating the survey in and of itself is a direct contribution. Practically speaking, the survey could be revised and used as a hiring tool where the importance of the constructs could be evaluated to understand the interests and future aspirations of potential GTAs. This would allow FYEPs to hire GTAs who are already highly motivated when it comes to teaching and those who identify with being a teacher. I propose that this survey could be used a hiring tool, along with the standard interview, as a way to gather more information about potential GTAs opposed to using it as the only criterion for hiring. If used as a hiring tool, modifications would need to be made to the instrument because it currently assumes a GTA has teaching experience. Initial modifications would include:

1. Increasing the focus on PST as that would help in understanding a GTA's goals and aspirations. Additionally, these questions directly relate to identity which was determined to be the most salient factor for determining the clusters so gathering information about this construct early could help with understanding future GTAs' perspectives on teaching and ultimately training needs (please refer to Section 5.2 for more information regarding the implications of the identity profiles).
2. Adapting questions to the hypothetical to understand what types of environments the GTA believes would be best for their needs. This adaptation would be challenging because some GTAs may not know what they need to be successful in this role if they have never taught, but since they have been students, I believe they can speculate what environments support their identity and motivation in general terms. These findings could then be translated as a starting point for what they need as a GTA (i.e.,

do they like to work alone or in a team – this would tie into relatedness and could be a point used to tailor GTA appointments).

3. Including more open ended questions to allow the participant to share their own perspective on past teaching and learning experiences. This would be important for new hires because, again, even if they have not taught before, they can draw upon other experiences for their GTA role (which was identified as a factor directly affecting competence in this work).

These types of modifications could allow the tool be used in hiring and to gather baseline information about GTAs. The baseline information would serve as a starting point and could be used to understand GTA development overtime for targeted training (i.e., those with low competence ratings might be given different training than those with high competence ratings in the beginning). Subsequently, the survey could be adapted and used to monitor GTA development both in terms of motivation and identity to ensure that all the GTAs are having their needs supported throughout their teaching appointments opposed to just at the start of the experience. This type of assessment would allow real-time changes to be made to programs helping to support GTAs individually based on their unique needs. Minimal modifications such as wording adjustments would be needed for this type of application as the tool is already situated for this timeframe (i.e., currently teaching). This type of information would be valuable in terms of targeted training based on GTAs developmental phases and changes both initially and overtime.

In terms of the theories that guided this work, the survey provides the application of the frameworks in a new setting both through the findings which were discussed in the sections above in detail and the adaptation of existing instruments. As discussed in detail in Chapter 2, little to no work has examined the motivation and identity development of GTAs in FYEPs. The survey developed out of this research directly contributes to the literature through the adapting of existing instruments. As discussed in Chapter 3, the SDT portion of the survey built on the Basic Psychological Needs Scale and the Perceived Competence Scale, both of which are available at http://www.selfdeterminationtheory.org/. The adaptation of these existing scales contributes to the SDT literature with developed and tested questions that are appropriate for GTAs and others in teaching roles. In terms of PST, the adapted survey questions based on the Next Year Possible Selves interview questionnaire (Oyserman et al., 2004) provide items that can be used by others

to again obtain information about GTA future possible selves or the future possible selves of others in teaching roles. The findings from the survey and the interviews contribute to the SDT and PST as discussed in the previous sections, but the survey questions adapted from existing scales contribute as well providing a new context for the instruments.

One of the major outcomes of this research was the survey. It provided a tangible way to measure both motivation and identity from the SDT and PST perspectives. Above, the survey has been discussed in relation to its practical and theoretical uses. A discussion of theoretical model developed out of this research with reference to SDT and PST is provided below in Sections 5.1.3.1 and 5.1.3.2.

5.1.3 The Framework Situated in the Literature

The third outcome from this research was a unified framework to describe GTA motivation to teach and identity development as a teacher. The framework proposed in Figure 2 of Chapter 2 sought to combine SDT and PST in a meaningful way based on past studies and personal insight into identity and motivation constructs. While the results of this work cannot prove the model due to the exploratory nature of this research (a quantitative study possibly employing path analysis would be needed for that), the results can be used to further support framework development and the linking of motivation and identity. Based on the findings of my study, the model should be revised to the right hand image presented in Figure 8 where the model initially proposed in Chapter 2 is on the left:

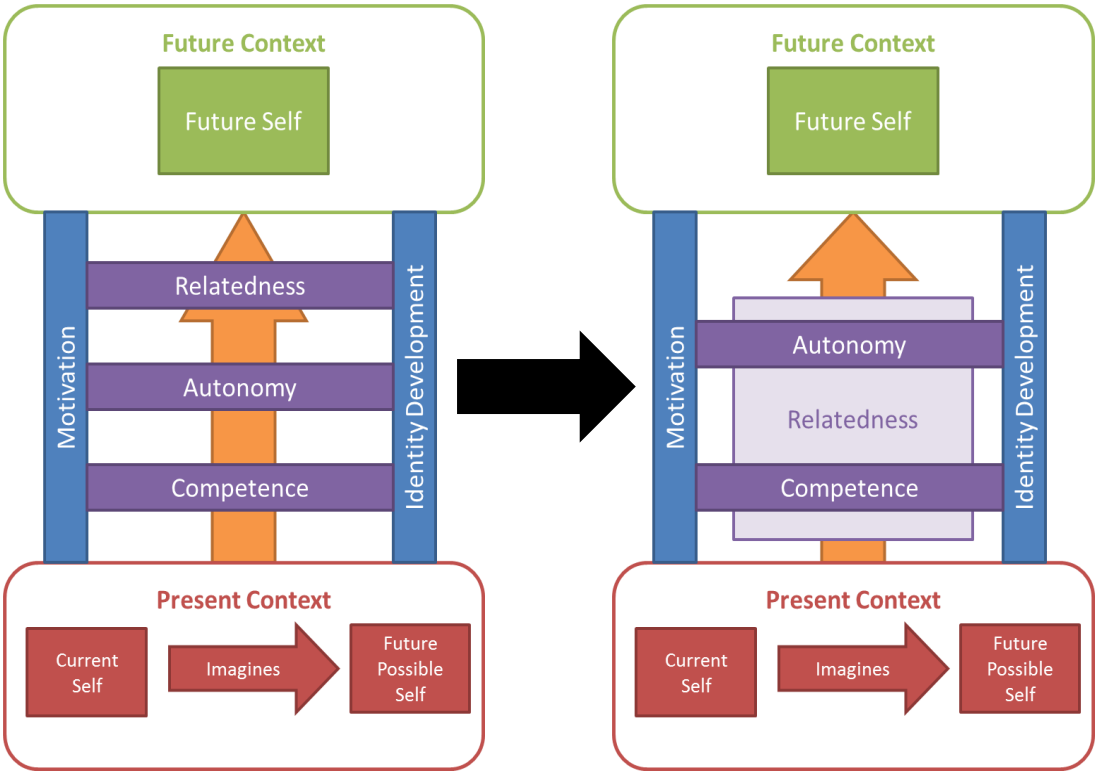

Figure 8: Revised Theoretical Framework

The main change in the model is to the relatedness construct. Based on the interviews and the survey data, relatedness seemed to be experienced in connection with competence and autonomy while competence and autonomy seem to be experienced more independently. As discussed in Chapter 4, I described relatedness as a filter opposed to a lens or profile to demonstrate the connection or interaction between relatedness and the other constructs. Also, the GTAs themselves reported that the components of relatedness fall within the other constructs (see Figure 7) opposed to the constructs being completely independent of one another. Future quantitative work will be needed to truly test this model confirming the hierarchical relationship between competence and autonomy and the interaction relatedness provides. These future tests will supplement the contribution this initial model already makes to both SDT and PST.

As with the original version of the framework or model, in the revised model identity serves as the foundational element and the motivation constructs are affected by moving through an experience to reach your future self. In this research, I did find that identity serves as the base for the experience (i.e., it was the most salient construct for determining the profiles), but I was not able to directly link or combine motivation and identity through my work. My research does support that there are some type of connections between the two constructs through my

qualitative coding analysis (i.e., when asked about motivation, GTAs often talked about identity items, and when asked about identity items, GTAs often talked about motivation components), but these are surface level findings. More work is needed to truly confirm the connections between motivation and identity as the two theories were most often viewed independently in my study. Nonetheless, I believe my work supports the continued joint examination of motivation and identity. Longitudinal research is also still needed to determine if the model is cyclical in nature or if through iterations it evolves. Below the impacts of the framework and the research findings in general have been discussed with regard to PST and SDT specifically.

5.1.3.1 Framework and Findings with Reference to PST

Use of PST in educational research started at the K-12 level to understand students' views of their ideal self in the future (Oyserman & James, 2011). My research (1) broadens the application of the theory beyond its original context, (2) focuses the theory on careers, and (3) further supports the use of the theory for not only identity but also motivational purposes. Through these three avenues, this research has made a significant contribution to PST as a body of research expanding what is already known about the theory.

Much of the early work related to PST focused on the K-12 landscape where early on researchers wanted to know how children who are in a prime developmental stage conceptualized their ideal self in terms of who they wanted to be like (Oyserman & James, 2011). According to Osyderman and James (2011) those initial studies focused more on "identifying *who* role models were rather than on the content and consequence of future identities" (p. 122). My research broadens or expands that initial perspective by applying PST to graduate students specifically focusing on their future possible teacher selves. Others have also used PST to study pre-service teachers (e.g., Hong and Greene (2011) who were previously discussed in relation to past experiences) and graduate students (e.g., Benishek and Chessler (2005) who were discussed in Chapter 2 as using PST to establish future researcher selves for counseling graduate students), but my work is unique in that it focuses on GTAs specifically in engineering. No research could be found that currently takes that perspective, therefore, my research expands past literature related to PST through the population I studied. It should be noted that while I did apply the theory to a new context, I also tried to keep the theory consistent with past uses as to not stray too far from the original purposes (i.e., my use still focuses on the principle of desired and not desired future possible selves).

Because my research focused on GTAs in FYEP, the responses to PST were more focused on future careers than on all future possible selves. Examining the Next Year Possible Selves interview questionnaire developed by Oyserman, Bybee, Terry, and Hart-Johnson (2004), the questions are intentionally broad to allow for reflection on a number of possible selves both positive and negative. For the GTA population in this research both in the interviews and the surveys, the reflection of participants were limited in terms of what they would share, but these bounded answers are somewhat expected. Considering the age of the participants and that they have chosen to pursue higher education, their focus on career is not unexpected. They have chosen to continue their education and most likely see a specific future career or field of work because of that. This restricted view demonstrates one of the challenges of using PST for this population and again expands current PST literature.

While PST was used as the identity theory and perspective in this work, it also supports motivation as PST has been used to study motivational orientation (Oyserman & James, 2011). In my research, the GTAs were asked to consider their future possible teacher selves which served as a source of not only identity development but also motivation to achieve the future desired self. This notion complements past PST work that also uses the idea of looking towards the future as a motivational influence (Markus & Nurius, 1986). Specifically with regard to PST and motivation, Hoyle and Sherrill (2006) studied college students finding that future possible selves can serve as a source of self-regulation which can affect motivation and behavior. This result also supports that this theory was an appropriate framework for this work that aims to document not only identity development but also motivation through an experience and visualization of a future teacher self. Additional research will be needed to see if this actual holds true for this population as it did for past studies.

The research presented in this dissertation connects to PST in three ways. It broadens the application of the theory to a new context, focuses the theory on careers, and supports the use of the theory for motivational purposes. These items allow my dissertation to not only provide meaningful findings to engineering education but to also contribute to the current body of knowledge related to PST.

5.1.3.2 Framework and Findings with Reference to SDT

SDT has been applied in a variety of contexts over the years ranging from healthcare and sports to education and family (Deci & Ryan, 2008). Each study has provided unique findings

that support the expansion of SDT. Below, I discuss (1) the framework and findings of this research in terms of broadening SDT as a field of inquiry, (2) how the findings of my work confirm past work related to SDT, and (3) the consequences of using profiles, lenses, and especially filters related to SDT. By examining each of these elements, I illustrate the contribution my dissertation is making to SDT.

My research falls broadly within the education category of past SDT research, but it provides information about the motivation of GTAs in FYEP which has not been studied with this theory. Most of the research related to SDT and education has focused on autonomous student environments and the roles that parents and teachers play in providing those environments to their students (Guay, Ratelle, & Chanal, 2008). Many of those studies report that autonomous supportive learning environments lead to gains in student learning and achievement (Guay et al., 2008). My research expands that area of work by studying graduate students and including a more in-depth investigation into competence and relatedness opposed to focusing on autonomy. This expansion contributes not only to engineering education research, but it also broadens the research using SDT in general. As stated above with regard to PST, despite using the theory in a new context, I did use the theory in ways that are similar to previous applications (i.e., I used the words supported and thwarted with reference to the needs because this is consistent with SDT literature).

A main finding of the SDT literature in education is that autonomous learning environments lead to gains in learning and achievement mainly in the K-12 scope (Guay et al., 2008). With additional research, that idea in SDT literature could be proven for GTAs and the college setting as well and that through this research, I have taken a step towards that goal. For example, in this study none of the interview participants who reported high autonomy reported low competence. Both are needs and one does not necessarily imply the other, but there does seem to be a connection between them in my data. This link relates to the notion of gaining knowledge in autonomous environments that could lead to competence (i.e., if you have autonomy, you are required to have competence). Again, more work is needed in this area, but with deeper investigation, I believe the trends that were observed for K-12 students mentioned above could be applicable to GTAs where autonomous environments would lead to gains in learning and achievement (i.e., competence) by GTAs and their students. Ryan and Deci (2000b) further support the connection between competence and autonomy when they stated

"people must not only experience perceived competence (or self-efficacy), they must also experience their behavior to be self-determined if intrinsic motivation is to be maintained or enhanced" (p. 58). Here they are supporting that the two constructs are directly connected, but they do not mention relatedness. Additionally, based on my literature review, relatedness does not seem to be researcher as often as competence or autonomy. Relatedness is something that is often discussed after these two needs in the theory which aligns with my research where relatedness was found to connect to both competence and autonomy as a filter. It is still a need, but it interacts with the other needs complicating the relationship between competence, autonomy, and relatedness.

Finally, the consequences of using profiles, lenses, and filters related to SDT seem to further support the theory and complement recent SDT developments. In SDT, "the needs for competence, relatedness, and autonomy are basic and universal, the individual differences within the theory do not focus on the varying strength of needs but instead focus on concepts resulting from the degree to which the needs have been satisfied versus thwarted" (Deci & Ryan, 2008, p. 183). This notion is echoed in my work related to competence, autonomy, and relatedness where the lenses and filters are classified as high, middle, or low indicating that the need is being fully supported (high), partially supported (middle), or not supported (low). The findings from this work uncover that each GTA's needs are met in unique ways also complements SDT where the needs are basic and universal, but they can be satisfied differently. I argue that the satisfaction of the needs of competence and autonomy are more independent, but through examining relatedness as a filter, the satisfaction of the need interacts with competence and autonomy. The importance and complexity of relatedness and relationships in general was recently explored in an article by La Guardia and Patrick (2008). In that article, the authors provide a review of past literature focused on SDT and relational processes recommending that additional research should be conducted that aims to understand the relationship between relationships and SDT needs. My work has taken a step towards meeting their recommendation by finding that the relationships GTAs have with their faculty, fellow GTAs, and students act as a factor for supporting or thwarting the relatedness need and that there is an interaction between competence/relatedness and autonomy/relatedness.

Additionally, recent work regarding SDT has proposed causality orientations that further support the use of profiles, lenses, and filters. This item was not initially discussed in Chapter 2,

but is further explained in relation to the findings from my dissertation research. According to Deci and Ryan (2008) "causality orientation are general motivational orientations that refer to (a) the way people orient to the environment concerning information related to the initiation and regulation of behavior, and thus (b) the extent to which they are self-determined in general, across situations and domains" (p. 183). This is similar to the profile approach in this work. The profile serves as the general orientation for a GTA based on his/her identity. The lenses and filters that follow better explain the experience of a GTA considering his/her competence, autonomy, and relatedness. This is similar to the strong autonomous orientation (satisfaction of all the needs), strong controlled orientation (partial satisfaction of competence and relatedness with thwarting of autonomy), and impersonal orientation (thwarting of all the needs) that have been discussed in SDT literature (Deci & Ryan, 2008). The lenses and filters proposed in this study provide a more detailed way to view these orientations where certain combinations would meet the orientations discussed above, but the other combinations would open up more possible orientations. Additional work is needed to fully vet this topic, but again, this research has taken a step to complementing this perspective in SDT.

SDT has been used as a motivational theory since the 1970s. Over the years it has been applied in a verity of contexts, and the research presented in this dissertation contributes to that overall body of work. The findings in this study both support past findings related to SDT, but they also push the theory into new domains.

5.1.4 Discussion of the Profiles, Lenses, and Filters

The profiles, lenses, and filters developed out of this work can be used by FYEP administrators, faculty, and even GTAs to understand the different experiences of GTAs in FYEPs related to competence, autonomy, relatedness, and identity. They highlight that while all GTAs are different in their identity and motivational needs, there are common trends that can serve to guide training and teaching appointments. To date, this approach to examining the GTA experience is new and therefore provides a new direction for considerations regarding the role and purpose of GTAs. To avoid duplication, the discussion of the profiles, lenses, and filters is situated in the following section regarding implications.

5.1.5 Summary of the Contributions of the Outcomes

For this study there were four distinct outcomes that were discussed in detail above. Table 27 below summarizes the outcomes and their contribution to both theory and practice.

Table 27: Study Outcome Contributions

Outcome	Contribution
Factors	Consistent with and expanded current literature (see Table 26 for more details)
Survey	Provided a tool to measure GTA motivation and identity for administrators
	Expanded the use of existing survey tools for researchers
Theoretical Model	Broadened the application of both SDT and PST beyond their original contexts
	Focused PST on careers
	Supported the continued study of both identity and motivation
	Confirmed past SDT findings specifically causality orientation
Profiles	Served as a source of implications for practice

5.2 Implications

In all research disciplines, the idea of research to practice where practice informs research and research informs practice is essential for continued improvement, but in engineering education this idea is extremely important as the discipline is still growing and developing directly out of practice (Jamieson & Lohmann, 2009). The implications presented in this section aim to meet this requirement where the findings from this study have been situated to supplement various changes and enhancements that could be made to GTA training programs and appointment structures. By making these types of changes, we can improve the programs GTAs participate in leading to an improvement in the quality of teaching through a focus on GTA motivation to teach and identity development as a teacher.

5.2.1 Profile Implications

The three identity profiles developed out of this work each have unique implications and applications that can be used in a FYEP context to support all types of GTAs. Each of the implication sections below provide concrete examples of things FYEPs can do to help support and encourage their GTAs and their future identity development.

5.2.1.1 Strong Teacher Profile Implications

GTAs associated with this profile want to teach and see it as a strong part of who they are. Many of them see their future careers involving teaching in some capacity. To support these individuals, programs should be developed that help foster advanced teaching experiences for these GTAs so they can continue to develop their skills as teachers. One such program may be a Preparing the Future Professoriate program where they take classes related to pedagogy and contemporary issues in higher education. If the GTAs are Master's students, they may also be

interested in PhDs in engineering education where they are able to further hone their teaching, but are also able to explore educational research.

I also suggest they be considered for advanced positions such as leadership roles, curriculum development, mentoring positions, etc. within their FYEPs so they can support the value of teaching in engineering in a unique way. With that said, not all strong teaching identity GTAs will be well suited for all roles so other characteristics (i.e., experience, personality, ambition, etc.) along with the strong teacher identity should be considered when making these appointments. Along these lines, as documented in Chapters 1 and 2, GTAs play a significant role in the education of engineers. Due to this responsibility, they should be given the opportunity to expand their interest and passion beyond their single classroom environment if they are interested. For example, by serving as a leader in some capacity, they are able to not only impact the learning of their students, they are also impacting the learning and development of their fellow GTAs and the FYEP. This impact is helping to contribute to improving the quality of engineering education as a whole. In K-12 teacher education, similar approaches have been taken where select K-12 teachers are involved in leadership roles to help with overall education reform at the school and district level (e.g., Kurtz, 2009; Wynne, 2001). I believe that those GTAs who have a strong teacher identity, may be ideal candidates for similar advanced positions with FYEPs. By incorporating GTAs into these types of advanced positions where they have the opportunity to have an impact outside of their class, engineering education as a field can continue to evolve with strong teacher identity GTAs leading the way.

In summary, the GTAs in the strong teacher identity profile serve as a valuable resource to the FYEP through their passion and long term interest in teaching. They should be given advanced teaching experiences to enhance their teaching knowledge and aid in the further development of engineering education as a field.

5.2.1.2 Transitional Teacher Profile Implications

GTAs in the transitional teacher identity profiles enjoy teaching but have not developed a strong identity as a teacher or are moving away from an identity as a teacher. Experiences should be given to these individuals that allow them to further explore what being a teacher means to determine is this is a future role that could work for them. To accomplish this, I suggest they be given various teaching responsibilities in the classroom ranging from lecturer to curriculum development to supervisor so they can fully explore teaching in multiple contexts.

Through this exploration they may be able to strengthen that teacher identity or they mind find a true calling in some other area. While strengthened their teacher identity is not necessary to their success, I believe it is important to move them out of the transitional group to help them better understand who they are and who they want to be.

Also mentoring may be appropriate for these individuals since they are in a transitional state and are balancing multiple roles aside from the teacher role which seem more prevalent or more of an issue in this profile than the others. All GTAs balance a variety of roles (Muzaka, 2009; Louis & McNair, 2011), but proper mentoring can help establish an appropriate balance. The mentoring could take the form of peer mentoring such as a cohort (e.g., Dorn & Papalewis, 1997) or the mentoring could be from faculty members (e.g., Roberts, Kemppainen, Hein, 2010). Either way, mentoring will help these students navigate this transitional period and hopefully strengthen or weaken their view of their teacher identity, again moving them out of the transitional phase allowing them to better understand who they are.

In summary, these GTAs have a passion for teaching, but for one reason or another, they question its value in their lives. GTAs that connect to this profile are the most venerable as they do not have a clear sense of what role teaching plays or will play in their lives. Through various teaching responsibilities and mentoring, they can be supported to work through this transitional stage.

5.2.1.3 Weak Identity Profile Implications

The GTAs in this profile ultimately have a life goal other than teaching and therefore have a weak identity as a teacher. However, they can be extremely valuable to the teaching team in a FYEP because they enjoy teaching and provide a unique application based perspective. These GTAs could provide real world applications of the course material since application in the real world is their passion and their true interest as they would like to pursue careers in mainly in industry. These individuals might best contribute to the overall mission of the FYEP by participating in projects that they find interesting aside from normal classroom routines such as designing class projects, speaking about the engineering disciplines, or even bringing their technical research into the classroom. By contributing in these ways their identity as an engineer is being supported but in a teaching context.

In terms of training, these individuals would benefit from discussions related to the skills developed while teaching that translate to other settings and general professional development.

While the skills they learn in a FYEP might be teaching focused, the leadership and communication skills they obtain will be transferable to any setting. By providing them with concrete translations for their skills, they will be able to see the value in their appointment even though it does not relate to their ultimate life goal or career. Additionally in terms of training, these GTAs would benefit from mentoring programs where their involvement could be observed by fellow GTAs and faculty to ensure they are still actively engaged in teaching. Based on the finding of this research, these GTAs do enjoy teaching but need an outlet for connecting their work more to their future aspirations. Through a mentoring program, I believe they will stay connected to teaching and excel in it, even if it is not their end goal after graduation.

In summary, the GTAs in the weak teacher identity profile serve as a valuable resource to the FYEP. They can assist in connecting concepts to the real world and can assist in the development of new technical labs and materials. To further enhance their experience, it is essential to remind them that the skills they are obtaining as GTAs are transferable. It should also be noted that these GTAs are extremely important to FYEPs because most of the students in the FYEP will go into industry type jobs so GTAs with industry interests can directly relate and connect with their students regarding future careers.

5.2.2 Lens and Filter Implications

For the lenses and the filter, the various implications have been based on the factors identified as affecting the constructs in Table 14. As with the implications related to the identity profiles, the findings are situated in FYEPs as that was the context for this research, but the implications may be applicable to other settings. Unlike the profiles, the implications for the lenses and filters may provide a means for a GTA to progress through the different groupings. The profiles are related to the identity of a GTA and directly map to future aspirations which may or may not include teaching. This situation means that GTAs may not necessarily move through the profiles, however, all GTAs could be in the high lenses and filter as it signals that their needs are being fully satisfied and supported which should be the main goal of all FYEPs with regard to GTAs.

5.2.2.1 Competence Implications

The two main factors identified as affecting competence were training and previous experience. Related to training, the weekly training that was cited as the most common type of training by the GTAs in this work should continue as it provides a venue for GTAs to learn a

great deal of important and directly applicable information. Additionally, I recommend that a department should offer engineering or even course specific training to supplement the training offered by the university about general teaching and pedagogy especially for those GTAs who had feelings of low competence. By supplementing that training, the importance of those topics can be reinforced and expanded, contributing to the competence of GTAs.

With regard to previous experiences, GTAs should be encouraged to pull information from their past experiences both as a teacher (if they have them) and as a student. These experiences can be a great source of information about content but also pedagogy. Additionally, thinking about past experiences, it is vital to understand that those GTAs who attended a different university for their undergraduate degree than the university they are currently teaching for have a lower initial level of competence compared to those to attended the same university in the two roles. Based on the findings from this work, I suggest that, if possible, those teaching at the same institution they attended for their other degree be paired with those who are new to the university. This way, the experienced GTA, in terms of the content and university knowledge, can serve as a source of information for the new GTA. If pairing is possible either in the classroom or through mentoring, I also suggest that those with any teaching experience be paired with those with no teaching experience. Again, they can learn from one another in this combination contributing to developing competence for the new GTA.

5.2.2.2 Autonomy Implications

The main factor affecting autonomy related to appointment or program structure. FYEPs tend to be large in size often requiring an army of instructors, GTAs, and graders which usually means that the material is fixed and pre-developed. If this is the case, GTAs should be given outlets for their autonomy that may include permission to alter slides, develop study guide materials or review sessions, or contribute to curriculum development. While all of the GTAs in this study who had low autonomy were from the same FYEP and were all engineering education students, they did have colleagues from the same program who were in the high and middle autonomy lenses. Those in the high and middle lenses were able to find outlets for their autonomy within the highly structured environment, while those in the low autonomy lens felt no control because they were not given those outlets early on. It is important for autonomous experiences to be given to GTAs early in their teaching experience to help in the development of their teaching motivation and identity. Specifically for the three GTAs who were in the low

autonomy lens and who were engineering education students, it is possible that they were more critical of their teaching situation because they have chosen to study education. Additional research is needed to truly understand if their experience is different than a GTA from a traditional engineering discipline, but the results of this work suggests that their need for autonomy may need to be met in a different way compared to other GTAs.

5.2.2.3 Relatedness Implications

There are many factors that contribute to a GTAs' sense of relatedness. The students, faculty, fellow GTAs, and even the program or institutional environment all have an impact. With this it is then essential to build relationships with all of these people in a FYEP. I suggest that the community of practice (Wenger, 1998) approach be actively taken in FYEPs. Crede et al., (2010) used a community of practice approach to study a teaching community of GTAs in engineering from a variety of engineering disciplines and found the community to be beneficial in professional development. Their approach could be used as a source of guidance for how this might be implemented in a FYEP. Specifically, in a community of practice, three things are needed. First, joint enterprise must be achieved through a shared goal (Wenger, 1998). For FYEPs this may be exposing freshman engineering students to the various fields of engineering, or it may be to teach them a specific programming language. Whatever the goal, everyone must be aware of the mission including the GTAs and the students. This shared mission could also support autonomy where everyone has a task and a shared drive to do their part. Next shared repertoire must be achieved through shared knowledge and resources (Wenger, 1998). This can be done through the mentoring discussed above where those with the knowledge share it with other or through training to bring in new knowledge and hone old skills. This also relates to competence where a shared repertoire helps to support the need for competence where knowledge is actively communicated and distributed. Finally, mutual engagement must be established where there are not just interactions between the various groups, but respect and understanding between the groups (Wenger, 1998). To do this, I again suggest a mentoring program between GTAs and faculty. This will allow relationships between these groups to be built. I also suggest that relationships with the students be developed where they feel they can approach their faculty and GTAs about the course and engineering in general.

5.2.3 Direct Implication for Stakeholders

In Chapter 1, four distinct groups of stakeholders were identified (the university, FYEP administrators, other engineering departments, and GTAs). For each of these groups, I have provided specific implications that are a result of this study. For the university, it is important to consider that graduate students are not only students but in many cases are serving as teachers. Since they are serving as teachers, it is important to ensure they are adequately prepared and supported for their teaching. If this is done, the quality of education at the university level can be improved as GTAs are not only current teachers, but are future faculty as well. For FYEP administrators, there are many direct implications. Broadly speaking, FYEP administrators should take the factors found in the study that contribute to motivation and identity development and make those the focus for GTA training and even hiring. Again, since GTAs are serving as teachers, it is essential to have highly motivated and identified teachers in the classroom because they have a direct effect on learning. To assist with training and hiring, I suggest administrators use the survey developed through this research to help benchmark and evaluate GTAs. This information can serve as a source of data for evaluation and hiring while I argue that it should not be used alone. For other engineering departments, their implications parallel those of the university and the FYEP administrators. They too should focus on the factors and use the survey to evaluate, but they should also look to hire successful GTAs as faculty to help improve the teaching in their departments. While research drives many universities or departments, especially at research intensive university which is where most FYEPs seem to reside, teaching is also an essential goal and should be valued as such. Finally, for GTA themselves, the implications are vast as they are directly impacted by the actions of the other stakeholders and this findings of this work. In terms of the findings, I hope they encourage GTAs to reflect on their teaching by understanding that each GTA is different in terms of his/her needs even in a highly structured FYEP. Directly from this work, GTAs can use the findings to self-assess their teaching and hopefully can use that information for professional development and improvement. While there are other stakeholders of this work, the four discussed above are the immediate stakeholders that have direct implications born out of the findings of this study.

5.2.4 Implications for Research

The research presented in this dissertation has the potential to affect individuals involved with GTAs and FYEP, but this work also has general implications for research which have only

been touched on above. Specifically for research there are three main implications. The first is related to theory. The theoretical framework developed for this work and then modified through the findings supports and expands not only the SDT and PST, but also theories related to motivation and identity in general. This work supports that the two constructs are indeed connected in some way and should be studied together for a holistic understanding on an experience. The second research implications relates to methods. This mixed methods multi-phased research can serve as an example of a mixed methods study where the data strands were mixed throughout the research. This approach allows the strands to strengthen one another, but it also allowed the analysis of one strand to impact the analysis of the other. For research, this study could serve as resource of a practical way in which mixing can occur. Finally related to implications for research, the profiles and survey developed out of this study could be used in future studies to gather data, group GTAs, or serve as a foundation for additional research related to motivation and identity. The research presented in this dissertation is multi-faceted and because of that the implications extend beyond the findings into research in general.

5.2.5 Summary of Implications

Being a research study focused on teaching practice, there are a variety of implications based on the qualitative, quantitative, and mixed findings. All of the implications begin to bridge the research to practice divide that is often present in educational research. Jamieson and Lohmann (2009) argue that for engineering education to succeed as a discipline and progress, research to practice and practice to research must be achieve. I believe that the implications discussed above related to the findings and the stakeholders help to address this issue.

5.3 Future Work

The future work for this study could take many forms. Some relate to expanding the findings with the given population in the FYEP context but others relate to expanding the findings to other areas of higher education. Both have been discussed below to provide a holistic view of areas of possible future work.

Within the context of this research, FYEPs, future work would first involve broadening the sample. Doing this would directly address the sample and scope limitations discussed in Chapter 3. This would require getting more FYEPs involved in the study, and ideally, those programs would involve common content based FYEP to begin with. This would help expand and confirm the findings beyond the interviews and survey responses gathered for this research.

Next, this work should also include other types of FYEPs including those that are discipline-specific or even success based courses. By including GTAs who work in these types of programs, I would be able to see if their experiences are similar or different in contributing to the knowledge based on GTAs in engineering. Additionally, once the sample has been broadened, I would like to conduct a longitudinal study of GTAs that would monitor their development over their graduate careers. This would allow further development related to the proposed cyclical nature of the theoretical model, and it would allow for a more in depth case study of participant experiences. Finally, another expansion to this work would be to change to the perspective all together looking at directors and supervisor views of GTAs and student views of GTAs in FYEP. This expansion would directly address the perspective limitation. In terms of the students' views of their GTAs, an initial step to extend this work would be assessing the quality of GTA teaching through the eyes of students using teaching evaluations. Given my research, I hypothesize that those GTAs with strong teacher identities would score higher in student evaluations. Additional measures of the quality of teaching could include observations, peer reviews, faculty evaluations, etc. Not only would these expansions provide a new perspective, they would also strengthen the need for this work in that identity and motivation are foundational to the quality of teaching and ultimately retention (see Figure 1). For this, I would initially draw upon the work of Cox et al. (2010; 2011) who developed an interactive computer based tool to evaluate GTAs called G-RATE. Their work is currently situated in the FYEP context so it would be appropriate to begin with their tool to assess GTA quality of teaching. Additionally, I would draw upon the existing work of researchers who have studied the various nuances related to student evaluations, quality of teaching, and grade influences (e.g., Zabaleta, 2007). This body of work would be essential to draw accurate and appropriate conclusions from future data regarding motivation, identity, and the quality of teaching as it provides perspective on student evaluations. All of the extensions discussed above would allow for a more holistic understanding of this situation so that the motivation and identity of GTAs can be better developed within this context.

This work could also be expanded beyond the FYEP context all together. First, this research could look at the motivation and identity of GTAs teaching in higher-level discipline-specific engineering course such as statics, dynamics, or technical electives. Additionally, this study could be extended even further to include disciplines other than engineering to understand the GTA experience as a whole as GTAs are used in a variety of programs and disciplines.

However, this expansion would need to consider the unique epistemological and disciplinary differences of the new contexts. Such differences might include overall views on learning, typical pedagogical approaches, and even, career-related expectations. All of these would impact GTA experiences and subsequently their motivation and identity. As a comparative case, consider English, which is another discipline that, like FYEPs, often has a format where all students must take a common course to develop baseline level information about a subject. Whereas English classes often focus on reading, writing, and interpreting texts such that there can be multiple meanings, engineering tends to focus on procedural and conceptual knowledge through problem-sets in a way that focuses on singular or "best" answers. While both approaches are evidence-based, with data (or evidence) coming from the text or context of the problem, English might be more likely to be structured through discussion and writing vs. lectures and practice problems in engineering. These examples of different approaches to teaching and learning would likely result in different responsibilities for GTAs in different programs. With regard to career expectations, consider differences in faculty roles (while not the only possible careers for graduate students such a possible future role is common across both disciplines). In engineering in higher education, many faculty have organized research laboratories funded by research grants, and in turn, they fund graduate students to help with research. In English, like many other humanities, research is often an individual effort and may or may not be substantially funded through outside sources, and it is not necessarily the norm to fund graduate students through research positions. Disciplinary norms with regard to roles of graduate students could also significantly impact GTAs' motivation and identity development. Capturing such differences in expansions to my research would require revisions to the instruments to align with different fields, additional pilot testing, and a reconsideration of the findings within the new landscapes. Using the example of assignment format discussed above, one modification to the survey for GTAs in English would be to ask about the various assignments they give their students and their approach to grading. This may require the survey questions related to time spent on activities to be modified to be more inclusive of activities in the new context. The value in extending the effort to evaluate this survey instrument in different disciplines is two-fold. First, disciplinary specific information could be useful to each discipline. Second, through considering the disciplinary differences and similarities, I would be able to see if engineering has unique circumstances and challenges that affect experiences or if the

experiences of engineering GTAs are common to all GTAs. These types of findings would also help in further developing and testing the framework used in this research.

Beyond GTAs continuing with the need to further test and develop the model, I would like to expand this research to early career faculty and students to see if the model holds true for those populations or if it requires changes to accommodate their unique needs. Initially, I would focus these studies on the SDT components of my work moving PST to the background as there is a great deal of complexity with SDT alone that needs to be further examined and developed. Additionally, identity was found to be the most salient construct for determining the profiles so progress was made in understanding that construct, but since no distinct patterns were observed between the identity and motivation or even within the motivation constructs themselves, more work is needed to understand the nuances of motivation for GTAs. Through further investigation into the motivational aspects of being a GTA through SDT, I believe motivational patterns may emerge which will provide additional avenues for continuing the investigation of the intersections of motivation and identity.

All of the expansions above would help to confirm and further expand the findings in this work in addition to addressing all three of the limitations discussed in Chapter 3. The expansions would contribute to the understanding of GTAs in general helping to build the literature on this understudied population in higher education while contributing to the broader discussion of motivation and identity in education.

5.4 Conclusions

GTAs are a vital component to higher education. Past studies have examined various programs developed for GTAs, but little to no work currently exists that studies GTAs' personal experiences especially in engineering. This study fills that gap by understanding the GTA experience in FYEPs by focusing on their motivation and identity as those are fundamental to how we act and who we are. Based on the results of this work, GTAs experience FYEPs in very different ways regardless of program. These experiences related to identity, competence, autonomy, and relatedness were best summarized in my research as profiles, lenses, and filters. To ensure change and progress in FYEPs, I urge program directors and administrators to use the outcomes of my research to take a more individualized approach to GTA experiences. In K-12 and higher education, we have moved from a teacher-centered approach of instruction to a

student-centered approach in many cases. While GTAs are teachers, they are also students and deserve similar considerations in their development.

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APPENDIX A: **Phase 1 Codebook and Sample Quotes**

Survey 1

1. What motivated you to become a GTA?
    a. Competence
        i. Gaining Experience
            1. *(becoming a GTA to have the opportunity to teach)*
            2. "I had not previous teaching experience and thought through a GTA I might achieve this experience." [1]
        ii. Previous Experiences
            1. Personal Experiences
                a. *(past personal experiences that GTAs could look to for information about how to be a GTA)*
                b. "I had a bad GTA my first semester and a great one my second semester in two sequential classes. I saw the differences and saw how well having a good GTA can help you in a class." [4]
            2. Professional Experiences
                a. *(past professional experiences such as being a UTA that GTAs could look to for information about how to be a GTA)*
                b. "I was a UTA for 3 years." [2]
    b. Autonomy – No items could be found that fit autonomy.
    c. Relatedness
        i. Student Interaction
            1. *(GTAs liked interaction with students)*
            2. "I really enjoy interacting with the students and wanted to continue supporting the […] program." [2]
    d. Other
        i. Funding
            1. *(a reason for being a GTA was to pay for their graduate studies)*
            2. "Opportunity to pay for my studies..." [20]
        ii. Enjoyment or Interest
            1. *(GTAs expressed an interest, joy, or happiness when teaching)*
            2. "I really enjoy teaching." [15]
2. What is the most rewarding part about being a GTA?
    a. Competence
        i. Learning New Skills or Honing Old Ones
            1. *(being a GTA allowed them to learn something new or practice something they learned elsewhere)*
            2. "The most rewarding part of being a GTA is acquiring new and honing old social skills and one's discretion when it comes to evaluating work; to know what work deserves what grade…" [17]
    b. Autonomy
        i. Responsibility
            1. *(being a GTA means you a responsible for the classroom or course)*
            2. "Also, it [teaching] comes with responsibilities as well..." [1]
    c. Relatedness

i. Working with Students
    1. *(as a GTA you get to directly assist students)*
    2. "The most rewarding part about being a GTA is working with a student trying to solve a problem. It is a great feeling watching the student figure out the answer to their own question by just guiding them to the right answer and not giving them all of the answers." [2]
ii. Helping Students
    1. *(as a GTA you get to help students learn)*
    2. "Helping students understand a concept that they previously didn't understand." [8]

d. Other
i. The Ah Ha Moment
    1. *(a motivating factor for being a GTA is better to see students understand and grasp a concept)*
    2. "When a student understands a difficult problem and that 'lightbulb' goes off over their head!" [19]

3. What is the most challenging part about being a GTA?
a. Competence
i. Understanding Other's Competence Levels
    1. *(GTAs need to understand the knowledge level of their students)*
    2. "Being patient and not taking knowledge for granted. I've been solving these problems for years whereas these students are just learning the skills." [4]
ii. Knowing the Content
    1. *(GTAs need to know the material they must teach)*
    2. "In addition, sometimes I don't feel that I've been prepared well enough for some of the content prior to the quarter beginning, and I don't like to feel unprepared!" [23]

b. Autonomy
i. Lack of Control Over Material
    1. *(GTAs comment on not developing any of the course materials)*
    2. "For me it has been the teaching as well. I have no problem talking to an audience or delivering a message, yet having material that you did not created is hard to go over it and impart it. You have doubts whether something is important or not really important." [1]

c. Relatedness
i. Working with Non-Motivated Students
    1. *(GTA specifically comment on helping or understanding students who do not show an interest in the class)*
    2. "The most challenging part is working with students who don't care or don't want to be there. There aren't that many of them, but when you come across them it is difficult to deal with. " [15]

d. Other
i. Life Balance
    1. *(talking about various roles that GTAs have beside being a teacher)*
    2. "Having to teach AND do research AND take classes is murder" [14]

Survey 2

1. What motivated you to teach each week?
    a. Competence – No new items could be found that fit competence.
    b. Autonomy – No new items could be found that fit autonomy.
    c. Relatedness – No new items could be found that fit autonomy.
    d. Other – No new items could be found that fit other.
2. As of today, do you think you will be a GTA next year? Why or why not?
    a. Yes
        i. Prefer Teaching Over Research
            1. "Yes. I feel that I've done a pretty good job, I've already been asked back, and I prefer teaching over doing research." [4]
        ii. Enjoyment and Relatedness
            1. "Yes. I plan to continue being till I finish my PhD program. I love teaching and enjoy working with my coworkers." [7]
    b. No
        i. Research Appointment
            1. "Sorrowfully no, I have a GRA appointment. If not, I would be doing this for a while." [1]
        ii. Graduating
            1. "No. I am graduating this quarter and already have a job […]" [25]
3. As of today, can you envision yourself in a future job with a teaching role?
    a. Yes
        i. Faculty Member
            1. "Yes, I certainly see myself in some sort of teaching role in the future. Teaching is something that has always fascinated me. I have observed teachers consciously and sub consciously throughout my academic career all the time thinking how I would do things differently. In the future, I see myself working in academia, hopefully as a professor doing my research on the side." [12]
        ii. High School
            1. "Possibly, in the distant future, I can see myself teaching full time. If I were to teach, I would most likely teach high schoolers." [2]
        iii. Consulting or Training
            1. "Though I do not plan to be in academia in the future I would like to take up small teaching roles […] like consulting and training." [7]
        iv. After Retirement
            1. "Currently, I do not see myself teaching. I think this will change over a couple of years. I think I might come back and teach when I'm close to retirement. I could see myself teaching in a college or high school setting." [13]
    b. No
        i. Industry
            1. "No. As great as this was, I am ready for job in a civil engineering field." [25]
    c. Not Sure
        i. "Perhaps - haven't quite decided yet." [19]

Survey 3

1. Looking back on the term, what is one thing you would change about your teaching experience?
    a. Competence – No new items could be found that fit competence.
    b. Autonomy – No new items could be found that fit autonomy.
    c. Relatedness
        i. GTA Interactions
            1. *(expressed interest in working with other GTAs)*
            2. "More preparation with engagement with the class would be desired – in addition to interaction with other GTAs." [3]
    d. Other
        i. Program/Appointment Structure
            1. *(comments related to their appointment or responsibilities in the class that are concrete items such as giving lectures, grading, office hours, etc.)*
            2. "I would try to give more lectures." [8]
2. Over the course of the semester, did your motivation to teach change? Why or why not, and how?
    a. Increased
        i. Improvement
            1. "It improved greatly. After each lecture I found myself thinking on how I would provide the next lecture or how I could improve my teaching technique." [1]
    b. Decreased
        i. Personal Considerations
            1. "My motivation to teach did not change but my motivation to grade decreased as I moved closer to my own graduation." [8]
        ii. Stress
            1. "Yes, I felt overloaded and unappreciated by students..." [22]
    c. Unchanged
        i. "It did not. The goal I had at the beginning of the quarter was to have the students understand the topic as good as possible, and that never changed throughout the quarter." [25]
3. Overall, do you consider yourself a teacher? Why or why not?
    a. Yes – No new No new items could be found related to any construct.
    b. No
        i. Just a Peer
            1. "I do not consider myself a teacher. Teachers, in my opinion, are on a higher level than students. I like to act as nothing more than a peer with a wider knowledge base of the topic." [29]

APPENDIX B: **Pre-Interview Survey and Final Interview Protocol**

Pre-Interview Survey

Title of Research Study
GTA Motivation and Identity in First-Year Engineering Programs

Research Investigators
Dr. Holly Matusovich, Department of Engineering Education, Virginia Tech
Rachel Louis, Department of Engineering Education, Virginia Tech (Graduate Student)

I. Purpose of the Research
This study aims to better understand the teaching experience of graduate students involved in first-year engineering programs as they relate to their motivation and identity.

II. Procedures
My participation in the above-mentioned study will involve completion of an internet-based pre-interview survey (this survey) intended to capture basic information related to my teaching. The survey should take no longer than 10 minutes to complete. After the survey, I will participate in a phone interview where I will discuss my experiences teaching in a first-year engineering program.

The phone interview should take no longer than 1 hour to complete. With my permission, the interview will be audio-recorded and transcribed. I understand that I may withdraw from the study at any time.

III. Risks
The risks associated with participating in this research are minimal.

IV. Benefits
The risks associated with participating in this research are minimal and there are no known benefits to participants. The data collected from participants during this research will be developed into one or more papers for publication in academic journals or for presentation at professional conferences.

V. Extent of Anonymity and Confidentiality
All information collected will be kept confidential and accessed only by authorized researchers or interview transcribers who have signed a confidentiality agreement. To better preserve my privacy, a pseudonym will be used in place of my name. Any other information that could potentially identify me will be removed. The original data files (pre-survey responses, interview transcripts, etc.) will be archived until the Principal Investigator decides that they are no longer needed, at which point they will be destroyed.

It is possible that the Institutional Review Board (IRB) at Virginia Tech will view this study's collected data for auditing purposes. The IRB is responsible for overseeing the protection of human subjects who are involved in research.

VI. Compensation
I will be compensated for my participation in the interview with a $10 Amazon gift card.

VII. Freedom to Withdraw
My participation in this research is entirely voluntary and my refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled. Similarly, I am free to withdraw from this research at any time. If I choose to withdraw from the research, any information about me and any data not already analyzed will be destroyed. I am free to choose to not answer any question, or to not complete any activity, and this choice will involve no penalty or loss of the above-mentioned benefits.

VIII. Participant's Responsibilities
I voluntarily agree to participate in this research. This phase of the study involves the pre-interview survey which should take no longer than 10 minutes to complete and the phone interview which should take no longer than 1 hour to complete.

X. Participant's Permission
I have read and understand the Informed Consent and the conditions of this research. I hereby acknowledge the above and give my voluntary consent as indicated below:

Please check all of the appropriate boxes...

- I do not wish to participate. I do not consent to participate in this study. Please do not read any further. Thank you for your time and consideration.
- I wish to participate in the pre-interview survey (this survey).
- I also wish to participate in the phone interview. I consent to being interviewed and audio recorded.

I have read the above and give my consent to participate in this study.

Please provide your full name below...
Email address...
Telephone number for interview...
Today's date...

If I have any questions about this research or how it is conducted, my rights as a participant, or whom to contact in the event of a research-related injury to me, I can contact:

Dr. Holly Matusovich, Co-Investigator (540) 231-4205 matushm@vt.edu
Dr. Stephanie Adams, Department Head (540) 231-6555 sqadams@vt.edu
Dr. David M. Moore, Chair, Virginia Tech Institutional Review Board for the Protection of Human Subjects
Office of Research Compliance
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, VA 24060 (540) 231-4991 moored@vt.edu

Please select next in the bottom right corner to precede to the pre-interview survey questions.

1. What university did you teach for during the Spring 2012 academic term?
2. What course(s) did you teach during the Spring 2012 academic term?
3. What were your responsibilities in that course (select all that apply).
    a. Grader
    b. Workshop/Lab Instructor
    c. Lecturer
    d. Curriculum Development
    e. Other
4. At the end of the Spring 2012 academic term...
   (strongly disagree, disagree, neutral, agree, strongly agree)
    a. I identified with being a teacher.
    b. I was motivated to continue teaching.
    c. I felt I had control over what I taught.
    d. I felt knowledgeable about the content I taught.
    e. I felt connected with my teaching colleagues.
5. How many academic years have you been teaching in your university's freshman engineering program including this past year?
    a. One or less
    b. Two
    c. Three
    d. Four
    e. Five or more
6. Have you taught outside of the freshman program and if so, what have you taught?
7. What is your ideal job after graduation? If you recently graduated, what is your current job?
    a. Working in industry
    b. Working for the government
    c. Working in academia
    d. Other
8. Are you a Master's or PhD student?
    a. Master's
    b. PhD
    c. Other
9. What is your major?
10. What is your gender?
    a. Male
    b. Female
11. Are you an international student?
    a. Yes
    b. No
12. Will you be teaching in the freshman program again next year?
    a. Yes
    b. No, I graduated
    c. No, I will be doing research
    d. No, Other

Interview Protocol

Interviewer: "Before this interview, you consented in the pre-interview survey to have your interview audio-recorded and then transcribed. Do you still agree to that?"

1. Basic Demographic Questions…
    a. Review of pre-interview survey for clarification and interview grounding
        i. Ask about the courses and responsibilities
    b. Please describe the training you've received to be a GTA including the activities you do at each level.
        i. University level
        ii. Department level
        iii. Course level

2. Future Possible Self
    a. Describe your ideal job after graduation.
        i. How is teaching part of that future career?

3. Self-Determination Theory Components
    a. Competence
        i. What have you learned from being a GTA? (Journal Survey Question)
        ii. Was there anything you knew before being a GTA that you were able to use when teaching? (Journal Survey Question)
        iii. How do you learn the content needed for your course?
            1. How comfortable are you with that content?
        iv. How do you learn about teaching practices and approaches that could be applicable to your course?
            1. How comfortable are you with teaching practices?
        v. Do you feel you understand how your program fits into the rest of an undergraduate student's engineering education? Why or why not?
        vi. On a scale from 1 to 10, where 10 is you are expert with regard to content and teaching practices, what is your level of competence?
        vii. How does this relate to your future career?
    b. Autonomy
        i. Do you feel you are responsible for your course? If so, how or in what ways? (Journal Survey Question)
        ii. How much control do you have over the content taught in your course?
            1. Please give examples of ways you have changed the content or how content is developed.
        iii. How much control do you have over the activities done in your course or the methods of instruction? (Journal Survey Question)
            1. Please give examples of ways you've changed the activities or the methods of instruction.
        iv. How much control do you have over course policies or classroom management approaches?

1. Please give examples of ways you have altered course policies or specific ways you manage your classroom.

v. On a scale from 1 to 10, where 10 is you are in complete control of your class, what is your level of autonomy?

vi. How does this relate to your future career?

c. Relatedness

i. In what ways do you relate or connect with to your students?

1. In what ways do you help or assist your students aside from the content? (Journal Survey Question)
2. Do you interact with your students outside of the classroom? (Journal Survey Question)

ii. In what ways do you relate or connect with your teaching colleagues?

1. How do you connect with fellow GTAs?
2. How do you connect with faculty and instructors?

iii. On a scale from 1 to 10, where 10 is you feel like you are extremely connected to your students and colleagues, what is your level of relatedness?

iv. How does this relate to your future career?

4. Would you say being a teacher is part of your identity? How or why? Please give examples.
   a. On a scale from 1 to 10, where 10 is you are a teacher, how much is being a teacher part of your identity?

5. Would you say you are motivated when it comes to teaching? How or why? Please give examples.
   a. On a scale from 1 to 10, where 10 is extremely motivated in teaching, how motivated are you to teach?

6. How do you think your motivation and identity are linked with regard to your teaching?

7. Is there anything else related to your teaching, motivation, or teacher identity you would like to share?

Thank you for your time!

APPENDIX C: **Participant Matrix for Interviews**

Basic University Info	University	**U1**						**U2**			**U3**	**U4**	**U5**
	Public/Private	Public						Public			Public	Public	Private
	Student Population	~40,000						~55,000			~30,000	~20,00	~10,000
	UG and Grad Instructional Program, Enrollment Profile	Prof+A&S/HGC, CompDoc/MedVet, HU						Bal/HGC, CompDoc/MedVet, HU			Bal/HGC, CompDoc/MedVet, MU	Prof+A&S/HGC, CompDoc/NMedVet, HU	A&S+Prof/HGC, CompDoc/NMedVet, MU
	UG Profile, Size and Setting, Basic	FT4/MS/LTI, L4/R, RU/VH						FT4/MS/HTI, L4/NR, RU/VH			FT4/MS/HTI, L4/R, RU/VH	FT4/MS/HTI, L4/R, RU/VH	FT4/MS/LTI, L4/HR, RU/VH
Basic FYEP Info	Program Structure	2 Course Sequence, Honors Track						2 Quarter Sequence for Standard Track and 3 Quarter Sequence for Honors Track, Use an Instructional Team Approach			2 Course Sequence, Physics Component, Honors Track, Computer Course	2 Course Sequence, Work Closely with Other Required Classes	2 Course Sequence, Honors Track in Spring Only
	General GTA Responsibilities	Lab/Workshop, Grader, Curriculum						Lab/Workshop, Grader, Curriculum			Lab/Workshop and Grader	All Responsibilities	Lab/Workshop, Grader, Curriculum
	Program Student Enrollment	1800						1600			600	700	460
Participant Info	Name	Sam	Brent	Jillian	Zachary	Susanne	Ingrid	Wesley	Dan	Gordon	Corey	Roberto	Maurice
	Interview Date	8/24/2012	8/24/2012	8/29/2012	8/30/2012	9/10/2012	9/25/2012	7/25/2012	8/2/2012	8/17/2012	8/3/2012	7/25/2012	8/2/2012
	Interview Start Time	10am	2pm	2pm	1pm	2:30pm	6:30pm	3pm	4pm	5:15pm	9am	9am	5:30pm
	(9) First Year Teaching or Less in a First Year Program	X		X	X	X	X	X	X		X	X	
	(3) Two or More Years Teaching in a First Year Program		X							X			X
	(3) Within an EngEd Program			X	X		X						
	(9) Traditional Engineering Discipline	X	X			X		X	X	X	X	X	X
	(9) Male	X	X		X			X	X	X	X	X	X
	(3) Female			X		X	X						
	Degree of Responsibility One - Grader	X		?	X	X	X	X	X	X	X	X	X
	Degree of Responsibility Two - Lab Only Instructor	X	X	?	X	X		X	X	X	X	X	X
	Degree of Responsibility Three - Instructor	X	X	?	X				X		X	X	
	(7) Masters	X	X			X			X	X	X		X
	(5) PhD			X	X		X	X				X	
	(2) International Student	X							X				

APPENDIX D: **Phase 2 Open Codebook**

General Grouping	Codes	Definition	What it is…	What it is not…
Teacher Identity	**Role Dominance**	A discussion of different roles both now and in the future where one role takes precedence over another.	Often this relates to a person's role as a teacher and student, other roles could be included are researcher, parent, engineer, etc.	This does not include other people's roles.
	View of Being a Teacher	Comments related to what it means to be a teacher.	This could be things a teacher (generic term) does or is. This includes things related to professionalism.	This does not include specific responsibilities of being a GTA.
Past Experiences	**Past Experiences as a Teacher**	Examples of when the GTA was a teacher in other role or position including how that effects them today.	This may include being an UTA, peer mentor, etc.	This does include teaching peers as a student.
	Past Experiences as a Student	Examples of when the GTA was a student that impacted their teaching.	This may include comments related to "walking in the students shoes," attending the same university as their students, learning about teaching styles by sitting in class, etc.	This does not include other people's past experiences as a student.
	Other Past Experiences	Any other past experiences that impacted their current role as a GTA specifically focusing on how they teacher or approach an aspect of teaching.	This could include things like past work experiences, serving as student organization leaders, etc.	This does not include past teacher experiences or experiences as a student.
Relationships	**Relationships with Students**	Comments related to how GTAs connect or bond with their students.	This could include learning students name, saying hi to them on campus, discussing things not related to class with them, etc.	This does not include simply answering class related questions.
	Understanding Your Students	Subset of relationships with students that specifically related to understanding the students.	This could mean talking with them about their knowledge, prior experience, learning their perspective, etc.	This is not just getting to know them on a surface level. It is a deep understanding of their needs.
	Relationships with Colleagues	Comments related to how GTAs connect or bond with their teaching colleagues or how they interact with them in general.	This includes fellow GTAs, instructors or faculty, and UTAs.	This does not include their connections to their students.
Responsibilities	**Learn the Content**	This is a responsibility of the GTA related to knowing the material of the course.	They comment that they must know the content for their job.	This is not how they learn the content.
	Course Logistics	This is when the student manages various logistical aspects of the course.	This includes course management software responsibilities, setting up the classroom, answering emails, collecting homework, etc. which all relate to the structure of the course.	This does not include the salient codes below such as grading, office hours, etc. which are responsibilities of the GTA. This also does not include activities related to knowledge, such as training.
	Lecturing	This is when a GTA mentions talking in front of the class.	Often they specifically call this lecturing, but it could encompass presenting as well.	This does not include one-on-one interactions with students.
	Facilitate Student Learning	This is stated as a responsibility of the GTA regarding helping students learn the material	When a GTA states or demonstrates that helping students learn is part of their job.	This is not simply lecturing or presenting the material.
	Follow Course Policy	Statements related to course procedures that must be followed.	This may include the way homework is collected, how emails are answered, how to handle instances of cheating, etc.	This does not include policies they set. These are predetermined policies.
	Office Hours/Review Sessions	When GTAs mentions office hours they have to hold or review sessions they have to conduct.	This could be things that they are required to do or volunteer to do.	This does not include time in class.
	Oversee UTA	Mentorship, leadership, oversight, etc. of UTA.	This could include overseeing their grading, mentoring their teaching, etc.	This does not include these types of actions with their students.
	Curriculum Development	When GTAs help with any aspect of curriculum development.	This could include developing lecture modules, quizzes, test questions, labs, etc.	This does not include presenting existing material.
	Grading	Any responsibility related to grading.	This could be grading exams, quizzes, homework, etc.	This does not include informal feedback to students.
	Other	Any other responsibility not covered above.	This may include lecturing, being on a leadership team, etc.	This does not include any of the items above.
Other	**Knowledge Needed Beyond the Classroom**	Comments related to things a GTA needs to know outside of the course content or how to teach.	This may include the universities structure, the profession of engineering, etc.	This does not include course content, teaching practices, etc.
	Emotions or Feelings Related to Being a GTA	Any feeling or emotion GTA discuss with regard to being a GTA.	This may be statements that specifically use the word "feel" or an emotion word directly.	This does not include statement that may imply an emotion. They emotion must be directly stated.
	Things Learned While Being a GTA	What the GTA learned while being a GTA.	This could relate specifically to teaching or other aspects of their lives.	This does not include things they had to learn before teaching.
	Job After Graduation	This relates to what they want to do after graduation.	This could be a specific job, how teaching relates to a future career, or an aspect of their future job.	This does not include references to their current job.
	Instructor or Faculty Role	Comments related to instructors', faculty', or supervisors' role in the classroom.	This could include a discussion of the instructor's job directly or how their jobs effects the work of the GTA.	This does not include statements related to how they connect with the instructors or faculty.
	Training or Ways of Learning	The specific training GTAs receive or the ways they learn materials to teach; this is the how of learning.	This may include university teacher training, weekly meetings, studying lecture slides, working practice problems, asking questions, etc.	This is not a statement about what they need to know.

APPENDIX E: **National Survey**

Title of Research Study
TA Motivation and Identity in First-Year Engineering Programs

Research Investigators
Dr. Holly Matusovich, Department of Engineering Education, Virginia Tech
Rachel Louis, Department of Engineering Education, Virginia Tech (Graduate Student)

I. Purpose of the Research
This study aims to better understand the teaching experience of students involved in first-year engineering programs as they relate to their motivation and identity.

II. Procedures, Benefits, and Risks
My participation in the above-mentioned study will involve the voluntary completion of an internet-based survey intended to capture basic information related to my teaching. The survey should take about 20 minutes to complete. The risks associated with participating in this research are minimal and there are no known benefits to participants. The data collected from participants during this research will be developed into one or more papers for publication in academic journals or for presentation at professional conferences.

III. Extent of Anonymity and Confidentiality
All raw information collected will be kept confidential and accessed only by authorized researchers. The original data files will be archived until the Principal Investigator decides that they are no longer needed, at which point they will be destroyed. It is possible that the Institutional Review Board (IRB) at Virginia Tech will view this study's collected data for auditing purposes. The IRB is responsible for overseeing the protection of human subjects who are involved in research.

IV. Compensation
If you choose to participate in this survey and provide your contact information, you will be entered in a drawing for one or four $25 Amazon gift card.

V. Freedom to Withdraw
My participation in this research is entirely voluntary and my refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled. Similarly, I am free to withdraw from this research at any time. If I choose to withdraw from the research, any information about me and any data not already analyzed will be destroyed. I am free to choose to not answer any question and this choice will involve no penalty or loss of the above-mentioned benefits.

VI. Participant's Permission
I have read and understand the Informed Consent and the conditions of this research. I hereby acknowledge the above and give my voluntary consent as indicated below:

a. I agree to continue with the survey
b. I do not agree to continue with the survey

1. What degree are you currently seeking?
    a. Bachelor's
    b. Master's
    c. Ph.D.

   d. Other ____
2. What university are you currently teaching for?
   a. Dropdown of participating universities
3. What course(s) are you teaching? Please list course name and number.
4. What is your current job title within the first-year engineering program? **(INTERVIEWS)**
5. Why are you currently teaching? (select all that apply) **(INTERVIEWS)**
   a. To receive funding
   b. Mandatory requirement for my degree
   c. I enjoy teaching
   d. A research opportunity was not available
   e. To gain experience for my future career
   f. Other _____
6. How many academic terms (semesters or quarters) have you been teaching in your university's first-year engineering program including this term?
   One or less, two, three, four, five or more
7. Did you have any teaching experience (formal or informal) before your current position in the first-year engineering program? If so, what was it (e.g., tutoring, undergraduate TA, TA for another course, etc.)?
   a. No
   b. Yes _____
8. What are your current responsibilities, and on average, how many hours a week do you spend on these activities? Please round to the nearest hour. If you do not have one of the listed responsibilities, leave it as 0. **(INTERVIEWS)**
   a. Learning content ___
   b. Preparing materials for class ___
   c. Answering class-related emails from students, colleagues, or supervisors ___
   d. Grading homework ___
   e. Grading in-class activities ___
   f. Grading lab reports/writing ___
   g. Consistently (e.g., weekly) delivering a traditional lecture (aside from a lab/workshop) ___
   h. Attending a traditional lecture given by someone else ___
   i. Leading a lab/workshop ___
   j. Holding office hours ___
   k. Curriculum development ___
   l. Other _____
9. I receive or have received the following training to be a TA. (select all that apply) **(INTERVIEWS)**
   a. One-time University Level training (usually given by a teaching and learning center) on pedagogy or teaching practices when I first began teaching
   b. Reoccurring University Level training (usually given by a teaching and learning center) on pedagogy or teaching practices
   c. One-time Departmental or Course Level training on pedagogy or teaching practices (usually given at the start of an academic year)
   d. Reoccurring Departmental or Course Level training on pedagogy or teaching practices
   e. One-time Course Level training on content or materials (usually given at the start of an academic year)
   f. Reoccurring Course Level training on content or materials (usually given on a weekly basis)

g. Other _____

10. I receive or have received training on the following topics… (select all that apply) **(INTERVIEWS)**
    a. Effective lecturing
    b. Course content and materials
    c. Student team management
    d. Learning styles
    e. Course procedures and policies
    f. Teaching ethics
    g. Proper ways to answer students questions
    h. Other _____
11. Based on your current experiences as a TA, please rate the following statements regarding your teaching choices, teaching knowledge, teaching community, or teaching in general… (strongly disagree, disagree, neutral, agree, strongly agree)
    a. Autonomy
        i. I feel like I can make a lot of choices in deciding how I teach.
        ii. I am free to express my ideas and opinions related to teaching.
        iii. I have control over the content I teach. **(LITERATURE)**
        iv. When I am teaching, I have to do what I am told. (REVERSE CODE)
        v. My feelings are taken into consideration when teaching.
        vi. I have control over the activities my students complete in my classroom. **(LITERATURE)**
        vii. There is not much opportunity for me to decide for myself how to go about my teaching. (REVERSE CODE)
        viii. I have control over classroom management strategies such as late policies, attendance procedures, etc. **(LITERATURE)**
        ix. I am comfortable with the level of control I have over my class. **(INTERVIEWS)**
    a. Competence
        i. I have been able to learn interesting new skills related to my teaching.
        ii. I do not feel very competent when I am teaching. (REVERSE CODE)
        iii. I feel knowledgeable about the technical content I teach. **(LITERATURE)**
        iv. When I am teaching, I often do not feel very capable. (REVERSE CODE)
        v. I feel knowledgeable about teaching practices. **(LITERATURE)**
        vi. I feel confident in my ability to learn the material I need to teach.
        vii. I feel able to meet the challenges of performing well as a teacher.
        viii. I feel knowledgeable about my courses places in the rest of a student's education at my university. **(LITERATURE)**
        ix. I am comfortable with the knowledge I have to teach my class. **(INTERVIEWS)**
    b. Relatedness
        i. I like the people I teach with.
        ii. I feel connected to my university. **(INTERVIEWS)**
        iii. I get along with the people I teach with.
        iv. I feel connected to my fellow TAs. **(LITERATURE & INTERVIEWS)**
        v. I consider the people I teach with to be my friends.
        vi. There are not many people who I teach with that I am close to. (REVERSE CODE)

vii. I feel connected to the instructors and faculty I teach with. **(LITERATURE & INTERVIEWS)**
viii. The people I teach with do not seem to like me much. (REVERSE CODE)
ix. I am comfortable with the level of connection I have with my teaching colleagues. **(INTERVIEWS)**
x. I feel connected to my students. **(LITERATURE)**
xi. I am comfortable with the level of connection I have with my students. **(INTERVIEWS)**

c. Identity **(INTERVIEWS)**
i. Being a teacher is part of who I am.
ii. I was meant to teach in some capacity.
iii. I have found teaching is not for me. (REVERSE)
iv. Teaching comes naturally to me.
v. I enjoy teaching.
vi. I am passionate about teaching.

12. Which roles do you serve as a TA? (select all that apply) **(INTERVIEWS)**
a. Leader of undergraduate students in the classroom – facilitate student learning
b. Leader of undergraduate TAs in the classroom – facilitate TA teaching
c. Leader of graduate TAs – facilitate TA teaching
d. Mentor to undergraduate students – offer guidance and serve as a role model
e. Mentor to undergraduate TAs – offer guidance and serve as a role model
f. Mentor to graduate TAs – offer guidance and serve as a role model
g. Manager of the classroom – ensure the classroom runs smoothly
h. Teacher – help others learn
i. Other _____

13. When thinking about your position as a TA, how do you feel? I feel… (select all that apply) **(INTERVIEWS)**
a. Confident +
b. Stressed –
c. Overwhelmed –
d. Passionate +
e. Scared –
f. Excited +
g. Prepared +
h. Anxious –
i. Enjoyment +
j. Unprepared –
k. Motivated +
l. Nervous –

14. Rank the following items in terms of importance related to being a TA. Drag and drop the items below to alter the list with your most important item at the top (1). **(FRAMEWORK)**
a. Knowledge of the content (e.g., the topics you teach)
b. Knowledge of teaching practices (e.g., ways of teaching, ways of learning, etc.)
c. Knowledge of the university (e.g., program structure, available support centers, courses available, etc.)
d. Connections/relationships with students
e. Connections/relationships with fellow TAs
f. Connections/relationships with instructors and faculty who you teach with
g. Control over content
h. Control over teaching techniques

i. Control over classroom management approaches
j. Other _____

15. Please provide any comments you have on the ranking question above to clarify you ranking if needed.
16. In general, what does being a teacher mean to you? **(INTERVIEWS)**
17. Please describe an event that significantly impacted your current view of yourself as a teacher? **(INTERVIEWS)**
18. Think about your life after graduation -- imagine what you will be like, and what you will be doing. Each of us has some image or picture of what we will be like and what we want to avoid being like in the future. In the text boxes below, write what you expect you will be like and/or what you expect to be doing after you graduate. Please list up to 5 goals.
19. In addition to expectations and expected goals, we all have images or pictures of what we do not want to be like, what we do not want to do, or what we want to avoid being. Think a minute about ways you would not like to be after you graduate -- things you are concerned about or want to avoid being like. In the text boxes below, write those concerns or selves to-be-avoided (STBA) after graduation. Please list up to 5 concerns or selves to-be-avoided.
20. On the previous page, you identified goals for after graduate (repopulated below). In the small text box to the left of each expected goal, mark NO (0) if you are not currently working on that goal or doing something about that expectation, and mark YES (1) if you are currently doing something to get to that expectation or goal. For each expected goal that you marked YES (1), also write what you are doing now to attain that goal with the goal in the corresponding larger text box.
21. On the previous page, you identified concerns or selves to-be-avoided after graduation (repopulated below). In the small box to the left of each concern or self to-be-avoided, mark NO (0) if you are not currently working on avoiding that concern or self to-be-avoided, and mark YES (1) if you are currently doing something so this will not happen after you graduate. For each concern or self to-be-avoided that you marked YES (1), also write what you are doing now to reduce the chances that this will describe you after you graduate with the concern or to-be avoided self in the corresponding larger text box.
22. My current experiences as a TA…**(INTERVIEWS)**
    (strongly disagree, disagree, neutral, agree, strongly agree)
    a. Are relevant to my ideal job after graduation.
    b. Have prepared me for my ideal job after graduation.
    c. Are unrelated to my ideal job after graduation. (REVERSE CODE)
    d. Have given me tools that are transferable to my ideal job after graduation.
23. At this time, do you think you will you be teaching in the first-year engineering program next year?
    a. Yes
    b. No, I plan to graduate
    c. No, I plan to be doing research
    d. No, I plan to be teaching in other program
    e. No, Other___
24. Please provide any further comments you have regarding your motivation, identity, or views on teaching.
25. What is your major?
    Dropdown list of engineering majors
26. Are you an international student?
    a. Yes
    b. No
    c. Prefer not to answer

27. Are you:
    a. Male
    b. Female
    c. Prefer not to answer
28. What is your age?
    a. 18-25
    b. 26-30
    c. 31-35
    d. 36-40
    e. 41-45
    f. 46-50
    g. 50+
    h. Prefer not to answer
29. Would you describe yourself as:
    a. American Indian/Native American
    b. Asian
    c. Black/African American
    d. Hispanic/Latino
    e. White/Caucasian
    f. Pacific Islander
    g. Other _____
    h. Prefer not to answer
30. Please provide your email address if you may be interested in participating in future studies related to this research.
31. Please provide your email address if you would like to be entered into the drawing for one of the four $25 Amazon gift cards.

Red Text – Basic Psychological Needs Scale
Blue Text – Perceived Competence Scale
Purple Text – Possible Selves Questionnaire

APPENDIX F: **Interview Participant Summaries**

Name of Participant: **Brent**
University: U1

- Brent has been teaching in the first-year engineering program for three years bring a lot of experience to his perspective of the program.
- While being a GTA he carried out the standard responsibilities, but he was also able to lecture quite a bit in the course with the permission of the instructor.
- At this time, Brent is unsure as to what his future will look like, but it may involve product development or teaching software.
- While teaching, Brent gained a lot of management experience. He was responsible for overseeing a group of undergraduate TAs in the course.
- Brent went through the program as an undergraduate so he's experienced the program from the student perspective. He's been in their shoes.
- In the course, he had very little to no control over the content or activities, but he felt responsible for the course because he's in charge of their grades.
- Brent sees a strong connection between the GTAs and students.
- Brent pointed out that there is a connection between identity and motivation in that motivation often drives how you see yourself.

Participant	Identity	Competence	Autonomy	Relatedness
Brent	Brent is very unsure as to what he wants to do when he graduates. He enjoys teaching so that is a possibility for him, but based on his responses, he seems like he will most likely go into an industry job.	Brent talks about things as being tough at first but then getting easier. He has a strong knowledge base for the class because he went to U1 as an undergrad and taught in the program as a UTA. He now refers to the content as "second nature" in his role as a GTA.	Brent has a high sense of autonomy in a vary structured course. He understands why things must be structured and still feels responsible for this students and their learning.	Brent has a great connection with his students and related to them because he has "walked in their shoes." He does not seem to have as strong of a connection with the faculty and also believes the students do not have a strong connection as well. His connection with his fellow GTAs seems to fall somewhere in the middle.

Name of Participant: **Ingrid**
University: U1

- Ingrid is a PhD student in the engineering education program at U1 where she taught as a graduate teaching assistant in their first-year engineering program.
- Ingrid described her role as that of a grader and course manager where she was involved in grading, attendance, in-class activities, and undergraduate teaching assistants.
- In the future, she would like to build engineering outreach programs.
- As a GTA she learned a lot about life lessons and leadership. She also learned to manage high stress environments.
- Ingrid ultimately felt responsible for the students and their learning in the course even though has had no control over the actual activities or content.
- Through her experience she built strong relationships with her fellow GTAs.
- Ingrid really sees herself as a mentor and since mentorship is part of teaching, she can see herself as a teacher as well.
- Ingrid commented that she truly gets joy from seeing others achieve their goals which directly contributes to her motivation to teach.

Participant	Identity	Competence	Autonomy	Relatedness
Ingrid	Ingrid has a strong tie to mentorship which she sees as relating to teaching. In the future, she may not teach per say, but she does she herself developing support systems and outreach programs for students.	Ingrid did not feel confident in her competence before and after she was a GTA. She often felt under prepared due to the wide range of responsibilities she had in the course. It seems that her competence suffered as she tried to balance her other duties.	Ingrid did feel responsible for her class, but did not have a sense of control at all. She even turned down an opportunity to provide input because she was overwhelmed and discouraged by her experience.	Ingrid had a great connection with her fellow GTAs. They helped her persevere through the GTA experience. With her students she had a good relationship but kept it very professional. Her relationship with the instructors was poor. While they were good teachers and tried to assist her, it seems that the relationships just never worked.

Name of Participant: **Jillian**
University: U1

- Jillian taught for the first-year engineering program for one semester and was in charge of the course management site, a group of undergraduate TAs, and had to set up the classroom.
- After graduate, she would like to work in the educational technology industry.
- While being a GTA she didn't get to do much direct teaching, but she did get to do a lot of management. Her position was more like that of a tutor than teacher.
- One of the ways she learned the material was to talk with her fellow GTAs.
- Jillian went through the program as an undergraduate bring a unique perspective to her experiences.
- Jillian had little to no control over the content or activities in the class, but she did feel responsible for her course and for helping her students learn.
- The GTAs in the program work as a team, but the instructors often work separately.
- Jillian is working on curriculum development this year so while she's not teaching in the first-year program, she's still connected to it.

Participant	Identity	Competence	Autonomy	Relatedness
Jillian	Jillian really enjoys teaching, but when asked about a teaching identity and a future teaching her answers are minimal. She mentions she would like to work in the areas of educational technology as a future career.	Jillian went through the course as a student so she was already familiar with the course materials and could easily work students through problems. She is not extremely confident in her abilities though because she has only been a GTA for one term.	Jillian has no control over the course in terms of content and activities, but she has been given an opportunity to participate in a flipped classroom curriculum change. While she does not have control, she seems comfortable with that.	Jillian has a strong connection with her students in that she often offers advice to them regarding being an engineering student at U1. She has a strong connection to a sub group of GTAs who she often grades with. Her connection to the faculty is the weakest. She even says "we pretty much let the faculty do their thing" implying there is not much interaction.

Name of Participant: **Sam**
University: U1

- Sam is relatively new to teaching within a first-year engineering program, but has been able to contribute in a variety of ways such as learning review sessions, working alongside an instructor, and holding office hours.
- Teaching has been a big part of his family so he's drawn to teaching, but he would like a job as a consultant. He may go into teaching later in life.
- Before being a GTA he was a student advisor so he brings a unique perspective to the classroom.
- Sam went to U1 as an undergraduate so he relates to his students on that level.
- Sam really wants to ensure the students are learning. He even made a YouTube video to help with instruction.
- He had very little control over the material in the course as a GTA, but he is able to give some input now that he is involved with curriculum development.
- Sam sees teaching as a rewarding experience. He equated it to serving as a mentor.

Participant	Identity	Competence	Autonomy	Relatedness
Sam	Sam enjoys teaching, but he wants to go into electrical engineering consulting when he graduates. Teaching does not seem to be a salient part of who he is.	Sam was a student advisor before his GTA role so in terms of competence he was very strong with understanding student issues and working with students before formally teaching. He attended U1 as an undergraduate so he remembered much of the content from his time as a student.	Sam describes his actual teaching in the classroom as very defined and structured, but he does mention that he has control over how he interacts with the UTAs in his classroom. He chose to hold weekly meetings with them to ensure consistency in his section taking ownership over the class he was working with.	Sam's relationship with his students is strong, and he really looks out for their well being. Also he worked closely with a group a GTAs using them as a support network. His connection to faculty seems weaker in the sense that he can relate to them being busy but does not have a personal relationship.

Name of Participant: **Susanne**
University: U1

- Susanne is relatively new to teaching and brings a unique perspective to her classroom through her industry experience.
- At U1, she is responsible for overseeing a group of UTAs, grades, their course management program, and teaching specialized extensive problems in the course.
- In the future, Susanne would like to work as a director of a first-year program, work for a minority in engineering program, or work in a position where she would be in academia, but network with industry.
- Susanne has control of the things in her classroom, but she does not have control over what is taught.
- At times, Susanne questioned the course policies, but she needed the instructors' approval for any changes.
- Susanne was a member of a group of new GTAs who really helped and supported each other through their first year.
- In terms of her identity, Susanne believes that being a teacher something that has always been part of her.
- Susanne would highly recommend this experience to everyone. She believes everyone who goes through it grows and learns a lot.

Susanne's Corrections:
With regard to the career goals bullet:
This is one of my career goals, I would explore working with industry to develop online based or stimulation based tools for STEM education and engineering design education. (I left this out of the interview)

Participant	Identity	Competence	Autonomy	Relatedness
Susanne	Susanne stated that being an engineer is the only thing she identified with as she never considered a teacher identity. When describing her future career she seems to want to work in education somehow, but the guidelines of that position are very fuzzy.	Susanne equates a lot of her knowledge to working in industry. That experience has helped her relate class materials to the real world. With regard to the actual class activities, her competence seems limited in that she often relies on others to learn the material by either watching them or asking them questions.	Susanne has limited control over the classroom activities and content, but she does seem to have ways to make the class her own by asking lots of questions in training and adjusting course policies for her class section. It seems like this may have caused some problems though.	Susanne has a strong connection with her UTAs calling them a "working team." With the students she tries to keep the relationship profession, but many times her comments sound mothering. With her fellow GTAs and the faculty she seems to have a mixed relationship. With some the relationship is very strong and they rely on each other and then with others they are just working together.

Name of Participant: **Zachary**
University: U1

- Zachary was a GTA for the first-year engineering program at U1 for one semester, but he had previous teaching experience at his last university.
- As of today, Zachary is unsure as to what his ideal job is after graduation, but it will be in academia.
- While being a GTA, Zachary learned a lot about patience and management, but the lack of autonomy was frustrating at times.
- Zachary had little control over the content, activities, or course management policies for his course.
- Zachary did oversee a group of undergraduate teaching assistants who were with him in the classroom. He noted that the UTAs have more direct contact with the students than he did.
- Zachary commented that the size of the program made things difficult. It was challenging to go to know your students and it impacted the course structure.
- He did comment that he does understand the lack of autonomy he had because the program was so large and things needed to be consistent among sections.
- Overall, Zachary enjoys teaching and wants to do well at it.

Zachary's Corrections:
On bullet points 4, I had little control over course content, activities, and management, but I did have some. And as I reflect, I begin to realize that much of the frustration at lack of autonomy might stem from this little amount of control I did have. Because of that modicum of control (or responsibility), I began to think about how I would do things, and inevitably how I would do things differently. I'm not exactly sure how I would have reacted to having absolutely no control over the learning environment, but I believe that I would have thought of those issues less, and just accepted the content and course structure that was defined for me. That's what I think right now at least.

Participant	Identity	Competence	Autonomy	Relatedness
Zachary	Zachary has an identity as a teacher. Teaching is ultimately what he wants to do when he graduates, and he views being a teacher as a salient component of his identity.	Zachary has a lot of prior teaching experience at another university that contributes to the knowledge needed to be a GTA. He does comment that the he's learning the content for the first time at U1 though.	Zachary has a very low sense of autonomy. While he is in a special section that allows him to provide input into the course and has UTAs to oversee, he does not feel in control of the course. This could be attributed to his prior teaching experience where he was more in charge of a course section.	Zachary does not have a strong connection to his students that he attributes to the size and structure of the course. He does have a relationship with the other GTAs who are also in a special section, but he does not have a personal relationship with the other GTAs or faculty.

Name of Participant: **Dan**
University: U2

- Dan has learned a lot while being a GTA which has allowed him to experience the teacher perspective in the student-teacher relationship.
- He switches between a future job in academia or industry. He likes teaching, but may work in industry for a while and then come back to academia.
- Dan has always been told he should be a teacher. He often explains things to others outside of the classroom. It all seems natural for him.
- He feels responsible for his course and sees it as more than just a job.
- He has experienced a strong community in his first-year program which he thinks is important.
- In the U2 first-year program there is a mentoring structure where experienced GTAs mentor new GTAs. This has been a helpful structure to Dan as he learned to navigate the program.
- Dan is highly motivated to teach and sees himself as a teacher. It really is part of who he is.

Participant	Identity	Competence	Autonomy	Relatedness
Dan	While teaching is important to Dan, he also values real world experience which could take the form of industry work or research. He did however turn down a research funding opportunity to continue teaching. He values teaching and enjoys it, but he seems to want to have a balanced teaching vs. engineering career.	Dan often talks about competence as preparedness to address students' questions. He is very concerned with knowing the material not just to deliver it but also to be able to explain it. While he seems confident in that he can now address students' questions, he also seems unsure of his competence as a whole.	Dan believes that he has about as much control in the course as the instructor does. This may be contributing to his view as himself as an equal. He did have a unique experience of curriculum development in the summer which has allowed him to provide input into various aspects of the program.	Dan really enjoys the mentoring aspects of his teaching community. He has been mentored by fellow GTAs and is now mentoring others. With regard to his students, he has a professional relationship with them, but also tries to have them see him as a real person, not just a robot as he puts it. He attributes much of his teaching success to this teaching environment.

Name of Participant: **Gordon**
University: U2

- Gordon was a UTA for 2.5 years and a GTA for 2 years giving a lot of experience with the first-year program at U2.
- Currently, he is working in the construction industry as a construction manager, but would not mind going back to teaching at some point in his career.
- Gordon was a member of the [leadership team] which gives him a unique perspective on the program and its structure.
- He went to U2 as an undergraduate so he understands what his students are going through and can relate to them on that level.
- Overall, the program at U2 is pretty fixed in terms of content and activities, but as a member of [leadership team] he was able to give some input on various curriculum development projects.
- Gordon talked about the balance between being a student and a GTA. While he really enjoyed teaching, at times he had to regroup and focus on his studies.
- He feels that while in the program, it was really a community atmosphere, where students, GTAs, and instructors really connected and helped each other.

Participant	Identity	Competence	Autonomy	Relatedness
Gordon	Gordon enjoyed his time teaching, but has chosen a job in industry. While teaching is important to him, he believes he would not go back into teaching for some time, if ever.	Gordon has been teaching in this program for quite some time because he also taught as a UTA. These experiences have made the material easy for him to learn, but in his leadership role he now needs to know the material on a different level to be able to teach it to his colleagues. This change has lowered his views on his competence, but he is extremely knowledgeable.	Gordon has a leadership position within his FYEP so not only does he teach freshman students, he also teaches follow TAs. Over the course of his teaching, his responsibilities have systematically increased.	Gordon relates to his students because he was "literally in their shoes" when he was an undergraduate. With his fellow GTAs, he talks about strong connections to those GTAs who came in with him. It seems that for Gordon the high turnover of GTAs requires the building of community quickly within a cohort.

Name of Participant: **Wesley**
University: U2

- Wesley taught for the first time formally this past year with the first-year engineering program. Had informal teaching experiences before last year.
- Wesley truly believes that teaching is an important part of who he is. He didn't really realize this before he started teaching with the first-year program, but now it has been strengthened.
- He wants a job in academia in the future where teaching slightly outweighs research in terms of daily responsibilities.
- Wesley knew most of the content before becoming a GTA.
- At U2 they don't have control over the content or materials, but Wesley feels he has responsibility for his courses because he's in front of the students and is in charge of their grades.
- Wesley believes that motivation and teaching are truly connected in some way and that they play off each other.
- Next year Wesley will be conducting research, not teaching.

Participant	Identity	Competence	Autonomy	Relatedness
Wesley	Wesley has a high sense of identity as a teacher and wants to pursue a job in academia. He would like to see his teaching as his main responsibility, but also wants to continue with research. He believes he has always been a teacher even outside of this context.	Wesley believes his competence for this position relates back to his previous experiences in industry specifically as an ISE. He often mentioned that the material was familiar to him because he has seen it before. Conversely, he believes his knowledge could improved with more experience as he is new to teaching.	While Wesley is in a structured program with assigned materials, he does add his own personality to his courses by discussing his own experiences, adding jokes to lectures, etc. He also feels a great level of responsibility when it comes to grading.	Wesley relates to his students because they are all engineers and share common characteristics. He relates to both his fellow GTAs and the faculty on a professional level where they are all there to teach. All of the relationships seem very surface level.

Name of Participant: **Corey**
University: U3

- Corey has taught the general intro course in the past but most recently he taught a course for non-freshman that is still housed within the first-year engineering program.
- Corey's most recently role in the program was to teach a recitation section.
- In the future, he would like to be a design engineer, but would love to teach high school math.
- Corey's wife is a teacher so he's able to talk with her about teaching approaches.
- As Corey has moved in the first-year program, he's gotten more control over his courses whether it is providing suggestions for content changes or approaches to classroom management.
- He feels connected to his teaching colleagues on a professional level and has even been able to develop friendships with some of the GTAs outside of teaching.
- While Corey doesn't really label himself as a teacher, he sees that he is a teacher.
- Corey sees being a GTA as more than just a paycheck. He really wants his students learn the material in his course that they will need for the future.

Corey's Corrections:
Statement 1) I would say that that first year program is housed in the [FYEP], than the first year program encompasses the other classes.
Statement 2) My most recent role is more of a lecture position. My first year in the [FYEP] was in the first year curriculum, which was when I lead the recitations sections.
Statement 4) My wife is trained as a teacher, but doesn't have her own class at present.
Statement 5) When I was involved in the first year class I did have the opportunity to make suggestions, but I do feel that now my suggestions are more readily integrated because we GTA's have a lot more teaching interaction with the students than the overseeing professor does (since we actually do the majority of the lecturing). For the first year class the professors did the lecturing while the GTAs did proctored the recitation sessions.

Participant	Identity	Competence	Autonomy	Relatedness
Corey	Corey enjoys teaching, but only sees it playing a minimal role in his future. He wants to be a design engineer. He did comment though that if he were to teach it would most likely be at the high school level in math. His wife is trained as a teacher so he struggles with calling himself a teacher because he really sees himself as a student.	Corey had previous tutoring experiences that helped him in this position with the content. He did discuss an initial stress he felt regarding the actual teaching in that he wanted perfection and did not know the university well when we started there as a GTA. Now as a seasoned GTA, he feels very confident in his abilities and knowledge.	Corey's current position allows for a lot of autonomy in terms of creating homeworks, designing lessons, and as he stresses, giving the lecture. He also discusses how he and his fellow GTAs have the ability to provide input on all aspects of the course.	Corey seems to have a strong professional relationship with his students, but he keeps it to that. He seems to have a good relationship with his is colleagues as well, but it is not particularly strong and again is very professional.

Name of Participant: **Roberto**
University: U4

- Roberto had prior teaching experiences in civil engineering (5 semesters).
- Being a GTA is a requirement at U4 for graduate students. The amount of time being a GTA varies for Master's and PhD students.
- Roberto currently prefers future jobs in academia where teaching is the focus. He actually has a teaching job set up for U4 in the future.
- At U4 they have little control over the content and materials in the course, but can deliver it as they choose.
- As part of their fellowship, they have pedagogical meetings once a month to discuss articles, teaching practices, etc. The fellowship seems to be very competitive since only 4 students are chosen for the position.
- Roberto feels connected to both his teaching colleagues and students, but tries to keep the relationship professional.
- His identity is currently transforming into that of a teacher from a student.
- Overall, Roberto feels that his experiences in the first-year program with the fellowship have prepared him for a future career as a faculty member.

Participant	Identity	Competence	Autonomy	Relatedness
Roberto	Roberto has a strong sense of a teaching identity and is actually teaching now for U4. He attributes this to his experiences in his FYEP as they prepared him for his current position.	Roberto has some industry experience that he was able to bring to the position. As a first-time GTA he seemed unsure of his competence, but based on the feedback he got from students and faculty, he seemed to be successful.	Roberto does not have control over the content or topics, but he does have control over his delivery methods and assists with test development. He seemed indifferent about his autonomy, but it seemed higher than most GTAs at other institutions.	Roberto he only has a very professional relationship with this students and seems to have little to no interaction with his fellow GTAs or faculty. This may be attributed to personality.

Name of Participant: **Maurice**
University: U5

- Maurice is still trying to figure out exactly what he wants to do in the future. It maybe research or teaching or industry or a mix.
- He was able to use leadership skills he learned in other places while teaching, but seeing being a GTA as a job with on the job training.
- Maurice has been involved with the program for some time. First he was a peer mentor as an undergraduate and now is a GTA. This long relationship gives him a unique perspective on the details of the program.
- The course that he teaches is very structured with little room for content changes, but he does have control over his section in terms of classroom management approaches.
- Maurice feels like a teacher inside and outside of the classroom. He helps others "learn" things regardless of setting.
- Maurice understands the tensions between teaching and research in the university setting and is trying to navigate things.
- Maurice sees mentoring as an important part of teaching and even if he's not formally teaching, he wants to give back through mentoring of some kind in the future.

Participant	Identity	Competence	Autonomy	Relatedness
Maurice	Maurice has a strong identity as a teacher stating that he enjoys doing it and he wants to do it in the future, but he sees barriers to teaching. He also is very avid about mentoring and wants to have that role in the future as well.	Maurice seems to have the standard competence required to be successful as a GTA. He understands the program since he was a mentor for the course and discuses that he learns the content by working through the required assignments.	Maurice does not have a lot of final control over the content or exercises, but he does mention that he gets to help with lesson plan design and coordination. Compared to other GTAs, he has a good amount of input in his course.	Maurice's experiences as a peer mentor have helped strengthen his relationships with his students. He seems to really value a strong personal connection with them. His relationships with this fellow GTAs and the faculty is not very strong.