UNDERSTANDING ONE INSTITUTIONS’ PROCESS IN PREPARING CIVIL ENGINEERING STUDENTS TO BE GLOBALLY COMPETENT

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Abstract

Civil engineering is an increasingly dynamic and global industry experiencing expansion cross borders, resulting in new required competencies sought out by employers and reflected in updated undergraduate program outcomes. These new competencies include attributes that result in global competence. Institutions of higher learning need to increasingly respond to these changes to ensure they are preparing globally competent civil engineers. With limitations in the rigidity of the curriculum, yet, significance of preparing globally competent civil engineers, this is an important problem to study. This case study investigated the process by which one four-year private research institution in the Northeast prepared its civil engineering students to be globally competent, how effective they are in this process, and identification of improvements.

A document review analysis and qualitative semi-structured interview phase of 13 participants, representing academia, career education, alumni, and industry who are directly affiliated with this institution was conducted. National professional association feedback was also secured to complement research findings. Using Saldana (2009) and Stake (1995) as guiding principles for coding and thematic analysis and triangulation of multiple data sources, results indicated that 1) the institution’s process is complex and inter-related with multiple internal and external stakeholders, 2) the institution is generally effective in its preparation of globally competent engineers as the primary goal is to develop competent engineers with transferrable skills to any environment, and 3) despite this general effectiveness, opportunities to augment its process in developing globally competent civil engineering students exists.

Keywords: globalization on higher education; global competencies; civil engineering and global competencies; preparing civil engineering students; engineering skills gap in 21st century; civil engineering and globalization
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Chapter I: Introduction

Statement of the Problem

Internationalization is the response to globalization by the higher education community (ACE, 2012). Given technological advancements and changes in societal, political, and economic climates, the manner in which business is conducted globally has evolved (Rizvi & Lingard, 2007; Fugate & Jefferson, 2001). This evolution of business practices has many implications, not only for the business community but also higher education worldwide. In response to globalization, the skills which employers are demanding for employees to succeed in global business practices have changed, which is putting greater pressure on higher education to respond and produce graduates to meet this change (Taylor, 2005; Jones, 2003; Bruett, 2006; Jesiek, Zhu, Woo, Thompson, and Mazzurco, 2014). With shifts in employer demands and the borderless concept of educational attainment in today’s 21st century, the higher education community within the U.S. and abroad has had to respond to globalization and assess its academics and preparation of its students to meet this dynamic society and workforce (Edwards, 2007; Hunter, 2004; Stromquist, 2007; Green, 2012; Harder, 2011; Jurgens & Robbins-O’Connell, 2008; Tymon, 2013; Schaefer, Panchal, Thames, Haroon, and Mistree, 2012; Jesiek et al., 2014; Catalano, Abdalla, Filho, 2012).

Given the increased consumer expectation with increasing tuition fees, employer cost of training on the job, international competition for jobs, and the student recruitment competition, preparing students to succeed in the global workplace is critical (Oreopoulos and Petronijevic, 2013; College Board, 2016). Over the past five years, the private four-year institution tuition rate, the public four-year institution tuition rate, and the public two-year institution tuition rate have increased by 11%, 13%, and 14%, respectively (College Board, 2016).
Given how globalization will continue to influence operational and systematic practices across the globe, which will continue to transform employer needs, this will continue to place a higher responsibility on educational institutions charged with educating and preparing college graduates with the skills and knowledge required of them to interact successfully in the global workplace. Nationally, governmental initiatives are also recognizing this increased need to address this education problem. The Presidential “100,000 Strong in the Americas” initiative (The White House, 2013), which emphasizes cultural exchange, is an example of a government driven initiative to address this education problem. Given the significant attention placed on higher education, by industry and national initiatives, a better understanding of the lack of preparedness amongst recent college graduates to enter the global workplace is critical.

With increasing tuition rates, the U.S. college student, the consumer, has increasing expectations from the education community for a robust return on their investment (Rothstein and Rouse, 2010; College Board, 2016). U.S. college students expect a solid education, a network from which they can maximize employment prospects, and adequate preparation of the required skills and knowledge of the 21st century and beyond (Rothstein and Rouse, 2010; College Board, 2016). With this in mind, it is imperative for academia to further understand the alignment between employer demand and college graduate preparation. One industry that is experiencing significant transformation is engineering (Lohmann, Rollins, and Hoey, 2006, Warnick, 2010, Schaefer, Panchal, Thames, Haroon, and Mistree, 2012, Sunthonkanokpong, 2011, Joyner, Mann, and Harris, 2012; Catalano et al., 2012; Jesiek et al., 2014; Rajala, 2012; Dunsmore, Turns, and Yellin, 2011; LaFave, Kang, and Kaiser, 2014; Grigg, 2013; Soibelman, Sacks, Akinci, Dikmen, Birgonul, and Eybpoosh, 2011; Chak, 2011; May, Wold, and Moore, 2015).
The transformation of the engineering industry due to globalization has influenced the preparation of a global engineer to enter today’s 21st century global workplace (Lohmann, et al., 2006, Warnick, 2010, Schaefer et al., 2012, Mahadevan, 2014; Sunthonkanokpong, 2011, Joyner et al., 2012; Catalano et al., 2012; Jesiek et al., 2014; Rajala, 2012; Dunsmore, Turns, and Yellin, 2011; LaFave, Kang, and Kaiser, 2014; Grigg, 2013; Soibelman, Sacks, Akinci, Dikmen, Birgonul, and Eybpoosh, 2011; Chak, 2011). Specifically, the way in which civil engineers are prepared is increasingly important due to the increasingly diverse field itself, the multi-national projects commissioned by governments worldwide and employer expectations that span across countries and cultures (Lohmann, et al., 2006, Warnick, 2010, Schaefer et al., 2012, Sunthonkanokpong, 2011, Joyner et al., 2012, Jesiek et al., 2014, Catalano et al., 2012; LaFave et al., 2014; Grigg, 2013; Soibelman et al., 2011; Itani and Srou, 2015; Bielefeldt, 2013).

With the challenges facing academia in how to well prepare engineering students, specifically, civil engineering students, this qualitative case study offers a deep investigation of a Private Four-Year Research Institution in the Northeast’s process on how they prepare civil engineering students to enter the global workplace. In particular, this case study unveils the process involved in preparing civil engineering students with the global competencies, increasingly being sought out by engineering-related employers in today’s 21st century. This is of particular importance for employers with a large multi-national presence and those with intentions to expand operations across borders; city, state, and country.

The applicability of the findings and recommendations of this case study will further enhance the existing scholarship on preparing civil engineering students to enter the global workplace as well as inform the civil engineering industry on practices in effect at one university in the Northeast. The results of this case study are not meant to be generalization but intended to
provide insight into this institution’s process informed by collective feedback from key stakeholders who are charged with the academic and practical preparation of civil engineering students. Each institution is unique with its own mission, strengths, limitations, and strategic plans. This case study will further the current understanding of a civil engineering students’ preparation entering the global workplace at this institution. Specifically, the focus on the civil engineering audience will offer research for an area of student preparation that has not been extensively studied and thus will allow industry, the academic community, and engineering departments to reflect on the findings and assess direct application. The benefits of better understanding the civil engineering college graduate audience are too many to ignore the necessity of this research study.

**Significance of the Problem**

According to Hunter (2004), “less than 7 percent of U.S. college graduates meet basic standards for global preparedness and only 1 percent of U.S. college students study abroad.” (p. 8). This statistic is troubling. Given the National Center for Education Statistics forecasted roughly 1.8 million bachelor’s degrees were awarded in the 2014-2015 academic year, only a small percentage of graduates met basic standards for global preparedness (NCES, 2014). Several studies highlight how higher education is primarily failing to well prepare its college graduates (Hunter, 2004; Stromquist, 2007; Andrews & Higson, 2008; Tanyel, Mitchell, & McAlum, 1999; Andersen, 2004; King, 2003; Tymon, 2013; Taylor, 2005; Jones, 2003; Bruett, 2006; Jesiek et al., 2014).

Students are graduating from U.S. colleges and universities with expectations of employability and integration into society and the global workforce (Tymon, 2013; Rothstein and Rouse, 2010). Research emphasizes graduates are ill prepared to enter the global workforce
based on employer surveys, therefore, industry is placing a higher responsibility on education to meet this growing need and skills gap (Kavanagh & Drennan, 2008; Milhauser & Rahshulte, 2010; Prestwich & Ho-Kim, 2007; Andrews & Higson, 2008; Lohmann, Rollins, and Hoey, 2006, Warnick, 2010, Schaefer et al., 2012, Sunthonkanokpong, 2011, Joyner et al., 2012; Catalano et al., 2012; Jesiek et al., 2014; Rajala, 2012; Dunsmore et al., 2011; LaFave, et al., 2014; Grigg, 2013; Soibelman et al., 2011; Chak, 2011).

In a survey of nine global business leaders, representing large international companies in engineering, human resources, international trade, information technology, and manufacturing, results highlighted how this surveyed employer audience expected international business degree graduates to have a higher level of global competency, compared to non-international business degree graduates however, a gap was present (Milhauser & Rahschulte, 2010). In a study of faculty and employers, Tanyel et al., (1999) not only identified changing skills sets required of recent business school graduates but also a discrepancy that existed between what employers seek and faculty perceptions of what industry needs from its employees. Prestwich and Ho-Kim (2007) further highlight how greater research on the needs of companies conducting business internationally is necessary. These results highlight the importance of recognition and necessary response to the education problem facing the academic community of ill prepared graduates entering the global workplace. A greater alignment between industry and the education community is critical in order to best prepare students. This case study will further the scholarship of civil engineering students to be globally competent, as prepared by this institution under investigation.

In a study of Irish and U.S. students, results from surveyed U.S. students suggested that they are not adequately prepared or provided with inter-cultural opportunities for global
competency acquisition, as compared to their Irish student peers (Jurgens & Robbins-O’Connell, 2008). It is important to note, however, that this is not just a U.S. education system phenomenon.

European institutions are also experiencing challenges in preparing graduates for European Union country employment as noted in the employer and recent graduate survey across four different European countries conducted by Andrews and Higson (2008). Given the global impact of workforce preparation and the responsibility assumed by colleges and universities, addressing this problem is critical and imperative to keep up with the competition and evolution of business practices, globally.

Within the engineering industry, Jesiek et al., (2014) further highlighted how the 21st century engineer is not only responsible for understanding the engineering technical and cultural nuances of their own home country of employment but because of the variability in cross cultural team projects, there is an increasing need to understand how to navigate the engineering cultural nuances of the host team project countries as well. This realization further drives the importance of higher education institutions, internationally, providing future engineers with the skills necessary to work effectively in the culturally diverse engineering field. Similar findings related to the newly evolved skills required of a global engineer were also cited by (Lohmann, Rollins, and Hoey, 2006), (Warnick, 2010), (Schaefer et al., 2012), and (Soibelman et al., 2011).

Given the vast institutional types, diversity in institutional strengths and resource limitations, and changing workforce dynamics, there is a need for additional research to better understand the alignment of recent graduate preparedness and their place(s) of employment. In particular, at the academic discipline level, the way in which institutions embrace and respond to
the transformational labor dynamics must be continually investigated in order to better understand how to best prepare graduates with global competencies.

Specifically, within this research case study, I will discuss the process by which this institution under investigation prepares its civil engineering students to enter the global marketplace. Each academic discipline has its own nuances and considerations that need to be investigated when considering student preparedness to enter the global workplace. Without further assessment of this problem of practice, U.S. college graduates might be at a disadvantage to successfully integrate into the global workplace. Qualitative feedback secured from a national perspective supports the increasing importance and need for U.S. college graduates to possess those competencies in which international students are excelling in, when compared to the U.S. student audience.

I think, yes, we’re almost at a natural disadvantage. A) we live in the U.S. and the U.S. has one primary language. If you go to Europe, kids learn how many languages? If you go to Asia, I don’t know how many you have to learn. There are many dialects, if you go to the Middle East, you have to learn different dialects. Now, English is a primary language for much of the world but that just spoils us, so yes, that is a big disadvantage growing up here (Professional Association Representative A, personal communication, December 22, 2016).

This possible ramification will influence the U.S. education system as well as lead to several considerations in the already competitive education and industry space. Specifically, the academic community must acknowledge and respond to the increasingly diverse engineering industry and civil engineering specialization current and anticipated trends.
Positionality Statement

Higher education institutions are charged with preparing the next wave of professionals to work at local, state, national, and international levels. However, there is evidence that suggests institutions are not meeting this charge in preparing students, across various academic disciplines, for global work (Stromquist, 2007; Andrews & Higson, 2008; Tanyel, Mitchell, & McAlum, 1999; Lohmann, Rollins, and Hoey, 2006, Warnick, 2010, Schaefer et al., 2012, Sunthonkanokpong, 2011, Joyner et al., 2012; Catalano et al., 2012; Rajala, 2012; Dunsmore et al., 2011; LaFave, et al., 2014; Grigg, 2013; Soibelman et al., 2011; Chak, 2011; Andersen, 2004; Tymon, 2013; Jesiek, 2014). Given variable institutional strengths, limitations, and mission statements, some institutions may be better positioned to provide greater levels of opportunity to support this charge.

The objective of this qualitative case study is to investigate the current process by which a Private Four-Year Research Institution in the Northeast prepares its civil engineering students to be globally competent and possess the skills employers seek in the 21st century, as defined in this research study. Through the interview process to collect first hand experiences of those individuals responsible for overseeing the preparation process, collective feedback was analyzed to inform the outline of the current process, its’ effectiveness, and opportunities for improvement as perceived by interviewed stakeholders. At this time, it is important to provide the context as to why this particular Private Four-Year Research Institution in the Northeast has been chosen as the institution for investigation in this case study. For the purposes of the dissertation, the Private Four-Year Research Institution in the Northeast will be referred to as the institution under investigation for the remainder of the study.
As Transformational Learning Theorist, Paula Cranton (2006) notes, understanding the setting and community of the organization or institution in which one chooses to study will inform the methodology. The data collection process, available opportunities and resources, and challenges when promoting the mission under the circumstances of the organization’s setting and community can determine change or transformation (Cranton, 2006).

In particular, the community or setting of the institution influences how the teaching is executed in the student body as well as the process stakeholders follow in order to accomplish teaching and learning outcomes (Cranton, 2006). The geographic location of this institution, the research site, lends itself well to promoting global competencies in its student body. The diverse, heavily populated urban city that is home to more than several thousands of students on an annual basis and serves as headquarters to large multi-national companies is an ideal geographic location to promote the importance of diversity, cultural awareness, and the global competency skills, employers are seeking in today’s 21st century.

Furthermore, the civil engineering department is likely one of the oldest departments at this institution with more numerous years of history, tradition in teaching, research, and community engagement. This department has contributed significantly to the development of the civil infrastructure and the environments at both national and international levels. The departmental website states the following:

“...we are embarking on an exciting period of growth in the department, expanding our faculty, rejuvenating and growing our laboratory facilities, and expanding our curriculum. This is an excellent time to study at [A Private Four-Year Research Institution in the Northeast]. (Institutional Website, 2016).
In addition to the departmental focused initiatives on transformation, growth, and national and international impacts, all to better equip civil engineers for the transformed engineering field, academic leadership of the College of Engineering states complementary feedback on its college’s initiative to “prepare the next generation of engineers” (Institutional Website, 2016).

Today’s engineering challenges are far more complex than anything we could have imagined even a decade ago. To meet these challenges, engineers from previously distinct areas are now overlapping and partnering with experts in other fields. [we] are optimally placed to respond to this paradigm shift; for more than a century, interdisciplinary collaboration and engagement with the real world have been our guiding principles...[faculty] research looks at critical issues in materials, processes, systems and infrastructure at every scale—nano to macro to global—grounded in a translational approach that integrates the values of fundamental and applied research to meet societal needs. Our students develop as innovators and leaders through [our] distinctive model of experiential learning... The combination of challenging classroom study with opportunities for professional practice and research ensures that we are preparing the next generation of engineers to keep pace with fast-changing global demands. (Institutional Website, 2016).

Given the emphasis on the student learning outcomes of the civil engineering undergraduate curriculum, this aligns with the updated Accrediting Board of Engineering and Technology (ABET) student outcomes that now reflect global team work, an understanding of engineering issues on a global level, and the like global competencies employers seek (ABET, 2016).
In addition, nationally, according to the U.S. News and World Report, the institution under investigation was ranked in the top 50 for 2017 and its College of Engineering is ranked in the top 50 in the nation (U.S. News and World Report, 2016). This national recognition suggests the strengths of the institution and its perception nationally, as a top institution of higher learning preparing future globally-minded students.

As Machi and McEvoy (2009) noted, when conducting research, it is imperative for the primary researcher, myself, to identify and mitigate personal biases. Having worked in higher education in some capacity for several years, I have acquired a significant passion for this field and in particular, the impact of globalization on the academic community, locally and globally. My experience as a consultative research analyst for a higher education consulting firm is one personal bias. In this role, I saw and heard first-hand how industry can drive student outcomes and how important international activity is to industry, which may in turn influence the institutional response on how to prepare students to enter the global workplace. Personal upbringing as noted by Jupp and Slattery (2009) can also impact research.

There is a significant correlation to my personal upbringing and my passion to work and study international education. I was born in Greece and moved to the United States when I was young, which makes me a bi-cultural individual. Over the past several years, I have conducted more than 30 international site visits, where I saw first-hand the effects of globalization on education, industry, and society. This reinforces my interest in preparing graduates to enter the global workplace. Specifically, in the past, I have worked with the Science, Technology, Engineering, and Math (STEM) populations in study abroad advising engineering students on study abroad opportunities to expand their perspectives while maintaining academic degree progress. My bi-cultural identity has influenced my overall perspective and interest in global
competency research. Emigrating to the U.S. from Greece and having multiple personal and professional international experiences, I value the importance of recognizing differences and the ability to interact within different cultures in order to be successful and a global citizen.

Briscoe (2005) further discussed how demographic positionalities impact research and discussed the other as a means to describe how the bias is generated. The other is the personal bias one has towards an audience in which one has chosen to study. Within this research study, the audiences are recent college graduates, engineering faculty, university career education administrators, and engineering employers who to some degree may have direct association to my past personal employment experiences in different capacities. My current personal biases arise given that I work with a graduate student body at a university that is committed to internationalization and preparing students to be global and succeed in the global work environment. Furthermore, in my past consulting experience I interviewed employers across different industries to understand their employer and industry needs and collaborated with universities to deliver appropriate educational programming to meet those needs. Another bias that cannot go unnoticed is my passion for international education and the professional network that I have, which spans across countries and cultures.

Given the fact that I leveraged past employment experiences to assist in sourcing my study participants and I am currently employed at an institution where global is emphasized in its mission statement, I was cautious as to not generalize my experiences. I controlled my perceptions of globalization and student expectations and limit to those institutions within a similar peer group of the current institution under investigation (Briscoe, 2005). Despite this, the recommendations and implications of the results of this case study will inform education practice
and based on institutional strengths and limitations, direct application of the recommendation will vary.

The fact that I am familiar with this institution under investigation, its global mission, geographic location, and personal perception of its strengths in preparing civil engineering students to be globally competent, all these aspects have influenced my current research and the problem of practice. As anticipated, given prior personal collaboration across various institutional offices, there was no barrier to access the permission necessary to recruit participants across respective departments to yield positive participatory levels and collaboration. This relatively smooth recruitment process did in fact, influence how I constructed my study and did possibly present favorable research study conditions. This leveraging of resources and power within this institution under investigation presented positionality though to the best of my ability I tried to mitigate any possibility of influencing my results and the interview process. Additionally, given the proximity of my physical location and location of the institution under investigation, where a number of interviews took place, this did in fact cut down on my travel costs and overall expenses in conducting this case study.

With regard to social influence, the fact that I have numerous familial ties and personal colleagues employed in the engineering industry has to some degree influenced the industry I have chosen to study, given conversations about its current state and the challenges with transnational projects. I was cautious to not incorporate my preconceived notions about the institution under investigation and influence the analysis of my data. However, there is a degree of knowledge that I bring to this research study influenced by past and current professional experiences working in higher education and international education for several years. This
knowledge has been incorporated as reflections on the transformed changing dynamics of the workplace and the need for students to acquire the skills necessary for the 21st century.

**Research Questions**

The below three research questions are explored in this dissertation:

Research Question 1: How does a private four-year research institution prepare its civil engineering students to be globally competent, as perceived by civil engineering faculty, career services administrators, civil engineering alumni, and industry partners?

Research Question 2: How do civil engineering faculty, career services administrators, civil engineering alumni, and industry partners perceive the private four-year research institution as effectively preparing its civil engineering students to be globally competent?

Research Question 3: How could the private four-year research institution better prepare its civil engineering students to be globally competent, as perceived by civil engineering faculty, career services administrators, civil engineering alumni, and industry partners?

**Significance of the Study**

Students, across academic disciplines, are graduating from U.S. colleges and universities with expectations of employability and integration into society and the global workforce. However, given how research emphasizes graduates of various academic disciplines are ill prepared to enter the global workforce based on employer surveys, industry is placing a higher responsibility on education to meet this growing need and skills gap (Kavanagh & Drennan, 2008; Milhauser & Rahshulte, 2010; Prestwich & Ho-Kim, 2007; Andrews & Higson, 2008; Lohmann, Rollins, and Hoey, 2006; Warnick, 2010; Schaefer et al., 2012; Sunthonkanokpong, 2011, Joyner et al., 2012; Catalano et al., 2012; Jesiek et al., 2014; Rajala, 2012; Dunsmore et
The lack of adequate preparation is troubling considering that 85 percent of college students have a career in mind at time of enrollment and 37 percent state how they may drop out if they felt that college would not support them to acquire their professional career (DuPre and Williams, 2011). With increasingly diverse workforces and international activities, many career opportunities will likely have an international dimension. As such, the importance of effective student preparedness for employment is critical and students must be able to apply acquired knowledge in real-work applications through critical analytical thinking, understanding new concepts, working in teams, and problem solving (Bruett, 2006).

Within the engineering field, there is a challenge with program outcome and global workplace alignment. The engineering field has evolved significantly from technological advancements and increased demand for greater productivity in the global engineering work environment (Warnick, 2010; Jesiek et al., 2014; Catalano, 2012; Joyner, et al., 2012; Schaefer et al., 2012; Sunthonkanokpong, 2010; Chak, 2011). Given the prescribed engineering curriculum, institutions must think creatively about internationalization for engineering graduates to meet the local and global economic needs. Engineers, who do not possess these additional attributes, resulting from the influence of globalization, may suffer or lose their competitive edge in the global workplace (Lohmann et al., 2006).

This case study will offer another perspective to the education community of one institution’s journey in preparing civil engineering graduates to be globally competent and possess the skills necessary for the global engineering workplace. The hard and technical skills of engineers, regardless of specialization are still in demand and necessary; however, given globalization and the multinational dimensions of business operations, there is a need to equip
engineers with global competencies, and those “soft skills’ that are increasingly important for
today’s business transactions, especially for those that cross borders. This case study will offer
an inside look at this institution’s current process, through engagement of various stakeholders to
understand how it works collaboratively with internal and external constituents to address the
changing employer and industry needs of engineers. The results will add to a body of knowledge
that states there is a lack of readiness for our graduates to enter the global workplace and
specifically, within the civil engineering field as noted by some employers and past research.

**Theoretical Framework: Cranton’s Fostering Transformational Learning Theory**

Globalization is here to stay. And so, institutions of higher learning must continually
transform to adapt and stay current with the changes resulting from the globalization of
industries (Rizvi & Lingard, 2007; Fugate & Jefferson, 2001, Taylor, 2005; Jones, 2003; Bruett,
2006). These shifts in employer expectations have a direct impact on colleges and universities
and how they prepare graduates to deal with this dynamic society and workforce (Edwards,
2007; Hunter, 2004; Stromquist, 2007; Green, 2012; Harder, 2011; Jurgens & Robbins-
O’Connell, 2008).

According to Warnick (2010), a sample of engineering employers most frequently seek
employees to exhibit a global mindset, understand and appreciate different cultures,
communicate cross-culturally, and work on international teams. And because of globalization,
engineers who do not possess these additional attributes may suffer in the global workplace
(Lohmann, Rollins, and Hoey, 2006; Warnick, 2010).

Given the significant attention placed on higher education, by industry and national
initiatives, a better understanding of the lack of preparedness amongst recent college graduates to
enter the global workplace is critical (Hunter, 2004; Stromquist, 2007; Andrews & Higson, 2008; Tanyel, Mitchell, & McAlum, 1999; Andersen, 2004; King, 2003; The White House, 2013).

Without further assessment of the problem of ill prepared college graduates, in particular, civil engineering students, U.S. civil engineering graduates may face employability challenges in a workplace that is increasingly calling for strong soft skills in addition to technical skills. This potential consequence will inform and influence how the U.S. education system adapts and stays current in order to maintain a competitive edge and prepare students to enter transformed industry sectors. Because of this transformation, this case study is grounded in fostering transformational learning theory (Cranton, 1994, 2006, 2010).

Transformational learning theory is grounded in the notion of discourse and changing one’s perspective or frame of reference. A primary goal of transformational learning theory is to develop autonomous thinking and synthesize different perspectives in order to cultivate personal meaning (Mezirow, 1997). Society engages in discourse; events, activities, conversations, and related to assess different perspectives, which ultimately inform their own meaning. Given the changing learning needs of the workforce; the need to think autonomously and put oneself in a situation where they are experiencing discourse, is increasingly critical and aligns well with my problem of practice. Advancements in technology, economic, political, and societal influences and internationalization efforts have influenced what the engineering industry expects of incoming employees. Transformational learning supports that learners need to evolve in their thinking with their personal experiences and interactions, which are influenced by a larger social responsibility and global citizenship reference (Mezirow, 1997). Gaining critical reflection of various worldviews and perspectives is a foundation of transformational learning theory, which has evolved in recent years to view the world through a holistic lens (Cranton, 2006).
Jack Mezirow (1997), a seminal author of transformational learning theory, states how transformative learning takes place “…in the way human beings communicate and is a common learning experience not exclusively concerned with significant personal transformations.” (p.10, Mezirow, 1997). Mezirow’s (1978) original transformational learning theory was grounded on Haberman’s (1971) three kinds of human interests with resulting kinds of knowledge – instrumental, practical, and emancipatory (Cranton, 2010). Within the individual focus a developmental perspective and cognitive transformation takes place within a frame of mind moving from a simplistic way of thinking to a higher order, more complex way of thinking (Cranton, 2010).

Recent scholars and theorists have focused on transformation as a social change and social context goal or have applied it to an organization or group of people (Cranton, 2010), compared to Mezirow’s (1978) emphasis on the individual. Social transformational theorists focus on ideology critique as the core to transformation and that without social action there is no self-reflection or change because there is no change (Cranton, 2010). Within the context of a faculty teaching, instructors question concrete aspects of instruction in a rational and cognitive way (Cranton, 2010). Other theorists include, Clark (1993), Dirkx (1998), and Elias (2000) (Cranton, 2010). Dirkx’s (1998) approach to transformation drew upon Freire’s (2000) idea of emancipatory education, which emphasizes passive listening and acceptance of facts (Cranton, 2010).

In contrast to Mezirow’s (2000) original theory on transformation, he postulates that critical reflection and self-reflection are at the core of a transformation, where other theorists, like Dirkx (2001), state imagination, intuition and emotion as the core of a transformation. Despite the discrepancy in what is at the core of a transformation, the truth is that a
transformation is possible and can occur from an individual or societal influence on an individual, group, or organization.

Wright and Clarke (2010) applied transformational learning theory to their marketing student study when assessing study abroad experiences and their impact on a student’s global mind. Hamza (2010) also reviewed the transformation that occurred when educators taught overseas and how this transformation influenced their point of view, their teaching when they return to the United States and their cultural awareness. With regard to the application to my specific problem of practice related to preparing engineering students with global competencies, Warnick (2010) conducted a study on engineers to determine the global competencies that are most sought out by engineering employers. Cranton’s (1994) fostering transformational learning theory will aide in explaining how stakeholders engage in discourse in the classroom or career advising session to develop these opportunities to transform a student’s mind frame to think critically and globally as required by 21st century employers. Consequently, the transformation in the pedagogical and career preparation process in preparing civil engineering graduates to be globally competent will be explored.

Cranton’s fostering transformational learning theory has a larger societal context application to the transformation process and application within the education setting, which stems from Mezirow’s (1978) transformational learning theory (Baumgartner, 2001; Sokol and Cranton, 1998). Fostering transformational learning theory focuses on the critical reflection of the transformative learning experience within the education setting (Taylor, 2007).

There are three assumptions associated with Mezirow’s perspective of practice that are reflective of fostering transformational learning theory (Cranton, 2006, p. 45);

1) creating a safe and inclusive environment,
2) focus on the individual learner’s needs,

3) building on a lived experience

It is important to address the individual need and not assume a “one size fits all” approach to transformation. In direct application of my central research question, which focuses on the process by which an institution prepares civil engineering students to be globally competent, there is an internal reflection process that an institution undergoes in order to capture the needs, demands, and expectations of industry to transform into practice within the university setting. The process is unique to this institution and does not follow a “one size fits all approach”. The emphasis is that a transformation occurs following a “trigger event” and is fostered by critical discourse and reflection (Sokol and Cranton, 1998). The transformation in employer expectations is to have globally competent civil engineers due to internal and external factors influencing the industry. This “trigger event” which in turn is internalized by this institution influences its process in the preparation of globally competent civil engineering students.

Given the intended focus of the process by which the institution prepares students, which is influenced by internal and external stakeholders and factors, one may equate this to “trigger events”. Industry and workforce changes resulting from globalization, variability in student expectations, and events that result from changes in societal, political, or economic climates can all inform how an institution prepares its students. These changes or “trigger events” transform the institutional, departmental, and career education foci of preparing students for the global workplace. The critical discourse and reflection that occurs by each stakeholder in their respective setting, enhances and transforms the process by which the institution prepares engineering students with global competency skills.
The constructivistic research paradigm approach aligns well with fostering transformational learning theory given the holistic approach to learning, understanding transformation, and making meaning of an activity where the researcher constructs an understanding of a phenomenon of interest from the perspectives of those involved in the experience (Cranton, 2006, p. 58). Given the goal of this case study is to understand how individual groups representing engineering faculty, university administrators from career services, and the alumni student population make meaning of their experiences in working within a civil engineering context this qualitative feedback is critical and necessary to inform the process this institution follows to equip its civil engineering students with global competencies.

“Learning occurs when an individual enters a process of reconciling newly communicated ideas with the presuppositions of prior learning.” (Cranton, 1994, p. 317). The discourse and transformation that occurs when there are multiple aspects, multiple conversations happening that influence the process and the thinking, is the piece of the puzzle that yields this transformation and evolution. The investigation unveiled not only the current process of preparing civil engineering students to be globally competent but informed how the process is perceived by interviewed stakeholders. Furthermore, it uncovered the pedagogical transformation of civil engineering curriculum to address the global competency construct. The process will be uncovered through discourse and dialogue with various stakeholders.

The documentation of a process an institution follows to equip its civil engineering students with global competencies is an important and critical one. This institution is globally-minded with an emphasis on direct theory application in the workplace that promotes its brand and mission as one that prepares global citizens. This case study will explore how the various interviewed audiences overlap and interact in this process to provide a transformative learning
experience to civil engineering students to align with industry expectations. As Cranton (2011) indicates, for an underlying transformation to take place, changes in individual perspectives on what is necessary to include in academics and career preparation to allow for global competency acquisition must be noticeable.

In review of Cranton’s fostering transformational learning theory (1996, 2006, 2010, 2011) and its application to student preparedness of civil engineering graduates for the global workplace, there is an increased understanding that in order for transformational learning theory to work, there needs to already be an independent frame of reference and foundation, which students/individuals can add to, in order to have that change in perspective and reference. The engineering field has an established hard skill set that is evolving like many industries. The expectations of those entering this field are changing and forcing them to think more abstractly in order to meet the competencies of the 21st century.

With multiple academic, professional, and social activities to engage in multi-cultural environments to develop the skills employers seek in the global workplace, curricular alignment of student learning outcomes to the ABET professional standards for the global engineer, and the global network of resources, the institution under investigation has the potential to be viewed as an institution that is preparing its graduates for the 21st century global workplace. The university has a globally-focused mission and strives to incorporate global citizenship qualities in its graduates through various institutional initiatives. As such, this case study will not only further enhance the institutional mission of global citizens but also allow for peer institutions and the academic environment, in general, to review the findings of this study for applicability as well further add to the scholarship surrounding civil engineering student preparedness. Each of the stakeholders in this study provided invaluable first hand feedback. Given the significant
importance of employability post-graduation, especially, in a STEM-related field, this study is timely and will enhance the existing literature on preparing students for the global workforce community and help bridge the gap between what employers are increasingly seeking and how the university prepares its civil engineering students.

Because this case study does not assess a particular activity related to a student experience to assess transformation, it will be challenging to yield which specific experiences offered by the institution under investigation are more likely to assist students with acquiring global competencies. Cranton’s fostering transformational learning theory (1994, 2006, 2010, 2011) captures how the critical reflection and discourse is important in assessing transformation. As such, the “trigger event” has already happened, so we are not able to capture the pre-and post-experience of the transformation that occurs from this event. In follow up studies, a quantitative pre-and post-test study would lend itself well to understanding how an experience produces global competency and consequently, be able to assess which institutional activity offers better results.

In addition, future research studies may include an in-depth employer analysis case study. This research case study is limited to a defined timeframe and set research questions. In order to further understand the alignment between employer expectations and university preparation of civil engineering graduates with global competency skills, a thorough study to include only employers can be conducted. This case study will lay the foundation and groundwork for better understanding how the university responds to the changing needs of the engineering industry. Overall, the benefits are too many to not conduct this case study for all stakeholders, at the micro and macro level.
Conclusion

The concept of globalization and the influence on industry and higher education is fascinating to me. There are ample opportunities to study this phenomenon and its influence on specific academic disciplines via different vehicles and constructs. The projects that focus on discussions around workforce readiness, the changing employment space, changing consumer expectations and the influence on educational programming are most attractive. I am keenly intrigued with the marriage of higher education and business and the evolution of this relationship as we enter the 21st century and beyond. The specific nature of this case study, which will focus on engineering and the civil engineering student population, will add to the body of knowledge that speaks to the lack of student preparedness.
Chapter II: Literature Review

In order to conduct a thorough investigation of the institution under investigation’s process in preparing its civil engineering students with global competencies, setting the context that informs how the civil engineering industry has evolved to adapt to these changing market dynamics is critical. This high-level overview will first introduce globalization and its impact on industry, in general. This will be presented through an employer and higher education lens citing relevant research on workforce development skills, gaps in alignment between employer and educational programming, the lack of student preparedness to enter a global workplace, and institutional efforts made to respond to these challenges. Following this high-level presentation of literature that addresses the impact of globalization on various industries in general, literature on engineering, the civil engineering industry and the global civil engineer will be presented.

Definition of Terms

When conducting scholarly research, it is imperative for the principal investigator to define the terms of the primary research question, the phenomenon that is the core of the study and additional concepts that will be central to the research study (Cranton, 2006). For the purposes of this dissertation, the following terms will be defined; globalization, internationalization, skills necessary to be globally competent, prepares, and process.

According to the Merriam Webster Dictionary, globalization is defined as “the act or process of globalizing, the state of being globalized, the development of an increasingly integrated global economy marked especially by free trade, free flow of capital, and the tapping of cheaper foreign labor markets.” (Merriam Webster, http://www.merriam-webster.com/dictionary/globalization, January 8, 2016). Hirst, Thompson, and Bromley, (2015) take this definition one step further and posit how the concept of globalization has taken over the
daily operations of how an organization, a society, a network, and an industry conducts transactions and carries on in their daily lives (Hirst, et al., 2015). Mulhauser and Rahschulte (2010) describe globalization as a sense that the world is becoming smaller and an individual’s perspective is broader. Essentially, “globalization refers to the trend towards organizations crossing economic and geographic boundaries and expanding from a local or regional perspective to a global one” (Mulhauser & Rahschulte, 2010, p. 79).

Given the focus of this case study is on the engineering industry, specifically, civil engineering the context of global competencies will be examined through this global civil engineer lens. Based on existing literature focused on the skills employers seek in civil engineers to enter the global engineering workplace the global competency skills necessary to be globally competent are defined as the following attributes that an individual possesses within the workplace: cultural awareness and appreciation, the ability to think innovatively and critically, and the ability to interact and work across different time zones with diverse backgrounds on international teams with an understanding of the local, in-country structure and organization (Schaefer et al., 2012; Joyner et al., 2012; Warnick, 2010; Lohmann et al., 2006; Bielefeldt, 2013).

Prepares is defined as providing students with the global competency skills necessary for successful integration into an engineering organization with international activity. This successful integration provides civil engineers with the skills and knowledge necessary to collaborate cross borders on diverse team projects in foreign societies and cultures.

Internationalization, which within an education context refers to institutional efforts to assist students in achieving intercultural skills and competencies, is the direct effect of globalization (ACE, 2012).
Process will be defined as the way in which the institution under investigation informs its civil engineering curriculum, engineering-related practical experiences, and administrative mechanisms to provide a platform from which to prepare civil engineering students with the relevant and current skills necessary to enter the global engineering workplace.

When reviewing the literature and organizing this literature review, multiple themes surfaced that were classified as either, supporting the discovery argument or the advocacy argument. Employers, researchers, and governmental agencies bring to the surface how higher education institutions play a critical role in preparing future leaders. The new future leaders must be equipped with not only the technical knowledge of practice and industry but also the knowledge and new skills resulting from globalization. Without this awareness and preparation, not only will graduates suffer with employability but industry itself will experience challenges in its business practices and operations, especially on a global level (Milhauser & Rahschulte, 2010; Mahadevan, 2014; Sunthankanokopng, 2010; Rajala, 2012; Catalano et al., 2012; Soibleman et al., 2011; Chak, 2011; Schaefer, et al, 2012; Joyner et al., 2012; LaFave, et al., 2014; Beilefeldt, 2013; Itani and Srour, 2015; May et al., 2014; Hunter, 2004; Stromquist, 2007; Andrews & Higson, 2008).

Within the context of this particular case study, globalization, the impetus behind the transformation of the engineering industry and the civil engineering specialization, was reviewed to understand how academic thinking and delivery of programming at the university has been reshaped. Specifically, the transformation of the civil engineering practitioner is presented through literature, highlighting the changing practitioner outcomes as desired by engineering employers who employ civil engineers in a global civil engineering industry. These changes have resulted in the engineering employers expecting civil engineers to possess global
competencies, those skills that are complementary to the technical hard skills in order to perform the projects necessary on a global level (Mahadevan, 2014; Sunthankanokopng, 2010; Rajala, 2012; Catalano et al., 2012; Soibleman et al., 2011; Chak, 2011; Schaefer, et al, 2012; Joyner et al., 2012; LaFave et al., 2014; Beilefeldt, 2013; Itani and Srour, 2015; May et al., 2014).

It is not surprising that the term; global competency, was frequently highlighted in the research given the rise of globalization (May et al., 2014). The manner in which this concept has transformed global business practices and operations has significantly influenced the employment sector with regard to the skills employers now seek to interact successfully in the global workplace (Warnick, 2010, Lohmann, Rollins, and Hoey, 2006, Mahadevan, 2014, Dunsmore, Turns, and Yellin, 2011, LaFave, Kang, and Kaiser, 2014, Soibelman, Sacks, Akinci, Dikmen, Birgonul, and Eybpoosh, 2011; Grigg, 2013; Sunthonkanokpong, 2011, Shaefer et al., 2012; Joyner, Mann, and Harris, 2012; Chak, 2011; Mahadevan, 2014; Rajala, 2012; Catalano et al., 2012; LaFave, et al., 2014; Beilefeldt, 2013; Itani and Srour, 2015; May, et al., 2014).

Despite some variability and controversy in the research of how global competencies are defined in different industries, these soft skills are increasingly becoming the norm when it comes to preparing students to enter the global workplace. As such, although this variability exists, there is a common understanding and a common theme that higher education institutions are ill preparing students for the global workplace (May, et al., 2014).

Employer surveys and institutional case studies, related to industry at large, followed by an in-depth investigation of the engineering field and civil engineering specifically, were reviewed that highlighted the importance of global competencies and the higher education response to this shift in academic preparation (May et al., 2014, Mahadevan, 2014; Catalano, 2012; Soibelman, 2011; Schaefer et al., 2012; LaFave et al. 2014; Grigg, 2013; Dunsmore et al.,
In addition to the employer and scholar lens, although limited, civil engineering student perceptions of global competencies and preparation for entering the global workplace, were also presented (LaFave et al., 2014; Dunsmore, et al., 2014; Bielefeldt, 2013; Itani and Srour, 2015).

Lastly, current institutional practices on how students; engineering and civil engineering students, are prepared to enter the global workplace are examined (May et al., 2014, Mahadevan, 2014; Catalano, 2012; Soibelman, 2011; Schaefer et al., 2012; LaFave et al. 2014; Grigg, 2013; Dunsmore et al., 2011). Despite these institutional efforts, some employers still find employees unprepared. As such, this case study seeks to better understand and define the process by which the institution under investigation prepares its civil engineering graduates for the global workplace. The findings and implications of this case study will inform the academic community on further addressing the preparedness of civil engineering college students to enter the global engineering field. Globalization and borderless transactions will continue to influence employment dynamics, as such, this scholarship will also serve the purpose of addressing a national education matter impacting multiple stakeholders with severe consequences, if not addressed.

**Review of Research**

**The New Global Workplace: Changing Employment Dynamics**

The world is becoming smaller. Globalization is transforming the way in which business and communication is conducted. Furthermore, with the response to world events and the way in which citizens interact within this transformed society, greater collaboration across borders is necessary as changes will be experienced at a macro level (Milhauser & Rahschulte, 2010; Mahadevan, 2014; Sunthankanokopng, 2010; Rajala, 2012; Catalano et al., 2012; Soibleman et al., 2011; Chak, 2011; Schaefer, et al, 2012; Joyner et al., 2012; LaFave, et al., 2014; Beilefeldt,

Within the United States, as noted by Chida and Brown (2011), since 2008, the United States has lost two of its competitive advantages that led to its growth up until the 1990s. These competitive advantages include scale to countries such as China and India and education attainment to the BRIC (Brazil, Russia, India, and China) countries.

The marriage of economic, societal, political, and educational changes is core to the concept of globalization. With increasingly borderless boundaries of educational attainment, business practices, and mobility of individuals, understanding and responding to the influence of globalization on workforce development skills is critical. The literature suggests that as industry expands its footprint beyond the U.S. or its’ native location, employers increasingly expect entering employees to have an understanding of the competencies necessary to work in a global environment (May et al., 2014). It is important to note, that the engineering employer profile, one that has a large multi-national presence versus one that is more locally-based may inform the degree to which and application of the global competencies expected for current civil engineering projects.

With borderless opportunities of knowledge, economic, societal, cultural and political exchange, “globalization refers to the trend towards organizations crossing economic and geographic boundaries and expanding from a local or regional perspective to a global one” (Mulhauser & Rahschulte, 2010, p. 79). Given the rising diversity in workforce and increasing transnational projects, it is not out of context to consider that the majority of future career
opportunities will likely have an international dimension. As such, the importance of effective student preparedness for employment is critical.

**The Engineering Industry: From Local to Global**

The engineering industry has experienced significant transformation over the past several years, which is a direct result of increased technological advancements that has made communication and project planning borderless (Warnick, 2010; Lohmann et al., 2006; Shaefer et al., 2012; Joyner et al. 2012; Rajala, 2012). This in turn has led to an evolution of the required skills engineering employers seek in engineers, across specializations and expectations of work output on a global level (Warnick, 2010, Lohmann, Rollins, and Hoey, 2006, Mahadevan, 2014, Dunsmore, Turns, and Yellin, 2011, LaFave, Kang, and Kaiser, 2014, Soibelman, Sacks, Akinci, Dikmen, Birgonul, and Eybpoosh, 2011, and Grigg, 2013; Sunthonkanokpong, 2011, Shaefer et al., 2012; Joyner, Mann, and Harris, 2012; Chak, 2011; Mahadevan, 2014; Rajala, 2012; Catalano et al., 2012; LaFave, et al., 2014; Beilefeldt, 2013; Itani and Srour, 2015; May, et al., 2014).

Warnick (2010) discusses the evolution of the engineering field resulting from technological advancements and increasing recent competition to perform well in a globalized marketplace. Joyner et al., (2012) further suggest how social networking developments have provided a larger forum for engineers to collaborate, transnationally. Chak (2011) adds further how the traditional employment of engineers in local companies will evolve to transition to larger multinational companies with travel abroad requirements and broad knowledge of local and foreign policy. Lafave et al., (2014) asserted how the entire professional engineering community has acknowledged this transformation in required skills due to globalization with an emphasis on acquisition of soft skills.
The New Required Skills: Global Competencies

The American Council on Education (ACE) defines internationalization as institutional efforts to assist students in achieving the evolving competencies and skills employers are looking for as they relate to working in multi-national corporations and transnational projects (ACE, 2012). Bruett (2006) supports that students must be able to apply acquired knowledge in real-work applications through critical analytical thinking, understanding new concepts, working in diverse teams, and problem solving.

These attributes were also observed in Billing’s (2003) study of employers across five countries; the United Kingdom, the United States, Australia, New Zealand, and South Africa. A comparative analysis of what employers sought in cognitive abilities, were identified as problem solving, teamwork, communications, and technical ability. However, in order to be most effective in learning outcomes in the education setting, the cultural context needs to be taken into consideration. This cultural context is important, given the emphasis of global practices and common transferable skills across different industries, which increases employability. Although Billing’s (2003) analysis reviewed certain industries and countries, the results are not generalizable and thus opportunities to further understand how higher education institutions are preparing students to meet the evolving needs of employers exists.

The Global Engineer: The Wave of the Future

Well-rounded and well-educated engineers are in high demand, globally (Rajala, 2012; Warnick, 2010; Mahadevan, 2014; Soibelman et al., 2011; LaFave et al., 2014; Lohman et al., 2006; Chak, 2011; Sunthonkanokpong, 2011). In order to effectively respond to the changing engineering work responsibilities, engineers will be required and must be trained to embrace the holistic view of hard and soft skills. The standard engineering technical skills are still and will
continue to be required, however, employers, especially those with an increasingly multi-national presence and transnational work projects, are now seeking engineers to also possess attributes of global competency (Schaefer et al., 2012; Joyner et al., 2012; Soibelman et al., 2011; LaFave et al., 2014; Chak, 2011; Itani et al., 2015; Lohman et al., 2006; Rajala, 2012; Mahadevan, 2014; Bielefeldt, 2013).

Global competency skills are defined as the following attributes (Schaefer et al., 2012; Joyner et al., 2012; Warnick, 2010; Lohmann et al., 2006; Bielefeldt, 2013), which an individual possesses within the workplace:

- cultural awareness and appreciation;
- the ability to think innovatively and critically;
- and the ability to interact and work across different time zones with diverse backgrounds on international teams with an understanding of the local, in-country structure and organization.

According to Warnick (2010), the most important skills identified by engineering employers in his study were the ability to exhibit a global mindset, understand and appreciate different cultures, communicate cross-culturally, and to work on international teams. These findings were also supported by Itani and Srour (2015) in their analysis of 235 engineering student perceptions of necessary soft skills as required by engineering employers. Itani and Srour (2015) supported how teamwork, communication, management, and interpersonal skills are increasingly sought out by engineering employers, given the dynamic and evolving engineering field.

Rajala (2012) emphasized the need for engineers to be able to demonstrate effective communication, creativity, teamwork, critical and entrepreneurial thinking, and comprehension.
of business in a global context. LaFave et al., (2014) echoed these attributes as necessary for the
global civil engineer as did Jesiek et al., (2013) in their empirical analysis of engineering case
studies and interviews with engineering professionals representative of individuals employed in
current or past roles involving technical global work in large companies.

Joyner et al., (2012) noted how engineering employers like Cummins, Inc., see
themselves as “a global power leader, a corporation of complementary business units that design,
manufacture, distribute, and service engines and related technologies…” (Joyner et al., 2012, p. 67). This dynamic corporation is representative of an industry that is a “social activity” (Joyner, et al., 2012, p. 68). Industry is influenced by various factors, ultimately creating a new type of
work and a new method of business practice that encompasses increased collaboration, diversity
and globalization, virtual teams, telecommunications, in essence “thinking and working
differently” (Joyner et al., 2012, p. 68). And because of this transformation of work dynamics
and culture engineers who are not exposed to situations or curriculum that yield these new
additional attributes that are non-technical, may suffer in the global workplace.

Lohmann et al., (2006) further supported how engineers need to adapt and evolve in order
to be global engineers and respond to the new demands of the engineering industry. The global
engineer must acquire three new skills in order to secure employment in the global engineering
industry. First, the global engineer needs to expand the knowledge they have to include areas
such as global socio-economic and political systems, international commerce and world markets,
environmental systems and research and technological innovation. Second, engineers must
refine their diverse interpersonal skills and lastly adapt and be open-minded to working and
living abroad comfortably in transnational engineering projects (Lohmann et al., 2006).

Schaefer et al., (2012) stipulated that despite core technical competencies remaining
important to succeed in the global workplace the lifelong engineer learner will need to acquire a number of additional soft skill competencies. In particular, those focused on forming communities, learning how to learn, and collaborate across different cultures, continents, and organizations will be necessary in order to well prepare engineers to become future global leaders in the 21st century (Schaefer et al., 2012).

The Global Civil Engineer: Why Is It Important?

The civil engineering specialization is a subsector of the engineering industry that is increasingly rising to the forefront as an area that needs further research to better understand the skills gap that exists between employment skills sets and college preparation (Soibelman, et al., 2011; LaFave et al., 2014; Grigg, 2013; Bielefeldt, 2013). As the field of civil engineering continues to evolve with increasing urbanization efforts, renewable energy projects, and overseeing large complex projects that are borderless, with increasing responsibilities of abroad travel, well-rounded educated engineers with strong hard technical skills and soft skills, such as global competencies will enhance employability (BLS, 2015; Bielefeldt, 2013).

The civil engineering industry is experiencing significant growth that is both healthy for employment but also brings challenges in the manner in which work will be commissioned and executed across borders (Bielefeldt, 2013). The Bureau of Labor Statistics (BLS) forecasts the job outlook for civil engineers to grow 8 percent from 2014-2024 (BLS, 2015). Compared to all engineers, regardless of specialization, over the ten-year period (2014-2024), the civil engineer specialized profession is projected to increase by 100%, 4% compared to 8%, respectively. Furthermore, when compared to all occupations, the civil engineer is projected to increase at a larger percentage rate as well, 8% compared to 7% (BLS, 2015).

Increasingly, U.S. engineering consulting companies are taking their operations overseas
and working in foreign yet exciting territories. This is a response to the significant growth in infrastructure that is needed in the fast-developing countries, which can be highly rewarding for those in civil engineering positions (Bielefeldt, 2013). However, as the BLS (2015) notes, individuals who participate in experiential and practical experiences during their academic career will fair more favorably than those who do not in this competitive and complex civil engineering employment landscape. Participant feedback also complements the need for graduates to possess relevant work experience upon graduation as they seek employment in engineering firms, “I am not looking as much…what was in their curriculum but what was in their resume of what they did besides college. I’m looking for the candidate who has done a true internship…to me that is irrelevant to the curriculum.” (Professional Association Representative A, personal communication, December 22, 2016). This fact supports the rationale as to why the particular institution under investigation was selected, given the emphasis on theory and practical application through experiential opportunities during the student’s academic career.

Grigg (2013) supported how this complex landscape is evidence that a single facet approach to problem solving and conducting business is no longer enough. The inclusion of cultural nuances, human behavior, and governmental and regulatory practices are critical to the technical issues of a civil engineering project that is commissioned offshore. As such, these alternative thinking modalities of problem solving, taking into consideration the restrictions and parameters of offshore projects must be addressed in the new global civil engineer (Grigg, 2013). There is an expectation that civil engineers will be culturally aware and are able to compete in the global environment (Soibelman, 2011; LaFave et al., 2014; Grigg, 2013; Bielefeldt, 2013).

LaFave et al.’s (2014) study further highlighted the importance of intercultural competency amongst undergraduate civil engineering students in order to meet the increased
expectations of engineering corporations in the global workplace. These findings are corroborated in a study by (Bielefeldt, 2013).

**The Engineering Professional Standards Are Evolving**

Because of the changing engineering employer demands and needs to operate in a globalized industry absent of borders and time zones and full of cultural and location specific nuances of regulation, history, political climates, and business operations practices, engineering professional standards are changing. The American Society of Civil Engineering (ASCE) and the Accrediting Board of Engineering Technology (ABET) are both fully committed to ensure engineering curriculum is reflective of these changing workforce trends (Grigg, 2013; Itani and Srour, 2015; Bielefeldt, 2013).

ABET’s recognition of the need to better prepare engineering students with the skills necessary to compete in today’s dynamic workplace is further evidence of the need to equip students with global competencies. Specifically, ABET has further articulated its definition of teams within its engineering program student learning outcomes as such:

**Teams** – A team consists of more than one person working toward a common goal and may include individuals of diverse backgrounds, skills, and perspectives (ABET website, 2016).

Given the prescribed engineering curriculum, institutions must think creatively about internationalization for engineering graduates to meet the local and global economic needs (May et al., 2014) and Dunsmore et al., (2011) emphasized the national awareness of this engineering employment and employer misalignment when it comes to preparing students for the evolving engineering industry.

In Sunthonkanokong’s (2011) study of 172 engineering undergraduate students at a
university in Thailand, engineering student perceptions indicated how the future of engineering education will transform to incorporate outcomes to yield greater acquisition of leadership skills, communication skills, ethical standards, creativity, lifelong learning, and practices to enhance the global vision of the engineering industry. Chak (2011) supported this evolution of the engineering curriculum to maintain a flexible and broad format in order to prepare engineering students to successfully enter into the global engineering workplace.

The changing role of the engineer in the 21st century and beyond may disadvantage recent U.S. engineering graduates entering the global workplace if not well prepared with the new required skill sets (Sunthonkanokpong, 2011). As such, it is critical and timely for colleges and universities to adapt to the changing employee needs of the engineering industry. And although there are initiatives in play at institutions across the United States they are not sufficient enough to meet the multiple dimensions of developing global competence, which can negatively impact engineering graduates entering the global engineering environment (May et al., 2014).

This case study will explore the process of the institution under investigation in its preparation of civil engineering students, specifically, with these global competency skills that are increasingly being sought out by industry. The intent of the focused study of the civil engineering curriculum, process, student outcomes, and experiential preparation seeks to further enhance this body of knowledge and add research to an area with limited yet highly necessary scholarship on global competency.

**Higher Education’s Struggle to Prepare Students for the Global 21st Century Workplace**

There is a gap between the knowledge students learn in the classroom and what is necessary to succeed in the real world. The gap exists across various industries; placing a high responsibility on colleges and universities to respond to the changing market dynamics to better
prepare college graduates entering the workplace. This response though is not adequate in terms of student preparedness for the global workplace (Childa and Brown, 2011; Moore, Fernie, and Burt, 2000; Andrews and Higson, 2008; Billing, 2003; Hunter et al., 2006; Kavanagh & Drennan, 2008; Milhauser & Rashchulte, 2010; Velasco, 2011; Crossman & Clarker, 2009; Altbach & Knight, 2007; Warnick, 2010; Sunthonkanokpong, 2011; Schaefer, et al., 2012; Joyner, et al., 2012; Mahadevan, 2014; Rajala, 2012; Catalano et al., 2012; Soibleman et al., 2011; Chak, 2011; LaFave, et al., 2014; Beilefeldt, 2013; Itani and Srour, 2015; May et al., 2014).

In general, the expectation is on institutions of higher learning to internalize global competencies within curriculum program offerings and university experiences to align with these changing industry needs. Given the global competition of education higher education accountability is significant. Colleges and universities must rise to the occasion and assess institutional profiles to meet the shifts of expectation resulting from globalization and its impact on industry. Despite this awareness, on a national and global level, several studies highlighted how higher education is primarily failing to prepare its college graduates well (Hunter, 2004; Stromquist, 2007; Andrews & Higson, 2008; Tanyel, Mitchell, & McAlum, 1999; Andersen, 2004; King, 2003; Schaefer, et al., 2012; May et al., 2014).

According to Yelland (2011), in 2007-2008, the U.S. employed 3.4 million people in the higher education sector. In 2007, the Organization for Economic Cooperation and Development (OECD) reported that it cost $193,584 on average for an individual to obtain a tertiary education. With the College Board’s anticipated annual tuition rate increases, this average in 2016, 2017, and so on will continue to grow and will likely drive student expectations and employability outcomes higher as well (College Board, 2015). This coupled with the increasing costs
associated with pursuing higher education it is imperative to adequately prepare students for
success in the global work environment, while meeting industry demands.

If higher education is to keep up with the changing economy and serve its intended
purpose to meet the needs of local economy and society at large, global literacy, defined as
“preparing graduates to function within a system that relies on a greater global interdependency
between economics, politics, environment, and culture” (Angew & Van Blakom, 2009, p. 451) is
critical. The answer to meet local and global economic needs is internationalization.

The goal of institutions of higher learning is to ultimately prepare future employees to
have the capability to work within different industries across continents. Individual institutional
strengths and limitations will inform how this goal is met, however, the fact remains that
globalization has influenced and will continue to influence the industry sector; public and
private. Given this evolution of preparation and employment trends, institutions are charged
with the task of keeping informed and responding to the evolving market dynamics.

Global awareness, civic engagement, analytical thinking, communication, and
understanding new ideas and collaborating transnationally are the twenty-first century
competency skills, required of incumbent employees (Bruett, 2006; May et al., 2014). Despite
the identification of these twenty-first century skills, the variation in how global competency is
defined in the literature, may cause a lack of uniform research for its application to industry and
higher education programming (Hunter, White, and Godbey, 2006). Although Hunter’s et al.,
(2006) findings suggest consensus regarding the skills, knowledge, attitudes, and experiences
necessary for today’s global society, amongst employer representatives of diverse industries and
international educators, it is critical to have a uniform definition of global competency within an
industry to inform how employees, current and future, in that respective industry are prepared by
As such, after a review of engineering specific literature, the common attributes and skills noted that informed the definition of global competency, which was used in this case study are as follows (Schaefer et al., 2012; Joyner et al., 2012; Warnick, 2010; Lohmann et al., 2006; Bielefeldt, 2013):

- cultural awareness and appreciation;
- the ability to think innovatively and critically;
- and the ability to interact and work across different time zones with diverse backgrounds on international teams with an understanding of the local, in-country structure and organization.

**Higher Education Challenges: Preparing for the New Role of the Global Engineer**

With the changes resulting from globalization, engineering academic programs and colleges and universities are being tasked with revising student outcomes and curricula to align with new employer demands. However, they appear to be failing to keep up with the evolving skills sets of the new global engineer with integration of global competencies (Warnick, 2010; Sunthonkanokpong, 2011; Schaefer, Panchal, Thames, Haroon and Mistree, 2012, Joyner, Mann, and Harris, 2012; Mahadevan, 2014; Rajala, 2012; Catalano et al., 2012; Soibleman et al., 2011; Chak, 2011; LaFave, et al., 2014; Beilefeldt, 2013; Itani and Srour, 2015; May et al., 2014).

In Warnick’s (2010) dissertation focused on engineering curriculum alignment to workplace demands, he argued that colleges and universities face a challenge when trying to provide an experience and opportunity for students to acquire global competency while completing degree requirements. This sentiment is further confirmed by Catalano et al. (2012) who argue how the industry of human resources is changing and employers are now expanding
the capabilities an individual should possess to enter the global marketplace, placing higher accountability on efficient academic preparation.

May et al., (2014) offered further insight on the evolution of technological systems, which are increasingly breaking down borders for collaboration and work activities and requiring engineering programming to rethink program and student outcomes. Jesiek et al., (2014) commented on the globally connected workplace and the new realities of globalization, which impact the academic community in preparing engineering students, for the new reality of the global engineering workplace.

Milhauser and Rahschulte (2010) investigated employer perceptions of important employee attributes necessary for the global workplace. Employers from the engineering, manufacturing, international trade, information technology and human resources industries highly rated cultural awareness, leadership competency, and business ethics as important employee attributes. The ability to network and build relationships, partner with foreign businesses, manage non-Americans and cross-cultural management, and have an overall general global awareness were also highly rated by employers. These findings are consistent with other studies that articulate the importance of acquiring global competencies prior to engaging in global workplace.

The majority of studies reviewed for this literature review include employer respondents to have some level of international activity in order to validate the demand for why employees must possess global competencies. For example, in Warnick’s (2010) dissertation on engineering global competencies, employer survey participants were required to have a degree of business activity abroad to complete this cultural competency section of the survey for analysis. Despite the variability in international activity of an organization in order to compete in today’s
employer landscape, firms will need to have an international strategy for expansion or at least in understanding the international consumer, which was explored by Idris et al., (2006). This sentiment was further corroborated by one participant who articulated the difference in organizational staffing, which might influence the skills in which those employers seek in their employees, “There are two different sets you need to look at when you are talking about the graduate. How many of the graduates go to work at firms over 100 people versus those who go to work at firms with fewer than 100 people.” (Professional Association Representative A, personal communication, December 22, 2016).

The knowledge and skills required of engineering employees in today’s 21st century have evolved to include the “soft skills” and foundations of problem identification and solving at the global level within various social, cultural, political, and economic environments. As colleges and universities prepare future engineers the struggles they will face, internal and external, are real.

The Case of the Civil Engineering Curriculum: Colleges Need to Rethink the Curriculum

There is no argument that civil engineers need to possess strong technical engineering skills in order to be successful in their daily tasks (Soibelman, et al., 2011; LaFave et al., 2014; Grigg, 2013; Warnick; 2010; Dunsmore, et al., 2011). Given the diversity of civil engineering-related projects that cross cultures, locations, and organizations, it is imperative that the university curriculum exposes students to the nuances of this dynamic industry. As Soibelman et al., (2011) indicate traditional academic preparation is not sufficient to take into account the required cross-cultural awareness, transnational team work skills, and understanding of foreign requirements and business practices that now are part of a civil engineer’s knowledge base.
The American Society of Civil Engineers (ASCE) supports how diversity is influencing the evolution of the civil engineering profession, “The future strength of the civil engineering profession will come from an engineering workforce that mirrors the population it serves.” (ASCE website, 2015). In Passow’s (2012) study of undergraduate engineering students at a large public university in the Midwest, the results indicated that graduates of 11 engineering specializations rated a cluster of competencies, including teamwork, communication, data analysis, and problem solving, significantly higher than contemporary issues, design of experiments, and understanding the impact of one's work (Passow, 2012).

Given the complexity of globalization and its application within the workplace and education setting, research on student perceptions on employment are an important dimension to understand. By understanding how students perceive the relationship between employability and the new desired skill sets institutions can better prepare students and address student misconceptions.

ABET has reformed its 11 priority learning outcomes for engineering education to take into consideration the global, economic, societal, and environmental contexts (May et al., 2014). ABET has introduced changes in its student learning outcomes of accrediting engineering undergraduate programs to incorporate specific references to a diverse and multi-ethnic team approach. The initial changes were anticipated to take effect fall 2016 with the first accreditation of programming to take place in the 2017-2018 academic year for the undergraduate engineering programming; however, as of May 2017, these anticipated changes are still under review, pending approval of ASCE and the designated committee (ABET website, 2017).

Graduates of programs accredited by the EAC (Engineering Accreditation Commission) must be prepared for professional practice of engineering, and engineering is evolving to
meet continually emerging demands. These criteria are intended to provide a framework of education that prepares graduates to enter the professional practice of engineering who are (i) able to participate in diverse multicultural workplaces; (ii) knowledgeable in topics relevant to their discipline, such as usability, constructability, manufacturability and sustainability; and (iii) cognizant of the global dimensions, risks, uncertainties, and other implications of their engineering solutions. Further, these criteria are intended to assure quality to foster the systematic pursuit of improvement in the quality of engineering education that satisfies the needs of constituencies in a dynamic and competitive environment. It is the responsibility of the institution seeking accreditation of an engineering program to demonstrate clearly that the program meets the following criteria (ABET website, 2016).

This national recognition to anticipated change is raising awareness and putting emphasis on higher education and the engineering college departments to respond accordingly and ensure graduates of engineering undergraduate programs are prepared for the global dynamic workplace.

Institutional Internationalization Efforts to Prepare Engineering Students for the Global Workplace

industry employers are setting new standards and are expecting employees to deliver on not only technical and content skills but also soft skills, which can be translated to competencies necessary for the increasing employer global footprint (Bielefeldt, 2013; Grigg, 2013; Soibelman et al., 2011; LaFave et al., 2014; Chak, 2011; Warnick, 2010; Mahadevan, 2014). There is a need for higher education institutions and engineering academic program administrators to better understand engineering employer needs and the challenges associated with an increasingly borderless engineering industry. Without further pilot program testing and intentional programming to incorporate global competency acquisition within the engineering curriculum, engineering students will graduate and may struggle to successfully integrate in the global engineering industry. Although some efforts have been attempted within the higher education landscape, it is not enough.

Mahadevan (2014) assessed a German university approach to integrating global competencies within an international industrial engineering bachelor degree. Although the integration of the intercultural components of study into the bachelor’s degree allowed for greater acceptance of the soft skills within curriculum by faculty it did present some challenges when hiring faculty with the qualifications necessary to teach the intercultural competencies. This multi-faceted approach to instruction of incorporating various dimensions of education is one illustration of how engineering programming is responding to how best prepare graduates for the new global engineering workplace. According to Mahadevan (2014), this appeared to be a novel program within Europe. The premature nature of the program offering made it challenging for significant takeaways and success outcomes of recent graduates as well as the ability to apply the model to different engineering specializations.

Catalano et al., (2012) investigated the institutional response of one Brazilian university
that incorporated curriculum aspects of emotional preparation for aeronautical engineers within an engineering degree. The project was implemented in 2009 with objectives of expanding the mind frame and perspective of the Human Factor in the business environment. The pilot program results indicated how the modern engineer needs this human factor perspective to be successful with the global problems that require skills beyond the traditional engineering education. The importance and success of teaching intercultural competencies was also found in LaFave et al.’s, (2014) study of teaching soft skills to undergraduate civil engineering students by incorporating a set of cross cultural intervention modules and critical reflections within a course. These skills mirrored those reflective of skills required for civil engineering students to enter the global workplace (Catalano et al., 2012; LaFave et al., 2014).

Georgia Institute of Technology offers an engineering graduate level course that serves as a “laboratory for experimenting with innovative design education…” (Schaefer et al., 2012, p. 382) to enhance global competency acquisition of its engineering students. The course included distance-learning formats; synchronous and asynchronous that provides a learning environment that is reflective of real world business operations. Findings from the study suggest that engineering education needs to continually evolve as the engineering industry evolves with domestic and international changes to work requirements and standards. The institution also has locations in France and Ireland, which allows for this international collaboration for curriculum design. Given the fact that not all institutions are in the same position with infrastructure and resources, this gives rise to the need for individual institutional case study analyses. This review will inform the preparation of engineering and specifically the civil engineering students.

Soibelman et al., (2011) investigated the International Collaborative Construction Management course offered by a consortium of four universities within the U.S. and abroad.
Undergraduate and graduate students across civil engineering and construction-related majors enrolled in this course with a goal to enhance a global competency of dealing with multinational teams on project deliverables. The course offered synchronous and asynchronous learning so as to allow for the time difference consideration and greater diverse cultural collaboration. Over the course of the three sessions between 2007 and 2009, more than 50 students participated in the course and provided feedback to allow for course enhancements that would better equip students with global competencies. Although this attempt to offer programming to increase diverse team management skills of engineering students was somewhat successful there is room for improvement. Despite the consistent feedback offered over the three courses there are still technical, cultural, and team management challenges that need to be addressed in order to optimize the goals for this course and equip engineering students with global competencies to succeed in the international workplace.

One national level participant provided feedback that further addressed the real challenges some institutions face with preparing civil engineering students to work in the global workplace, “With the public universities, the battle we’ve been having… the student of today and the universities in [this state] are only required to have 120-124 credit units, how do you put anything more in that? We’re barely getting the basics now.” (Professional Association A, personal communication, December 22, 2016).

A close review of internal processes on how each institution prepares its engineering and civil engineer graduates to meet these new employer demands and build the global competencies within existing curriculum for students to acquire these skills, is necessary. Not only is the internal institutional review necessary, but student insight will also help to inform the evolution of the preparation process.
Engineering Student Perceptions on Global Competency: It is Important

Bielefeldt (2013) conducted a survey of civil and environmental engineering students between 2008-2011 to assess perceptions of globalization and personal interest in working on an international level to inform the engineering education program development. The study was based at the University of Colorado, Boulder. Beilefeldt (2013) noted that given the size of the organization; Engineering Without Borders, with 140 student chapters and more than 6,000 student members, global interest among engineering students appeared high. Despite this fact at the University of Colorado, Boulder only a small percentage of civil engineering students studied abroad or participated in such experiences to capture those global experiences for better preparation in the workplace. After a pre-and post-test survey of civil and environmental engineering students in a first-year engineering course results indicated fairly strong interest in global issues pertaining to civil and environmental engineering among first-year students. Although this sample is only representative of one institution with results five to seven years old it offers evidence that civil and engineering students would likely be open to acquiring global competencies during their academic career (Bielefeldt, 2013).

Student perceptions of engineering career aspirations and reflections of globalization of the engineering industry were investigated further by Itani et al., (2015). Results from more than 200 engineering student respondents indicated that these students chose the profession of engineering due to its association with high-level scientific abilities and positive job outlook. Although there was a perception of good job outlook students indicated how engineers lack good communication and those soft skills that are increasingly being sought out by engineering employers in today’s global engineering workplace. Furthermore, when students were asked if they felt prepared to enter the workplace preparedness on technical skills was rated high, yet
lower on dealing with an ethical dilemma, delivering oral presentations, and evaluating risk. It is important to note that these findings are representative of student perceptions at one time in their academic career. Additionally, this population is representative of various engineering specializations with a small percentage of civil engineering student feedback. Despite these limitations given the changing engineering workplace and perceived misalignment with engineering employer demands, there is opportunity for higher education to reform its programming to better prepare its engineering students. This case study will include civil engineering alumni feedback from the institution under investigation to inform how the process has directed them to acquire global competencies and reflect post-graduation.

Institutions working closely with the civil engineering industry and the professional associations charged with setting curricular and student outcome standards to ensure students are exposed to the content necessary to meet employer preferences will be best positioned in preparing civil engineering students with global competencies. Although some employers will provide the necessary training if certain global competency skills are lacking in their employees, this can present challenges (Prestwich and Ho-Kim, 2007). A company that relies exclusively on their internal resources for training will increase its operating costs, work productivity decreases, and the ability to compete successfully and efficiently in a global marketplace is compromised.

Academic discipline administration within the College of Engineering at the institution under investigation highlights the direct marriage of theory and practice in the delivery of experiential learning to its engineering student population that addresses the changing market dynamics.

Started in [the early 20th century], the college was the first school…to adopt [experiential education]. Over the past century, this experiential learning environment has nourished
the entrepreneurial spirit of countless engineering students who have gone on to successful careers around the world. (Institutional Website, 2016).

Within engineering in particular, the hard skills necessary to be effective in the engineer role will still be required. However, there is employer awareness that additional soft skills and competencies are necessary in order to interact successfully with the increasingly diverse and global engineering industry. As such, institutions must re-evaluate academic content to deliver a holistic experience to align with these employer demands. Institutions who collaborate with engineering sector employers and incorporate diversified learning opportunities will be well positioned to better prepare civil engineering graduates for the borderless workplace.

Conclusion

Overall, this literature review supports that as industry expands its global footprint, there will be an increasing expectation for employees to acquire global competencies. In order to succeed in the global economy, as noted previously, higher education institutions should be in alignment with these pressures to identify means for resolution during the college experience. If higher education institutions fail to adequately align curriculum with employer needs, as discussed, then students are not well-prepared to enter the global work environment and employers must take on the responsibility to train these individuals, which costs money and time. Furthermore, as Sax (2004) notes, higher education institutions have an obligation to prepare global citizens.

Given the educational and professional outcomes of a college degree, it is important to keep in mind the community and social outcomes as well. Graduates must be able to engage successfully at a state, national, and international level, given the highly global society. As such, the importance of well preparing college graduates for the global society and workplace is
Despite the variability in definitions for global competency skills resulting from various scholarship that addresses different industries, there is agreement that the skills required of employees entering the workplace have changed and will continue to evolve with further enhancements to the global business operations system. Furthermore, there is also agreement on how higher education is charged with embracing these new employer demands on how graduates should be prepared to enter the global workplace. As we specifically view the civil engineering industry, colleges and universities are coming up short on this task in meeting employer demands, particularly with those who have an increasingly large multi-national presence.

This case study will provide one institution’s perspective on how it prepares its civil engineering students to be globally competent. The findings and results of this case study are not meant to be generalizable as each institution has its own strengths, limitations, resources, initiatives, and mission. However, what this case study will provide is further attention to the ever-growing problem of ill prepared civil engineering students entering the global workplace and add scholarship to the academic community on how to leverage these findings and implications within an individual institution's context.

This literature review suggests that although institutions are aware they face internationalization and recognize the evolution of employer needs, there is a gap that exists between successful institutional implementation and employer perceptions as it relates to college graduate readiness to enter the global workplace. The hard-technical skills required of civil engineering students to perform well at their place of employment will always be present, however, given the transformations influencing business practices, civil engineering employers are increasingly seeking employees to have a larger awareness of non-technical skills to navigate
the complexities of the global work environment.

Institutional portfolios will vary in the manner they deliver this preparation, however, the expectation from employers is that it will be delivered in some way. In the 2010 Job Outlook report from the National Association of Colleges and Employers, in which 219 U.S. employers were surveyed, 49.7 percent list communication skills as a most sought out skill in employees. However, this skill was also found to be the most lacking amongst new college graduates (DuPre and Williams, 2011). This finding suggested there is work to be done by higher education to prepare students with what employers seek in today’s global society.

By merely incorporating an international component to curriculum, requiring a foreign language, providing international work opportunities or similar approaches as presented previously this does not necessarily provide a best practice for institutions to follow because of institutional profile variance, individual student motivation, and varied industry needs. As such, many institutions, four-year and two-year colleges have started to make efforts to prepare globally competent students, however, because of this variance and varied institutional profile, this presents an obstacle in uniformly presenting a formula to increase global competency across academic disciplines. With a focused discipline of study on civil engineering, this case study sought to articulate the story of the institution under investigation in its process of preparing civil engineering students with global competencies.

With multiple academic, professional, and social activities to engage in multi-cultural environments and develop the skills employers seek in the global workplace, along with professional engineering learning outcome standards alignment, the institution under investigation may be viewed as an institution that is preparing its civil engineering graduates well for the 21st century global workplace. The university has a globally focused mission and
strives to incorporate global citizenship qualities in its graduates through various institutional initiatives. Unique matriculated and pre-matriculated educational programming with a global focus, the integration of theory and practice through experiential learning, nationally ranked as a top 20 institution hosting a large number of international students (IIE, 2016) with a focus on community service, and geographically located within a diverse and corporation rich urban environment, the institution under investigation lends itself well for in-depth analysis of its process in preparing civil engineering students with global competencies.
Chapter III: Research Design

Methodology – Qualitative Research

This qualitative case study approach provided an in-depth investigation of how a private four-year research institution, located in the Northeast, responds to the globalization of its engineering curriculum, through developing globally competent civil engineering students. In particular, the process it is following in how it is responding to the increasingly global and complex civil engineering field was investigated. I chose to study an institution, which I believe is a leader in its internationalization efforts of the college campus through its’ experiential and increasingly globalized curriculum, its’ expansive global footprint, and the opportunity for exposure to diversity and cultivation of global competencies. This institution strives to create borderless access to education, through its commitment to internationalization. Furthermore, the institution’s geographic location affords its community and student body access to a community rich of opportunity, academic and experiential. Because the case study approach is "time bound" and there are "parameters" of research, this aligned well with my intent to study the institution’s current process in its preparation of civil engineering students to be globally competent and its effectiveness, as perceived by interviewed study participants. This institution and its’ civil engineering program ranks in the top 50 nationally, which lends itself well to exploration in how it prepares its civil engineering students for the global civil engineer in today’s society. This private four-year research institution located in the Northeast will be referred to as the institution under investigation, throughout this dissertation.

Through a collective data gathering of secondary information for the document review phase and qualitative feedback secured through interviews, I captured the "essence" of how globalization has impacted the College of Engineering and the career education department at the
institution under investigation, with regard to the process they follow to prepare civil engineering students. It is important to note that the qualitative feedback, was the critical component for me to capture the “essence” of this problem of practice. In order to maintain confidentiality throughout the research study to protect the institution and the respective civil engineering department, the secondary information presented in this study is absent of identifiable information and certain terminology was substituted to avoid exposing the institution’s identity. This information coupled with the interview data unveiled key information about the problem of practice and assisted in better understanding how the institution under investigation positions itself within this critical problem facing higher education.

In particular, researchers, like Stake (1995, 2005), Merriam (1988), and Yin (2009), have noted how the case study approach allows the researcher to capture a “holistic understanding of a phenomenon within real-life contexts from the perspective of those involved” (Boblin, 2013, p. 1268). Additionally, as Boblin (2013) stated, incorporating various types of data, allows for a richer perspective and this data source variety is in fact indicative of the case study research methodology approach. Creswell (2013) suggested how the information is presented and analyzed will allow the researcher to bring context to the case study. Cranton (2006) also supported how the setting, community, and institution itself informs the research process. The geographic location of the institution under investigation informed the process of how it prepares its civil engineering students, especially as time has transpired.

**Research Paradigm**

Given the deep understanding and ability to capture rich knowledge reflective of a qualitative approach, the constructivist research paradigm aligned best with this case study. In particular, as Ponterotto (2005) noted, the **constructivism – interpretivism** research paradigm
allows the researcher to understand the "lived experience" from study participants. As Stake (1995) posited, “The aim of the research is not to discover #1, for that is impossible, but to construct a clearer reality #2 and a more sophisticated reality #3, particularly ones that can withstand disciplined skepticism.” (Stake, 1995, pp. 101). The semi-structured interviews allowed me to intimately capture themes and feedback from university administrators, students, and faculty to identify the intricacies and importance the institution under investigation places on global competency acquisition. Furthermore, although, not as robust, I was able to provide brief raw data and feedback to complement the findings, by incorporating some feedback from engineering employers who employed civil engineering graduates from the institution under investigation.

The goal of the problem of practice was to subjectively understand through key stakeholder conversations how the institution prepares its civil engineering students to be globally competent through academic and practical programming. Furthermore, the transformation of how these practices have evolved is critical and have informed the research question. The feedback shared by university administrators and engineering faculty as well as recent civil engineering graduates on their thoughts, ideas, and the “lived experience” informed the overall objective of better understanding the level of preparedness of students entering a global workplace with varied 21st century skills sets (Arnd-Caldigan and Pozzuto, 2008; Ponterotto, 2005).

Additionally, the secondary data and qualitative information collected through this research approach provided a unique individual perspective to the civil engineering student preparation process. The interviewed participants provided feedback that informed how the institution under investigation addressed the problem of unprepared civil engineering students to
enter the global engineering workplace. Through this “lived experience” learning, I captured an individual’s response to circumstances and the experiences he/she is exposed to, which build on the constructivist approach, to inform the overall process of developing globally competent civil engineering students (Ponterotto, 2005).

Given my problem of practice was focused on civil engineering student preparedness to enter the global engineering workplace, I analyzed student experiences, the environment of the university, the civil engineering department, and the employer, to collectively assess the nuances associated with civil engineering programming. Specifically, the alignment of alumni perceptions and employer perceptions, where applicable, on global competency expectations as well as faculty perceptions at the institution under investigation were explored. This data informed the delivery of the academic and practical civil engineering programming to students, which helped them succeed given the changing landscape.

With regard to the role of the researcher, Ponterotto (2005) posited there is a dynamic relationship between the researcher and the study participant, which informs a successful research study. Through this researcher/study participant interaction, a deeper meaning can be unveiled through qualitative research data collection approaches. Together, the researcher and the participant, collectively identify findings from the interactive dialogue and interpretation. With this constructivist-interpretivist paradigm, I employed an interview-based methodology across the different audiences. Being conscious of researcher bias, I leveraged personal knowledge of the impact of globalization on industry and the higher education community resulting from personal professional experiences to inform the interview guide questions. My role as the researcher in this paradigm was more as an involved member of the data collection
process to ensure transparency and encouraged deeper and more meaningful interactions and conversation between the study participants and myself.

**Research Questions**

The below three research questions will be explored in this dissertation:

Research Question 1: How does a private four-year research institution prepare its civil engineering students to be globally competent, as perceived by civil engineering faculty, career services administrators, civil engineering alumni, and industry partners?

Research Question 2: How do civil engineering faculty, career services administrators, civil engineering alumni, and industry partners perceive the private four-year research institution as effectively preparing its civil engineering students to be globally competent?

Research Question 3: How could the private four-year research institution better prepare its civil engineering students to be globally competent, as perceived by civil engineering faculty, career services administrators, civil engineering alumni, and industry partners?

Given the informative and exploratory nature of the research questions, there is alignment between the questions and the qualitative research approach methodology. Specifically, the research captured a deeper and richer understanding of “how”:

- The university prepared civil engineering students for the global engineering field;
- The civil engineering pedagogy addressed global competency acquisition;
- The students perceived the engineering field has changed and what that is being required of them;
- The students perceived the university prepared them with global competencies
Additionally, through the qualitative research approach, participants offered greater genuine insight and provided feedback that might not have necessarily been captured through the stated interview questions. This solicited and unsolicited feedback ultimately assisted in the review of the institution’s process of developing globally competent civil engineering students.

Given the central theme of preparing civil engineering students with global competencies for successful integration into the global engineering workplace trying to best understand experiences and bring a “voice” to the participants of this study, the qualitative research approach provided the best vehicle to capture this research objective. The interview protocol aligned well with text analysis to capture common themes resulting in emergent key themes across the interviewed populations. Therefore, based on the aforementioned commentary, the qualitative research method was best aligned to meet the objectives of this research study.

Study Context

The research site of this case study was a private four-year research institution located in the northeast. The institution was founded in the late 19th century, with a focus on theory and practical application to learning, community engagement, and offers an array of programs across its nine colleges. According to the institutional website (which for the purposes of this study, to maintain anonymity, was not listed) a few notable accomplishments are highlighted below to showcase the rationale as to why I pursued this institution for a case study:

- Almost 90% of 2014 graduates employed full-time are doing work related to their major.
- A significant number of 2015 graduates had an international learning experience
- Domestically and abroad, more than 5,000 students had a practical experience in the 2014-2015 academic year
- Compared to the fall 2006 freshman class, there was a drastic increase of more than
350% in international student enrollment for the fall 2015 freshman class

Specifically, the College of Engineering’s distinctive approach to education and research has positioned the college as one of the top engineering colleges in the world, according to the academic leadership testimonials on the department’s institutional website. Specifically, the academic leadership highlights the preparedness of its engineering students in order to meet the evolving demands of the engineering profession, via an integrative model of theory and practice.

Our students develop as innovators and leaders through [our] distinctive model of experiential learning...The combination of challenging classroom study with opportunities for professional practice and research ensures that we are preparing the next generation of engineers to keep pace with fast-changing global demands (Institutional Website, 2016).

Study Participants

The sampling strategy used for this case study was purposive sampling. Because of the pre-selected criteria of the participants, this sampling strategy aligned well. Purposive sampling is most effective when data collection, analysis, and review are done concurrently. However, with this sampling strategy it was also important that I did not lead participants in any one direction as to taint the results. Also, given that some of the faculty participants and civil engineering alumni were specifically targeted to receive an invitation to participate, this might have presented a bias that is a possible limitation to this study.

The appropriate permission protocol was conducted and included initial outreach to the Dean of the College of Engineering, the Department Chair of the Civil and Environmental Engineering Department, the senior level career education administrator, and the Office of Alumni Affairs representative. There were three primary audiences that were targeted for this
research study; civil and environmental engineering faculty, career education administrators, and civil engineering alumni, all directly affiliated with the institution under investigation. Furthermore, two additional audiences were targeted to augment the research, engineering-related employers who employ graduates of the institution and engineering-related professional associations who inform academic and practical programming on a national level.

Regarding the faculty participants, 44 civil and environmental engineering tenured faculty were identified through the civil and environmental engineering department institutional website. After consultation with the department chair to inform which faculty were best suited to inform this research study, ten faculty were initially invited to participate. Of the ten faculty who were initially invited to participate, five participated in face-to-face interviews over a two-month period. The civil and environmental engineering faculty all held doctoral degrees in their field, were employed at the institution under investigation for more than five years, ranging from six to 35, had practical and academic engineering experience, taught civil engineering students, specifically, and were both male and female. The interviews ranged between 45 to 58 minutes.

The second population of participants were career education administrators working to some degree with civil engineering students. Of the six initially identified administrators who had some affiliation with the employment preparation and career education of civil engineering students, three participated in face-to-face interviews, over a three-month period. The career education administrators worked at the university under investigation for a range of two to over 15 years in different capacities, working directly with civil engineering students and employers to some degree. The interviews ranged between 45 to 55 minutes.

The third population of participants were civil engineering alumni. The selection criteria for alumni to be invited to participate in this research were 1) individuals aged 22 and above; 2)
male and female, no gender restriction; 3) civil engineering alumni who graduated from the institution under investigation at least three to five years from the anticipated start date of data collection of September 2016; 4) employed in an engineering-related firm, organization or company; and 5) located anywhere, globally with no geographic restriction. Given the protocol to contact alumni, the Office of Alumni Affairs initially sent out a targeted email to the alumni in their database that met the selection criteria. The email invitation informed alumni of this research study and provided an option that if students were interested in learning more or participating in this research study, they gave permission to me to contact them directly with the approved IRB email invitation language. Of the civil engineering alumni who received the email, three alumni participated in virtual interviews, over a one-month period. Two of the alumni were 2011 graduates and one was a 2013 graduate. Two had received their graduate degrees as well and all three had been working with an engineering-related employer for at least two years and up to five years. The interviews ranged between 20 to 28 minutes.

To capture the engineering-related employers’ perspective, I solicited the assistance of the Career Education Office. In consultation with the career services administrator, because the Career Education Office lacked relevant employer contact information, I was recommended to source employers using the institution’s career services database to identify employers attending the university career fair that was hosted on campus in the spring 2017 semester. With the career services administrator's permission and assistance, the career fair registration database was researched to identify relevant employers. Based on the selection criteria for this population of participants, which included employers who seek to or currently employ civil engineering graduates, employers who registered for the career fair as seeking Civil Engineering major students for employment were initially identified to invite to participate. This career services fair
A database search returned 73 employers who listed Civil Engineering as a major in which they were recruiting for at the career fair. From the initial list of 73 employers, the sample list was further refined to 19 employers based on a review of the type of employment they were seeking; either full-time, internship, or practical experience with a civil engineering-related job title. I was encouraged to engage in preliminary discussions with the 19 identified potential engineering employers to explore interest in receiving information about the research study and confirm the contact information of the most appropriate individual best positioned to offer insight into the civil engineering graduate's global competency.

On the day of the career fair, I engaged in introductory conversations with 10 of the 19 employers. Due to limited hiring of relevant civil engineering graduates, two of the 10 engineering-related employers declined to participate. Following the career fair, an initial email to participate was sent to the remaining eight employers. Of the eight employers, two agreed to participate. Both of the engineering-related employers had multi-national offices with one organization employing more than 50,000 individuals globally. Over a two-week period, one interview was completed in person and one was completed virtually, given scheduling conflicts. The interviews ranged between 20 and 25 minutes.

To provide high level feedback on the civil engineering field, especially as the trends related to global competency and the impact of globalization of the industry, initial outreach for participation was made to two national professional associations, the Accrediting Body of Engineering and Technology (ABET) and the American Society of Civil Engineers (ASCE). I secured participation from one leadership representative. During the month of December, I completed this interview, virtually, because of geographic limitations and it lasted roughly 40 minutes. Some of the feedback secured from this professional association was incorporated in
chapters 1 and 2 to support the literature review with the majority included in the results section, chapter 4, in order to corroborate the findings of this study.

All 14 interviewed participants provided me with signed consent forms and all agreed to have their interviews recorded. I was the only one privy to the recordings and I completed all the transcription, manually. The transcripts were sent to the participants to confirm the interview content for member-checking, as a means to enhance the validity of the qualitative results.

Data Collection

The total sample size for this research study was 14 participants. The sample of study participants (N=13) were individuals affiliated with this research site as well as a sample of employers representing the engineering field who employ the civil engineering graduates of the institution under investigation. Brief feedback from an engineering national professional association representative (N=1) was included to complement the existing literature reviewed on the problem of practice and address national engineering trends. Semi-structured interviews were conducted with participants representing; civil and environmental engineering faculty, civil engineering alumni, career education administrators, engineering-related employers and a professional association. Upon successful completion of the interview, each participant was compensated with a $10 Starbucks gift card.

To capture background information on the research site, I conducted documentation analysis of the civil engineering curriculum, the undergraduate general education requirements, civil engineering departmental program information, and alumni stories, where publicly available. I reviewed the institution’s website, the civil and environmental engineering department’s website and marketing material reflective of the engineering field, and degree program requirements, with all efforts made to mask identifiable information as to protect the
institution and department’s identify and maintain the anonymity of participants.

Data Storage and Management

The data storage and management of the collected information is critical to ensure ethical research practices and compliance, as outlined by the Institutional Review Board and the National Institute of Health (NIH, 2011). For confidentiality purposes and to ensure there was no possible risk to the participants or the institutional reputation, full anonymity was maintained throughout this dissertation of the institution under investigation, the faculty participants, career education administrators, alumni, and engineering-related employers who participated in this research study.

Each interview was recorded by me on my iPhone voice recording. I was the only privy to the recordings, and upon manual transcription by myself, the recordings were erased. The transcribed interviews were saved on my personal laptop on the hard drive, as well as my personal USB. For records keeping, the transcripts will be kept in a secure location in my home office for at least three years, as required by law (U.S. Department of Health and Human Services, 2016). The institution was defined and addressed throughout the research study as the institution under investigation and a pseudonym was assigned to each participant’s feedback, such as “Career Education Administrator A”, “Civil and Environmental Engineering Faculty A”, and “Civil Engineering Alumni A”.

Data Analysis

Upon completion of the data collection, I employed a data analysis process informed by the foundational philosophical underpinning of the case study methodology approaches of Merriam, Yin, and Stake (Yazan, 2015). Specifically, this research study followed the constructivist research paradigm of Stake (1995), which consequently informed the analytical
process. Stake (1995) emphasized the process of giving meaning to the information through a concurrent process of data collection and data analysis. This was explored through *categorical aggregation* and *direct interpretation* (Yazan, 2015; Stake, 1995).

The interviews representative of alumni, university administrators and faculty, and engineering employers were read in depth, by me, in order to capture a deep understanding of the meaning of the feedback and underlying emotions and feelings. This inductive analysis process was critical to this case study approach. The individual transcripts were shared with the interviewees for member-checking to maximize reliability and validity of the feedback.

Saldana (2009)’s coding methodology was used for first and second cycle coding using Stake (1995) as the guide for coding and thematic analysis based on his recommendations for strategic data analysis processes of *categorical aggregation* and *direct interpretation*. First, I manually coded each interview in a Microsoft Word document, reading line by line, to determine relevant descriptive codes, which was the first level coding. The frequency of each descriptive code was reported and an individual participant profile was created to visualize the first level coding analysis. Saldana’s (2009) first level coding allows the researcher to analyze and make meaning of the qualitative feedback.

I transferred first level analysis codes into an Excel spreadsheet by participant. From the first level coding, which returned multiple and repetitive codes, I conducted second level coding by interpreting and refining these repetitive codes into unique codes by participant audience. Table 1 in Appendix A highlights the coding frequency in first and second level cycle coding by participant. The unique codes that resulted from this categorical aggregation and direct interpretation were grouped by theme and an individual stakeholder profile was created for each participant. This coding exercise was conducted for each of the 13 interviews. I did not include
the professional association interview in the coding analysis, as this was used to supplement the findings, as opposed to directly support the research questions. Upon completion of each transcript by audience type (alumni, employers, faculty, and career education), there were four unique stakeholder profile groups that were analyzed to determine emergent themes. This data analysis process allowed the data to be explored from a stakeholder perspective and then a thematic perspective, noting the frequency of occurrence, exploring the interrelationships, and observing variances within the data (Miles & Huberman, 1994).

Following this coding exercise, both, the individual transcript and coded participant profiles were uploaded into the NVivo software. The first level coding scheme was used as a foundation for the second level coding where emergent themes across each set of interviews (alumni, faculty, employers, and career services administrators) and across the groups for common themes, were identified. These emergent themes of the inductive analysis process provided the foundation for the findings and consequent discussion and conclusion sections.

Limited qualitative feedback representing the professional association perspective was incorporated throughout chapters 1 and 2 to complement existing literature on the current state of the civil engineering industry and the necessity for civil engineers to be globally competent; however, the vast feedback was highlighted in chapter 4 to support research results.

In addition to the sourced primary qualitative feedback, secondary data was also sourced for a document review phase of the data analysis. Secondary resources included institutional websites, national accreditation information, civil engineering employment data, course catalogs, and alumni student profiles, which were also uploaded into NVivo for triangulation.

**Trustworthiness**

Qualitative research can be regarded as having less validity or reliability because of the
nature of the data that is collected and the process of how the collection occurs (Boblin et al., 2013, Yazan 2015, Merriam, 1998, Stake, 1995, Yin, 2009). As such, to increase the validity of the research study, a well-designed research methodology was employed to ensure credibility (Yin, 2009). Firstly, the research site was very familiar to me, by nature of professional awareness, and credibility of the qualitative feedback collected was verified (Creswell, 2013). A diverse audience of participants were interviewed, which allowed individual perspectives to be cross-checked among the experiences of those participating in the research, and member-checking was also completed. Member-checking allowed participants to confirm the accuracy of their feedback to ensure the information was captured in a way that supported true intentions of the participant experience, as well as the researcher’s interpretation of the qualitative feedback (Stake, 1995; Shenton, 2004; Creswell, 2013). Upon completion of the manual transcription, each participant received their transcript to review and comment to ensure accuracy.

The researcher bias is detailed to highlight educational, professional, and personal situations that may influence my perspective on this study. Given the constructivistic paradigm research approach, “thick description”, the collection of in-depth feedback retrieved from the different participant audiences, was applied in the interest in capturing a holistic picture of the interviewees and their influence in the institution’s process of developing globally competent civil engineers (Stake, 1995, pp. 102). The potential threats to internal validity included familiarity with the research location, my past experiences in consulting to higher education institutions on industry informed programming, the location of the permanent residency of the participants, and instrumentation.

**Limitations**

In order to mitigate threats to accuracy with the qualitative research approach,
Triangulation was employed. Triangulation is “the process of corroborating evidence from different individuals, types of data, or methods of data collection in descriptions and themes in qualitative research” (Creswell, 2008, p.266). Specifically, the data source triangulation method was employed (Stake, 1995). Given the diversity in perspective from the interviewed participants, results that aligned and those that did not, were highlighted in the research results.

Each source of information, including the participant interview, and secondary sources such as labor market data, institutional websites, curriculum maps, and accreditation program information, were analyzed to support the theme of globally competent civil engineers. Because I drew upon multiple sources to inform the research findings, I was able to analyze data across these multiple sources to analyze data and produce a credible report as well as assess how widespread the phenomenon of global competency was across these different primary and secondary sources (Stake, 1995; Creswell, 2008).

Using the NVivo software, triangulation was conducted to mitigate validity concerns of the qualitative research methodology. These various data sources were cross-analyzed to not only set the context of the institution and its’ position in the engineering industry and preparation of civil engineering students to enter the global economy but to perform triangulation on the topic under investigation. To the degree that the researcher could, every effort was made to mask identifiable institutional information.

The fact that I have not studied engineering or am employed in this field presented a slight challenge in trying to identify with the participants. Given the fact that I did not have experience, like that of the stakeholder audience, specific to the civil engineering industry, or having been an engineering student myself, or employed in an engineering firm, nor having constructed engineering programming to meet the changing employer needs, this presents
limitations. However, through deeper exploration and study of the research problem through a different paradigm lens and theoretical framework, this helped to frame the process and expose blind spots.

Given the emphasis on the civil engineering field, I had the opportunity to understand this sector in depth and investigated how it has evolved over time given globalization and specifically explored transnational business practices in this space. Additionally, the opportunity to learn from the alumni population who shared their lived experiences further enhanced my knowledge on this population specifically as it related to the institution under investigation. Not only did I learn from the faculty, the career education administrators, the students, and the engineering employers on current processes but I was able to determine what the alignment was between the institution under investigation and preparing future graduates to be globally competent. Through this qualitative process, varied outcomes developed, which assisted in determining the current position of the institution as well as opportunity for enhancement in its process of developing globally competent civil engineering students to be globally competent.

Protection of Human Subjects

A thorough articulation and description of how the intended research methodology will protect the human subjects participating in this research study is critical (NIH, 2011). The specific procedures and processes outlined by the Institutional Review Board at Northeastern University, as the institution where I am pursuing my doctorate, as well as those by the National Institute of Health under the Protection of Human Subjects were followed (NIH, 2011). Given the qualitative nature of this study and possibility of exposing feedback reflective of particular individuals at the research site, ensuring the confidentiality of the subjects was critical.
During the data collection, there was no harm inflicted on the study participants. Because of the possibility of indirect "harm" to a participant's reputation, or the department’s itself, given the nature of the information and desire of the civil and environmental engineering department chair to maintain as much confidentiality as possible, pseudonyms were developed for participants, the institution was masked, and terminology was substituted to avoid identification of the institution under investigation. Despite the extreme efforts to mask the information representative of the institution, given its national recognition and leadership in the global education community, there is a possibility that an individual might recognize the institution after process of elimination and thus be a possible limitation to this study.

As part of the sourcing protocol, clearly articulated directions of the study and objectives of how participation in this research study will enhance the overall higher education community’s response to globalization, was communicated. In particular, how institutions react to preparing civil engineering college students to meet the global needs of the engineering field. Participants were briefed of any potential matters that might concern them and each signed a consent form. The informed consent form served as the guarantee that their feedback was confidential and only pseudonyms were articulated once results are published. Additionally, the member-checking process allowed participants to remove any identifiable information from the transcript. The degree to which participation was influenced by a $10 Starbucks gift card upon successful completion of the interview is unknown, though, it is important to note as a possible limitation. Each participant was offered the opportunity of a face-to-face or virtual interview and I made every attempt to make participants feel comfortable and conduct the interview at a preferred location.
Chapter IV: Research Results

This chapter focuses on this qualitative case study’s results, highlighting the core themes and findings that emerged through the inductive and deductive coding analysis process and review of this raw data. Interviewed participants included multiple audiences that are representative of academia, students, career preparation educators across the career education department and the College of Engineering, and engineering employers who employ civil engineering graduates from this institution under investigation. Civil and environmental engineering faculty and mid- and senior level career education preparation administrators provided feedback into the process the institution follows in preparing globally competent civil engineering students. The number of years of participant employment at the university and College of Engineering varied. This allowed me to capture feedback from participants with deep institutional knowledge to those with recent employment to provide a spectrum of institutional and College of Engineering mission and values growth in preparation of its global citizens over time. Civil engineering alumni, another key audience of this research study, also shared their experiences at this institution regarding their perspectives on acquiring global competency skills to enter the global engineering workplace.

The purpose of this study was to better understand the current process that one private four-year research institution in the Northeast follows as it relates to developing globally competent civil engineers. Given the significant and complex responsibility to develop and prepare civil engineering students to meet the demands of the global engineering workplace coupled with the favorable employment dynamics for civil engineers, in increasingly diverse and emerging market geographic locations, this study aimed to offer another lens or perspective on how one academic institution prepares its civil engineering students for this challenge.
Questions were focused on understanding the process each stakeholder audience follows to prepare the civil engineering students, how effective the process is, individual global competency definitions, and identifying opportunities where development may exist to augment the process to prepare globally competent civil engineers. As outlined in Chapter 3, Cranton’s Fostering Transformational Learning Theory (2006, 2010) based on Mezirow’s Transformational Learning Theory (1997) was the underlying theoretical framework guiding the research principles of this study. Understanding how one institution equips its civil engineering students with global competency through education, experiential and practical discourse and activities was the central construct to this research investigation.

Through manual first and second level inductive coding, analysis of the participant feedback resulted in seven primary themes. Saldana (2009)’s coding methodology was used for first and second cycle coding using Stake (1995) as the guide for coding and thematic analysis based on his recommendations for strategic data analysis processes of *categorical aggregation* and *direct interpretation*. First level coding was conducted in MS Word, followed by second level coding in Excel, and the coding analysis was imported into the software NVivo. These themes were focused around the three primary research questions related to 1) better understanding the process in which the institution follows to prepare globally competent civil engineering students, 2) the effectiveness of this process, and 3) determining if there are opportunities for better preparing globally competent civil engineers, as defined by civil engineering faculty, career education administrators, civil engineering alumni, and engineering employers.

This qualitative feedback was supplemented with a document review analysis of secondary data highlighting civil engineering curriculum maps, labor market trend data, ABET
accreditation documents, alumni spotlight stories, and institutional website information to augment the validity of the qualitative feedback through data source triangulation using the NVivo software. Analysis of the interview data through first level and second level coding led to the emergence of seven primary themes. The qualitative feedback retrieved from the national professional association representative was included in this chapter to support the research findings. The seven emergent themes and the associated subthemes are presented in Table 2.
Table 2

*Emergent Themes and Subthemes*

<table>
<thead>
<tr>
<th>Emergent Theme</th>
<th>Subtheme</th>
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<tbody>
<tr>
<td>Developing and Fostering the Well-Rounded Civil Engineer</td>
<td>The Unique Civil Engineer Persona</td>
</tr>
<tr>
<td>Global Competence is Necessary Though Complex</td>
<td>Varying Perceived Definition of Global Competency</td>
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<tr>
<td></td>
<td>Support for Research Study Global Competency Definition</td>
</tr>
<tr>
<td></td>
<td>Efficient and Effective Civil Engineering Project Management Practices</td>
</tr>
<tr>
<td></td>
<td>Regionality of Civil Engineering Projects</td>
</tr>
<tr>
<td>Institutional Orientation to Internationalization</td>
<td>Collaboration</td>
</tr>
<tr>
<td></td>
<td>Empowerment/Encouragement of Civil Engineering Students</td>
</tr>
<tr>
<td>Diversity and Immersion as Learning Tools</td>
<td>The Academic Classroom: Student Diversity</td>
</tr>
<tr>
<td></td>
<td>The Academic Classroom: Faculty Diversity</td>
</tr>
<tr>
<td></td>
<td>Experiential Education</td>
</tr>
<tr>
<td>Limitations: Uncovering the Complexities Of Developing Globally Competent</td>
<td>The Globally Competent Civil Engineering Curriculum Blueprint: Innovation with Limitations</td>
</tr>
<tr>
<td>Students</td>
<td>Non-engineering Technical Skills: Communication</td>
</tr>
<tr>
<td></td>
<td>Monetary and Human Capital Limitations</td>
</tr>
<tr>
<td>Maturity and Transformation of Civil Engineering Students</td>
<td>Network of Opportunity: Engagement in Academic and Experiential Activities</td>
</tr>
<tr>
<td>The Institution is Effective, Though Opportunities to Augment the Process Exist</td>
<td></td>
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</tbody>
</table>
Each theme is discussed below, followed by a summary that ties the findings back to the original research questions this study was designed to answer.

**The Dynamic Civil Engineering Industry**

To understand the context of the participant’s perspective on the civil engineering industry and its influence on the preparation of the future civil engineer, I asked each participant to generally comment on the current state of the civil engineering industry as they observe and understand trends in the industry. Commonly noted characteristics reflective of the dynamic industry were as follows:

- A mobile civil engineering professional, able to adapt and work in local and global placements
- A global industry; representative of a diverse workforce with increasingly transnational scoped projects commissioned by individual and global group entities
- Civil engineering projects have a societal impact for the greater good
- Societies and communities benefit from civil engineering projects
- The economy of an environment influences project scope
- The political agenda of an environment influences project scope

The below dimensions of the dynamic state of the civil engineering industry resonated most with participants.

**The Political and Economic Influence**

There was a common thread around political climate and the state of an economy influencing the civil engineering industry. Given how the industry reflected societal needs, a healthy economy suggested a healthy demand for infrastructure, which resulted in healthy employment prospects. The growth of civil engineering projects, domestically and abroad are
also influenced by political agendas. Despite the possible fluctuation of the factors that influence the growth of the civil engineering industry, there will always be a need to maintain existing infrastructure and address the emerging trends in the field as they relate to sustainability, technological advancements and innovation, and safety measures. One participant commented on how the recession influenced the industry on a global level; “1990-1991 forced [employers] to diversify and they diversified both in terms of sector and location and a lot of [employers] got themselves out of the recession by starting to work globally.” (Civil Engineering Faculty E, personal communication, November 10, 2016).

*Sustainability as A Growth Area*

According to qualitative feedback, the field of environmental science and its application to civil engineering was an important component of this industry. This complementary area to civil engineering created an additional opportunity for graduates, faculty, and employers to collaborate to ensure the relevant practices and knowledge are present in the curriculum. Furthermore, as noted by one participant, the growth of the environmental dimension of the civil engineering industry has influenced the way in which civil engineering students select employment paths; “I think this generation is taking it upon themselves to try and address the problem. They want to do work that is meaningful and that is connected to some kind of purpose and contributing to society.” (Career Education Administrator B, personal communication, October 14, 2016).

*Foreign Engineering Practice Influencing the US Engineering Practice*

The civil engineering industry is a global industry not only because of its growth in transnational projects and collaboration of a diverse workforce, domestically and overseas but also because of the variety in specializations embedded within civil engineering. Interviewed
participants shared their personal experiences on how foreign engineering best practices influenced their former and current domestic work responsibilities. “Europe is a very good example, they have been concerned about the preservation of their heritage structures for many years…A lot of the policies in the U.S. are based on policies from Europe that and [the U.S. government] has sort of adapted [to our structures and our historic sites.] (Civil Engineering Alumni, personal communication, January 9, 2017).

Faculty commented further on the best practices of varied specializations within civil engineering that informed practice in respective countries, which resulted in a global civil engineering industry. Certain regions, for example, Singapore, and Europe appear to excel in certain areas of the industry that impact the U.S. infrastructure best practice and consequently, the competent civil engineer practitioner. At the national and international level, the standards of the civil engineering field are global and the audience in which it represents is vastly international, “We have many structural standards, ASCE 7, is literally now a global standard and it’s about structural design and everything and it’s been worked on for the last 30 years from people around the globe.” (Professional Association Representative, personal communication, December 22, 2016). The next section highlights the seven emergent themes identified through the research analysis.

**Developing and Fostering the Well-Rounded Civil Engineer**

The first major emergent theme resulting from the data analysis is that of developing and fostering the well-rounded civil engineer. The goal of the College of Engineering is to develop competent civil engineers that are prepared to enter the global workplace. This preparation is heavily focused on equipping students with the knowledge, skills, and technical savviness to undertake the projects of a civil engineer, currently and in the future. As one faculty
commented, “global competency is an important dimension of preparation for the future of engineering, which not only equips you well for local employment but international employment potential as well.” (Civil and Environmental Engineering Faculty E, personal communication, November 10, 2016). Table 3 highlights a sampling of participant feedback on developing well-rounded civil engineers.

Table 3

*Quotes Illustrating Preparing Well-Rounded Civil Engineering Students*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Preparing Well-Rounded Civil Engineering Students as Perceived by Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil and Environmental Engineering Faculty A</td>
<td>We work hard to get our students to understand the American context in which they are working. They have to understand how to deal with the public. We make them go to public meetings so they learn how to listen to the public. We try to make them understand the interweaving arms of government, at the very local level, the conservation commissions, the city department of transportation, the state department of transportation. So, we have increased our efforts to help them understand those things but we’re doing it in an American context. Now, to the extent that these are transferrable skills, we could use that in any country.</td>
</tr>
<tr>
<td>Civil Engineering Alumni A</td>
<td>I think the best engineers are not only the ones that are technically savvy but have a high emotional intelligence and the ability to communicate with people in your region, nationally or internationally, not a skill that every engineer possesses, but I think that an engineer who is successful on the global level and is able to sort of read people in other regions, that is unique.</td>
</tr>
<tr>
<td>Civil and Environmental Engineering Faculty C</td>
<td>It’s all about preparation and its preparation to think on your feet, it’s preparation to think in an engineering way, to think methodically, to communicate those points methodically and so we try to keep up with the demands of the employers and the demands of the global environment, the societal needs by preparing the students the best we can in the classroom in a way that makes them an independent, creative, methodical engineer.</td>
</tr>
<tr>
<td>Civil and Environmental Engineering Faculty D</td>
<td>We’re working on public presentation skills always in our classes, we have them do a lot of report writing not just to go through the motions but with meaning.</td>
</tr>
</tbody>
</table>
Each interviewed participant audience agreed on the importance that a well-rounded civil engineer is the expectation of the future to achieve the tasks of the future global civil engineer. According to interviewed participants, compared to the other engineering specializations, there appears to be a greater business dimension to the civil engineering industry. This further supports the importance of well-rounded preparation to not only include technical and hard civil engineering skills knowledge but also professional ethics, communications, and the business acumen that will aide civil engineers once they enter the workplace. The institution under investigation understands it needs to prepare well-rounded engineers, which are presently in demand and most certainly in the future.

*The Unique Civil Engineer Persona*

Interestingly, faculty, employer, and the career education administrator feedback appeared to surface a common theme of unique individual attributes that differentiated a civil engineering student as compared to another engineering specialty student. The focus of sustainability, a broader perspective on impact, a political, societal, and cultural inclination towards problem solving, and a demeanor towards bettering the world were characteristics noted by those who work most closely with the civil engineering students at the institution under investigation and employers who hire these graduates. Additional common descriptive codes that resonated with the interviewed faculty, employers, and career education administrators were as follows:

- Ambitious and eager
- Flexible
- Adaptable
- Patient and Tolerant
- Motivated
- Empathy

Two participants demonstrated very well how the unique civil engineering persona was reflected in their direct interactions with the civil engineering students at the institution under investigation.

I think folks that are drawn to civil, they are different from other engineers that I talk to. They are doing this because they want to address issues in society. Civils want to solve problems that are much more societal, urban issues, transportation issues, environmental issues. I feel they are more political and more sociological in their thinking. They have a broader perspective. They are motivated differently in my view about what they are using their engineering background to do. (Career Education Administrator B, personal communication, October 26, 2016).

When we do a poll asking [civil engineering students] what is their driving factor in becoming an engineer, almost always it is to help people or to offer new and innovative ways to better the world, essentially. (Career Education Administrator A, personal communication, October 14, 2016).

**Global Competence is Necessary Though Complex**

The second theme that emerged from the data analysis was global competence is necessary though complex. Participants across all audience types; faculty, career education administrators, alumni, employers, and professional association provided feedback to suggest global competency is necessary, though, the way it was defined and applied to civil engineering by each varied slightly, which suggests it is necessary though has its nuances.
Varying Perceived Definition of Global Competency

Each of the interviewed participants were asked to define global competency, as it related to the civil engineering industry. Specifically, the goal of this question was to better understand how they viewed the global competencies that are increasingly being required of civil engineers in today’s global engineering workplace. Each of the participants provided their own definition. A sampling of feedback is highlighted in Table 4, found in Appendix B.

There were some common and divergent themes that resonated amongst the feedback related to their definition of global competency. Specifically, all participants agreed to the importance of global competency, especially as industry trends reflect an increasingly diverse workforce and increased transnational projects as well as employment in multi-national companies. Cultural awareness, having an understanding and appreciation of different perspectives as it related to completing civil engineering projects, and being resourceful to identify what works in one region versus another region were common perspectives highlighted by the interviewed participants. There was some variability in foreign language as a component of global competency, where some faculty and the professional association representative agreed that language acquisition was a part of global competency, specifically to have opportunities of international employment.

It is interesting to note that upon the initial questioning of defining global competency, the level of overt awareness to this term raised some ambiguity amongst some participants, as they paused to reflect on the term “global competency” and its application to the civil engineering student. One faculty commented on the frequency of the use of the term though questioned what does the term actually mean when we use it in dialogue, “I’m drawing a blank on that one. I mean everyone keeps throwing that around, there are all these words, like
innovation, global competency, and I feel like it’s one of those buzz words that it’s in vogue now…” (Civil and Environmental Engineering Faculty D, personal communication, November 3, 2016).

Amongst the interviewed engineering employers, the awareness of global competency and its direct application to their immediate work varied, which consequently, informed their definitions of global competency. In particular, although both engineering employer participants represented multi-national engineering firms, the level of engagement in non-American or non-North American focused responsibilities, varied. These employer quotes related to their direct global work responsibilities, are presented in Appendix C.

Support for Research Study Global Competency Definition

Each of the attributes I defined as resulting in global competence resonated amongst all participants. Despite the level of applicability for each competency, each audience articulated well how the future civil engineer must possess these global competencies. Table 5 provides a sampling of quotes related to the cultural awareness and appreciation attribute of global competency, found in Appendix B.

The ability to think innovatively and critically was universally well received as necessary for direct application to the civil engineering field. Alumni commented on the importance of an innovative civil engineer, not only because the future depends on innovation but without innovation, there would be no critical thinking around best practice and identification of the best solution for a project. Faculty and career education administrators shared collectively the belief that critical thinking and innovation is an engrained attribute in any discipline and particularly important in civil engineering.
The ability to interact and work across different time zones with individuals from different backgrounds on international teams with an understanding of the local in-country structure and organization, in general resonated by participants as important. Interviewed participants generally agreed on the importance of transnational communication taking into consideration different time zones with an understanding of the local in-country structure. However, there was some feedback to suggest that this competency merely reflects basic communication skills. The question was raised by some participants on what is the best avenue to pursue in order to acquire this experience to result in increasing a student’s global competency.

Although one career education administrator agreed on the importance of the third dimension of the global competency definition (be able to work and interact with individuals from diverse backgrounds on international teams with an understanding of local in-country structure and organization), they questioned the reasonability of expecting a new graduate to have the opportunity where they are exercising this skill around cross border communications. The caveat was raised, however, on the institution’s orientation to global, which encourages its students to engage in international experiences. This may result in civil engineering students at this particular institution having an advantage and an opportunity to exercise this global competency dimension, as perceived by this career education administrator participant.

One participant commented further on the importance of all the defined competencies, as they are not only reflective of the future civil engineer but, more tangibly, the current diverse civil engineering classroom that is the platform for educating future civil engineers; “This reflects our classroom, right? You have a really diverse base where we are taking our students. We have a lot of international students from the Middle East, China, South America...we have
students from all over now.” (Civil and Environmental Engineering Faculty D, personal communication, November 7, 2016).

Efficient and Effective Civil Engineering Project Management Practices

Feedback across all participants suggested that due to the complexity and nuances of each civil engineering project, the attributes under exploration in this research study will be necessary and increasingly important in the work that many civil engineering practitioners will engage with in their future to deliver efficient and effective civil engineering projects.

To ensure the success of a civil engineering project, a civil engineer must understand the client, the community, the politics and finances of that environment, as well as the resource strengths and limitations. One participant articulated the importance of global competency as it related to their work and the work of an engineer as; “When solving a problem as a team, it’s best to understand where people are coming from…they might have problems which they are not articulating clearly…understanding how they work is essential in helping…[to solve] a problem that works.” (Civil Engineering Alumni C, personal communication, January 25, 2017).

Regionality of Civil Engineering Projects

Because of the regionality and uniqueness of each civil engineering project, a global civil engineer must be well-equipped with the knowledge and resources to carry out effective and efficient civil engineering projects. Each project has specific regulations, technical specifications, and limitations in resources, given geographic location. Furthermore, each project has a societal impact and safety concern that must be taken into consideration as well. One participant commented further “It is important for civil engineers to understand that what works in one part of the world, one part of the region, or one part of the state even, is not going
to work in other places.” (Career Education Administrator C, personal communication, February 21, 2016).

Figure 1 presents a visual representation of common feedback that surfaced amongst interviewed participants on the requirements of the global civil engineer due to the unique nature of a civil engineering project.

![Diagram of the global civil engineer requirements]

**Figure 1.** The global civil engineer requirements.

As presented in Figure 1, given the nuances of unique projects, the expectations of a global civil engineer are vast. As such, since the efficient and effective management of unique civil engineering projects, is the goal of today and the future, global competency is important.
Institutional Orientation to Internationalization

There is no doubt that the institution under investigation, the College of Engineering, and the Department of Civil and Environmental Engineering is committed and motivated to progress the student’s mind frame and attitude towards a globally-minded citizen. This finding resulted in the third theme of institutional orientation to internationalization. Through various types of programming, domestic and international activities, diversity of faculty, student population, and curricular enhancements to incorporate competencies for the 21st century, there is vast support for fostering this level of global mind frame amongst not only civil engineering students but the entire institutional student body. Common descriptive codes that resonated with the interviewed faculty, alumni, and career education administrators were as follows:

- Commitment
- Determination
- Support
- Globally-minded

One faculty comment illustrated the institutional support and commitment to affording each student an international experience; “One thing is for sure, as much as the President and the senior leadership talk about globalization, we’re all over it, we’re on board and so the level that the university is doing it, we’re on board, we’re trying to embrace it.” (Civil and Environmental Engineering Faulty E, personal communication, November 10, 2016).

Collaboration

In general, collaboration was an important subtheme that surfaced in the research results that informed the process of developing globally competent civil engineers. As part of the institutional orientation to internationalization major theme, collaboration was highlighted
amongst student groups, industry, peer faculty, career education administrators, and institutional departments as an important practice in the process of developing globally competent civil engineers to enter the global workplace. Collaboration appears to be an institutional practice that is a response to developing globally competent civil engineers. Based on the dimensions of collaboration that surfaced from the research results, I present Figure 2. Figure 2 provides a visual representation of the different entities at the institution under investigation that collaborate to inform the process of developing globally competent civil engineers.

![Collaboration Diagram](image)

**Figure 2.** Entities impacting collaboration emergent theme

As Figure 2 showcases, collaboration was identified as an underlying activity at the institution that takes place between numerous administrators, faculty, departments, and entities that may support institutional efforts in preparing globally competent students. One participant emphasized employer collaboration, domestically and abroad, which informed the career
education programming in its application of developing globally competent civil engineers,

“There is constant engagement…we are very innovative in the approach that we take to getting
employers and students connected.” (Personal Communication, Career Education Administrator
B). Collaboration is also an important dimension of application to Cranton’s Fostering
Transformational Learning theory (2006, 2010) due to the discourse and engagement that occurs
between entities that promotes learning and fosters the construct of global competency within
this collaborative environment.

Empowerment/Encouragement of Civil Engineering Students

Another underlying practice that surfaced in the institution’s efforts to develop globally
competent students, is the empowerment and encouragement of civil engineering students.
Based on the respective feedback of civil and environmental engineering faculty and career
education administrators, these audiences empower and encourage their students through various
means of engagement to inform the global competence development process.

Faculty and career education administrators empower and encourage students to:

- Go abroad
- Be empathic
- Be culturally aware
- Appreciate diversity
- Be an independent thinker
- Engage in development work
- Think critically with a global mindset
- Be a competent civil engineer

This empowerment and encouragement that is practiced by faculty and career education
administrators appeared to be an important dimension in the process as it affords ownership on the student to fully engage in activities that promote global competency and think from a different perspective outside of their own; an underlying foundation to Cranton’s Fostering Transformational Learning theory (2006, 2010).

**Diversity and Immersion as Learning Tools**

Diversity and immersion resonated with all interviewed participants; either it be through the workforce, the classroom setting, the faculty composition, the civil engineering industry, or the diversity and immersion of experiential education opportunities. Diversity and immersion as learning tools was the fourth emergent theme that resulted from the analysis.

*The Academic Classroom: Student Diversity*

The diverse institutional student body and the engineering classroom were commonly raised as dimensions of diversity that provided a unique learning environment for civil engineering students to interact and learn from their diverse classmates. In particular, this interaction between diverse students in the classroom was nicely articulated by one faculty participant; “We have students from all over and we put them in teams…I want them to learn American culture, because that’s why they are coming here. So, you put them in a team with Americans but then the Americans learn from that student’s culture as well.” (Civil and Environmental Engineering Faculty D, personal communication, November 7, 2016).

*The Academic Classroom: Faculty Diversity*

The faculty composition was often commented on as a vehicle to facilitate the global competency development process. Interviewed faculty all commented on the diversity of the department and the strengths and benefits this brought to the learning process of the student in the classroom. Specifically, alumni often reflected on their interactions with the diverse faculty
who often brought their personal industry and home country experiences into the classroom. Furthermore, this faculty linkage to international or foreign practices allowed students the exposure to and opportunity to immerse in non-traditional or foreign academic assignments that provided another lens to the civil engineering curriculum that focused on themes outside the U.S.

Experiential Education

The participation in various domestic and/or foreign experiential education and practical activities was commonly noted by alumni, faculty, and career education administrators. The overseas work placements, study abroad programs, overseas faculty led programming, and Engineers Without Borders service learning program, were all identified as important when informing the process of developing globally competent civil engineers. As one faculty mentioned, “In the [classroom setting], the [exercise] is only an assignment, in the [international context] it is a life experience.” (Civil and Environmental Engineering Faculty B, personal communication, October 17, 2016).

Interviewed participants agreed that opportunities to immerse oneself in a country other than where one is studying allowed the civil engineering student to not only be a good engineer with best practice but also understand the context and environment overseas. As one participant noted, “the opportunity to immerse oneself in a foreign culture…exposure to different from what you are used to, provides you an opportunity to think innovatively, to be more culturally aware and sensitive…and be able to interact in diverse teams.” (Professional Association Representative A, personal communication, December 22, 2016).

Limitations: Uncovering the Complexities of Developing Globally Competent Students

Although intent and commitment was present to develop globally competent students, certain limitations were identified as impacting this process. As such, the fifth theme that
emerged from the analysis was limitations and uncovering the complexities of developing globally competent students.

_The Globally Competent Civil Engineering Curriculum Blueprint: Innovation with Limitations_

The integration of technical skills of the practice and the additional skills required for students to develop as globally competent civil engineers upon graduation was identified as a challenge, despite the intention and commitment of the institution to develop globally competent civil engineering students. One faculty member highlighted the importance of global competency, yet raised the challenge of an effective way of teaching this within the curriculum that suggested a student responsibility to develop this competency as well.

I think a lot of [the students] are going to need to learn some [of the global competency] on their own of what it means to be globally competent. One of the traits to be globally competent would be sensitive to other cultures and how to fit in, understanding global economies better and how to take advantage of those, and how to keep an eye out for issues, that’s a really hard thing to teach. (Civil Engineering Faculty E, personal communication, November 10, 2016).

This challenge of providing an opportunity for exposure of these attributes to the student in the curriculum was also shared by the national professional association perspective.

…times zones and…recognizing that there are cultural differences and understanding how you coordinate a project that you might be working on with a team that is literally around the globe. Those are things that not every young person is going to ever do but if you can figure out how to introduce them into a general curriculum. (Professional Association Representative, personal communication, December 22, 2016).
As faculty and career education administrators noted, developing the civil engineering curriculum is no easy task. The process requires the careful consideration of national level academic standards, institutional level academic standards, and the standards associated with successful integration into the global economy. The national standards for accreditation set by ABET for the general criteria and ASCE for the program criteria set the foundation for the department’s review process as it strives to align itself with accreditation requirements as well as incorporate the skills, experiences, and knowledge that are increasingly important to address the nuances of the civil engineering industry in this global economy.

Faculty and career education administrators noted how the civil engineering curriculum evolves with time. The evolution aims to address aspects such as; innovation, communication, data analytics and coding, diversity, international exposure, and cultural awareness. These outcomes are increasingly required by national standards and the institution under investigation’s general education undergraduate requirements. These aspects are not exclusively the responsibility of the civil engineering department but a collaborative effort working in alignment with the institution’s undergraduate education division. The alignment seeks to incorporate specific areas in the curriculum that addresses foundation knowledge to prepare well-rounded and globally-minded graduates. This general education curriculum is a body of knowledge and curriculum that has been developed at the institutional level to augment individual departmental academic programs, regardless of major, to better prepare students to enter the global workplace.

Faculty feedback indicated how the civil engineering curriculum review process is frequent and strives to not only continue to meet the national accreditation standards, align with employer expectations of graduate skills sets, but also continue to evolve to ensure the development of future global civil engineer. These efforts are frequent and consistent within the
Department of Civil and Environmental Engineering with international work experience, study abroad, and integrated learning and practice opportunities for current civil engineering students.

Another area that surfaced as a limitation to innovate within the civil engineering curriculum, as a result, of national accrediting and community standards, is that of safety. Employers and career education administrators frequently commented on given the impact of the civil engineering projects on society and the community, they must be executed with safety in mind. To drive innovation that might result in a more efficient process of implementation, this requires a trial and error period. However, in civil engineering, there is little room for trial and error and so driving innovation can occur only through the lens of safety.

**Non-Engineering Technical Skills: Communication**

Although not a primary focus of this research investigation, communication and non-engineering technical skills surfaced as a challenge area in developing well-rounded globally competent civil engineer students. Experiential education opportunities appear to afford civil engineering students the ability to gain professional and business acumen skill sets, which may better prepare the civil engineering student. However, some feedback indicated how the development of non-technical knowledge skills can be a limitation in the effective preparation of globally competent civil engineering students. Given how interviewed participants emphasized the importance of a well-rounded civil engineer with technical, business, and soft skill knowledge, some alumni commented on the opportunity to better prepare students in effective communication and presentation skills. According to some faculty, intentional programming is under development to strengthen civil engineering student communication skills.
Monetary and Human Capital Limitations

In general, as noted by interviewed participants, there is a financial burden placed on civil engineering students to engage in international experiences. Although these experiences are provided to augment student global competency through direct immersion in a foreign culture, the monetary dimension of this experience was raised as a possible limitation in the process of developing globally competent civil engineers. The opportunity cost of the international experience, mostly working or studying overseas, came with a price tag.

From a departmental human and financial capital perspective, a challenge arose with capacity. Interviewed career education administrators suggested that allocation of time to each individual student can be compromised due to other professional responsibilities and volume of work. Departmental budgetary resources were identified as a possible challenge in preparing globally competent civil engineers. “I think we probably need to invest in some cultural resources, we are obviously limited, which really limits what we can purchase in terms of information resources for students and for us.” (Career Education Administrator B, personal communication, October 26, 2016).

The Preparation of International Versus Domestic Civil Engineering Students

An important distinction that surfaced during the interviews is that of the student type; domestic student versus international student. For example, feedback primarily representative of faculty, career education administrators, and engineering employers, often introduced the distinct student audiences of the international student versus the U.S. domestic student, when it came to global competency skills and preparation to enter the global engineering workplace. One faculty commented on their intentional concern around preparing an international civil engineering
student who intends to travel back to their home country to practice engineering compared to a
domestic civil engineering student.

One group of people I think about with this the most are our international students. Many
of whom are going to go back home…I am thinking [how] I need to prepare [them] to be
a good engineer. My main thinking is learn good American engineering and you will
have a leg up to all students who did not study in America because we have best practice
[in construction management]. (Civil and Environmental Engineering Faculty A, personal
communication, October 7, 2016).

Yet another perspective raised by one participant focused on the possible disadvantage
the U.S. domestic student might have as compared to the international civil engineering student,
simply because of the personal background that affords these international students greater
exposure to a diverse environment.

We’re almost at a natural disadvantage. A) we live in the U.S. and the U.S. has one
primary language. If you go to Europe, kids learn how many languages? If you go to
Asia, I don’t know how many you have to learn. There are many dialects, if you go to the
Middle East, you have to learn different dialects. Now, English is a primary language for
much of the world but that just spoils [us], so yes, that is a big disadvantage growing up
here and where do you put that into the curriculum? (Professional Association
Representative A, personal communication, December 22, 2016).

This fifth theme underscored the complexities of the civil engineering academic
preparation and the industry that are realistic considerations when preparing globally competent
civil engineering students.
Maturity and Transformation of Civil Engineering Students

The sixth theme that emerged from the analysis focused on the personal growth, maturation, and transformation of the civil engineering student that appeared to result from participation in and engagement with various activities, as perceived by faculty, career education administrators, and alumni. The practical learning component to the institution’s academic preparation of its graduates is a foundation to developing well-prepared students to enter the global workplace, in general. Specifically, given the technical nature of civil engineering and need to secure work experience during the undergraduate education experience, the institution under investigation provides a unique environment for civil engineers to have access to a network of opportunity.

Network of Opportunity: Engagement in Academic and Practical Activities

As faculty commented, the international faculty led academic experiences were identified as a means for civil engineers to gain global competence through the immersive and direct experience within a host culture. This type of integrative program was relayed as providing students the opportunity to live, study and work, and interact in a host culture. Although, evaluation of this program was not the focus of this research investigation, according to some faculty, this experience was one way in which students may be better prepared to enter the global workplace with global competence.

It is interesting to note however, that none of the three interviewed civil engineering alumni commented on this faculty led summer program as an experience that impacted their global competency. None of the interviewed alumni participated in this type of experience and even more interesting was the fact that this experience was not even referenced during the interviews at all. This might simply be a result of the composition of the alumni who
participated in this research study, not having the opportunity, or electing to not participate in this activity.

The programs that resonated with the students were *Engineers Without Borders* and the practical work experience. Participation in *Engineers Without Borders*, appears to have resulted in development of empathy; a transformation that faculty and career education administrators noted as present upon completion of this program. Faculty and alumni, unanimously agreed that participation in a work, study, or service learning experience, domestic or abroad, can have a meaningful impact on a student, especially as related to exercising and cultivating global competency.

**The Institution is Effective, Though Opportunities to Augment the Process Exist**

The last theme that emerged from the results is the fact that, in general, as perceived by the interviewed participants, the institution under investigation is generally effective in preparing civil engineering students to be globally competent, as defined for this research study. Though, there are particular dimensions of the process that resonated more with interviewed participants. As one faculty commented, “I think we’re doing a great job at raising people in the American way of thinking to be aware of the world rather than necessarily competent in the world.” (Civil and Environmental Engineering Faculty E, personal communication, November 10, 2016).

Specifically, civil engineering faculty were often identified as positively influencing the alumni experience in raising their global competency because of the diverse faculty composition and the experiences they brought to the classroom, as highlighted by alumni.

[The college] had a very diverse staff, many of the faculty, the lecturers, and the TA’s were from countries all around the world and they often brought anecdotes into the classroom from their experiences abroad or their former home so I guess that’s one way
how the institution wove culturalism into the curriculum.” (Civil Engineering Alumni C, personal communication, January 25, 2016).

Although the institution under investigation is generally effective in its preparation of developing globally competent civil engineers, opportunities to augment the process exist, as qualitative feedback suggested. This is reflective of not only further refinement of the process to intentionally address the attributes of global competency as defined for this research study but also ensure alignment with institutional goals that will inform overall student learning outcomes, regardless of student concentration. As one participant noted, “I think we need to do a better job and we’re working on this and trying to match our thinking with the academic plan of the university.” (Career Education Administrator B, personal communication, October 26, 2016).

Specific opportunities for development that were discussed by participants as ways to enhance the process are discussed in Chapter 5.

**Fostering Transformational Learning Theory**

As noted by Cranton (2006), the community and setting of the institution under investigation informed the data collection process and methodology. The institution under investigation is one that is geographically well-situated in a rich urban setting that is ethnically diverse with a presence of global employer headquarters. The data collection process, available opportunities and resources, and challenges when promoting the mission under the circumstances of the organization’s setting and community can determine change or transformation (Cranton, 2006).

In particular, the community or setting of the institution influences how the teaching is executed in the student body as well as the process stakeholders follow in order to accomplish teaching and learning outcomes (Cranton, 2006). The geographic location of this institution, the
research site, lends itself well to promoting global competencies in its student body. The diverse, heavily populated urban city that welcomes a large volume of students on an annual basis and serves as headquarters to large multi-national companies is an ideal geographic location to promote the importance of diversity, cultural awareness, and the global competency skills, employers are seeking in today’s 21st century.

Creating a Fostering Environment for Transformation to Take Place Among Civil Engineering Students in the Classroom

The civil engineering department is likely one of the oldest departments at this institution with more than numerous years of rooted history, tradition in teaching, research, and community engagement. This department has contributed significantly to the development of the civil infrastructure and the environments at both national and international levels, and continues to grow; expanding its faculty base, infrastructure, and augmenting its curriculum

“...we are embarking on an exciting period of growth in the department, expanding our faculty, rejuvenating and growing our laboratory facilities, and expanding our curriculum. This is an excellent time to study at [A Private Four-Year Research Institution in the Northeast]. (Institutional Website, 2016).

In addition to the departmental focused initiatives on transformation, growth, and national and international impacts, all to better equip civil engineers for the transformed engineering field, College of Engineering academic leadership stated complementary feedback on its college’s initiative to “prepare the next generation of engineers” (Institutional Website, 2016). This institutional website feedback is highlighted in Appendix D.

The emphasis on the student learning outcomes of the civil and environmental engineering undergraduate curriculum aligns with the updated Accrediting Board of Engineering
and Technology (ABET) body of knowledge outcomes that now reflect of 1) *global team work*, and 2) *understanding of engineering issues on a global level*, and the like global competencies employers seek (ABET, 2016).

As Cranton (2010) suggests, the academic discourse that occurs in the classrooms can inform and impact a student's learning process. In this case, the academic discourse through means of integrating international case studies as assignments complemented by personal faculty discourse of diverse background experiences appeared to assist in the development of globally competent civil engineers. All faculty commented on how they integrated their personal experiences working on international research and work projects, and their involvement in informing national and international standards of the profession.

Faculty and civil engineering alumni participants both shared insight on the diversity of the civil engineering faculty, which influenced and informed the process in developing globally competent civil engineering graduates. Both audiences shared experiences where the classroom became a global classroom and learning environment. Faculty reflected on their academic discourse activities, which primarily focused on international experiences, case studies or capstone and design projects that offered a different perspective to a civil engineering challenge. With commitment to programming that supported and fostered critical thinking and innovation, the goal of these discourse activities was to promote diverse and critical thinking in how a civil engineering student thinks about a project to ensure effective and resourceful practices. Through exposure to domestic and international work opportunities and individual and group advising sessions, career education administrators, were able to, reach students in a manner that empowered them to think globally and outside the parameters of the institution under investigation’s geography. In particular, this integrative discourse approach fostered and created
a learning environment conducive to raise awareness of global competency. Table 6, in Appendix B, provides a sampling of faculty feedback on the academic discourse that took place in their classroom.

In general, interviewed alumni provided similar feedback on the types of academic discourse and activities that took place in the classroom that appeared to have influenced their development of global competency. They reported how faculty encouraged them to participate in related activities, domestically and abroad that offered a distinct learning environment that could foster global competency acquisition.

Creating a Fostering Environment for Transformation to Take Place Among Civil Engineer Students in the Workplace

Within the workplace context, as the field of civil engineering continues to evolve with increasing urbanization efforts, renewable energy projects, and overseeing large complex and borderless projects, that require travel abroad, well-rounded engineers with strong hard technical skills and soft skills, such as global competencies will be required (BLS, 2015; Bielefeldt, 2013).

The civil engineering industry is experiencing significant growth that is both healthy for employment but also brings challenges in the way work will be commissioned and executed across borders (Bielefeldt, 2013; BLS, 2015). Increasingly, U.S. engineering consulting companies are taking their operations overseas and working in foreign yet exciting territories (Bielefeldt, 2013). This is a response to the significant growth in infrastructure that is needed in the fast-developing countries, which can be highly rewarding for those in civil engineering positions (Bielefeldt, 2013). However, as the BLS (2015) notes, individuals who participate in cooperative education programming and practical experience during their academic career will fair more favorably than those who do not in this competitive and complex civil engineering
employment landscape. This fact supports that experiential education and opportunities to enhance a student’s mind frame related to the application of theory in the workplace and through various assignments, in the field, aligns well with the underlying principles of Cranton’s Fostering Transformational Learning Theory (2006, 2010).

Although identification of which specific discourse employed at the institution under investigation had the greatest impact or influence on the civil engineering student’s development of global competency, there is no doubt that through these meaningful experiential opportunities, an individual is better prepared to enter the civil engineering global workplace.
Chapter V: Findings, Discussion, Limitations, and Implications

According to the National Academy of Engineering, “From urban centers to remote corners of Earth, the depths of the oceans to space, humanity has always sought to transcend barriers, overcome challenges, and create opportunities that improve life in our part of the universe.” (NAE Website, 2017). This statement is a true testament to the impact of civil engineering projects and how the future of the industry is heavily influenced by those projects that will impact overall societal well-being, regardless of location. The 14 Grand Challenges for Engineering in the 21st Century, promoting borderless operations, further supports the significance of developing globally competent civil engineers. For this reason, research in this study focused directly on preparing globally competent civil engineering students. This research emphasized the increasing need to further investigate this population to ensure civil engineering graduates are prepared to enter the global engineering workplace and tackle the challenges of the future of civil engineering, such as these 14 Grand Challenges (NAE Website, 2017).

This study employed a qualitative case study research design to explore the lived experiences of civil and environmental engineering faculty, career education administrators, civil engineering alumni, and engineering-related employers who are directly affiliated with the institution under investigation. Feedback secured from the professional association representative was incorporated to support research findings and emphasize certain themes. The personal experiences of each of the interviewed participants shape the research findings and inform how the institution under investigation prepares its civil engineering graduates to be globally competent. Fourteen individuals in total, participated in this study; five civil and environmental engineering faculty, three career education administrators, three civil engineering alumni, one professional association representative, and two engineering-related employer
representatives. The data analysis specifically informing the research questions and emerging themes is generally representative of all interviewed participants, with the exception of the professional association feedback representative.

Researchers (Stake, 1995, 2005; Merriam, 1988; Yin, 2009) have stipulated how the case study approach allows the researcher to capture a “holistic understanding of a phenomenon within real-life contexts from the perspective of those involved” (Boblin, 2013, p. 1268). Furthermore, in order to provide a richer perspective, reflective of different data sources, this research study also included a review of applicable secondary resources to complement the retrieved qualitative feedback (Boblin, 2013). This variety of information allows me to capture a holistic perspective of the education problem under investigation. Data was collected using semi-structured interviews and document review of publicly available secondary data. Data was analyzed using Stakes’s (1995) categorical aggregation and direct interpretation analysis of first and second level coding. This method was employed to better assess participant’s underlying attitudes and feelings in describing their experiences with the institution under investigation’s process of developing globally competent civil engineering students. The primary goal of this study is to understand the process one institution follows to prepare globally competent civil engineering students, as perceived by the four interviewed participant groups. The feedback solicited from the national professional association highlights the significance of the education problem and corroborates the feedback retrieved from the other participants directly linked to the institution under investigation.

The study was conducted at a private four-year research institution in the Northeast. The geographic location of this institution lends itself well to promoting global competency in its study body. The diverse and heavily populated urban city is home to a diverse college student
population and industry international headquarters. This environment’s robust composition of diversity is ideal to promote the importance of cultural awareness and the global competency skills, employers are seeking in today’s 21st century. The study focused on civil engineering students for three reasons: 1. The civil engineer needs to prepare for the future as this profession expands, 2. The civil engineering industry is highly diverse, and 3. Every civil engineering project is unique.

**Findings**

Interview data from the participants helped to inform the answers to one main question and two secondary questions. In addition, the feedback retrieved from the professional association was incorporated in Chapter 4 and not included in the overall analysis of the institution’s process to directly answer the research questions. The main research question was:

*How does a private four-year research institution prepare its civil engineering students to be globally competent, as perceived by civil engineering faculty, career services administrators, civil engineering alumni, and industry partners?*

The secondary questions for this study were:

1. *How do civil engineering faculty, career services administrators, civil engineering alumni, and industry partners perceive the private four-year research institution as effectively preparing its civil engineering students to be globally competent?*

2. *How could the private four-year research institution better prepare its civil engineering students to be globally competent, as perceived by civil engineering faculty, career services administrators, civil engineering alumni, and industry partners?*

The following section uses data presented in chapter four to answer the three research questions.

**Main Question:** *How does a private four-year research institution prepare its civil*
engineering students to be globally competent, as perceived by civil engineering faculty, career services administrators, civil engineering alumni, and industry partners?

As the data analysis suggests, the process in preparing globally competent civil engineers is complex and inter-related. There are many considerations that inform the process by which the institution under investigation prepares its civil engineers to be globally competent. Figure 3 highlights the four dimensions of an inter-related process that the institution under investigation follows to prepare civil engineering students with the knowledge and competencies reflective of the national accredited engineering standards and outcomes for a competent civil engineer.

Within this inter-related process, there is opportunity to incorporate the global competency conversation to ensure students are developing those competencies, as defined for this research study. These competencies being; 1) culturally aware and sensitive, 2) innovative and thinking critically, and 3) be able to work and interact with individuals from diverse backgrounds on international teams with an understanding of local in country structure and organization.
The visual representation of Figure 3 showcases the different stakeholders in the overall process at the department level that is responsible for curriculum review and alignment to national and institutional student outcomes and competencies. The undergraduate review committee, faculty meetings (that are representative of specializations within the civil engineering field), the student perspective, and the industry advisory board all work in tandem to ensure students are competent civil engineers. This platform of review, allows each stakeholder audience to inform the conversation of global competency within the curriculum, when feasible. As one faculty mentioned, the process of developing globally competent civil engineers, as it is reflected in the academic program is heavily informed by the demands of employers and civil engineering market trends. Although none of the industry advisory board representatives were
interviewed in this research study, faculty whom work closely with this board acknowledged that despite the recognition that cultural awareness is critical for civil engineers, there appeared to be a lesser emphasis on this competency as a requirement for their immediate work needs. This feedback, which is an integral part of the curriculum review process in the department, might suggest a rationale as to why some faculty paused to reflect on the definition of global competency.

However, Figure 3 represents one dimension of the overall process in how the institution prepares its civil engineering students to be globally competent. The process is also clearly informed by career education administrators through promotion and dialogue around employment and experiential opportunities. In addition, the institution’s overall orientation in preparing globally-minded students also informs the process. This dimension of preparation is executed through its network of opportunity, which allows students to engage in activities that exercise the different aspects of the global competency definition articulated in this study. This collaboration, between the College of Engineering and other relevant university stakeholders, appears to be somewhat intentional in order to provide students with opportunities to participate in academic discourse and experiential education to result in enhancing global competency skills. The institution, College of Engineering, its faculty and career education administrators provide a foundation for students to exercise each of the global competency skills researched in this study.

- Because of the institution’s physical location, its diverse faculty and student populations, its institutional commitment to diversity and global, and its ethos of theoretical application to the workplace through experiential education, the university provides the foundation for civil engineering students to experience and practice cultural awareness and appreciation.
• Through its increasingly intentional academic and experiential discourse in the classroom and in practice, the university supports civil engineering students to optimize *critical thinking and innovation*.

• Through its curriculum and more specifically, through its experiential education opportunities, the university’s civil engineering students are exposed to academic and real world activities that can promote *communication across different zones with a diverse team, with an understanding of the local in country structure and organization*.

It is important to note that although experiential education and real world work experience is an embedded component of education within the university’s academic path, because the civil engineering student can satisfy the experiential education university requirement through a variety of experientially-related opportunities, the level of opportunity and exposure to domestic and international experiential activities to exercise and practice global competency, varies.

**Secondary Question One:** How do civil engineering faculty, career services administrators, civil engineering alumni, and industry partners perceive the private four-year research institution as effectively preparing its civil engineering students to be globally competent?

Faculty and career education administrators are primarily responsible for developing socially competent students that are independent, creative, and lifelong learners, important for the civil engineering industry. As one faculty noted, “I have no idea about [how effective] we are in preparing globally competent civil engineers but I’m not worried about it…I think if you are prepared to work domestically you are pretty well prepared globally…” (Civil Engineering Faculty A, personal communication, October 7, 2016). From a career education perspective, one
participant commented positively on the effectiveness of the institution, “I think if you put us together, as part of the larger umbrella, I would say very effective. I think the combination of the student’s experience in practical education and what [the students] get from us is really the secret sauce.” (Career Education Administrator B, personal communication, October 23, 2016).

The institution under investigation was noted as a premier institution in its preparation of globally competent civil engineers, by interviewed employers, given its exposure to the integral part of practical experience during a students’ undergraduate career, which appears to influence their global competency, as determined in this research study. Furthermore, although there is a general perception of effective preparation of its students to enter the workforce and global engineering workplace, feedback does suggest the process can be augmented to enhance preparation. Specifically, enhanced preparation related to communications or presentation skills and an increased knowledge of foreign engineering practices or environments may be warranted. This increased knowledge may provide a greater holistic perspective to the global engineering industry and afford students additional exposure to opportunities to augment their understanding of foreign engineering practices and environments, an attribute of global competency.

It is important to note that each participant was probed to define how they believe the institution is effective in developing globally competent civil engineering students. Since there was variability in their responses, the answer to this research question is truly subjective in manner. This finding, though, does provide a strong foundation for further research to quantitatively assess the effectiveness of the institution and specifically, assess individual activities that inform the student’s global competency acquisition level.

**Secondary Question Two: How could the private four-year research institution better
prepare its civil engineering students to be globally competent, as perceived by civil engineering faculty, career services administrators, civil engineering alumni, and industry partners?

Figure 4 presents a visual representation of how the institution under investigation might consider augmenting its process in developing globally competent civil engineers, resulting from the synthesis of qualitative feedback and my recommendations.

Figure 4. Augmenting the process to develop globally competent civil engineers

Specifically, the recommendation to explore APEC, the academic and practical exchange consortium, may align well with the institution’s ethos of theory and application within the real world as a true learning environment. Taking a similar approach of institutional and employer integration to provide a vehicle of mobility for civil engineering students across borders may allow students an opportunity to interact with different cultures, think in terms of the local
community, and exercise global competencies. This consortium model was investigated by Soibelman et al., (2011) through an International Collaborative Construction Management course that was delivered by a consortium of four universities within the U.S. and abroad to increase engineering student global competencies. Schaefer et al. (2012) also explored Georgia Tech’s civil engineering program that crosses three different European locations with a goal of raising engineering student global competency. The institution under investigation may consider a similar APEC model. A model that incorporates curriculum and practical training in the real world which aligns with its institutional and departmental mission and strengths in resources to leverage existing or new partnerships at a local and international level. This exploration might include collaboration with not only institutions but also national professional association organizations who help to prepare the civil engineers of the future.

*Focused International Engineering Education to Raise Student Awareness*

The opportunity to increase exposure to international engineering trends and global engineering practices, in general, within the curriculum is raised as another opportunity for augmenting the institution’s current process. Feedback suggests the early exploration of a minor focused on global engineering be revitalized to align with institutional and departmental mission and goals for preparing students to be globally-minded individuals. Institutions like Georgia Tech and Oregon State University offer global engineering-related minors that promote global leadership and enhance global competencies to better prepare students to work in the global engineering environment (GA Tech website, 2017; Oregon State University website, 2017).

*Cultural Diversification of the Practical Education Experience*

The direct application of theory to the real world is critical. There was consensus, universally, among the interviewed participants and synthesis of secondary data on the
significance of the hands-on learning approach to prepare globally competent civil engineers. Given how technically heavy the civil engineering field is, practice and work experience, is critical. Not only is practice and work experience critical but also practicing in different geographies. As interview feedback indicated, there is a regionality associated with civil engineering projects. Projects have location-specific resources and limitations that must be taken into consideration in order to yield a sustainable execution of a project. With this in mind, immersion in varied geographies, local or international resonated with participants. Although challenges might exist with diversification of the experiential and practical experiences representing different cities or countries, feedback did indicate how one experience in one city on the West Coast affords a different cultural and regulatory environment experience compared to a city in the East Coast or even internationally. This exposure to variability of experiential or practical experiences presents an opportunity to refine the process in exposing students to different communities, thus exercising different competencies to augment global competency.

*Development of a Civil Engineering Alumni Working Group*

Although the curriculum review process at the institution under investigation is inclusive of former students now holding key positions on their industry advisory board, the interviewed alumni offered a unique perspective on their own reflections of going through the academic program. This feedback is an important piece of ensuring the “student voice” is not lost in the on-going curricular review conversation. The interviewed civil engineering alumni, those who have recently entered the workplace offer a valuable perspective to this research study that can further inform and augment the existing review process in ensuring students are globally competent. As shared feedback indicated, the civil engineering alumni, graduates three to five years from 2016, articulated how the academic and experiential activities prepared them for their
employment. With this in mind, civil engineering alumni, similar to the ones who participated in this research study are able to offer a recent perspective from their employment experience that can help inform the process.

Discussion

The field of civil engineering like many other disciplines and professions is evolving as various dimensions of labor market trends, diversity, political, societal, and cultural factors inform industry expectations and competencies expected of employees to enter the global workplace (Mahadevan, 2014; Chak, 2011; Grigg, 2013; Dunsmore, et al, 2011; Rajala, 2012; Joyner, et al, 2012; Schaefer, et al., 2012; Soibelman, et al., 2011; Downey et al, 2006). Specifically, as identified through the results of this study, the current state of civil engineering is a dynamic transnational industry. This dynamic industry will continue to evolve and transform the requirements of the global civil engineer that institutions must respond to in their preparation of civil engineering students for successful entry into the global engineering workplace (Chak, 2011; Rajala, 2012; Bielefeldt, 2013; Itani & Srour, 2015).

Like May, et al.’s (2014) findings, despite the complexity of the term global competency, institutions are still responsible for preparing globally competent students. When I extracted each attribute of the global competency definition, there was no ambiguity around the term and there was general support for all attributes, among participants. As such, this raises the question of are the global competency attributes I investigated in this study, “universal competencies” that are required to be an effective civil engineer in any context? There is strong support that each attribute is critical for any discipline, which informed the thinking of the universal competency.

There is evidence to support that regardless of the civil engineering employment context; domestic or international, because of the specificity of each civil engineering project the global
competency attributes studied in this research are important for any civil engineer to possess. Each specific project location has its own cultural and societal nuances, which will require the civil engineer to understand the resources necessary to maintain and execute the project. As such, the moderate variability in responses to the terminology of “global competency” may suggest that further exploration into the terminology is warranted.

In addition to the opportunities highlighted in Figure 4 to reflect enhancements to the current process, based on a synthesis of research findings and my analysis, I present Figure 5 as one example of a visual representation of the life cycle of developing globally competent civil engineers, at the institution under investigation.

![Diagram](image)

**Figure 5.** An example of the life cycle of developing a globally competent civil engineer student

Throughout the student’s journey, they are exposed to coursework and practical experiences that prepare them to be competent civil engineers. As Figure 5 presents, the
student’s journey is robust. They will interact with a variety of departments on campus and may engage in domestic and international experiences that can assist them with developing global competency. Given the rigid curriculum standards required of this discipline with minimal flexibility to deviate from this journey, it is critical to incorporate discourse and learnings related to global competency throughout the life cycle.

The findings of this study, in particular, the captured alumni perceptions on the necessity of developing a globally competent civil engineer due to the changing industry support the findings of Sunthonkanokong’s (2011) study. Engineering undergraduate students indicated how the future of engineering education is influenced by the industry’s global vision and commented on the importance of lifelong learning, communication, innovation, and critical thinking; a finding similar to interviewed alumni perceptions on the innovation and critical thinking component of global competency.

The institution under investigation’s portfolio of international education programming is vast and robust, which creates opportunity for students to seek out as much and often as they want. The international faculty led experience according to one faculty appears to be instrumental to a student’s maturation and they have observed a transformation in their students due to the immersive learning and practice through simulations, role plays or site visits that afford a student a different learning environment in which to cultivate and foster global competency attributes.

A lot of these students who decide to come on this [international program], they are already open minded but a lot of them haven’t had any abroad experience so for them, the expectations are high but at the same time, they learn so much, they all come back as a
different person and I would say those 5 weeks are transformative for a lot of students. – Civil and Environmental Engineering Faculty B

Although faculty raised the international faculty led programming as a means to expose oneself to an opportunity to gain global competence, alumni perceptions of this activity did not reflect a similar result. However, given that the interviewed alumni had graduated from the institution under investigation in the past three to five years, it is unclear if the lack of mention of this faculty led program in the interviews was because this experience was not available to them, it was only recently added to the department’s international experience portfolio, or it was not something that had resonated with the students during their time of studies. This is an interesting further research opportunity, which can assist in better understanding the significance of various activities on the impact of global competence development in civil engineering students.

An interesting distinction that resonates in the results and is significant to further explore is the distinction of developing globally competent U.S. civil engineering students compared to developing an international civil engineering student. As noted by national rankings, the institution under investigation is one that hosts a significant international population. As such, the resources available to international students to support their transition and integration into the community are vast and growing. According to Cranton’s Fostering Transformational Learning Theory (2006), the type of discourse a student engages in will assist in the development of a broader perspective or a construct. Faculty did specifically mention their ability to better prepare international students who participated in international programming compared to those who had not, in becoming competent civil engineers with best practice knowledge. For this reason, attention to these distinct populations should be an area of further exploration when considering the process, the institution under investigation follows in preparing globally competent civil
engineers. Figure 6 is a visual representation that showcases how the diversity of not only the workforce of civil engineering but also the student body is a transient exchange between continents, which supports the integrative approach to learning and preparing globally competent civil engineers. This civil engineering platform is an arena of diversity that needs to be embraced and fostered via the classroom and workforce to result in efficient and effective practices and preparation.

Figure 6. The civil engineering platform for learning and work

The career services center at the institution under investigation provides intentional cultural programming for international students, specifically, to augment their experience and allow an international student to gain confidence and an understanding of the U.S. cultural nuances. As such, depending on the students’ intent, emphasis might be placed on best preparing them with the technical engineering best practices knowledge for a return to their home country or educating the international students on the U.S. workforce nuances. On the contrary, even though a domestic student audience may never work globally, they should acquire global competency skills to be able to work with counterparts overseas and across different cultures,
given the diverse civil engineering workforce. This is an important distinction as it raises the question of how does the process differ in application to a domestic civil engineering population versus an international civil engineering population? The institution under investigation appears to tailor to both audiences well and faculty and career education administrators appeared to be aware of the nuances of each population.

The concern of monetary challenges associated with participation in international experiences is a consideration for the institution as it might inform its process. It appears that since the compensation of domestic practical experiences are more attractive compared to overseas work experiences, coupled with the expenses associated with the overseas experience, this might hinder a civil engineering students’ intention and ability to engage in international experiences that may assist in their global competency development. Although this was not an explicit variable researched in this study, this does offer an opportunity for future studies to explore how variables may impact a civil engineering student’s feasibility to participate in immersive experiences that may have a monetary impact.

The academic discourse of “immersion” that surfaced in this research study is an underlying principle of Cranton’s Fostering Transformational Learning (Cranton, 2006, 2010). As participants noted, the ability to exercise theory in a practical and real world setting is invaluable. Specifically, the institution’s ethos on practice in the real world provides students with a vehicle so as to exercise the cultivation of the global competency attributes within this learning environment.

I would say the practical work is an essential element to being globally competent.

Although, I personally did not [have an international experience] I have had many friends do them and it’s very enlightening from them and I think it changed their global
perspective…I [worked on the west coast] which I know is not international, but it does have subtle cultural differences from the East coast. – Civil Engineering Alumni C

Another alumni commented on how their varied work experience gave them an opportunity to foster the cultural awareness and appreciation attribute through their interaction in the work place with the diverse workforce and international projects.

Just the fact that this institution was able to give me those opportunities has been incredibly useful…I was able to take away, a lot of knowledge of work culture, both in America and other countries, basically, I’m very happy with where I ended up. – Civil Engineering Alumni A

Through the implementation of surveying workshops, Awange, Faisal Anwar, Forootan, Nikraz, Khandu, and Walker (2017) also found support on the importance of the relationship between hands on learning and better preparation of civil engineering students for the workplace. This type of immersive discourse where civil engineering students can experience best practice or have the opportunity to learn in the environment which promotes best practice is the ultimate learning tool when it comes to developing globally competent civil engineering students. Studies (Bielefeldt, Patterson, and Swan, 2010; Joyner et al., 2012; Stein & Schmalzbauer, 2012) support immersion as a learning tool through internationally-focused activities that allow students to experience a reality where theory, practice, culture, and society come together to promote and foster global competency.

The popular Engineers Without Borders immersive international program not only allows students, across different disciplines to participate in meaningful and impactful activities in a community with limited resources but it also appears to help to foster an important trait; empathy. This type of programming, which allows students to engage in meaningful discourse
in the environment as a learning tool, is reflective of the underlying principles of Cranton’s Fostering Transformational Learning Theory. The focus in Cranton’s Fostering Transformational Learning Theory is adjusting one’s mind frame based on the context, setting, discourse, and opportunity to foster the transformation that is taking place because of a societal impact (Cranton, 2010).

Faculty and career education administrators emphasized participation in the Engineers Without Borders program as one that is critical to exposing a civil engineering student to a different environment and experience that will allow them to exercise different global competency attributes.

[By participating in Engineers Without Borders], part of a global understanding is knowing that there are some [disadvantaged] people out there and to develop an understanding of them, compassion for them. We learn that people in such and such country live on a $1.5 a day. Nobody can live on that. Nobody in America can understand that…You have to understand… that’s a part of a global world. – Civil and Environmental Engineering Faculty A

This alumni’s perspective captures their Engineers Without Borders experience very well as it relates to the evolution of the classroom and where and the learning is taking place.

I traveled [abroad] to put in drinking water systems, to do assessments and a couple of other things and I spoke with the engineers and the community members there and the politicians and I got to see both my mentors speaking with them as well and implementing projects. There’s no experience quite like actually, no learning tool, quite like actually going out and doing it so I actually got a global experience while I was at [the institution]. – Civil Engineering Alumni B
Furthermore, Stein and Schmalzhbauer (2012) support this transformation as a result from their study of the Montana State University community; “Engineers Without Borders – Khwisero partnership has since had a transformational effect on the Montana State Community.” (Stein & Schmalzbauer, 2012, pp. 205). Joyner et al. (2012) further note how emotional intelligence is an attribute resulting from these immersive and meaningful experiences that increase global competencies. This type of transformation that appears to influence the civil engineering persona speaks to the empathy and humanistic personal development reflective of the institution under investigation’s civil engineering population, as identified by interviewed participants.

As noted by the interviewed faculty and career education administrators, it appears that through their collective experience in speaking with civil engineers and retrieving relevant survey feedback, these students chose to pursue the civil engineering profession because of the social impact of the work. These results vary to the findings of Itani et al., (2015), which indicate that engineering students chose the profession of engineering due to its association with high-level scientific abilities and positive job outlook. A possible distinguishing factor in this variance might be that only a percentage of the more than 200 surveyed students in the Itani et al., (2015) study were civil engineering students and so the exact rationale as to why they chose to pursue civil engineering may not be fully segmented out in the research. There were though similarities found between my research study and Itani et al., (2015)’s study with students lacking good communication and those soft skills that are increasingly being sought out by engineering employers in today’s global engineering workplace (Itani et al., 2015).

The importance of civil engineers possessing cultural appreciation and awareness, a component of the global competency term in this study, was also identified by Bielefeldt et al.
(2010) in their study of service-learning project-based engineering education amongst an engineering student population. They posit how activities where a student is immersed in a community completing a project can impact a student’s knowledge and attitude of cultures (Bielefeldt et al., 2010). As career education administrators noted, the civil engineering student audience is reflective of a more holistic and societal-minded group. As such, participation in like academic and experiential discourse activities may only further enhance their empathy.

This case study explores the global competency construct through Cranton’s Fostering Transformational Learning Theory (1994, 2006, 2010) that emphasizes community, setting, orientation, and type of discourse that all play a role in how a civil engineering student develops global competency. As referenced by participants, the civil engineering student appears to have a unique mindset when it comes to cultural awareness, empathy, and an awareness of the social impact of the civil engineering practice. As such, application of this theoretical framework aligns well in the exploration of the type of discourse and activities each participant audience engages in with the civil engineering student audience to further refine or transform their global competency. Faculty are increasingly committed to engage students throughout their academic career to foster their creativity and innovation as the upperclassman classes can be technical focused with a missed opportunity to cultivate the innovation and soft skill dimension given the rigidity of the civil engineering curriculum.

As supported by Bruett (2006), the results of this study indicate the need for students to have the ability to apply acquired knowledge in real-work applications through critical analytical thinking, understanding new concepts, working in diverse teams, and problem solving. Furthermore, LaFave et al., (2014) also found the transformation of the civil engineering industry
now reflects and will continue to demand new skills with an emphasis on acquisition of soft skills, including those related to global competencies studied in this research.

The institution under investigation offers a varied spectrum of immersive experiences. Through promotion and encouragement of this network of opportunity; either experiential, study, or service-learning, either domestic or overseas, this allows for the students’ mindframe to change in perspective and expand. Participation in such immersive experiences provides the forum for which to further cultivate, reflect, and foster learning that is taking place outside the traditional classroom and in this other learning setting. Specifically, these immersive real world experiences, either domestic or international, place students in the settings in which the real dialogue takes place, the real interaction with various constituents takes place, and the real critical discourse and reflection takes place so as exercise the attributes and have this transformative experience.

**Summary**

The global competency construct takes on various forms of definition and application. In particular, I suggest the term “global” yields activities, experiences, or attributes that have an international application or an attribute resulting from an international experience. However, as the findings of this research study suggest, global competencies as related to the global civil engineer can take on a different meaning; one that may result in competencies that are generally important for all civil engineers to possess, regardless of work placement or overseas context.

Given the diversity of the civil engineering industry workforce, in the U.S. and abroad, the uniqueness of each civil engineering project, the business dimensions of the industry, as well as the fact that the civil engineering projects are for the public good, regardless of employment location, civil engineers must possess attributes that are global or more accurately, perhaps,
universal. For example, a global civil engineer or one that can universally work in any environment leveraging their resources and tools, must be 1) culturally aware and sensitive to societal and community nuances, 2) think critically and innovatively, and 3) be able to work on diverse teams that may require international counterpart collaboration, all to ensure current and long term project success. Qualitative feedback often noted how being an innovative and critical thinker requires the civil engineer to think from a different perspective or be aware that different modes of solutions work in different cultures. This finding is further supported in Downey, Lucena, Moskal, Parkhurst, Bigle, Hays, Jesiek, Kelly, Miller, Ruff, Lehr, and Nichols-Belo’s (2006) study, which suggests how “the key achievement in the often-stated goal of working effectively with different cultures is learning to work effectively with people who define problems differently than oneself” (Downey, et al., 2006, p. 107).

The findings of this case study suggest that the institution under investigation is generally effective in preparing its’ civil engineers to be globally competent, as defined for the purposes of this research study. Each of the participant audiences; faculty, employers, alumni, and career education administrators interviewed for this case study play a role in the process of developing globally competent civil engineers. The integrated approach of theory and application, classroom and workplace, faculty and career education administrators, and alumni and industry provide a solid foundation in which the institution under investigation builds and develops its process to effectively prepare civil engineers for the global engineering workplace. This integrative approach of learning in the classroom and outside the classroom, where there is an intentional discourse that may influence a student’s global competency construct is an underlying principle of Cranton’s Fostering Transformational Learning Theory (2006, 2010). The institution under investigation is uniquely positioned to draw upon a network of opportunity that
results in augmenting the process to further address the nuances of effectively preparing an international versus domestic civil engineering student audience.

This network of opportunity lays the groundwork for civil engineering students to take advantage of and seek out activities and experiences that will prepare them for the global engineering workplace. As participant feedback, labor market data, and industry trends suggest, the field of civil engineering is an increasingly global field representative of an increasingly diverse workforce that is forecasted to experience greatest growth compared to other engineering specializations (BLS, 2015). It is in the interest of students, faculty, departments, institutions, and employers to continue to investigate the civil engineering profession as it continues to evolve with influences from the political, cultural, societal, and monetary environments.

Limitations

The study was limited to one college, and so generalizability is difficult, given the considerations of any given institution. I have professional experience with the institution under investigation, and while every attempt was made to capture participation completely voluntarily, past knowledge of some participants through past professional experiences might have resulted in participants feeling more inclined to participate to assist a fellow former colleague. In addition, every attempt was made to mask the institution under investigation, however, given the unique institutional profile, it is conceivable that an individual might be able to ascertain the research site through process of elimination.

Although my primary method of data collection was qualitative feedback secured by myself, interviewing participants through semi-structured interviews, as Spector (2006) notes, using a single method approach, where only one researcher interviewed individuals, might have introduced bias. To combat this possibility, a complementary document review phase of
secondary data variables was introduced. Civil engineering labor market data, website content, civil engineering degree mapping, and other data sources were reviewed to help mitigate bias. Future research might include additional researchers interviewing participants or coding the interview data to potentially combat bias.

In order to assess the effectiveness of the institution’s process in developing globally competent civil engineering students, a quantitative study to assess variables positively or negatively impacting global competency is necessary. The ability to assess effectiveness in this study, was purely retrieved through a qualitative approach comprised of interviews and a document review of relevant secondary data. As such, in order to determine a statistical significant effectiveness of the process that develops globally competent students, quantitative data analysis of relevant variables is necessary.

**Implications for Practice and Research**

Qualitative feedback supports the importance of conducting this research study as it is a concept that many grapple with in preparing future civil engineers for the global workplace. This research study provides an additional body of knowledge to augment the existing scholarship highlighting the importance and significance of developing work ready college graduates. It further supports the need to expand the audiences which are studied to ensure colleges and universities are well preparing college graduates, in particular in better understanding how institutions develop globally competent students, specifically, civil engineering students. This in-depth analysis of one institution’s process in how they develop globally competent civil engineering students creates a platform for further studies, similar in nature, to further understand how institutions of various type, size, mission, strengths and
limitations, and internationalization efforts to prepare globally competent civil engineering students.

The findings suggest that the process is one that is complex, inter-related, and relies on internal and external stakeholders to inform how civil engineers are prepared to be globally competent. The fact that the civil engineering field is increasingly becoming global emphasizes the fact that the student body needs to be well equipped to meet the challenges of the 21st century, especially as they relate to the skills and competencies sought out by the employer perspective, now and in the future. Through the qualitative analysis of the participants in this research study, there is a notion that practice and application of practice, in the local and global environment, is critical. The institution under investigation appears to provide a solid foundation of process that is frequently revisited and informed by key players so as to yield a competent civil engineer to enter the global engineering workplace. Although, the process appears to be effective in preparing globally competent civil engineering students, there is room for development.

Given the emphasis on the regionality of civil engineering projects that may cross cities, states, and countries, the level of work commissioned by an engineering-related employer may very well inform the degree to which global competency is necessary and/or its application to a specific project. As such, a future research opportunity may focus exclusively on specific engineering-related employers that hire the institution’s graduates to intentionally explore competencies based on the work responsibilities within the diverse civil engineering industry (both overseas but also workforce diversity on local projects). This research study included employer feedback from two organizations that had a multi-national presence; however, one employer had a larger global presence compared to the other. As such, a follow up employer
study with greater selection criteria for participating engineering employers may help to inform the process in preparing globally competent civil engineering students based on the engineering employer profile.

Furthermore, given the established controversy around the global competency definition and moderate ambiguity identified by interviewed participants when asked to define global competency, there was no doubt that cultural appreciation and awareness is a required skill set for the global civil engineer. However, given this variability in participant feedback this might lend itself well to a follow up study researching multi-cultural competence versus global competence amongst an engineering employer population to further investigate the global competence nomenclature controversy.

Although not a competency studied in this research, participant feedback did indicate the importance of foreign language for civil engineering students because of the workforce diversity and increasingly global projects. The knowledge of another language suggests increased cross border employment opportunities and the ability to efficiently interact with individuals from different backgrounds or work in that respective host country, as needed. This supplementary competency may equip the civil engineering students with a different dimension of global competency that although not explored in this study could serve as a future research opportunity.

Specifically, this case study provides a foundation for additional research at the institution under investigation focusing on the international versus domestic civil engineering undergraduate audience, which types of activities and discourse most significantly impact global competency development in civil engineering students, how class level might impact the global competency development, and investigating the necessity of foreign language competency in civil engineering students.
**Concluding Remarks**

This case study presents a deep investigation into one institution’s process in developing globally competent civil engineers. Collective feedback of the participants confirm that the future global civil engineer needs to be well-equipped with not only technical and hard skill engineering knowledge but also competencies of the 21st century that have been defined as global competencies for the purposes of this case study. The core work of the civil engineer is to collaborate with multiple constituents, societies, and communities, in order to deliver a public good. Given the intent of a civil engineer, regardless of specialization is to build safe, efficient, and effective projects to serve a community and society, the imperative to develop globally competent civil engineers is present.

As identified in this research study, the institution’s process in developing globally competent civil engineers that will be able to collaborate on and deliver efficient and effective civil engineering projects is inter-related and complex. This inter-related process with emphasis on experiential education, immersion, and diversity in the classroom through the engineering faculty and its diverse student body, all well position the institution to provide a foundation for an effective process in developing globally competent civil engineers. The expectation that an institution prepares its civil engineering students to work globally means that the institution has prepared the student with the skills and knowledge for them to be able to work effectively in any environment, regardless of location. This expectation is coupled with an underlying understanding that local engineer and local structural design is necessary to complement their existing engineering background. The institution under investigation, through various forms of discourse and activities of engagement provide all civil engineering students with the competence of being a good engineer and an understanding that competencies around
collaboration, communication, cultural appreciation, innovation and critical thinking are a necessary complementary component to work in the global engineering workplace.

By extracting each of the attributes of the term global competency, trends in preparation and specific activities, classroom assignments, immersion and engagement discourse surface that tailor to the development of each attribute of global competency. Each attribute resonates as important to develop and foster in civil engineering students. The institution under investigation and the Department of Civil and Environmental Engineering is committed to graduating globally competent civil engineers. However, this process does not come without its challenges or limitations – strict civil engineering degree requirements, financial and human capital challenges, safety requirements, national accreditation standards, economic and political trends that influence the industry and the projects commissioned by clients and teaching students to thrive in different environments; locally and internationally.

Like many colleges and universities, nationally and internationally, the focus on well preparing students to enter the global workplace is a key priority. The institution under investigation, although is generally effective and moderately intentional in its preparation of globally competent civil engineering students, opportunities to enhance the experience to create a more robust and overt process exists to combat the future challenges that civil engineers will address as the industry continues to evolve.

I personally hope to share key highlights from this research study through identification of appropriate forums, such as relevant conferences and engineering-related publications to shed further light into this important engineering education conversation.
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Appendix A

Table 1

*Number of Codes Identified in First and Second Level Coding by Participant*

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<th>Participant</th>
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<th>N (Second Level Coding)</th>
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<tr>
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<td>14</td>
</tr>
<tr>
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Appendix B

Table 4

*Quotes Illustrating Global Competency Definition*

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<tr>
<th>Participant</th>
<th>Perceived Definition of Global Competency as Applied to Civil Engineers Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumni B</td>
<td>To me, global competency skills means being able to understand where different people’s perspectives and needs come from, both, technologically, physically, culturally, and financially.</td>
</tr>
<tr>
<td>Alumni C</td>
<td>Basically, an understanding and patience that your clients or your peers may have a different basis for their professional interactions… when solving a problem as a team, it’s almost best to understand where people are coming from because they might have problems which they are not articulating clearly and understanding where they come from or how they work is essential in solving a problem that works culture.</td>
</tr>
<tr>
<td>Career Education</td>
<td>First and foremost, students that will work in any engineering discipline, in any company and/or entity, anywhere in the world is going to be working with a diverse set of people. So, your coworkers will be from another country. You know engineering is a very diverse field and especially within civil engineering, it’s extremely diverse because of the nature of the work so I tell them, if you want to have that well rounded global experience, if you want to move yourself up in your field/career, you really need to have that in order to succeed.</td>
</tr>
<tr>
<td>Administrator A</td>
<td>It’s just understanding that people come from all different places, all different backgrounds, all different life choices, all different education, and being a globally competent engineer in the future means embracing that and accepting that sitting in a room full of people that have gone through the exact same upbringing, the exact same viewpoint, exact same education as you, are not going to probably come up with the best solution and you need that broader diversity of experience and history to come up with better ideas. In terms of the work, it’s important for civil engineers to understand that what works in one part of the world, one part of the region, or one part of the state even, is not going to work in other places.</td>
</tr>
<tr>
<td>Administrator C</td>
<td>I think for the students, we are a global society, what is the global need? So be able to respond to those needs and participate actively in that discussion in terms of not only technology but also policy. Try to influence the policy, being aware of the issue which we might not have any more in the U.S. but they are still there at the global level.</td>
</tr>
</tbody>
</table>
### Table 5

**Quotes Illustrating Importance of Cultural Awareness and Appreciation**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Importance of Cultural Awareness and Appreciation Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineering Alum B</td>
<td>That definitely resonates with me because even if you bring a product or a solution to a place if no one uses it or it is not maintained properly it’s not a good solution.</td>
</tr>
<tr>
<td>Career Education Administrator C</td>
<td>When it comes to diversity in the workplace and global competency, it’s just understanding that people come from all different places, all different backgrounds, all different life choices, all different education, and being a globally competent engineer in the future means embracing that and accepting that than sitting in a room full of people that have gone through the exact same upbringing, the exact same viewpoint, exact same education as you, are not going to probably come up with the best solution and you need that broader diversity of experience and history to come up with better ideas. In terms of the work, it’s important for civil engineers to understand that what works in one part of the world, one part of the region, or one part of the state even, is not going to work in other places</td>
</tr>
<tr>
<td>Civil Engineering Faculty E</td>
<td>One of the traits to be globally competent to me it would be sensitive to other cultures and how to fit in, understanding global economies better and how to take advantage of those, and how to keep an eye out for issues, that’s a really hard thing to teach.</td>
</tr>
<tr>
<td>Professional Association</td>
<td>[If] I have to deal with foreign cultures it might be the local Hispanic community but more often than not, it’s…the Native American communities, which [are] considered international if you think about it… And then you have the diverse workforce, we have people from all over the globe, literally. This is the case of the global population being in the U.S. and working and how we deal with it.</td>
</tr>
</tbody>
</table>
Table 6

*Quotes Illustrating Academic Discourse Activity in the Classroom*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Quote Related to Academic Discourse Activity in the Classroom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineering</td>
<td>It mostly comes up in design projects because in standardized exercises it doesn’t come up. But in design projects, um, emphasize, do you understand what the client wants clearly? Here’s the client’s objective and have you met it? And then do you understand the society, the impact of your project on the people around you and what do they want? Yeah, I do exercises like that, yes.</td>
</tr>
<tr>
<td>Faculty A</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>It depends on the level of the student, I would say. On a sophomore level, we definitely do case studies. So, we try to see examples of engineering in the world, not only how we solve things here but global crises or climate change, specific topics and we try to look from different perspectives and try to understand those issues from different points of views…In general, I’ve always asked [my class] to present a case study and some case studies are drawn from…how it’s seen around the world and how it’s assured that it’s safe for everybody and we look at specific case studies.</td>
</tr>
<tr>
<td>Faculty B</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>When you look at the homework, when you look at the assignment, when you look at projects that we are doing, not giving students everything that they need. So, you have to go out and use the Internet, you need to use your resources because guess what in the real world, no one is going to hand you a list of things and say here are the givens go design this roadway, go design this infrastructure. It’s going to be fact finding, you need to figure out, what you need and how is it applied. You are on your own and there’s nobody around.</td>
</tr>
<tr>
<td>Faculty C</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>Instead of having students write reflection papers...[students] write a one to 2-page letter of work interest to a future employer [on their projects]. You’re basically summarizing your work of what was learned of an audience of a professional engineer. All of our students work so well together. Even if you are from another country they just always seem to understand and I’ve also incorporated in my 2nd assignment that I give them they have to do team contracts…Based on literature that I’ve read…so they have to understand/respect transparency, inclusion and fairness, can all be defined differently so they have to define what that is for each...what will your policies be on work lateness? On punctuality?</td>
</tr>
<tr>
<td>Faculty D</td>
<td></td>
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Appendix C

Engineering Employer Quotes Illustrating International Business Operations

…having a cultural awareness… if [engineers] are looking to move around and be in an international level, or whether that’s working on project to project and kind of getting moved or being in a global office that tends to work on different projects but having a knowledge and understanding maybe of depending on the type of projects you work on, you might work with other international offices and being able to work with them and discuss with them, and converse with them and whether that is dealing in different languages or just understanding their cultures, or just basic time zones and things of that nature. (Engineering Employer B, personal communication, February 21, 2016).

So, within the North American, the global competency I don’t see as forefront but…as part of the parent company and they do, those global competences are much more important to them. For example, Australia or Asia where a civil engineer covers a much bigger territory so that civil engineers need to have the ability to jump across boundaries, different cultures, and have that skills set…in the other global areas that we work engineers have a greater opportunity and need to have those global competencies. (Engineering Employer A, personal communication, February 13, 2016).
Appendix D

Institutional Website on Future of Engineering

Today’s engineering challenges are far more complex than anything we could have imagined even a decade ago. To meet these challenges, engineers from previously distinct areas are now overlapping and partnering with experts in other fields. [we] are optimally placed to respond to this paradigm shift; for more than a century, interdisciplinary collaboration and engagement with the real world have been our guiding principles...[faculty] research looks at critical issues in materials, processes, systems and infrastructure at every scale—nano to macro to global—grounded in a translational approach that integrates the values of fundamental and applied research to meet societal needs. Our students develop as innovators and leaders through [our] distinctive model of experiential learning... The combination of challenging classroom study with opportunities for professional practice and research ensures that we are preparing the next generation of engineers to keep pace with fast-changing global demands. (Institutional Website, 2016).