PREPARING ENGINEERING COLLEGE STUDENTS FOR A CULTURALLY DIVERSE GLOBAL JOB MARKET

A Dissertation

by

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ABSTRACT

According to the National Academy of Engineering, a core need for engineers today is to be able to work with a diverse, multinational, multidisciplinary workforce. Accordingly, colleges of engineering must develop strategies to graduate engineers ready for this global and diverse job market. Actions taken by colleges of engineering to add global preparedness to their curriculum are add-ons to the core curriculum, such as optional study-abroad programs, elective courses, minors, and certificates, and have only reached a small percentage of the students and/or sometimes have not proven sufficient for today's and future demand. Therefore, most engineering students in the United States are graduating not fully prepared to engage with the global job market they will be part of.

The purpose of this study was to identify the intercultural maturity level, as determined by the Intercultural Maturity Framework, of students in the College of Engineering at Texas A&M when exposed to intercultural concepts in relation to cognitive, intrapersonal and interpersonal development. Therefore, as a result, understand how students come to appreciate cultural differences to interact effectively with different others is important. This qualitative study followed the Naturalist inquiry paradigm and used the interpretive method relying on information from interviews, documents and reports. The population for this study was the eight students enrolled in the Global Engineering Design Class during Fall 2014.

The results of this study showed that this global course had a positive impact on students' intercultural maturity development. The engineering project the company provided linked their cultural learning to the engineering workplace reality. The cultural assignments and the work with the Brazilian students awakened the global interest of the students who had not traveled abroad, and it deepened the cultural understanding of the students who had traveled abroad. Most of the students who return from a study-abroad experience believe it was a life changing experience, but when they talk to potential employers about this experience, they describe the experience with the superficial "touristy" activities they took part in while abroad. In contrast, after the Global Engineering Design class, students described this experience in a less "life changing" manner. Interestingly, they were able to articulate, when describing the experience, their learning and what they will bring to the work environment from this experience.

DEDICATION

I would like to dedicate this dissertation study to my family and friends who, from near or far, were my inspiration and support during this long process. Without them, this would not have been possible.

Since I started my PhD in 2009, it has been an amazing journey. It has not been easy, as I was working full time during the whole program. However, life did not stop; it just got more intense. One year after starting the program, I met my husband. Almost 2 years later, we were engaged, and around the same time, I was promoted to a new job – Director for Engineering International Programs. At this new job, I found the topic for my dissertation, and a new area of interest. In 2012, I got married, and in March 2016, one year before defending my dissertation, I became the mom of twin boys – Arthur and Bruno. This was the greatest challenge and, at the same time, a stimulus to finish my PhD.

I want to thank my parents and sister for their unconditional support, not only now, but my whole life; my in-laws, who were instrumental in helping me get back to the dissertation after Arthur and Bruno were born; my babies, for understanding the time I had to be working instead of spending time with them. And, saving the best for last, my husband, who met me in this process and during this last year was the reason I was able to achieve this major goal.

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I would like to give a special thanks and demonstrate my gratitude to the professors of the course: Drs. Jorge Leon, and Marcelo Savi, for agreeing to teach this course and allowing me to use it as the context for this dissertation study. I also would like to thank Amber Muenzenberger for supporting the virtual component of this class and Jim Wilson for providing the classroom space. In addition, I want to thank FMC Technologies for providing the project and, more specifically, Cristina Fetter, who has always been eager to collaborate and create ways to prepare students for the global engineering industry.

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All work for the dissertation was completed independently by the student.

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CHAPTER I

INTRODUCTION

The National Academy of Engineering states that one core need of the engineering profession is for engineers to be able to work with a diverse, multinational, multidisciplinary workforce (National Academy of Engineering, 2004). Engineers need to have a global mindset to be prepared for the global job market (Chan & Fishbein, 2009). Therefore, colleges of engineering in the United States have started to provide ways for students to develop those skills, but only as add-ons to the curriculum, such as study-abroad programs, elective courses, minors, and certificate programs - and only reaching a select number of students (Lohmann, Rollins, & Hoey, 2006). As a result, global preparedness is not integrated into, or part of, the core curriculum of most engineering schools in the United States.

Advances in communications and transportation technologies, together with a historical trend of nations moving toward market economies, have made it possible for companies to function using the best locations and resources. These changes have transformed the engineering industry. As a result, companies without employees prepared to work effectively with people from all over the world are struggling in these global business environments today and will continue in the future. Engineering organizations, Fortune 500 companies, and the Carnegie Foundation, to name a few, agree with the statement that engineers of the 21st century will be part of a globally connected industry. Consequently, "… engineering colleges must develop strategies that

provide global perspectives and international experiences to help their graduates excel in their future work environment" (Borri, Guberti, & Melsa, 2007, p. 267).

Study-abroad programs is one of the ways universities have found to provide a global perspective to students. However, it has two limitations: low participation of engineering students and effectiveness in providing global perspective. The low participation is because only few students can afford to have a study-abroad experience. Despite the growing awareness of the benefits of study-abroad by students, the challenges preventing students from studying abroad are numerous and complex (Berdan & Johannes, 2014). A study by the Institute for International Education (IIE) shows that, the primary challenges for many U.S. students to pursue study-abroad programs can be grouped into to three categories: cost, curriculum, and culture (Berdan & Johannes, 2014) . Even though most colleges of engineering in the United States have increased their offerings of study-abroad programs, they are still not reaching the majority of the students. The 2015 Open Doors report from the IIE shows that nationally only 5% of engineering students studied abroad during the 2014/2015 academic year (Institute of International Education, 2015).

The second limitation of study-abroad programs is effectiveness of some programs in enhancing students' global perspective. Some of the study-abroad experiences are too short or focused only on the engineering teaching or technical aspects, limiting the intercultural learning the students obtain while abroad (Lemmons, 2013). There are studies showing that study-abroad alone may not improve cultural understanding (Fischer, 2011). Maddux et al. (2013) stated that the exposure to new

cultures alone is insufficient to bring the benefits associated with multiculturalism (Maddux, et al., 2013). They add that what seems to be critical is that individuals actively engage with new cultures to produce a transformation in basic cognitive processing and to leave a lasting impact (Crisp & Turner, 2011; Tadmor, Tetlock, & Peng, 2009) in Maddux et al, 2013.

Whereas industry and academia agree on the need for cultural humility (Groll, 2013), also referred to as global competency, there is less agreement on how to ensure students have this skill set. In their Engineer of 2020 report, the National Academy of Engineering (2004) reminds educators of the importance of creating a body of evidence on the effectiveness of programs created to develop global competency so claims about the success of educational practices might be evaluated (National Academy of Engineering, 2004) in Groll, 2013. This dissertation was based on the need to identify ways to effectively prepare undergraduate engineering students for the global job market they will engage in after they graduate.

Disclaimer

Current research efforts in global preparedness show a multitude of terms to describe the qualities required for engineers to sustain participation in the diverse, multinational, and global workforce (Groll, 2013). According to Groll (2013) this creates silos of research and inhibits collaborative conversations. Because this research does not seek to negotiate a shared meaning, the terms *global competency, intercultural sensitivity, cultural humility, intercultural maturity*, among others, will be used interchangeably when describing the skills engineers need to be prepared for the global

job market. This approach will be done mainly to be consistent with the terms used by the researchers as I refer to their studies. The literature shows a broad agreement that global preparedness is a needed skill for the engineers entering today's job market. Less agreement exists as to what this skill is about, what to call it and how to prepare our students. The terminology discussion on this topic is presented in Chapter 2, in the literature review section of this study.

Problem Statement

A problem is a situation resulting from the interaction of two or more factors, which yields a perplexing or enigmatic state, an undesirable consequence, or a conflict, which renders the choice from among alternative and undesirable courses of action (Clark, Guba, & Smith, 1977). In this case, the problem is an undesirable consequence:

Factor 1: The engineering industry today is global and requires professionals who are skilled to work in a global job market.

Factor 2: Actions taken by colleges of engineering to add global preparedness to their curriculum are add-ons to the core curriculum, such as optional study-abroad programs, elective courses, minors, and certificates, and have only reached a small percentage of the students and/or sometimes have not proven sufficient for today's and future demands.

Problem: Colleges of Engineering in the United States are graduating professionals lacking intercultural maturity (cognitive, interpersonal, and intrapersonal understanding), a skill set needed to be successful in the global job market according to industry, accreditation bodies, and academic organizations (Bowering, 2013; Chan & Fishbein,

2009; Groll, 2013; Lohmann, Rollins, & Hoey, 2006). In other words, most engineering students in the United States are graduating not fully prepared to engage with the global job market they will be part of once they are employed.

Purpose of the Study

The purpose of this study was to identify the intercultural maturity level, as determined by the Intercultural Maturity Framework (King & Baxter Magolda, 2005), of students in the College of Engineering at Texas A&M when exposed to intercultural concepts in relation to cognitive, intrapersonal and interpersonal development. In doing so, my objective was to understand how students come to appreciate cultural differences to interact effectively with different others in the context of a global engineering course.

The relevance of this study is based on three considerations: 1) the engineering industry today is global and requires professionals who are skilled to work in a global job market; 2) Bennett's statement that intercultural sensitivity is not some innate characteristic, but a learned ability (Bennet, 1986); and 3) Colleges of engineering in the United States not having comprehensive programs to teach that ability to all engineering students, and, therefore, engineering students are graduating not fully prepared to engage with the global job market they will be part of once they are employed.

Research Questions

1. What is the intercultural maturity level of undergraduate students in the College of Engineering at Texas A&M as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their cognitive development?

2. What is the intercultural maturity level of students in the College of Engineering at Texas A&M as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their intrapersonal development?
3. What is the intercultural maturity level of students in the College of Engineering at Texas A&M as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their interpersonal development?

Theoretical Framework

No inquirer can investigate a problem from all perspectives simultaneously (Clark, Guba, & Smith, 1977). For this study, the perspective of identifying and understanding the intercultural maturity level of students in the College of Engineering at Texas A&M when exposed to intercultural concepts in relation to cognitive, intrapersonal and interpersonal development will be the Intercultural Maturity Framework developed by King & Baxter Magolda (2005).

King and Baxter Magolda's (2005) developmental model of intercultural maturity is interesting because it is grounded in existing theoretical models of college student development (Brown, 2008) and because it is holistic. They use a

> "lifespan development perspective to argue that reaching intercultural maturity entails multidimensional growth in the ways that individuals understand the world (cognitive dimension), themselves (intrapersonal dimension), and their relationships with others (interpersonal dimension). They hypothesize that competency in all three dimensions is necessary for intercultural maturity" (Brown, 2008, p. 19).

However, this framework is relatively new and has not been empirically tested. This framework was chosen because it explores *how* intercultural development occurs and articulates the developmental steps involved in achieving intercultural sensitivity, competence, and effectiveness (Brown, 2008).

Intercultural Maturity Framework

The Intercultural Maturity framework from King and Baxter Magolda (2005) looks at the question of "How do people come to understand cultural differences in ways that enable them to interact effectively with others from different racial, ethnic, or social identity groups?" (King & Baxter Magolda, 2005, p.571). This framework fits well with the present study, which is looking at the problem of colleges of engineering in the United States graduating professionals lacking intercultural maturity (cognitive, interpersonal, and intrapersonal understanding), a skill set required to be successful in the global job market according to industry, accreditation bodies and academic organizations (Bowering, 2013; Chan & Fishbein, 2009; Groll, 2013; Lohmann, Rollins, & Hoey, 2006). The assumption I make is that if engineering students are able to understand cultural differences and to interact effectively with others from different racial, ethnic, or social identity groups, then they will be prepared and equipped to join the global engineering workforce to, be effective, and to have the tools to life-long learning, as an engineer with a global perspective.

One important study that influenced the development of this framework was *A multidimensional model of intercultural consciousness: A reconceptualization of multicultural competence* by Lisa Landreman (2003). In this study, Landerman

conducted a comprehensive review of the intercultural competence literature and suggested that the definitions of "competence" are theoretically and empirically inconsistent. Competence does not address the application of one's understandings and skills to intergroup relationships, and that educating for this outcome requires a broader, more comprehensive approach than training for knowledge or skills alone (Landreman, 2003, November) in King & Baxter Magolda, 2005. Landerman (2003) proposed that intercultural consciousness is a more appropriate educational goal than multicultural competence. The prefix "inter" includes both domestic and international contexts and implies that cultures interact. She added that "achieving consciousness implies an understanding of self and identity (intrapersonal), while interacting with others in a historical and socio-cultural-political context (interpersonal); leading to reflection (cognitive) that motivates action" (Landreman, 2003, p. 41-42 in King & Baxter Magolda, 2005, p 572).

Considering Landreman's (2003) study, King & Baxter Magolda took a holistic approach "to identify [the] underlying capacities that may guide (or at least affect) a learner's ability to integrate knowledge, skills, and awareness, and to act in interculturally mature ways" (King & Baxter Magolda, 2005, p.572). They proposed a "multidimensional framework that describes how people become increasingly capable of understanding and acting in ways that are interculturally aware and appropriate - they called this capacity intercultural maturity" (King & Baxter Magolda, 2005, p.573).

The Intercultural Maturity framework is based on the literature of college student and adult development, and it is built on Kegan's (1994) model of evolution of

consciousness (King & Baxter Magolda, 2005). The focus of Kegan's (1994) evolution of consciousness theory is "the personal unfolding of ways of organizing experiences that are not simply replaced as one grows but subsumed into more complex systems of mind" (Kegan, 1994, p. 9). "Growth involves movement through five progressively more complex ways of knowing, which Kegan referred to as stages of development in 1982, orders of consciousness in 1994, and forms of mind in 2000" (Evans, et al., 2010 p. 177). The phases are summarized well by Evans et al. (2010) and based on their summary the phases are described below:

Order 0 – Infants. Kegan (1982) described this phase as "living in an objectless world, a world in which everything sensed is taken to be an extension of the infant" (Kegan, 1982, p. 78). "As a result, when the infant cannot see or experience something, it does not exist. By the time infants are eighteen months old, they begin to recognize the existence of objects outside themselves, propelling them into the next stage." (Evans, et al., 2010, p. 178)

Order 1. This order is developed around age two, when children realize that they have control over their reflexes (Kegan, 1982) and become aware of objects in their environment as independent from themselves (Kegan, 1982). Children are egocentric and "are attached to whatever or whoever is present at the moment. Parents should support their children's fantasies while challenging them to take responsibility for themselves" (Evans, et al., 2010, p. 178).

Order 2 - Instrumental Mind. Individuals are able to construct classifications of objects, people, or ideas with specific characteristics (Kegan, 1982). "As a result, their

thinking becomes more logical and organized, their feelings are more enduring, and they relate to others as separate and unique beings. […] In this order, individuals develop a sense of who they are and what they want. "Competition and compromise" (Kegan, 1982, p. 163) are characteristic themes of the second order and are often played out within peer group settings. It is important to support the development of the child with the confirmation of the person the child has become. To foster the development to Order 3, involves "encouragement to for the person to take into consideration the expectations, needs, and desires of others." (Evans, et al., 2010, p. 178-179).

Order 3 - Socialized Mind. "Cross-categorical thinking and the ability to relate one durable category to another is evident in the third order of consciousness. As a result, thinking is more abstract, individuals are aware of their feelings and the internal processes associated with them, and they can make commitments to communities of people and ideas (Evans, et al., 2010, p. 179)". "How the individual is perceived by others is of critical importance since acceptance by others is crucial in this order. Support is found in mutually rewarding relationships and shared experiences, while challenge takes the form of resisting codependence and encouraging individuals to make their own decisions and establish independent lives." (Evans, et al., 2010, p. 179).

Order 4 - Self-Authoring Mind. Systems thinking is perceived in the fourth order of consciousness (Kegan, 1994). In this stage, individuals "have the capacity to take responsibility for and ownership of their internal authority" (Kegan & others, 2001, p. 5) and establish their own sets of values and ideologies (Kegan, 1994). Relationships become a part of one's world rather than the reason for one's existence. "Individuals are

encouraged to develop further when significant other refuse to accept relationships that are not intimate and mutually rewarding" (Evans, et al., 2010, p, 179).

Order 5 - Self-Transforming Mind. This is a less frequently achieved order, and never reached before the age of forty (Kegan, 1994). In this order "individuals see beyond themselves, others, and systems of which they are a part to form an understanding of how all people and systems interconnect" (Kegan, 2000). They recognize their "commonalities and interdependence with others" (Kegan, 1982, p. 239). Relationships can be truly intimate in this order, with nurturance and affiliation as the key characteristics."(Evans, et al., 2010, p. 180).

"Each succeeding order consists of cognitive, intrapersonal and interpersonal components" (Evans, Forney, Guido, Patton, & Renn, 2010 p. 177). Kegan's model (1982 and 1994) is holistic in nature because it provides a way of looking at these three dimensions and how they interrelate (Brown, 2008). The development of the orders in these three dimensions - cognitive, intrapersonal and interpersonal - is the structure of the Intercultural Maturity Framework: (1) The cognitive dimension focuses on how one constructs one's view and creates a meaning-making system based on how one understands knowledge and how it is gained. In the intercultural maturity framework this is very much related to people's ability to see and understand cultural differences. (2) The intrapersonal dimension focuses on how one understands one's own beliefs, values, and sense of self, and uses these to guide choices and behaviors. (3) The interpersonal dimension focuses on how one views oneself in relationship to and with other people

(their views, values, behaviors, etc.) and makes choices in social situations (King & Baxter Magolda, 2005).

"Kegan argued that development in all three dimensions is required for a person to be able to use one's skills" (King & Baxter Magolda, 2005, p. 574). The Intercultural Maturity Framework suggests that without this foundation, students may be able to learn about cultural differences but they will find it difficult to use this knowledge in an intercultural interaction. In summary, "demonstrating one's intercultural skills requires several types of expertise, including complex understanding of cultural differences (cognitive dimension), capacity to accept and not feel threatened by cultural differences (intrapersonal dimension), and capacity to function interdependently with diverse others (interpersonal dimension)" (King & Baxter Magolda, 2005 p. 574). Figure 1 illustrates the interdependency of the three dimensions for achieving intercultural maturity.

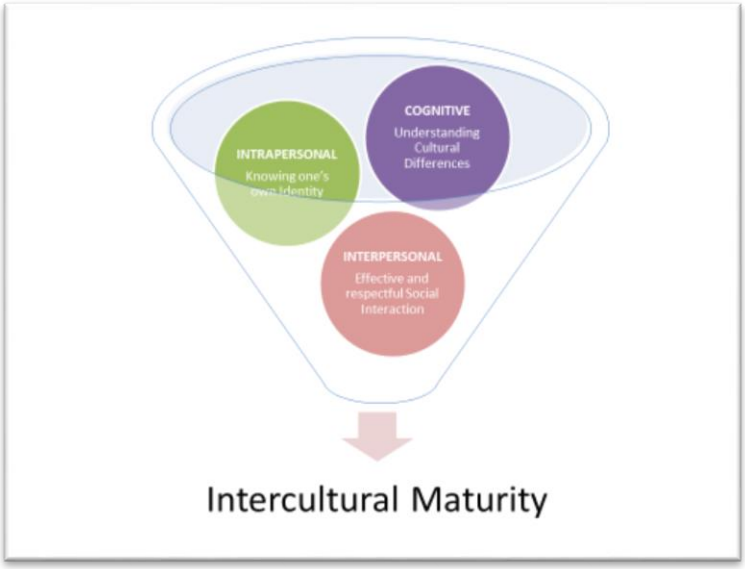


Figure 1. Three Dimensions of the Intercultural Maturity Framework

The choice of the word "maturity" in the name of this educational goal and framework refers to the developmental capacity that undergirds the ways learners come to make meaning, that is, the way they approach, understand, and act on their concerns (King & Baxter Magolda, 2005). According to Kegan (1994), mature individuals are better equipped to approach and respond to complex life tasks because they exemplify what he has termed "self-authorship" (Kegan, 1994). Self-authorship is the ability to generalize across abstractions, and in this stage individuals have the capacity to establish their own sets of values and ideologies (Kegan, 1994). "Self-authorship requires complex ways of making meaning of experience, drawing on one's understanding in all three dimensions of development" (King & Baxter Magolda, 2005, p.571) – cognitive, interpersonal and intrapersonal.

Besides Kegan's (1994) model of lifespan development there were several studies and authors that also influenced the framework and the benchmark of each dimension. Those studies will be mentioned below as each dimension is described. However before I move to describe each dimension I would like to make reference the framework, which added the global dimension to the developmental phases of this framework - Bennett (1986) Intercultural Sensitivity Development.

The Intercultural Sensitivity Development presents a continuum of stages of personal growth that moves from ethnocentrism to ethnorelativism (Bennet, 1986). Earlier stages of the continuum include the denial of difference, the evaluative defense against difference, and the minimization of difference. Later stages include the acceptance of difference, adaptation to difference, and the integration of difference into

one's world view. Those phases are illustrated on figure 2 presented below, and detailed in the next paragraphs.

Denial. A denial of difference may occur when physical or social isolation precludes any contact with significant cultural differences (Bennet, 1986). Since difference has not been encountered, meaning has not been created for such phenomena and one's own worldview is unchallenged as central to all reality (Bennet, 1986).

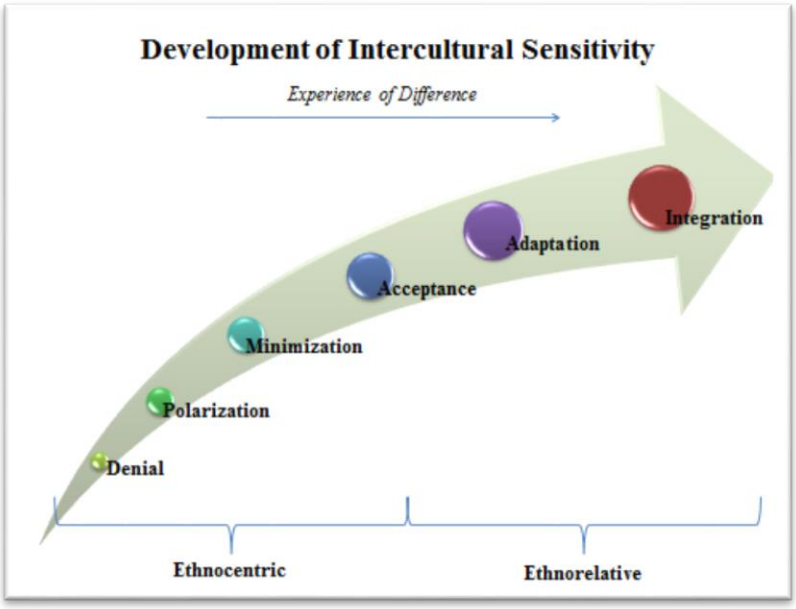


Figure 2. Development Phases of Intercultural Sensitivity Model. Adapted from Bennet, 1986

Defense or Polarization. The defense against difference involves attempts to counter perceived threat to the centrality of one's world view - At this stage difference starts to be recognized (Bennet, 1986). The most common defense strategy is denigration of difference or "negative stereotyping," where undesirable characteristics are attributed

to every member of a culturally distinct group (Bennet, 1986). Another defense strategy is the assumption of cultural superiority, where rather than denigrating other cultures, one simply assumes that one's own culture is the acme of some evolutionary scheme (Bennet, 1986).

Minimization. The last attempt to preserve the centrality of one's own world view involves an attempt to conceal difference under the weight of cultural similarities (Bennet, 1986). The state of minimization represents a development beyond denial and defense where cultural difference is trivialized (Bennet, 1986).

Acceptance. The acceptance of cultural difference represents a move from ethnocentrism to ethnorelativism. At this stage, cultural difference is acknowledged and respected, and it is perceived as fundamental in human affairs. Particular cultural differences are not evaluated at this stage, they simply exist (Bennet, 1986).

Adaptation. The acceptance of cultural difference allows the adaptation of behavior and thinking to that difference. It is the ability to change processing of reality that constitutes an increase in intercultural sensitivity when it occurs in a cross-cultural context (Bennet, 1986). The most common form of adaptation is empathy, which involves a temporary shift in frame of reference such that one construes events "as if" one were the other person. This ability to act outside one's native cultural worldview is based on the acceptance of difference as a relative process (Bennet, 1986).

Integration. The integration of difference is the application of ethnorelativism to one's own identity. One of the skills of intercuItura1 sensitivity that occurs at this

stage of development is the ability to evaluate phenomena relative to cultural context (Bennet, 1986).

Intercultural Maturity Dimensions

The Intercultural Maturity framework is presented in a 3 × 3 matrix linking the three domains of development (cognitive, intrapersonal, and interpersonal) with three levels of development (initial, intermediate, and mature). Table 1 illustrates this framework, that show how development in each domain unfolds across the three developmental levels; the level on the far right column describes the kind of maturity that is desired for engineering professionals (King & Baxter Magolda, 2005). King & Baxter Magolda (2005) argued that, "less complex levels of cognitive and intrapersonal (identity) development may hinder one's ability to use one's intercultural skills" (King & Baxter Magolda, 2005, p. 573). Below I describe the Cognitive, Intrapersonal and Interpersonal dimensions and the three developmental levels in each.

Cognitive Dimension. The first row of Table 1 describes the cognitive dimension and how it progresses in relation to the way people think about and understand diversity issues (King & Baxter Magolda, 2005). Bennett's (1993) model of intercultural sensitivity specifically describes the role of cognitive complexity in the development of intercultural competence, focusing on the ways individuals come to understand cultural differences (King & Baxter Magolda, 2005). Bennett's model is grounded in constructivism, which is how individuals make meaning of experience (King & Baxter Magolda, 2005) and, in particular, how individuals interpret their experiences with diverse others (King & Baxter Magolda, 2005).

Table 1. A Three-Dimensional Development Trajectory of Intercultural Maturity. Reprinted from King, & Baxter Magolda, (2005).

A Three-Dimensional Developmental Trajectory of Intercultural Maturity

Domain of Development and Related Theories	Initial Level of Development	Intermediate Level of Development	Mature Level of Development
Cognitive (Baxter Magolda, 1992, 2001; Belenky et al., 1986; M. Bennett, 1993; Fischer, 1980; Kegan, 1994; King & Kitchener, 1994, 2004; Perry, 1968)	Assumes knowledge is certain and categorizes knowledge claims as right or wrong; is naïve about different cultural practices and values; resists challenges to one's own beliefs and views differing cultural perspectives as wrong	Evolving awareness and acceptance of uncertainty and multiple perspectives; ability to shift from accepting authority's knowledge claims to personal processes for adopting knowledge claims	Ability to consciously shift perspectives and behaviors into an alternative cultural worldview and to use multiple cultural frames
Intrapersonal (Cass, 1984; Chickering & Reisser, 1993; Cross, 1991; D'Augelli, 1994; Helms, 1995; Josselson, 1987, 1996; Kegan, 1994; Marcia, 1980; Parks, 2000; Phinney, 1990; Torres, 2003)	Lack of awareness of one's own values and intersection of social (racial, class, ethnicity, sexual orientation) identity; lack of understanding of other cultures; externally defined identity yields externally defined beliefs that regulate interpretation of experiences and guide choices; difference is viewed as a threat to identity	Evolving sense of identity as distinct from external others' perceptions; tension between external and internal definitions prompts self-exploration of values, racial identity, beliefs; immersion in own culture; recognizes legitimacy of other cultures	Capacity to create an internal self that openly engages challenges to one's views and beliefs and that considers social identities (race, class, gender, etc.) in a global and national context; integrates aspects of self into one's identity
Interpersonal (M. Bennett, 1993; Chickering & Reisser, 1993; Gilligan, 1982; Kegan, 1994; Kohlberg, 1984; Noddings, 1984)	Dependent relations with similar others is a primary source of identity and social affirmation; perspectives of different others are viewed as wrong; awareness of how social systems affect group norms and intergroup differences is lacking; view social problems egocentrically, no recognition of society as an organized entity	Willingness to interact with diverse others and refrain from judgment; relies on independent relations in which multiple perspectives exist (but are not coordinated); self is often overshadowed by need for others' approval. Begins to explore how social systems affect group norms and intergroup relations	Capacity to engage in meaningful, interdependent relationships with diverse others that are grounded in an understanding and appreciation for human differences; understanding of ways individual and community practices affect social systems; willing to work for the rights of others

The Cognitive dimension was influenced by other studies such as: *Forms of intellectual and ethical development in the college years: A scheme* by Perry, 1968; *Women's ways of knowing: The development of self, voice, and mind by* Belenky, Clinchy, Goldberger, & Tarule, 1986; *Knowing and reasoning in college: Gender-related patterns in student' intellectual development by* Baxter Magolda,1992;

Developing reflective judgment: Understanding and promoting intellectual growth and critical thinking in adolescents and adults by King & Kitchener, 1994; and A *theory of cognitive development: The control and construction of hierarchies of skills* by Fischer, 1980 (King & Baxter Magolda, 2005).

In the initial level of the cognitive domain, knowledge is certain and statements are judged as right or wrong based only on one's own values, and it is difficult to accept differing points of view or concepts. This is aligned with the ethnocentric reasoning of Bennett (1993), as well as dualistic thinking of Perry (1968), received knowing of Belenky, Clinchy, Goldberger, & Tarule (1986), absolute knowing of Baxter Magolda (1992), pre-reflective thinking of King & Kitchener (1994), and as the use of representational skills of Fischer (1980) (King & Baxter Magolda, 2005).

In the intermediate phase of the cognitive trajectory, views about knowledge shift from seeing knowledge as certain to increasingly acknowledging the uncertainty associated with making a knowledge statement (King & Baxter Magolda, 2005). Increasing uncertainty shows that person is more open to different ideas and accepting the view that different people can hold different views for legitimate reasons. The intermediate phase has been characterized as multiplistic thinking by Perry (1968), subjective and procedural knowing by Belenky et al., (1986), transitional and independent knowing by Baxter Magolda (1992), quasi-reflective thinking by King & Kitchener (1994), the beginning stages of ethno-relative reasoning by Bennett (1993), and as the coordination of representational systems and abstract mapping by Fischer (1980) (King & Baxter Magolda, 2005).

The mature phase of the cognitive domain is marked by the ability to have multiple perspectives in multiple contexts and to use multiple cultural frames (King & Baxter Magolda, 2005). The ability to consciously shift perspectives occurs because judgments derive from personal experience and evidence from other sources and experiences. This mature phase has been described as relativistic thinking by Perry (1968), constructed knowing by Belenky et al., (1986), contextual knowing by Baxter Magolda (1992), reflective thinking leading to the ability to make reflective judgments by King & Kitchener (1994), integration, the final ethnorelative stage of Bennett's (1993) model, and coordination of abstract systems by Fischer (1980) (King & Baxter Magolda, 2005).

Intrapersonal Dimension. The second row in Table 1 illustrates ways in which the intrapersonal dimension facilitates how people think about and come to understand diversity issues (King & Baxter Magolda, 2005). This category includes topics surrounding one's identity ranging from ways people use their values and beliefs to make life choices and decisions to how they view and interpret their social identities based on factors such as race, ethnicity, class, sexual orientation, and religious affiliation (King & Baxter Magolda, 2005). Several studies influenced the definition of this dimension such as: Cass, (1984); Chickering & Reisser (1993); Cross (1991); D'Augelli (1994); Helms (1995); Josselson (1987 and 1996); Marcia (1980); Parks (2000); Phinney (1990); Torres (2003) (King & Baxter Magolda, 2005).

At the initial level of the intrapersonal dimension, there is a general lack of awareness about one's own social identity. This level is also characterized by having

identity being defined by others' expectations; by endorsing cultural beliefs, values, or practices in an unreflective or unconsidered way; and by being threatened by different cultural values or by others of different social identity groups (King & Baxter Magolda, 2005). Therefore "the "resistance" multicultural educators experience from some students may result not only from their reliance on simplistic cognitive mind frames that do not accommodate multiple cultural perspectives, but also from a sense of self that is largely defined by others, as described in Kegan's (1994) "third order" (King & Baxter Magolda, 2005, p. 578).

The second level of intrapersonal development is characterized by an intentional self-exploration that allows for the simultaneous examination of one's experiences in one's own cultural contexts and an examination of that culture in broader social contexts (King & Baxter Magolda, 2005). It is reflected in Cross's (1991) Immersion/Emersion stage, Helm's (1995) Reintegration and Pseudo-Independence statuses, Phinney's (1990) Diffusion-Foreclosure stage, and in the ability to take a more candid look at the nature of one's own privilege by McIntosh, (1989) (King & Baxter Magolda, 2005).

By contrast, a mature level of intrapersonal development as applied to diversity issues is characterized by a sense of self in which various aspects of one's identity are integrated in ways that provide a culturally-sensitive and well considered basis for making decisions about intercultural interactions (King & Baxter Magolda, 2005). This level of development is reflected in Cross's (1991) Internalization and Internalization-Commitment stages, Helms's (1995) Immersion-Emersion and Autonomy statuses, and Phinney's (1990) Identity Achievement stage (King & Baxter Magolda, 2005). In this

maturity level, individuals are still open to have their views and perspectives questioned, but are not threatened by this process, which resonates with Kegan's (1994) fourth order meaning making (King & Baxter Magolda, 2005).

Interpersonal Dimension. The third dimension of intercultural maturity involves the ability to interact effectively and interdependently with others different from oneself (King & Baxter Magolda, 2005). In particular, this draws on the mature capacity to construct and engage in relationships with others in ways that show respect for and understanding of the other's perspectives, values and experiences, but that are also true to one's own beliefs and values (King & Baxter Magolda, 2005).

The developmental theories that influenced the social dimension of intercultural maturity included: Towards ethnorelativism: Education and identity by Chickering & Reisser (1993); In a different voice: Psychological theory and women's development by Gilligan (1982); Essays on moral development: Vol. II. The psychology of moral development by Kohlberg (1984); Caring: A feminine approach to ethics and moral education by Noddings, 1984. Individuals in this stage tend to change from an egocentric, individualistic perspective to a perspective that acknowledges that different social groups have different values, sensitivities, and experiences, to a perspective that reflects an appreciation for ways in which social systems affect relations between and among culturally different groups (King & Baxter Magolda, 2005). Bennet's (1986) Intercultural Sensitivity Model and Kegan's (1994) model of lifespan development reflect this dimension very well and are illustrated below in each level.

At the initial level of the interpersonal domain, social relations are grounded in one's primary social identity or affinity group, often using egocentric standards to judge cultural differences "that's not how my family celebrates that holiday" or to judge social policy issues "what's in it for me?" (King & Baxter Magolda, 2005). Values and perspectives held by others may be tolerated, but are judged as ignorant or wrong (King & Baxter Magolda, 2005). This kind of view is also reflected in the ethnocentric stages of Bennett's (1993) model, the Personal Interests schema (similar to pre-conventional reasoning) of Kohlberg's theory (Rest et al., 1999a), and with Level I of Gilligan's (1982) model, which is characterized by an egocentric, survival orientation where self-interest motivates moral reasoning (King & Baxter Magolda, 2005).

At the intermediate level of the interpersonal domain, individuals tend to be less judgmental, acknowledging the legitimacy of multiple perspectives (King & Baxter Magolda, 2005). This mindset is consistent with the early ethnorelative stages of Bennett's (1993) model and with the Maintaining Norms schema as applied to Kohlberg's (1984) theory, reflecting a more inclusive view of roles, rules, and duties as having society-wide implications (King & Baxter Magolda, 2005). However, this openness to new perspectives is mitigated by the continued use of others' approval as a standard for one's decisions about what to believe and how to act, as described in Kegan's (1994) third order reasoning (King & Baxter Magolda, 2005).

The mature level of the interpersonal dimension is characterized by heightened awareness and capacity to engage in intercultural interactions that are interdependent, respectful, informed by cultural understanding, and mutually negotiated (King & Baxter

Magolda, 2005). This type of understanding is reflected in Bennett's (1993) stage of Integration, in which an individual can integrate distinct aspects of one's identity as one moves between cultural perspectives (King & Baxter Magolda, 2005). It is also consistent with Kohlberg's (1984) description of Post-conventional reasoning, where moral criteria (such as respect for human rights) have primacy over social conventions (such as roles or contracts) in making moral decisions (King & Baxter Magolda, 2005). At this level, individuals acknowledge that there are many possible social arrangements, so members' duties and rights should derive from the moral purpose of the arrangement, not from its existence per se (King & Baxter Magolda, 2005).

Determining the Fit of the Chosen Framework

In the naturalistic study once a framework has been proposed, it is important to ask what advantages and disadvantages may accrue as the result of using it (Clark, Guba, & Smith, 1977). When the researcher is able to demonstrate that the proposed framework does have relevance for the study the validating function of this section of the proposal has been met (Clark, Guba, & Smith, 1977). The framework of Intercultural Maturity looks at the question of "How do people come to understand cultural differences in ways that enable them to interact effectively with others from different racial, ethnic, or social identity groups?" (King & Baxter Magolda, 2005). This framework presents a holistic and comprehensive way of looking into the problem of colleges of engineering graduating professionals lacking intercultural maturity (cognitive, interpersonal and intrapersonal understanding), a skill set needed to be successful in the global job market according to industry, accreditation bodies and

academic organizations alike (Bowering, 2013; Chan & Fishbein, 2009; Groll, 2013; Lohmann, Rollins, & Hoey, 2006). In addition, this framework takes a constructivist approach, which is appropriate for the answering the research questions of this study.

Context for the Study

The context for the study was the ENGR410 Global Engineering Design Class This class was piloted in the College of Engineering at Texas A&M during fall 2014 and exposed students to intercultural models and their application to engineering design in diverse, multinational, and multidisciplinary settings. Students carried out an engineering design project working in teams of international students, faculty and industry experts. In addition to applying engineering skills in the project, topics also include the study and application of intercultural models, global enterprise fundamentals, and remote collaboration technologies. In 2014, the class was co-taught with the Federal University of Rio de Janeiro in Brazil (UFRJ). There were eight students from the College of Engineering and seven from the UFRJ. Students did not travel but met and worked together virtually. The same content was taught to the two groups of students.

Significance of the Study

The literature shows a broad agreement in the sense that global competency is needed for the engineers entering today's job market. However, less agreement exists as to what this skill is about, what to call it, and how to prepare our students. The National Academy of Engineering (2004) in their Engineer of 2020 report state the importance of creating a body of evidence on the effectiveness of programs designed to provide global competency to students so that claims about the success of educational practices might

be evaluated (National Academy of Engineering, 2004) in Groll, 2013. This reflects a major gap in the literature.

This study will add to the body of knowledge on how to and what prepares engineering students to be ready for the global job market they will face once they graduate by understanding how students come to appreciate cultural differences to interact effectively with different other in the context of a global engineering course.

This research supports the lifelong learning concept and ways to develop the five competencies rated most important by the industry, which includes appreciating and respecting cultural differences, collaborating and working on a multicultural team, using collaboration technologies in intercultural interactions, practice tolerance and flexibility, and practicing cultural equality (Ball, et al., 2012). This study also has the potential to increase access to global programs, in addition to have economic and social impacts.

Access - Providing Global Competency to All: This study will contribute to the body of knowledge on how colleges of engineering in the United States can prepare their students in regards to their global competency. This study can impact the development of programs that will reach engineering students who cannot afford or do not participate in study-abroad programs or other types of global experiences and, therefore, support the development of their global competency skills.

Economic Impact - Global Minded Engineers: This study will provide initial information on the preparedness of students to join the global engineering industry. By adding information on developing the global preparedness skills mentioned above, colleges of engineering can create programs that will provide the necessary tools for our

students to work more effectively once in the job market. Having the necessary tools will allow students to implement requested projects faster, and smother, and will allow them to assume leadership positions, which in today's world require global competency.

Social - Better Interaction among People: By affecting how students are prepared for the global job market this study will also have a social impact helping our graduates to have deeper appreciation for cultural differences and be equipped to respect and interact in a diverse environment effectively. Developing the five competencies rated most important by the industry, mentioned above, students will create a better work and personal environment based on respect and appreciation for differences.

Content of the Study

This study is presented in five chapters. Chapter I presents an overview of the problem, purpose of the study and research questions, along with the theoretical framework used for the study. Chapter II includes the literature review, which presents studies showing the need for the global engineer, the current state of engineering students and their intercultural maturity developmental, the actions being taken by colleges of engineering to prepare the global engineer, discussions on definitions and terminologies related to global competency, and the competencies rated most important by the industry. Chapter III describes the methodology used in the study. Chapter IV is the report of results from the data analysis of the two rounds of interviews with the students including analysis of their class work and other related existing data. The last chapter provides a summary of the findings as well as conclusions, implications, and recommendations for further research.

CHAPTER II

LITERATURE REVIEW

The job of an engineer has been deeply affected by the global transformation of companies. Engineers working in research and development, design, production, service and other areas can be located anywhere in the world as required by the business. In addition, globalization has accelerated and broadened the specialization and outsourcing of business functions to include international producers, suppliers and services, which require a change in how engineers approach, model, formulate, and solve problems (Maddux, Bivolaru, Hafenbrack, Tadmor, & Galinsky, 2013).

Furthermore, leadership positions now require a global mindset. The statement below from Jack Welch, former chairman of General Electric describes this reality: "The Jack Welch of the future cannot be like me. I spent my entire career in the U.S. The next head of General Electric will be somebody who spent time in Bombay, in Hong Kong, in Buenos Aires. We have to send our best and brightest overseas and make sure they have the training that will allow them to be the global leaders who will make GE flourish in the future." - Jack Welch, former chairman, General Electric (Maddux, et al., 2013, p.1).

With globalization affecting the engineering industry, this dissertation study was based on the need to identify ways to effectively prepare undergraduate engineering students for the global job market they will face after they graduate. The purpose of this study was to identify the intercultural maturity level, as determined by the Intercultural Maturity Framework (King & Baxter Magolda, 2005), of students in the college of engineering when exposed to intercultural concepts in relation to cognitive,

intrapersonal, and interpersonal development. In the following sections, I present some of the concepts discussed in the literature that describes the need for global engineers; what universities are doing to respond to this demand; and the different terminologies and concepts of the global job market preparedness, including the selected terminology and framework - Intercultural Maturity. I conclude the literature review with a study that presents the industry view on global competency and the industry view of the skills most valued in their perspective.

The Need to Form Global Engineers – 2020 Engineer

The ability to effectively work with diverse, multinational others is a core professional attribute for the Engineer of 2020 (National Academy of Engineering, 2004 as cited in Groll, 2013). In their profile of the Engineer of 2020, the National Academy of Engineering states that a core need for engineers will be to be able to work with a diverse, multinational, multidisciplinary workforce (National Academy of Engineering, 2004). The Accreditation Board for Engineering and Technology (ABET) also articulates desired outcomes of an engineering graduate to be related to the preparedness to be part of a global industry. ABET lists : "(g) an ability to communicate effectively; (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context; (i) a recognition of the need for, and an ability to engage in life-long learning."(ABET Engineering Accreditation Commission, 2011, p. 3 as cited in Groll, 2013).

Throughout most of the 1990s, the international engineering community engaged in vigorous dialogues concerning the impact of globalization on society, commerce, the

environment and the engineering profession (Lohmann, Rollins, & Hoey, 2006). For example, Wulf (1997) offered the seven trends that he proposed had 'the potential to change the practice of engineering significantly and hence the education required to be an engineer (Lohmann, Rollins, & Hoey, 2006). Among the trends were: the vast array of new materials and processes that broaden an engineer's design; the use of information technology; the increasing number and complexity of constraints (cost, safety, ecology); the rise in the need to have both specific technical knowledge and breadth of knowledge; the need for teamwork and broad business knowledge; the rapid pace of change calling for life-long learning; and globalization (Lohmann, Rollins, & Hoey, 2006).

One agreement from the different papers, discussions, and conferences on the "new engineers" is that engineers need more refined and diverse interpersonal skills, particularly in global collaborations (Sheppard et al. 2003, Swearengen et al. 2003, Andersen 2005, Shuman et al. 2005) as cited in Lohmann, Rollins, & Hoey, 2006. To be successful in the rapidly changing world, engineers need to be globally competent and locally relevant (Bowering, 2013).

Another confirmation of this need came from the focus groups conducted by Engineers without Borders with engineering faculty, students and industry leaders, that resulted in a set of characteristics of the global engineer (Chan & Fishbein, 2009). According to this study, a global engineer is an engineer who:

> "Understands the broad, bigger-picture context of engineering work, including cross-disciplinary aspects, as well as the business and social implications; has expertise in a specific field, but is comfortable in many engineering disciplines

> and able to work in an interdisciplinary way; is a problem solver and is creative; can adapt to new situations, deal with complexity and is skilled at systems thinking; is able to collaborate on a global basis, including knowledge and/or understanding of people, culture and language, along with knowledge of collaboration techniques and software; is able to communicate effectively both orally and in writing in English, and is able to communicate across language and cultural differences; has an understanding of sustainability efforts and the ability to factor environmental impact and energy-use characteristics into all aspects of his/her work; is up to date on current world issues and emerging trends and is constantly expanding his/her skills to be able to respond to these issues appropriately; has a well-developed sense of social responsibility and ethics, with due consideration in his/her personal and professional activities for the world and society; and is entrepreneurial and is prepared to work with a varying level of resources and in various types of organizations in many different roles" (Chan & Fishbein, 2009 p.8).

For the past several years, the American Society for Engineering Education (ASEE) Corporate Member Council's (CMC) Special Interest Group (SIG) for International Engineering Education developed, presented, and vetted with its stakeholders a series of attributes representing the desired competencies and characteristics needed by engineers in order to effectively live, work, and perform in a global context (Hundley, 2015). The framework defined by this group includes five broad categories needed for global engineering effectiveness:

- Technical: Engineering-related knowledge, skills, and abilities needed for success. This included the understanding of engineering, science, and mathematics fundamentals; information technology, digital competency, and information literacy; stages of product lifecycle; Demonstrates an understanding of project planning, management, and the impacts of projects on various stakeholder groups (Hundley, 2015).
- Professional: Workplace related competencies for global performance. This includes, the ability to communicate effectively in a variety of different ways, methods, and media to both technical and non-technical audiences. The commitment to high-level of professional competence and quality principles/standards and continuous improvement. And the application of personal and professional judgment in effectively making decisions and managing risks (Hundley, 2015).
- Personal: Individual characteristics needed for global flexibility. This includes the ability to think both critically and creatively, as well as both individually and cooperatively. Maintain a positive self-image and possesses positive self-confidence. Show initiative and demonstrates a willingness to learn (Hundley, 2015).
- Interpersonal: Skills and perspectives to work on interdependent global teams. This includes the ability to function effectively on a team. And mentor or helps others accomplish goals/tasks (Hundley, 2015).

- Cross-cultural: Society and cultural understanding to embrace diverse viewpoints. This includes the ability to demonstrate an understanding of political, social, and economic perspectives. Demonstrate an understanding of the ethical and business norms and applies norms effectively in a given context. Possess an international/global perspective and fluency in at least two languages. And Embraces an interdisciplinary/multidisciplinary perspective (Hundley, 2015).

In summary, engineers need the ability to live and work comfortably and effectively in a global engineering environment (Lohmann, Rollins, & Hoey, 2006). Therefore, the engineering curricula must instill this global mindset, which, when translated to skills and abilities, might be called 'global competence' (Lohmann, Rollins, & Hoey, 2006).

Engineering Students and the Intercultural Development

Groll (2013) conducted a study to establish baseline measurements at a large Midwestern university based on two previously validated assessment tools that measure different aspects of cultural humility: the Intercultural Development Inventory (IDI) based on Bennett's (1993) developmental model of Intercultural Sensitivity and the Miville-Guzman Universality-Diversity Scale (M-GUDS-s) based on Miville's Universal- Diverse Orientation (2000). The IDI results indicated that 89% of the students are in ethnocentric stages. In addition, the group collectively had a mean score of 82 placing them solidly in polarization (Groll, 2013). Results from M-GUDS-s tool indicate that students overestimate their skills by two developmental levels.

Groll's research presented two interesting findings, first, that first-year engineering students are at the beginning stages of a lifelong journey towards cultural humility; and second that students believe they know more about their global competency than they actually do (Groll, 2013). She points out that engineering educators have the opportunity to create student-centered programs geared toward students in denial, polarization and early minimizations, the ethnocentric stages of cultural humility (Groll, 2013).

Groll also completed a qualitative study where engineering students in their first year of college provided a rich trove of stories about interactions with those that they considered to be culturally different. Students communicated a desire to develop relationships with cultural others (Groll, 2013). However, the data revealed that first-year engineering students largely communicated their understanding of culture as nationality alone, thereby limiting their perception of encounters and experiences with cultural differences (Groll, 2013). Students struggled to find language to discuss the differences they noticed - Many students' primary concern was unintentionally offending someone (Groll, 2013). The study also showed that first-year engineering students have a limited sense of intrapersonal development, as they communicated little understanding of how their own cultural experiences, their sociopolitical histories, and positions of privilege had shaped their own world-view (Groll, 2013).

Actions Taken by Universities to Prepare the Global Engineer

How are universities preparing the global engineer? How can universities on top of the technical skills required, provide the tools for an engineer to become a global

engineer? Defining global competence is challenging, creating globally competent engineers capable of thriving in the 21st century is an even greater challenge (Lohmann, Rollins, & Hoey, 2006). In the United States, a number of universities have developed international programs designed to prepare students to live and work in the global context of the 21st century, although most do not specifically mention global competence as a goal (Lohmann, Rollins, & Hoey, 2006). The programs being created by universities fall into three main categories: co-majors or dual majors; minors or certificates; international experience including international internships, projects or study-abroad (Lohmann, Rollins, & Hoey, 2006)

Co-majors or Dual Majors

In this category, students earn the equivalent of two bachelor degrees, one in engineering and the other in liberal arts or international studies. The University of Rhode Island offers a five year dual degree in engineering and language (German, French or Spanish). In addition to meeting the requirements for the language and engineering degrees, students spend an academic year outside the United States, either on an internship, studying at an exchange university or undertaking a combination of study and internship. Among all universities reviewed by Lohmann, Rollins and Hoey (2006), the Rhode Island program provides the most extensive language study, study of another culture (through advanced language courses) and the longest period of study overseas.

However, this comprehensiveness comes at the cost of requiring an additional year of study. Other limitations are, that it appears to be little linkage between the international study and the student's engineering major (Lohmann, Rollins, & Hoey,

2006) and it only serves a selected group in the college of engineering. The other co-majors (Penn State and Iowa State) involve taking 10 courses outside the major, including second language study and coursework in international studies. Penn State requires minimal international experience (9 weeks), whereas Iowa State requires none (Lohmann, Rollins, & Hoey, 2006). Even though those are good programs, only a selected group of students can or are taking advantage of that opportunity.

Minors and Certificates

According to Lohmann, Rollins and Hoey (2006) two universities offer international minor in engineering (Illinois and Michigan). Both programs require significant second language learning, two or three international courses and a period of study or work (minimum six or eight weeks) outside the United States. Few other universities offer international/global engineering certificates. Pittsburgh offers a global studies certificate designed to impart global competence through second language learning and international coursework, but with no international experience (Lohmann, Rollins, & Hoey, 2006). Texas A&M offers an Engineering International Certificate which includes 3-credits of 200 level foreign language course, 6-credits of International Culture and Diversity course, 3-credits of international design classes (international capstone) and 3-credits of experience abroad. The certificate was created in 2009 and to the date, only 68 students have received it - very low considering that on the academic year 2015-2016 more than 1,000 students studied abroad.

International Experience/Study-Abroad Programs

A number of universities place exclusive emphasis on international experience. As example, both Penn State and Worcester Polytechnic offer students a variety of well-developed international projects (Lohmann, Rollins, & Hoey, 2006). In Penn State's Prestige Consortium students spend a semester overseas. Students collaborate on a four-week design project with peers at European partner universities and then spend an additional four to eight weeks on internships (Lohmann, Rollins, & Hoey, 2006).

In the Global Perspective Program Worcester Polytechnic Institute offers its engineering students a seven week overseas project design course that immerses the students in the host country, designing solutions to local problems (Lohmann, Rollins, & Hoey, 2006). The University of Minnesota has focused on integrating study-abroad into engineering and other disciplines (Lohmann, Rollins, & Hoey, 2006). For the matter of this study, Texas A&M offers a variety of opportunities for engineers to study-abroad including 2 to 6 weeks faculty led study-abroad programs, 10 weeks summer internships, semester long exchange programs and international capstone projects. During the 2015-2016 academic year there were more than 40 engineering specific programs offered and 1,024 students participated in those programs. The goal for the college is to have at least 50% of the engineering students graduate with a global experience. For that we will have over 2,000 students studying abroad each year.

Study-abroad programs is one of the ways universities have found to provide a global perspective to students. However, it has two limitations: low enrollment of engineering students and effectiveness in providing global learning. First, not all of the

students can afford to have a study-abroad experience. For example, at Texas A&M the offers of study-abroad programs in the college of engineering have grown significantly, but it still cannot serve all its students. The college has 14,190 undergraduate students including Texas A&M, Texas A&M at Galveston and Texas A&M at Qatar and graduates over 2,000 Bachelor-level engineers a year. In the 2010-2011 academic year, 372 engineering students studied abroad. With the globalization efforts, this number has almost triple for 2015-2016 academic year with 1,024 engineering students participating in global programs. Whereas about 6% of the engineering population is studying abroad each year, 20% of the students graduate with a global experience. The Nationally the numbers are s little lower, the 2015 Open Doors report from Institute for International Education shows that nationally only 5% of the engineering students studied abroad during the 2014/2015 academic year (Institute of International Education, 2015).

Second, efforts to assess the impact of study-abroad in particular on students' "intercultural competence" have shown mixed results (Sample, 2013). There are studies showing that study-abroad alone may not improve cultural understanding (Fischer, 2011). Maddux et al (2013) stated that mere exposure to new cultures is insufficient to bring about the benefits associated with multiculturalism (Cheng et al., 2008; Maddux, Adam, & Galinsky, 2010; Tadmor, Galinsky, & Maddux, 2012; Tadmor & Tetlock, 2006; Maddux, Bivolaru, Hafenbrack, Tadmor, & Galinsky, 2013). In fact, research is demonstrating that students who are not at an appropriate developmental level in terms of understanding cultural differences may regress during study-abroad experiences when

encountering overwhelming cultural differences (Hammer, 2012; Salisbury, 2011; Lemmons, 2013; Groll, 2013).

In addition, Hunter (2006) study noted that language learning and travel abroad are not necessarily at the core of what takes to become globally competent (Hunter, 2006). He points out from his study that the most critical step in becoming globally competent is for a person to develop a keen understanding of one's own cultural norms and expectations (Hunter, 2006).

Other Programs

In this section I describe two other programs that were different from the one was mentioned above and worth including as other best practices of global programs in engineering. The Georgia Tech International Plan and the Pacific University study-abroad program.

The Georgia Tech International Plan is designed to go well beyond the traditional approaches to instill global competence (Lohmann, Rollins, & Hoey, 2006). The program is designed for completion within four years, and includes the three components deemed by them essential for global competence: coursework in international studies, language proficiency and an immersive international experience. A hallmark of this program, and one that sets it apart from other programs, is that it is integrated into the student's disciplinary studies.

Participants gain an appreciation for how cultural context affects the practice of the student's own discipline. Successful participants receive a designation on their diploma and transcript signifying the depth and breadth of their global competence in the

discipline (Lohmann, Rollins, & Hoey, 2006). Georgia Tech's International Plan was designed with those components because according to Lohmann et al. (2006) the curricular elements needed to instill global competency are international studies, second language proficiency and international experiences.

Pacific University study-abroad program is unique in the sense that it prepares their student before the international experience and helps student "digest" that experience after the program. All students who choose to study-abroad for at least one semester are required to take a two-unit, half semester course. The first unit is called Cross Cultural Training I, which engages students cognitively and experientially with not only a range of pedagogies including traditional reading and writing and audio/visual presentations, but also observational assignments, and careful debriefs (Sample, 2013). Pacific claims that they want their students to be highly functional while living overseas, including successfully navigating their classes, and forming genuine relationships with host country nationals (Sample, 2013). They assume that this can only happen if they learn to appropriately communicate and behave in a new cultural environment, and assume that this will not happen naturally, but will be greatly facilitated by appropriate intervention (Vande Berg & Paige, 2009; as cited in Sample, 2013).

The second unit course required by Pacific is offered upon returning home and is called Cross Cultural Training II (Sample, 2013). In this course, students are discouraged from putting their experiences in a "shoebox" with their photographs and going right back to their life as if there had been no study-abroad experience. Rather, students are encouraged to integrate the experiences into their lives, personally and professionally, in

a reflective, meaningful, and useful way (Sample, 2013). The primary objective of this course is to have students place what they learned while abroad - about the process of culture learning, about themselves, their values and goals, about their own culture, and their host culture, and so on - into a larger framework of lifelong development of intercultural competence (Vande Berg & Paige, 2009) as cited in Sample, 2013.

Summary of Engineering Colleges Global Programs

Developing global competence within the traditional engineering curriculum has been so challenging that colleges of engineering have done with add-on to the curriculum, such as minors and certificates, or limiting it to short summer experiences abroad; therefore only a few students have access. (Lohmann, Rollins, & Hoey, 2006). A more integrated and immersive approach is needed and warranted if future engineers are to graduate with a global mindset and ready for the global job market (Lohmann, Rollins, & Hoey, 2006). Most of the programs described above consider international experiences as a crucial component for the students to be prepared for the global job market, however during the 2014/2015 only 5% of the engineering students studied abroad (Institute for International Education, 2013). This low number is attributed to the challenges (perceived and real) that can be grouped into to three overarching categories: cost, curriculum and culture (Berdan & Johannes, 2014).

Whereas international experiences may strive to teach global competency (and there is some evidence to indicate that it may not be as effective as these researchers hope (Cutler & Borrego, 2010; Fischer, 2011; Lohmann et al., 2006). This dissertation study is based on the need to identify ways to effectively prepare undergraduate

engineering students for the global job market they will face after they graduate. The purpose of this study is to identify the intercultural maturity level, as determined by the Intercultural Maturity Framework (King & Baxter Magolda, 2005), of students in the college of engineering when exposed to intercultural concepts in relation to cognitive, intrapersonal and interpersonal development.

Discussion on Definitions and Terminologies

While there is broad agreement as to the need to better prepare engineers for global practice, there is much less agreement as to what skills and abilities are needed and how to call and define this preparedness for the global job market. There are different believes on the combination and duration of international experiences, what global preparedness means and what metrics should be used to judge whether students have attained it (Lohmann, Rollins, & Hoey, 2006).

Several scholars have proposed conceptual models to describe intercultural (or multicultural or cultural) competencies (e.g., Howard-Hamilton, Richardson, & Shuford, 1998; Ottavi, Pope- Davis, & Dings, 1994; Pope & Reynolds, 1997; Pope, Reynolds, & Mueller, 2004; Pope- Davis, Reynolds, Dings, & Ottavi, 1994; as cited in King & Baxter Magolda, 2005). While these models provide useful starting points for identifying the attributes that are associated with this ability they do not provide a holistic view (King & Baxter Magolda, 2005). Groll (2013) in reviewing the literature lumped the terms together as they all relate to the negotiation of cultural differences and found that there are significant overlaps in the meaning of the terminology being used in the literature (Groll, 2013). However, in considering these terms collectively, she found that important

relational issues of power, production, and symbolism are missed and differences are minimized thereby unintentionally perpetuating oppressive practices (Groll, 2013).

Multiple educational approaches have been developed to add to the need for growing cultural competency. Finkelstein, Pickert, Mahoney, and Barry (1998) wrote that traditional approaches have come from area studies, international studies, cross-cultural studies, and multicultural studies. Taking the view that cultural learning is intrinsically tied to language skills, educators in this arena have asserted that cultural understanding is a necessary bi-product of language learning (Finkelstein et al., 1998) as cited in Groll, 2013. Taking a global focus, international studies concentrates on the acquisition of factual knowledge regarding nations and regions (Finkelstein et al., 1998). Taking a psychological approach, cross-cultural studies have focused on the personal adjustment skills necessary for living abroad (Finkelstein et al., 1998). Taking a politically and emancipatory driven approach, multicultural education requires a commitment to cultural diversity (Finkelstein et al., 1998; as cited in Groll, 2013).

According to King and Baxter Magolda (2005), theory development on multicultural competence has been limited by heavy reliance on the assessment of attitudes as a proxy for competence (King & Baxter Magolda, 2005). Below I present some of the terminology and frameworks being used today in this filed including the one chosen as the framework for this dissertation – Intercultural Maturity.

Global Competency

Olson and Kroeger (2001) define a globally competent person the one who has enough substantive knowledge, perceptual understanding, and intercultural

communication skill to effectively interact in our globally interdependent world (Olson & Kroeger, 2001). According to Lohmann, Rollins and Hoey (2006), basic global competence is the product of both education and experience. For them, a global competency includes being able to, 1) communicate in a second language via speaking, listening, reading, and writing. 2) Demonstrate substantively the major social, political, economic processes and systems (comparative global knowledge). 3) Assimilate intelligently and with ease into foreign communities and work environments (intercultural assimilation). And 4) communicate with confidence and specificity the practice of his or her major in a global context (disciplinary practice in a global context) (Lohmann, Rollins, & Hoey, 2006). As can be noted, even when scholars refer to the same terminology – global competency – they refer to different skill set or characteristics needed.

One global competency's framework in cross-cultural training practice comes from Deardorff (2006). Deardorff's model derives from her research using inductive theory to outline the theoretical consensus among a group of experts (higher education administrators and intercultural scholars) in intercultural competence (Sample, 2013). The model suggests that certain attitudes (respect for other cultures, openness, and curiosity) facilitate the acquisition of greater knowledge of one's own and a target culture and sociolinguistic awareness, as well as skills of observation and analysis (Groll, 2013). This comprehension and skill set then facilitate a changed internal outcome of flexibility, ethnorelativism, and empathy, which in turn should facilitate the

desired external outcome, which is appropriate and effective communication with others in an intercultural environment (Deardorff, 2006; as cited in Groll, 2013).

One of the conclusions from Deardorff (2006)'s study is that intercultural scholars and higher education administrators did not define intercultural competence in relation to specific components. Instead, both groups preferred definitions that were broader in nature (Deardorff, 2006). However, there was an 80% agreement on these skills. Using the items on which 80% or more of both the intercultural scholars and administrators agreed, Deardorff (2006) organized these items into two visual ways of defining intercultural competence that could be used as a framework by administrators and others in their work in developing and accessing intercultural competence (Deardorff, 2006). Below I show one of them, which is in the shape of a pyramid.

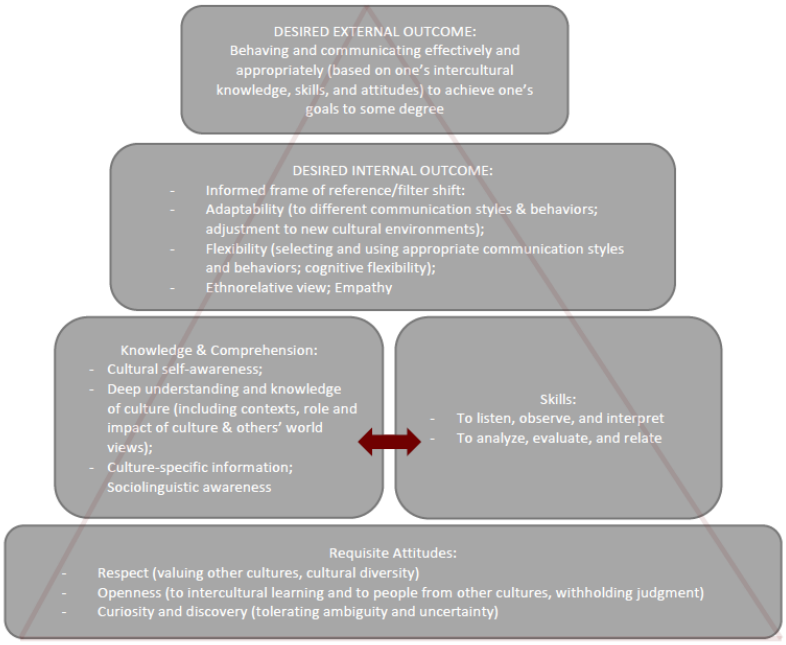


Figure 3. Model of Intercultural Competence in Pyramid Format. Adapted from Deardorff, 2006

Even thought Deardorff was able to develop this framework, her 2006 study showed several issues still controversial when defining the skills for global competency. Those include, the use of quantitative methods to assess competence; the use of standardized competency instruments; the value of a theoretical frame in which to place intercultural competence; the use of pre-and post-tests and knowledge tests to assess intercultural competence; the role and importance of language in intercultural competence; whether measuring intercultural competence is specific to context, situation, and relation; and whether this construct can and should be measured holistically and/or in separate components (Deardorff, 2006).

A conclusion from the study is that the definition of intercultural competence continues to evolve, which is perhaps one reason why this construct has been so difficult to define (Deardorff, 2006). Therefore, to assess intercultural competence, higher education institutions need first to be defined the concept considering that there are multiple definitions of intercultural competence from a variety of academic disciplines as well as the intercultural field (Deardorff, 2006). It is important for administrators to be aware of these definitions instead of recreating a definition without any influence or grounding from the intercultural field (Deardorff, 2006).

Groll (2013) synthesizes the definitions on global competence as a set of attributes that include: knowledge, attitudes, behaviors and skills - that allows one to work effectively with people who have different ontological, epistemological, and axiological perspectives (Groll, 2013). One issue Groll points out is that the current use of the term global competency within the engineering education literature appears to

arise out of a Western, individualistic, competitive perspective (Groll, 2013). Where the lists of competencies were formed with input from U.S. human resource representatives, successful U.S. expatriates, and U.S./Western European multinational corporate executives (Allert, Atkinson, Groll, & Hirleman, 2007; B. Hunter et al., 2006; Olson & Kroeger, 2001) with no input from either indigenous and/or non-dominant hosts (Groll, 2013). This is important because it is looking at global competency from just one angle, when what we would like our students to have as they develop global competencies is to see situations from different angles and appreciate/understand those differences. This view of global competency perpetuates the view of Western superiority.

The body of literature for global competency reviewed by Groll (2013) showed that the models typically rely on Hofstede's work to provide a definition of culture, and despite the sophistication of these classification models, they lack the link of how context impacts these models and how power impacts structures (Groll, 2013). In addition, most of these models are either lists or pyramids (Groll, 2013). While Downey et al. (2006) offers a more complex classification and relational model by making reference to students' standing in terms of Bennett's (1986) Developmental Model of Intercultural Consciousness, their conceptualization appears to be constant and be unidirectional as well as independent of the context (Groll, 2013).

Cultural Humility

For engineering education, Groll (2013) suggested that the better term and framework to use is cultural humility. The concept of cultural humility brings with it a complex history that evolves out of but does not belong to the history of cultural

competency (Groll, 2013). Unlike a competency that indicates a fixed mastery, the notion of humility indicates that these dynamic qualities are in the process of ever becoming globally, historically, and politically located. The notion of cultural humility operates from a dimension of cooperation, inclusion and care (Groll, 2013). Cultural empathy is one of the components of cultural humility (Groll, 2013).

While a few researchers have conceptualized humility as a personality factor, Ashton and Lee (2005) found in their investigation of the notion of humility within the context of the big five factors of personality that mostly humility is considered a virtue within the psychological literature, (Davis et al., 2011; Davis, Worthington, & Hook, 2010; Tangney, 2000 in Groll, 2013). Groll (2013). Other researchers suggest that one particular argument with the term humility is understanding an accurate view of self or an interpersonal stance toward others (Davis et al., 2010 as cited in Groll, 2013). Davis et al. (2011) note that while the quantitative study of humility is in progress, it is slow due to the complexity of the term. Culture is also complex, and according to Groll, the model of cultural humility supports that complexity because it uses a model that is outside of cause and effect linear thinking (Groll, 2013).

Cultural humility is more than a sum of the components of technical knowledge, professional skills, and attitudes and relationships between individuals (Groll, 2013). Cultural humility shapes technical knowledge in the recognition that various technical approaches are privileged based on the academic system in which an engineer is educated (Downey et al., 2006 as cited in Groll, 2013). Those with cultural humility recognize that there are multiple technical approaches and that while they may have a

preference for one way of defining a problem over another as well as one way of justifying a solution over another, they have the flexibility of mind and command of technical knowledge to be able to adjust and adapt to multiple ways of defining as well as resolving problems (Groll, 2013).

Cultural humility also means recognizing when we do not have the technical knowledge to accomplish a task and having the wherewithal to acknowledge this deficit and seek out this knowledge either through bringing in outside expertise or additional education, as called for in the Code of Ethics of a Professional Engineer (Groll, 2013). In addition, it means recognizing cultural humility shapes professional skills in providing the awareness and adaptability to being able to adapt to organizational and team norms as well as negotiate conflict and communicate effectively with those who may view the world differently (Groll, 2013).

Intercultural Sensitivity

One important model in the literature for cultural studies that has been used and cited by many scholars as well as used by King and Baxter Magolda (2005) as a base for their intercultural maturity framework is the Intercultural Sensitivity Model of Bennett (1993). Bennett's model has been used in several fields including engineering education. Bennett argues that intercultural sensitivity is not some innate characteristic, but a learned ability (Bennett, 1993). As people gain experience in intercultural situations, and reflect on those experiences, they develop a more complex understanding of culture. This leads to greater ability to discern cultural differences and ultimately, to

appropriately modify their own behavior in nonnative cultural circumstances (Bennett, 1993) and therefore work more effectively in the global job market.

Bennett (1986, 1993b) suggested a framework for conceptualizing dimensions of intercultural competence in his developmental model of intercultural sensitivity (DMIS). The DMIS constitutes a progression of worldview ‘‘orientations toward cultural difference’’ that comprise the potential for increasingly more sophisticated intercultural experiences (Hammer, Bennett, & Wiseman, 2003). Three ethnocentric orientations, where one’s culture is experienced as central to reality (Denial, Defense, Minimization), and three ethnorelative orientations, where one’s culture is experienced in the context of other cultures (Acceptance, Adaptation, Integration), are identified in the DMIS (Hammer, Bennett, & Wiseman, 2003). Based on this theoretical framework, the Intercultural Development Inventory (IDI) was constructed to measure the orientations toward cultural differences described in the DMIS. The result of this work is a 50-item (with 10 additional demographic items), paper-and-pencil measure of intercultural competence (Hammer, Bennett, & Wiseman, 2003)

Intercultural Maturity

The concepts presented above illustrate that intercultural competence is a complex, multifaceted construct, and that educating for this outcome requires a broader, more comprehensive approach than that suggested by training for knowledge or skills alone (King & Baxter Magolda, 2005). Using holistic lens to examine scholarship on intercultural or multicultural competencies allows one to identify underlying capacities

that may guide a learner's ability to integrate knowledge, skills, and awareness, and to act in interculturally mature ways (King & Baxter Magolda, 2005).

King and Baxter Magolda (2005) state that educators could be more effective in achieving diversity outcomes if they could organize their goals and programs using a conceptual framework that provides a more holistic approach to defining diversity outcome goals and how students' progress toward these goals. In particular, they propose a multidimensional framework that describes how people become increasingly capable of understanding and acting in ways that are interculturally aware and appropriate; they call this capacity intercultural maturity (King & Baxter Magolda, 2005). This concept supports the viewpoint of providing the tools for students for lifelong learning.

The King & Baxter Magolda use Kegan's (1994) model as the base because it is holistic incorporating and integrating the interaction of three dimensions of development: The *cognitive* dimension focuses on how one constructs one's view and creates a meaning-making system based on how one understands knowledge and how it is gained; The *intrapersonal* dimension focuses on how one understands one's own beliefs, values, and sense of self, and uses these to guide choices and behaviors; The *interpersonal* dimension focuses on how one views oneself in relationship to and with other people (King & Baxter Magolda, 2005).

Summary of Terminologies

One outcome of internationalization efforts at postsecondary institutions is the development of interculturally competent students. Yet, according to Deardorff (2006),

"few universities address the development of interculturally competent students as an anticipated outcome of internationalization in which the concept of "intercultural competence" is specifically defined" (Deardorff, 2006, p. 241). One assumption that can be made is that the lack of specificity in defining intercultural competence is due to the difficulty of identifying the specific components of this complex concept (Deardorff, 2006). Below I present a table with the main terminology being used currently in engineering with their definitions and authors.

Table 2. Terminologies, Definitions and Authors

Terminology	Definition	Authors
Global Competency	A globally competent person is one who has enough substantive knowledge, perceptual understanding, and intercultural communication skill to effectively interact in our globally interdependent world.	Olson and Kroeger (2001)
Global Competency	Basic global competence is the product of both education and experience. They add that it is characterized by a graduate's ability to: 1) communicate in a second language via speaking, listening, reading, and writing; 2) demonstrate substantively the major social, political, economic processes and systems (comparative global knowledge); 3) assimilate intelligently and with ease into foreign communities and work environments (intercultural assimilation); and 4) communicate with confidence and specificity the practice of his or her major in a global context (disciplinary practice in a global context).	Lohmann, Rollins and Hoey (2006)
Global Competency	Categorical topics comprising global competence: 1)Cross-cultural communication: Second language; Cultural communication rules; Interpersonal representation; Communication technologies. 2) Cross-cultural dispositions: Global citizenship; Global exploration; Cultural equality; Cultural flexibility; Cultural appreciation; Cultural openness. 3) World knowledge: General knowledge; World Cultures; Global interrelations. 4) Cross-cultural teams: Team leadership; Team processes; Conflict resolution; Cross-cultural team experience. 5) Engineering specific cross-cultural competencies: Cross-cultural engineering attitudes; Cross-cultural engineering interaction; Cultural engineering skills and practices; Global engineering occupations; Culture-centered product design.	Ball, A. G.; Davies H. R. ; Tateishi, I.; Parkinson A. R.; Jensen, C. G.; Magleby, S. P. (2012)
Cultural / Intercultural Competency	Behaving and communicating effectively and appropriately (based on one's intercultural knowledge, skills, and attitudes) to achieve one's goals to some degree. Informed frame of reference/filter shift: Adaptability (to different communication styles & behaviors; adjustment to new cultural environments);Flexibility (selecting and using appropriate communication styles and behaviors; cognitive flexibility); Ethnorelative view; Empathy	Darla K. Deardorff (2006)

Table 2. Continued

Terminology	Definition	Authors
Cultural Humility	Unlike a competency that indicates a fixed mastery, the notion of humility indicates that these dynamic qualities are in the process of ever becoming globally, historically, and politically located. Cultural humility is more than a sum of the components of technical knowledge, professional skills, and attitudes and relationships between individuals . Those with cultural humility recognize that there are multiple technical approaches and that while they may have a preference for one way of defining a problem over another as well as one way of justifying a solution over another, they have the flexibility of mind and command of technical knowledge to be able to adjust and adapt to multiple ways of defining as well as resolving problems	Groll (2013)
Intercultural Sensitivity	A progression of worldview ‘‘orientations toward cultural difference’’ that comprise the potential for increasingly more sophisticated intercultural experiences. Three ethnocentric orientations, where one’s culture is experienced as central to reality (Denial, Defense, Minimization), and three ethnorelative orientations, where one’s culture is experienced in the context of other cultures (Acceptance, Adaptation, Integration)	M. Bennett (1986; 1993)
Intercultural Sensitivity/Intercultural Competence	‘‘intercultural sensitivity’’ to refer to the ability to discriminate and experience relevant cultural differences. The term ‘‘intercultural competence’’ to mean the ability to think and act in interculturally appropriate ways	Hammer, M. R.; Bennett, M. J.; Wiseman, W. (2003)
Intercultural Maturity	intercultural maturity draws from several genres of research in multicultural education as it attempts to integrate three major domains of development (cognitive, intrapersonal, and interpersonal). It is a holistic model incorporating and integrating the interaction of three dimensions of development: The cognitive dimension focuses on how one constructs one’s view and creates a meaning-making system based on how one understands knowledge and how it is gained; The intrapersonal dimension focuses on how one understands one’s own beliefs, values, and sense of self, and uses these to guide choices and behaviors; The interpersonal dimension focuses on how one views oneself in relationship to and with other people.	King, P.; Baxter Magolda, M. B. (2006)

This section of the literature review and the table above, present the most relevant authors and their definition/framework in global engineering. However, in her literature review, Deardorff identified a number of scholars throughout the past 30 years who have defined intercultural competence (Deardorff, 2006). Her review shows one more time that there has not been agreement on how intercultural competence should be defined. Those authors identified by Deardoff include: Baxter Magolda, 2000; Beebe, Beebe, & Redmond, 1999; Bennett, 1993; Bradford, Allen, & Beisser, 2000; Byram,

1997; Cavusgil, 1993; Chen, 1987; Chen & Starosta, 1996, 1999; Collier, 1989; Dinges, 1983; Dinniman & Holzner, 1988; English, 1998; Fantini, 2000; Fennes & Hapgood, 1997; Finkelstein, Pickert, Mahoney, & Douglas, 1998; Gudykunst, 1994; Gundling, 2003; Hammer, Gudykunst, & Wiseman, 1978; Hampden-Turner & Trompenaars, 2000; Hanvey, 1976; Hess, 1994; Hett, 1992; Hoopes, 1979; Hunter, 2004; Kealey, 2003; Kim, 1992; Koester & Olebe, 1989; Kohls, 1996; Kuada, 2004; La Brack, 1993; Lambert, 1994; Lustig & Koester, 2003; Miyahara, 1992; Paige, 1993; Pedersen, 1994; Pusch, 1994; Rosen, Digh, Singer, & Phillips, 2000; Ruben, 1976; Samovar & Porter, 2001; Satterlee, 1999; Spitzberg, 1989; Spitzberg & Cupach, 1984; Stewart & Bennett, 1991; Storti, 1997; Tucker, 2001; Wiseman, 2001; Yum, 1994, Zhong, 1998 (Deardorff, 2006).

Skills and Industry View on Global Competency

Although previous research contributes to the breadth and depth of the understanding of cultural and global interactions that form the basis of global competence, there remains a lack of a descriptive, comprehensive, and consolidated set of statements describing global competence that has been validated by experts (Ball, et al., 2012). Looking from the engineering industry perspective, Ball et al (2012) did a review of the literature from which numerous global competencies were identified. From this list of competencies, a set of global competencies with an associated conceptual model was developed to group the competencies by contextual topics. Those competencies were:

- Cross-cultural communication: Second language; Cultural communication rules; Interpersonal representation; Communication technologies.
- Cross-cultural dispositions: Global citizenship; Global exploration; Cultural equality; Cultural flexibility; Cultural appreciation; Cultural openness.
- World knowledge: General knowledge; World Cultures; Global interrelations.
- Cross-cultural teams: Team leadership; Team processes; Conflict resolution; Cross-cultural team experience.
- Engineering specific cross-cultural competencies: Cross-cultural engineering attitudes; Cross-cultural engineering interaction; Cultural engineering skills and practices; Global engineering occupations; Culture-centered product design.

Based on that list, Ball et al (2012) did a survey with leaders of engineering companies to define what is more important from the industry perspective. They found that the five competencies rated most important by this industry group (listed in order of importance) were: 1) appreciate and respect cultural differences; 2) collaborate and work on a multicultural team; 3) use collaboration technologies in intercultural interactions; 4) practice tolerance and flexibility; 5) and practice cultural equality (Ball, et al., 2012).

These findings bring a new perspective to global competency that considers not what scholars and higher education administrators believe to be important, but what the

industry values, more specifically in engineering, which is the focus of this study. These competencies relate well to the intercultural maturity definition and framework, which was the one chosen for this study.

Conclusion

The literature shows several terminologies referring to the preparedness of engineers to the global work force. In addition, it also shows different set of skills deemed important and different ways universities are using to develop those skills in students. It is important to notice that in a rapid changing environment, a key aspect is to provide the tools for life-long learning in the global world as the skill sets required to be successful in the global job market may change as the world changes. As stated by Deardorff (2006), to assess intercultural competence, the concept first needs to be defined by the institution, keeping in mind that there are multiple definitions of intercultural competence from a variety of academic disciplines as well as the intercultural field. Therefore, in defining intercultural competency for each institution, it is important for administrators to be aware of these definitions instead of recreating a definition without any influence or grounding from the intercultural field.

This study focus on understanding the intercultural maturity level of students in the college of engineering when exposed to intercultural concepts. It takes the intercultural maturity as the definition and frameworks, and it assumes that developing the three levels of cognitive, intrapersonal and interpersonal knowledge students will be better equipped to face the global and ever changing engineering job market. The chapter that follows will describe the methodology used for the study.

CHAPTER III

METHODOLOGY

This study was done using the naturalist paradigm described below. A qualitative interpretive methodology was used to identify students' intercultural maturity level as determined by the Intercultural Maturity Framework (King & Baxter Magolda, 2005) when exposed to intercultural concepts in relation to cognitive, intrapersonal and interpersonal development. In this chapter, I will present the methodological approach that guided the study and how the data was collected and analyzed (University of Southern California, 2016).

Research Perspective - Using Naturalistic Inquiry

Once the study problem, purpose and the research questions were defined, it became clear that the Naturalistic paradigm was the best approach to guide this study. The purpose of a naturalist research inquiry is to resolve the study problem in the sense of accumulating sufficient knowledge to lead to understanding the dialog process that plays off the favorable and unfavorable factors that form the problem (Lincoln & Guba, 1985). The study problem was that most engineering students in the United States are graduating not fully prepared to face the global job market they will be part of once they graduate. The purpose of this study is to identify the intercultural maturity level, as determined by the Intercultural Maturity Framework (King & Baxter Magolda, 2005), of students in the college of engineering when exposed to intercultural concepts in relation to cognitive, intrapersonal and interpersonal development. This includes to

understand how students come to appreciate cultural differences to interact effectively with different other in the context of a global engineering course.

The "Naturalistic inquiry central purpose is to make sense of human experience and to understand and derive shared meaning within a particular context (Guido & Lincoln, 2010). To fulfill the purpose of this study as mentioned above, it was crucial to "understand the experiences of students within the context of their lives, explore the meaning of phenomenon within the context of a research study, and listen to multiple participant voices and experiences" (Guido & Lincoln, 2010), which is part of the naturalist approach.

The naturalistic paradigm considers five assumptions that were part of this study. First that realities are multiple, constructed and holistic. Second, the inquirer and the "object" are interactive. Third, the aim of the inquiry is to develop a body of knowledge in the form of a working hypothesis that describe the individual case. Fourth, all entities are in a state of mutual simultaneous shaping so that it is impossible to distinguish causes and effects. Fifth and final assumption is that realities are multiple and it is context dependent and value-bound (Lincoln & Guba, 1985).

This study, as most Naturalistic studies, used qualitative methods over quantitative because they are more adaptable to dealing with multiple realities (Lincoln & Guba,1985, p. 40). This qualitative study used the interpretive method relying on data from interviews, informal observations, documents and reports, as well as publications from the literature and from the college of engineering. As stated by Merriam (2009) the interpretive study focus on how people interpret their experiences, how they construct

their worlds and what meaning they attribute to their experiences (Merriam, 2009). The overall purpose of an interpretive study, as for this study, is to understand how people make sense of their lives and their experiences (Merriam, 2009)

The principle supporting this research is a social constructivist worldview, where the researcher assumes a subjective position and interacts with what is being studied (Guba, 1990). This position holds the assumption that individuals seek understanding of the world in which they live and work, which is the goal of this study. According to Creswell (2009), "individuals develop subjective meanings of their experiences…. these meanings are varied and multiple, leading the researcher to look for the complexity of views rather than narrowing meanings into a few categories or ideas" (p.8).

Opponents of this theoretical position have argued that since this approach involves subjective interpretations of respondents' views, there is a lack of objectivity (Argyle, 1978). The critical point, however, is that it is important that those adopting a social constructivist philosophy to provide the kind of descriptions of their research processes that enable readers to judge the extent to which subjectivity has colored the data collection and analysis (Utuka, 2012).

Research Design

The study was designed following the provisions of the naturalistic paradigm and it is reflected below on the description of the sampling methods, instrumentation choice, data collection and analysis methods. The study looked into the problem of most engineering students in the United States graduating not fully prepared to face the global job market they will be part of once they graduate.

To understand this problem, the population selected for this study was students from the College of Engineering at Texas A&M, more specifically students who took the Global Engineering Design Course (ENGR 410) during the fall semester of 2014. The Global Engineering Design Course was a new course in the college of engineering piloted with eight students during the fall 2014 semester. This course, which was the context of the study, aimed at helping students to develop a global mindset in a highly engineering context without travel.

Sampling and Participants Information

The sample in naturalistic studies is done to maximize the scope and range of information obtained; therefore, sampling is not representative but contingent and serial (Lincoln & Guba, 1985). In this study as most of the naturalistic studies, I used a non-probabilistic purposeful sampling as it is more likely to uncover the full range of multiple realities (Lincoln & Guba, 1985). The population sample for this study was students who participated in the pilot of the Global Engineering Design Course that took place during Fall 2014. There were eight students participating in this pilot class, therefore they were unique within the population. From the eight students taking the class, three were in their Junior year and five in their Senior year. Six of them are male and two females. On chapter four each participant is described in detail.

Instrumentation (Positionality)

The instrument of choice to gather data in the naturalistic inquiry is the human because only humans can grasp and evaluate the meanings of the situations and context (Lincoln & Guba, 1985). The data was collected by me, the researcher of this study. Two

items are important to consider with the human element as the instrument to collect data, the background of the person and training (Lincoln & Guba, 1985).

In regards to my background, I am female, and originally from Brazil. I came to the United States after high school in Brazil with a scholarship to play tennis and pursue my undergraduate education. I came to the United States because I was looking for a place where I could continue to play competitive tennis, but not professional, while pursuing my undergraduate education. In addition, I believed it would add value to my professional career to acquire my degree in another language (English) and culture. I now see that living in another country/culture helped me not only grow professionally but also personally and made me a well-rounded person. At this point in my life, I realize how much this experience has influenced me. I believe people gain personally and professionally by spending time, studying abroad, and or getting to know other cultures. The other point that is important to point out is that by being abroad, I went through the phases presented in Bennet's Intercultural Sensitivity Development Model (Bennet, 1986) sometimes without even realizing it at the time.

In regards to training, after getting my undergraduate and master degree in marketing both in the United States, I started working first in advertising and then moved to higher education with a position at a large research university. I have been working in international higher education since 2005, first as assistant director for Latin American Programs, then as program manager for South America, and since 2012 as director for Engineering International Programs. After two years in the college of engineering working in creating and implementing international experience to

engineering students and interacting with engineering education professionals and the industry, I realized the gap on how colleges of engineering are preparing the students to face the global job market. For a long time the emphasis was in the number of students studying abroad, with no attention to the impact of those experiences on the professional and personal development of the students. In 2009 I started this PhD in higher education, which has broaden my view of higher education and thought me how to do quality research. More importantly, it thought me how to use research to create better and more informed programs for students.

Introducing the Study to Respondents

Once IRB was approved, which was close to the end of the fall 2014 semester, I went to one of the last classes and explained to the students the study at hand and invited them to participate. I explained that students did not have to make the decision at that time as an email was going to be sent to them with all the details of the study. That same day, I emailed all of the students the consent form and asked them to return it to me in case they were willing to participate in the study.

The email and consent form included information about the study and explained that their participation on the study would consist of two interviews with me. Each of the interviews would be for about 30 to 60 minutes. As an incentive for their participation and in appreciation of their time, I gave each student a $10 gift certificate to Starbucks and a small Texas A&M gift. All eight students agreed to participate in the study and replied to the email with their availability for the first interview. Some of the students emailed the consent form with the acceptance email and others signed before the first

interview took place. When students enrolled in the class, they knew this was the first time this class was being offered and that it was a pilot class. This fact probably helped the willingness of the students to participate on the study.

Developing Interview Questions

For the semi-structured interviews one and two, an initial interview guide was developed to ensure all participants were asked similar questions and that the main topics of the study would be covered. The questions were guided by the three research questions of the study to define the cognitive, interpersonal and intrapersonal maturity level of the students who participated in the ENGR410 Global Engineering Design class of Fall 2014. Each participant was asked slightly different questions, as appropriate. A sample of the first and second interview guide is shown in Appendix B.

Data Collection

With the human subject operating in an unknown situation, the techniques recommended for the naturalistic paradigm were used for this study and included interviews, pre-study observation for field acquaintance, documents and record analysis, as well as nonverbal cues (Lincoln & Guba, 1985). Data for this study came from two main sources: interviews with students and analysis of documents. The questions asked and what documents were analyzed were linked to the Intercultural Maturity framework selected for this study. Observation was not one of the data collection instruments. However, it was used for me to be acquainted with the participants and the context that students were as the experience unfolded.

Interview

The interviews were the core source of data for this study and provided rich information to define the intercultural maturity level of the students. The purpose of doing an interview includes: " (1) obtaining here-and-now constructions of persons, events, organizations, feelings, motivations, claims, and concerns; (2) reconstruction of such entities as experienced in the past; projections of such entities as they expected to be experienced in the future; (3) verification emendation and extension of information obtained from other sources, human and nonhuman; (4) and verification emendation and extension of constructions developed by the inquirer" (Lincoln & Guba, 1985, p. 268).

Interviews can be categorized by their degree of structure, overtness, and quality of the relationship between the interviewer and interviewee (Lincoln & Guba,1985 p. 268). For this study, I used an overt semi-structured interview method, which is a mix of more and less structured questions that are guided by a list of questions or issues to be explored. This format allowed the researcher to respond to the situation at hand, to the emerging worldviews of the respondent, and to new ideas on the topic (Merriam, 2009).

I conducted two interviews with each student who participated in the Global Engineering Design Class. The Global Engineering Design course was a new course in the College of Engineering that exposes student to different concepts of being a global engineer. The course was implemented during the fall semester of 2014 as a pilot course with only a small number of students enrolled in the class, a total of eight students. I interviewed all of the students enrolled in the class two times, totaling 16 interviews. Both interviews were with open-ended questions in a semi-structured format.

An initial interview guide was developed for both interviews in order to frame the most general questions to the participants. The interviews started with the "grand tour" type of questions. The questions became more specific as the interview developed. In addition, on both interviews, each participant was asked slightly different questions, based on their answers as the interviews unfolded. From the interviews, I also collected demographic and socioeconomic information of the participants, including gender, nationality, past academic and non-academic experiences among others.

The first round of interviews took place right after the class was completed, and before student left for the holiday break in the month of December 2014. The first round of interviews lasted for about one hour with each student. The second round of interviews took place during the spring semester - March and April 2015 - few months after students have taken the class. The second interview lasted about 30 minutes with each student and followed the same semi-structured format with a general set of question to all of the students in addition to some specific ones based on their answers from the first interview. The purpose of the second round of interview was not only to gather the information that was missing on the first interview, but also to understand if the class had a long lasting effect on the students.

Accurately capturing the answers during an interview session is as important as asking the right questions and establishing rapport with the interviewees. It adds fidelity to the study. Fidelity is the ability of the researcher to reproduce exactly the data as they become evident to him/her in the field (Lincoln & Guba, 1985). For that, interviews were audio-recorded and field notes were taken as the instruments to record the data.

The field notes were limited as I wanted to be engaged with the participants and create a more informal setting, like a conversation. The audio-recorded interviews were transcribed. Two of them transcribed by me and fourteen of them by a third party called REV.com. I revised all of the transcribed scripts after transcription was completed twice and made the necessary changes for fidelity purposes.

Documents

According to Creswell (2009), documents are considered a valuable source of information in qualitative research (Creswell, 2009). The documents that were collected and analyzed included papers, my journal and student course assignments. The faculty member teaching the course shared with me for research purposes the students' class assignments including the online discussions, final report and cultural essays. Students agreed to provide me access to their assignments and other related material when they signed the consent forms.

Students' course assignments were particularly helpful in adding meaning to the data collected from the interviews and providing additional insight to students' intercultural maturity level. The data from the student assignments allowed me to cross analyze the data from the interviews with what students were responding in their assignments. "Triangulation of data is crucially important in naturalistic studies. As the study unfolds and particular pieces of information come to light, steps should be taken to validate each against at least one other source. No single item of information (unless coming from an elite and unimpeachable source) should ever be given serious consideration unless it can be triangulated" (Lincoln & Guba, 1985, p.283). The

triangulation of the interview data with the students 'course assignment was essential in identifying the intercultural maturity development of the students and how they came to appreciate cultural differences to interact effectively with different other in the context of a global engineering course.

The five assignments that were part of the course and used for this study are presented on appendix C and included:

Cultural Differences – Context. Students had to answer four questions. After that, watch few videos about "East versus West" and reflect on how their answers compared to people surveyed in the eastern or western world. In addition, after watching the videos, students had to give an example on how they could use this knowledge about eastern and western cultures to improve the communication between people from these cultures when working in a technical project setting.

Cultural Differences – Hofstede's Dimensions. Student had to interview another student in the class and explain his/her answer. The interview topics included a) Relation to authority; b) Relation between individualistic and collectivist societies; c) Dealing with ambiguity, stress, and conflict; d) Time orientation; e) Concepts of masculinity and femininity

Introduction to culture. Students had to watch the video "Everything you always wanted to know about culture," by professor Saba Safdar. After that, answer questions on how, according to the presenter, insults and humor are manifestations of culture values and explain their answers.

Culture and Cultural Difference Applications. Students had to consider the context of a "hypothetical" group of engineering students from Brazil and the United States working together and answer questions related to patterns in the behavioral graphic presented. The graphic included the relationship between Individualism/Collectivism and Low-/High-context dimensions. Students had to analyze and describe if the data suggests that individuals behave the same as their cultural group from Hofstede's dimensions. They had to reflect on stereotyping. In addition, students had to write about knowing what they know now about cultures, what they would do differently to improve the results in an international meeting or when working in a multinational team.

Bennett's Developmental Model of Intercultural Sensitivity. Students had to learn about Bennett's Developmental Model of Intercultural Sensitivity (DMIS) and answer the following questions a) What stage do you think you are in the DMIS model and explain their answer; b) Interview another person and determine in what stage of DMIS this person is and explain their answer.

Observations

Observation was not one of the data collection tools used for this study because the study IRB approval was not granted until the end of the course. By the time I received the consent from the students, the course was concluded already. However, I participated in the class throughout the semester for two purposes. First, to support the faculty member teaching the course in developing and implementing the course. Second

to be acquainted with the participants and the context that students were as the experience unfolded.

Being acquainted with the field site is an important provision under the Naturalistic paradigm. “Willian Corsaro (1980) has strongly recommended the use of what he terms ‘prior ethnography’: becoming a participant observer in a situation for a lengthy period of time before the study is actually undertaken. Such prior ethnography not only helps to diminish the obtrusiveness of the investigator, but also provides a baseline of cultural accommodation and informational orientations that will be invaluable in increasing both the effectiveness and the efficiency of the formal work” (Lincoln & Guba, 1985, p. 251).

Being an observer of the class before the study started was of essence to understand the experience and the impact of that experience on the students. The knowledge acquired during that time, guided the interpretation of the data. Once the IRB approval was granted and the study could start, I wrote some research memos and notes on my research journal about some aspects of the class interaction that I noticed during my time in the classroom.

Researcher Reflexivity

To ensure trustworthiness I kept a reflexive journal describing in detail my experiences during this research project. The research journal was electronic and was kept during the time of the study. In this journal, I kept notes about the interview process, scheduling interviews, general observations, new ideas and thoughts and

interaction with students. As I did the data analyses and the writing of this study, I went back and read some of the notes on the journal few times.

Peer Debriefing

To keep check with the information analyzed, I invited the professor teaching the ENGR410 class to be the de-briefer for this study. A de-briefer must be "someone who is in every sense the inquirer's peer, someone who knows a great deal about both the substantive area of the inquiry and the methodological issues" (Lincoln & Guba, 1985, p. 308). Even though I was not involved in teaching the class, the faculty member and I were developing this class together; therefore, we were peers in this endeavor.

I met with the de-briefer twice to discuss the data gathered from the interviews. One time after each set of interviews were transcribed. Discussions included the impression of the students, further information that could be obtained for clarification, conversations about interpretation of the students' answers, and adjustments that could be done in the class to increase the impact of the experience in students' intercultural maturity.

Member Check

Member check is important to ensure accuracy of the data collected. For that, at the end of each interview, I informally summarized the conversation and asked for additional comments from the interviewee. After each interview was transcribed, the transcription documents were e-mailed to each interviewee to confirm the data collected was accurate. Before the second interview started, I asked each participant if they were comfortable with the transcription of the first interview and all of them agreed. Some of

the participants stated they had not read the document but were fine with that. After the audio files of the second interview were transcribed and revised, it was again emailed to each of the participants. The email asked them to review and reply to the email if more data should be added in order to clarify any of the topics discussed. Some students replied with a positive answer and other students did not reply.

Assurance of Confidentiality

The research followed university Institutional Review Board (IRB) procedures to ensure the confidentiality of the students participating on the study. One of the methods I used to ensure confidentiality was to remove the name of the students from the interview answers when transcribing and analyzing the data. Data was coded as student1 interview1; student1 interview2; student1 assignment1 and so on. After giving numbers, each student was also given a pseudonym. The data in the next chapter is presented using their pseudonym. Analyses and reporting of the data followed this participant code described above.

Data Analysis

The naturalistic inquiry negotiates meaning and interpretation with the human sources from which the data have been drawn (Lincoln & Guba, 1985). "Within the naturalistic paradigm, data are not viewed as given by nature, but as stemming from an interaction between the inquirer and the data sources" (Lincoln & Guba, 1985, p. 332). So following the naturalistic paradigm process, the data collected through interviews and document reviews were transcribed, unitized, coded, placed into categories and analyzed using the content analysis method. This method is defined as "any technique for making

inferences by objectively and systematically identifying specified characteristics of messages" (Holsti, 1969, p.14). "The process of data analysis is essentially a synthetic one, in which the constructions that have emerged by inquirer-source interactions are reconstructed into meaningful wholes - data analysis is thus not a matter of data reduction, as is frequently claimed, but of induction" (Lincoln & Guba,1985 p. 333). The constant comparison was the method of choice as it provides an excellent fit for continuous and simultaneous collection and processing of data (Lincoln & Guba, 1985).

The full range themes that emerged started from the selected theoretical framework – the intercultural maturity framework. The three initial themes were: I) Cultural Differences (Cognitive Dimension); II) Knowledge/description of self (Intrapersonal Dimension); and III) Interaction with Different Others (Interpersonal Dimension). Three other themes emerged from the analyses of the data: IV) Barriers to Intercultural Interactions; V) Learning from the Experience; and VI) Student's Definition of Global Engineer. The analysis of the data involved identifying recurring patterns that characterize the data and the findings from which they were derived (Lincoln & Guba, 1985). Besides the six themes described above, eighteen categories and thirty subcategories emerged from this data analyses. The complete list of the categories are listed further down in this chapter on table 3.

The naturalistic study uses inductive data analysis, which "begins not with theories or hypotheses but with the data themselves, from which theoretical categories and relational propositions may be arrived at by inductive reasoning processes" (Lincoln & Guba, 1985 p. 333). This was the data analysis method of choice,

"because it is more likely to identify the multiple realities to be found in the data; because such analysis is more likely to make the investigator-respondent interaction explicit, recognizable, and accountable; because this process is more likely to describe fully the setting and to make decisions about transferability to other settings easier; because inductive data analysis is more likely to identify the mutually shaping influences that interact; and because can be an explicit part of the analytic structure" (Lincoln & Guba, 1985, p. 40).

For this study, the intercultural maturity framework was selected and served as the initial base for the data analyzes. However, I was not locked to the three themes mentioned above. New categories emerged with the data analyzes to help answer the research questions.

As recommended for naturalistic studies, data analysis was carried out in an open-ended way following the steps called in the constant comparative method, where data analyses needs to start after the first set of data is collected (Lincoln & Guba, 1985). As concluded by Lincoln and Guba (1985) "the naturalistic data processing falls toward the inductive-generative-constructive-subjective end of the Goetz LaCompte continuum, and the processing strategies of analytic induction and constant comparison is most appropriate" (Lincoln & Guba,1985 p. 336). This is because it is less extreme and because it makes explicit the continuous and simultaneous nature of data collection and processing (Lincoln & Guba, 1985).

This constant comparison method was described well by Glaser and Strauss (1967) with the purpose of deriving (grounding) theory, not as means for processing data

(Lincoln & Guba, 1985). Lincoln and Guba (1985) adapted their description to the data processing method for the naturalistic inquiry (Lincoln & Guba, 1985). This was the data analyses process used for this study and consists of the four steps described below:

Step 1: Comparing incidents applicable to each category: The first rule of the constant comparative method is that "while coding an incident for a category, compare it with the previous incidents in the same and different groups coded in the same category" (Glaser & Strauss, 1967, p. 106). "Thus the process of constant comparison stimulates thoughts that lead to both descriptive and explanatory categories" (Lincoln & Guba, 1985, p.341). Once the analyst finds conflicts in the researcher thinking the second rule of the constant comparative method applies, which is to "stop coding and write a memo on your ideas" (Glaser & Strauss, 1967, p. 107). The aim of the memo writing is, primarily, to uncover the properties of the category. Knowledge of properties makes it possible to write a rule for the assignment of incidents to categories that will eventually replace tacit judgments of "look-alikeness" or "feel-alikeness" with propositional rule-guided judgments. (Lincoln & Guba, 1985, p. 342).

Step 2: Integrating categories and their properties: begins with a shift from comparing incidents with other incidents classified into the same category to comparing incidents to the primitive versions of the rules (properties) describing the category (Lincoln & Guba, 1985). "The process not only becomes more rule-oriented but at the same time tests the properties; if new incidents fail to exhibit some of the properties, perhaps they ought not to be used to define the category, perhaps a subcategory is needed, or perhaps the category needs to be redefined (Lincoln & Guba, 1985, p. 342). It

is this dynamic working back and forth that ensures that the researcher is converging on some stable and meaningful category set (Lincoln & Guba, 1985)

Step 3: Delimiting the (theory) construction: The word "theory" should be substitute for "construction" since this is not a theory study, but data analyses stage (Lincoln & Guba, Naturalistic Inquiry, 1985). "Delimiting begins to occur at the level of the theory or construction, because fewer and fewer modifications will be required as more and more data are processed" (Lincoln & Guba, 1985, p.343). The inquirer begins to realize both meaning and scope in his or her formulation (Lincoln & Guba, 1985). As delimiting occurs, the original list of categories will be reducible in size because of improved articulation and integration; options need no longer be held open, at the same time the categories become saturated (Lincoln & Guba, 1985, p. 343).

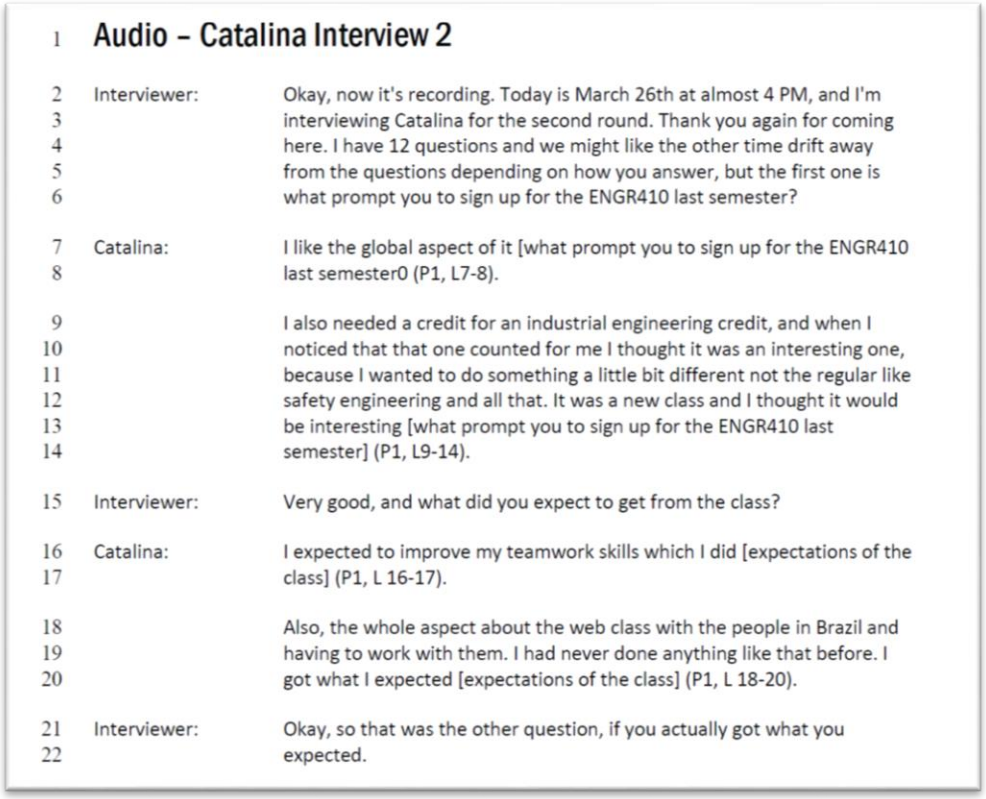
Step 4: Writing the (theory) construction: The construction of this study, as described in the constant comparative method, was written in case study format because it provides to the reader a high level of details of what the report deals with (Lincoln & Guba, 1985). In addition "it builds on the reader tacit knowledge, provides a "thick description" necessary for the judgment of transferability, and it provides grounded assessment of the context, among others" (Lincoln & Guba, 1985, p. 359).

Unitizing Data

One of the first steps, not mentioned above but very important to be described is the unitizing of the data. This process should take place once data is collected. Unitizing the data is where the data is divided in "units of information that will, sooner or later, serve as the basis for defining categories" (Lincoln & Guba, 1985, p. 344). "These units

are found within observational and interview notes, documents and records, notations about unobtrusive informational residues or nonverbal cues, and the like" (Lincoln & Guba, 1985, p. 346).

After transcribing each interview into a Microsoft Word document, I revised each transcript one more time by listening to the audio recording and making any needed change to the transcript. After that, it was time to unitize each interview transcript. I added a line number to the document, and started unitizing. After each unit, I added the page number and the line number in parentheses and "pressed enter" so each unit would be separated by a line, like this on the sample below.



Audio – Catalina Interview 2

Interviewer: Okay, now it's recording. Today is March 26th at almost 4 PM, and I'm interviewing Catalina for the second round. Thank you again for coming here. I have 12 questions and we might like the other time drift away from the questions depending on how you answer, but the first one is what prompt you to sign up for the ENGR410 last semester?

Catalina: I like the global aspect of it [what prompt you to sign up for the ENGR410 last semester0 (P1, L7-8).

I also needed a credit for an industrial engineering credit, and when I noticed that that one counted for me I thought it was an interesting one, because I wanted to do something a little bit different not the regular like safety engineering and all that. It was a new class and I thought it would be interesting [what prompt you to sign up for the ENGR410 last semester] (P1, L9-14).

Interviewer: Very good, and what did you expect to get from the class?

Catalina: I expected to improve my teamwork skills which I did [expectations of the class] (P1, L 16-17).

Also, the whole aspect about the web class with the people in Brazil and having to work with them. I had never done anything like that before. I got what I expected [expectations of the class] (P1, L 18-20).

Interviewer: Okay, so that was the other question, if you actually got what you expected.

Figure 4. Example of Unitizing the Data in Interview Transcript

For Lincoln & Guba (1985) a unit should have two characteristics. “First, it should be heuristic that is, aimed at some understanding or some action that the inquirer needs to have or to take. Second, it must be the smallest piece of information about something that can stand by itself” (Lincoln & Guba, 1985, p. 345). Data from the interviews were transcribed and unitized in a word document following the characteristics described above.

Coding

Having located a unit, the analyst enters it onto an index card; each index card should be coded (Lincoln & Guba, 1985). For that, I followed the video developed by Dr. Mercer on developing and printing unit cards. First, I converted the text into a Microsoft Word Document table. This way each unit was inside a cell. On the table, following the instructions on Dr. Mercer’s video, I added a row on top to add the labels: code (Student X, Interview X), card number and unit (Mercer, 2014).

After that, I added one more step that was not described in the video, I created a Microsoft Excel file by copying the table from the Microsoft Word Document into a Microsoft Excel document. I did that because the Microsoft Excel allowed me to add the card number just by dragging the numbers down, while in word I would have to add each card number manually. When you have 100 or more cards per interview and 16 interviews, this helps a lot. I saved the Microsoft Excel file, and continued to follow the instructions in Dr. Mercer’s video and opened a new word document. On page layout, I sized the page to be a 6x4 inches card, set the margins to a narrow margin line, so more information would fit in each card in case needed (Mercer, 2014).

With the card word document opened, I continued to follow the instructions on Dr. Mercer's video and went to the "mailings" tab of word document and clicked on "select recipients" – "select existing list" and opened the excel file I had just developed. Then I clicked on "insert merge files" and selected all of the items in there, which were: code, card number and unit. After that, on the card, I organized the layout of the card putting the unit one line below the code and card number and separated the code from the card number, putting the card number all the way to the right. Back on the "mailings tab" I clicked "finish & merge" and "edit individual document" this allowed me to see the cards and save the cards file before printing (Mercer, 2014). Figure 5 below shows a data card picked at random. The code in Figure 5 indicates that this is card number 17, taken from interview 1 with student 7. That unit was on Page 3 of the transcription between line 79 and 82.

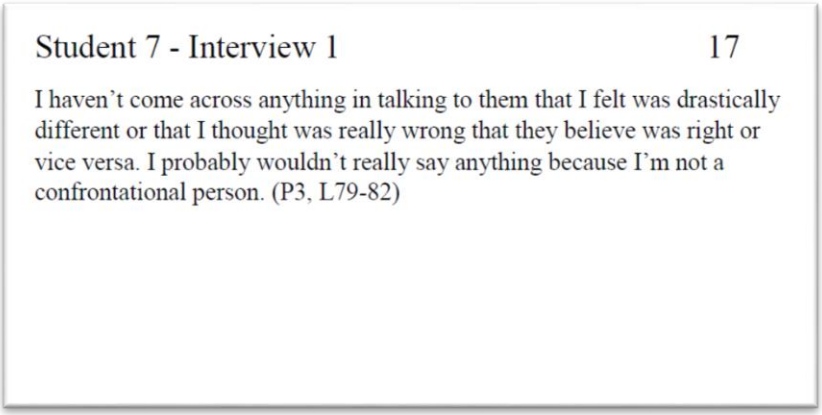


Figure 5. Example of a Unit Card

The information that is part of the unit cards include:

- Student Number: Student 7
- Interview number: Interview 1
- Card number: 17
- Unit: Data from Page 3, L (line 79 to 82)

To support the data analyses process and make it more visual, I color-coded the cards when printing them. The colors used are listed below:

White cards: Latin Students – There were four Latin students. Two male and two female students. Those were students who were born in Latin America and moved to the United States at some point either with their families or to study.

Green cards: Nontraditional student – One male student. This student is older than the regular college student is. He is married with three kids and was in the military and worked before starting his college education. Texas A&M defines the non-traditional student as anyone whose over the age of 25, married or partnered, having dependents, who served in a branch of the Armed Forces, is financially independent, who works full-time, who is enrolled part-time (Texas A&M University, 2016)

Yellow cards: Hispanic student – One male student. This student was not included in the Latin group because even though his family is of Mexican origin, he was born and raised in the United States.

Orange cards: American Students – Two Caucasian male students, born and raised in the United Stated who had never traveled abroad before the ENGR 410 course.

Pink cards: Categories – the categories created were printed in pink cards and are listed in the section below

Categorization and Discovering Patterns

Using the constant comparative data analysis method described above, I followed the steps described by Gonzalez y Gonzalez (2005) to develop the categories of this study. "The researcher selected the first index card, studied it, and placed it into a pile to be created using cards with similar data, thus forming categories. Then, the researcher selected the second card, studied it and if it contained similar relevant information placed it with the first card, or started a new stack if the relevant information differed. Eventually, each card was analyzed so that piles of similar information are created under different categories." (Gonzalez y Gonzalez, 2004, p 53).

Continuing with the process, "miscellaneous cards that did not appear related to any category were put in a separate stack. Each category set was reviewed until all cards were used. During this step, the miscellaneous cards were categorized, set aside or, discarded if irrelevant. Finally, categories were compared so that possible patterns could be found, and themes could emerge" (Gonzalez y Gonzalez, 2004, p 53).

The categories evolved and changed names several times during the process of data analyses. Even though the development of the rules for each category was done "post facto" as the data was being analyzed, the process was systematic. This is because the inclusion or exclusion of content was done according to consistently applied rules, and at the end, all of the data was processed according to the same final version of the

rules (Lincoln & Guba, 1985). The final list of eighteen categories are described below and contains the rules used to include or eliminate the cards into those categories.

Category 1 - Previous cultural experiences (before ENGR 410 class): Students description of their cultural, international or global experiences and activities before the course.

Category 2 - Ability to see cultural differences: Student description of cultural differences, or lack of it, when describing their experiences in the course or in life.

Category 3 - Attitude towards cultural differences: Students description of how they accept cultural differences

Category 4 - Interest in learning about cultural differences: Students description of their desire, or lack of it, to learn more about other cultures. As well as seeing, or not seeing, the importance of it for life and for engineering.

Category 5 - Cultural knowledge learned during class: Students' description or my interpretation of what students gained from the class in regards to cultural differences.

Category 6 - Impact of cultural differences in engineering problem definition: Students description of whether the background of the person can influence how they see engineering problems.

Category 7 - Relation between student's background and experience to knowledge of own cultural values before the course: How students described their cultural values in relation to their background.

Category 8 - Impact of class in knowledge of won cultural values: Students' description or my interpretation of what students gained from the class in regards to their own cultural values.

Category 9 - Interaction with society: Students' description of their general interaction with society.

Category 10 - Interactions classmates during the class: Students' description of the interaction with their classmates.

Category 11 - Learning about teamwork/interaction from the class: Students' description or my interpretation of what students gained from the class in regards to teamwork and interacting with different others.

Category 12 - Time: Students comments in relation to time difference and their notion of time when working in binational teams.

Category 13 - Communication: Students' description or my interpretation of their ability to communicate with people from different cultural background and language.

Category 14 - Virtual environment: Students' description or my interpretation of their ability to interact and work on a virtual environment. Included comments from the students in regards to working in virtual binational teams and or the virtual component of the course.

Category 15 - Realizing the engineering industry today is globally interconnected: Students comments related to engineering industry today.

Category 16 - Clear communication learning: Students description of their learning from the course that were related to communication.

Category 17 - Be well prepared for the group meetings: Students description of their learning from the course that were related preparedness to work in teams.

Category 18 - Global Engineering from Student's perspective: Students perspective of global engineering, or themselves seen as global engineers.

Identifying Themes

Based on the analysis of the data, the categories that emerged, the discussion with the peer de-briefer, and the research memos, I identified six themes. The research memos were important in the identification of the themes and included methodological procedures; description of the context; observations from the data being analyzed; thoughts about the theoretical framework, and descriptions of the participants among others. Below I list and describe the six themes identified in this study.

Theme I - Cultural Differences (Cognitive Dimension). One of the first aspects of being able to interact effectively with people from different cultures and to work well in a diverse environment is to recognize and understand cultural differences, as well as respect and appreciate those differences. This is described as the cognitive dimension of the intercultural maturity framework. The categories that emerged that were related to cultural differences were place under this theme. Those included: previous cultural experiences (before ENGR 410 class); ability to see cultural differences; attitude towards cultural differences, interest in learning about cultural differences; cultural knowledge learned during class; and impact of cultural differences in engineering problem definition.

Theme II - Knowledge/Description of Self (Intrapersonal Dimension).

Understand student's identity including ways they use their values and beliefs to make life choices and decisions and how they view and interpret their social identities based on factors such as race, ethnicity, class, sexual orientation, and religious affiliation (King & Baxter Magolda, 2005). This means that to be able to identify, respect, and appreciate cultural differences, it is important for students to also know their own culture and to feel confident about who they are. This allows students not only to identify what is different from them, but also to interact with different others without losing their identity. The categories that emerged that were related to knowledge of self were place under this theme. Those included: Relation between student's background to knowledge of own cultural values before the course, and impact of class in knowledge of won cultural values.

Theme III - Interaction with Different Others (Interpersonal Dimension).

The ability to interact effectively and interdependently with others different from one (King & Baxter Magolda, 2005). In particular, this draws on the mature capacity to construct and engage in relationships with others in ways that show respect for and understanding of the other's perspectives, values and experiences, but that are also true to one's own beliefs and values (King & Baxter Magolda, 2005). The categories that emerged that were related to interaction with different others were place under this theme. Those included: Interaction with society; interactions classmates during the class; learning about teamwork/interaction from the class.

Theme IV - Barriers to Intercultural Interactions. Students recognized some of the barriers they faced when trying to work with people from a different country in a virtual environment. The students described them often as frustrations and I am calling them barriers to a more effective interaction with the group. The categories that emerged that were related to those barriers others were place under this theme. Those included Time; communication; and virtual environment.

Theme V - Additional Learning from the Experience. There was other important learning, beyond the three research questions, that were worth mentioning in this study. The categories related to the additional learning from the experience is mentioned under this theme. Those include realizing the engineering industry today is globally interconnected; clear communication learning; and being well prepared for the group meetings

Theme VI - Student's Definition of Global Engineer. The final theme only has one category which is the student's view and understanding about global engineers. Table 3 outlines the themes, and categories identified during the data analyses.

Table 3. Themes, Categories and Subcategories

Theme I	**Cultural Differences (Cognitive Dimension)**
	Previous cultural experiences (before ENGR 410 class)
	Ability to see cultural differences
	Lack of ability to see cultural differences
	Able to see cultural difference
	Attitude towards cultural differences
	Positive attitude
	Negative
	Interest in learning about cultural differences
	Seeing the importance of it for life and for engineering and the desire to learn more about it

Table 3. Continued

Theme I	**Cultural Differences (Cognitive Dimension)**
	Cultural knowledge learned during class
	From class assignments
	From working on the project in bi-national teams
	Impact of cultural differences in engineering problem definition
Theme II	**Knowledge/Description of Self (Intrapersonal Dimension)**
	Relation between student's background to knowledge of own cultural values before the course
	Family background
	General background
	Age/school year
	Impact of class in knowledge of won cultural values
	Increased knowledge about themselves
	Improved their self-confidence and comfort level for socialization via the course
Theme III	**Interaction with Different Others (Interpersonal Dimension)**
	Interaction with society
	Interactions classmates during the class
	Two sides: Brazil x USA
	Changing teams
	Frustrations: power distance and communication
	Multidisciplinary
	Learning about teamwork/interaction from the class
	More interaction with teammates
	Tolerance and patience
	Better communication
Theme IV	**Barriers to Intercultural Interactions**
	Time
	Time difference
	Time crunch - Tight deadlines and notion of time
	Communication
	Communication style: The ability to communicate with people from different cultural background
	Cultural differences
	Language
	Virtual environment
	Text messaging was added to the communication means to facilitate
Theme V	**Additional Learning from the Experience**
	Realizing the engineering industry today is globally interconnected
	Clear communication learning
	Do not assume what the other person is trying to say
	To better understand the project a
	To working better within their groups

Table 3. Continued

Theme V	**Additional Learning from the Experience**
	Be well prepared for the group meetings
	Get equipment for virtual collaboration ready early
	Research more about the project early on
Theme VI	**Student's Definition of Global Engineer**
	Global engineering from student's perspective

Ensuring Trustworthiness

The naturalist must be concerned with trustworthiness and the planning for it should start at the design phase (Lincoln & Guba, 1985). Some of the tools used to ensure trustworthiness in this study, were activities described by Lincoln and Guba (1985) such as: maintaining field journals, audio recording the interviews, triangulating of data, and doing debriefings. These activities are directed to increasing the probability of trustworthiness and making it possible to assess the degree of trustworthiness after the fact was done during this process (Lincoln & Guba, 1985). Below I described the tools used to achieve credibility, transferability, dependability and confirmability (Lincoln & Guba, 1985) in this study.

Credibility. "Credibility corresponds to the positivistic notion of internal validity, assessing the "truth value" of an inquiry" (Gonzalez y Gonzalez, Lincoln, & Paprock, 2005, p. 62). Lincoln and Guba (1985) suggest five techniques to ensure the credibility of the study: 1) activities to make finding and interpretations more credible such as prolonged engagement, persistent observation, and triangulation. 2) Activities that provide an internal check such as peer debriefing. 3) Activities that refine the

working hypothesis such as negative case analyses. 4) Activities that make possible to check preliminary findings such as referral adequacy. And 5) activities to check finding and interpretation with the human source such as member checking (Lincoln & Guba, 1985, p301). During this study, I used several of these techniques described above.

First, I conducted prolonged interviews and became acquainted with the field to increase the probability of producing credible findings. There were two rounds of interviews, the first round of interviews lasted for about an hour with each student and the second round of interviews for about 30 minutes with each student. For accuracy, the interviews were audio recorded and kept during the study. In times of doubt, the original source was checked. Although observation was not one of the data collection tools used for this study, I participated in the class throughout the semester to be acquainted with the participants and the context that students were as the experience unfolded. "Becoming a participant observer before the study is actually undertaken, not only helps to diminish the obtrusiveness of the investigator, but also provides a baseline of cultural accommodation and informational orientations that will be invaluable in increasing both the effectiveness and the efficiency of the formal work" (Lincoln & Guba, 1985, p. 251).

Second, I kept a reflexive journal describing in detail my experiences during this research project and made reference to it as the study unfolded. Third, the member check technique was used. At the end of each interview the interview, question and answers were orally summarized for confirmation of the interviewee. Also after is each interview was transcribed, it was shared with interviewee to confirm information was collected and interpreted correctly according to the point of view of the respondent.

Fourth, peer debriefing technique was used. The peer debriefing should be done by "someone who knows a great deal about both the substantive area of the inquiry and the methodological issues" (Lincoln & Guba, 1985, p. 308). The professor teaching the class was the de-briefer for this study. Two long meetings happened with the de-briefer, one after each set of interviews. Finally, I did triangulation of the interview data with the reports students did for the class. According to Lincoln and Guba (1985), "triangulation of data is crucially important in naturalistic study. As the study unfolds and particular pieces of information come to light, steps should be taken to validate each against at least one other source (Lincoln & Guba, 1985, p 283).

Transferability. Transferability for the naturalistic inquiry is very different from positivistic notion. "The naturalistic cannot specify the external validity (generalizability) of an inquiry; he or she can provide only the thick description necessary to enable someone interested in making a transfer to reach a conclusion about whether transfer can be contemplated as a possibility (Lincoln & Guba, 1985, p 316)". For that, I provided a thick description of the context of the study, the participants, the methods and methodology used, as well as information about my background, believes and bias. Within this and the next two chapters, these thick descriptions can be found so the transfer possibility can be determined by the reader.

Dependability. "There is no credibility without dependability, thus a demonstration of the former is sufficient to establish the latter" (Lincoln & Guba, 1985, p 316). The five activities described above under the credibility section should be referred for how dependability was achieved in this study.

Confirmability. Confirmability corresponds to the positivistic notion of objectivity and it helps assure that data, interpretations, and findings are grounded in the context from which they came (Lincoln & Guba, 1985 in Gonzalez y Gonzalez, 2004). The emphasis of objectivity in naturalistic study is on the data and not on the investigator (Lincoln & Guba, 1985). To ensure confirmability the interviews were audio recorded and notes were taken through the study and kept for the duration of the study. The note included a reflexive journal, research memos and interview notes. I went back to my notes and audio-recordings several times during the study to ensure it interpretations were grounded in the context from which they came.

Working Hypotheses

"Working hypotheses exist in seminal form before the research process begins and continues to take shape through the completion of the study" (Erlandson, Harris, Skipper, & Allen, 1993, p. 59 in Gonzalez y Gonzalez, Lincoln, & Paprock, 2005). Some of the working hypothesis the researcher had before the study and as the study unfolded were:

- Engineering students are not aware of how global experiences and global competency will affect their careers.
- Engineering students are not aware of their own culture and generalize engineers anywhere in the world as the same.
- Engineering students are able to elaborate on the importance of their hard skills but not so much on their soft-skills.

- The combination of the class components (lectures and exercises on cultural concepts together with work in binational team in a real-life engineering project) would increase students' intercultural maturity and make them engineers who are better prepared for the global market.

In the next two chapters, I present the data analyses and the results of the study in regards to the intercultural maturity level, as determined by the Intercultural Maturity Framework (King & Baxter Magolda, 2005), of students in the college of engineering when exposed to intercultural concepts in relation to cognitive, intrapersonal and interpersonal development.

CHAPTER IV

DATA ANALYSIS AND RESULTS

In chapter IV, I present the results from this study. After presenting a thick description of the context of the study and each of the eight participants, I present the results of the data analyzes. Six central themes emerged from the data analyses to identify the intercultural maturity level of students in the college of engineering and to understand how those students came to understand cultural differences through the ENGR410 Global Engineering Design Class. The six themes - 1) Cultural Differences; 2) Description of Self; 3) Interactions with Different Others; 4) Barriers to Intercultural Interactions; 5) Learning from the Experience; and 6) Student's Definition of Global Engineer - are supported by the categories that emerged by analyzing the interview answers of the students after taking the ENGR410 Global Engineering Design course and the students' class assignments.

Context of the Study

This study of students in the College of Engineering at Texas A&M took place in the context of the ENGR 410 Global Engineering Design course piloted during the Fall 2014 semester. The study aimed to identify students' intercultural maturity level as determined by the Intercultural Maturity Framework (King & Baxter Magolda, 2005) when exposed to intercultural concepts in relation to cognitive, intrapersonal and interpersonal development.

Context is an important component of this qualitative study. Understanding the ENGR410 course in which students participated before partaking on the study will

influence the interpretation of the data and therefore the results of the study. During the two interviews, participants expressed their ideas, perceptions, and interpretations of global competency, based on the context of the ENGR410 course and their previous life experiences, which shaped how they view the world. Jarvis (1987) stated the fact that "learning always occurs within a social context and that the learner is also to some extent a social construct" (Jarvis, 1987 p.15 in Gonzalez y Gonzalez, 2005). In this study I would like to understand the context of the course in impacting the intercultural maturity development of the students.

The ENGR 410 Global Engineering Design Class

During the Fall 2014 semester the College of Engineering piloted a new course called ENGR410 Global Engineering Design. The course was jointly taught with a University of Rio de Janeiro (UFRJ) in Brazil. Eight Texas A&M students from several engineering departments and seven UFRJ students from their mechanical engineering department were enrolled in the course. The course was taught by a faculty leader from Texas A&M and a co-faculty member from UFRJ. Students from Texas A&M and from UFRJ were part of exact the same course. Students from UFRJ were granted access to e-campus, the teaching platform used by Texas A&M, and had access to all of the assignments, lectures and were part of the same industry project. The faculty members taught the course with three learning objectives:

1) To implement a real engineering project for a company: The engineering project was provided by a multinational company in the oil industry. The faculty members provided guidance as students worked on binational teams to complete the

project. At the end of the semester, the students presented the results to the company. There were two people from the company who contributed to the project, an engineer and a liaison from the human resources department.

2) To work within the virtual environment: The course was conducted jointly with UFRJ using videoconferencing tools. Students never traveled abroad for this course and only met virtually. For the class meetings the Blackboard Collaborate tool (videoconference within the e-campus system) was used. For student group meetings, students used a variety of tools such as google hangout (free of cost videoconference within google), WhatsApp text messaging (free of cost international text messaging app on smart phones), and Skype (free of cost videoconference tool). The faculty members provided information about those tools and gave class assignments to allow students to practice using those tools.

3) To work effectively with people from a different country: The faculty leader at Texas A&M teaching the ENGR410 course provided lectures on intercultural concepts, which included videos, articles, and exercises on cultural differences, intercultural communication and working with people from different backgrounds. The objective was that the students would use the learning from the intercultural assignments to work better in the binational teams and therefore be more effective in the project.

One working hypothesis for the class was that the combination of these components would increase students' intercultural maturity and make them engineers who are better prepared for the global market. An important aspect of this course is that it is integrated into the engineering curriculum. A common issue with global competency

courses is that they add extra courses to the students' curriculum. Therefore, demanding additional time and effort from the students who wish to develop those global competency skills. The ENGR410 course is part of the engineering degree plan counting as a technical elective. In addition, this course also part of the international engineering certificate in the College, and is the first engineering course, not being taught abroad, to count as ICD (International Culture and Diversity) credit, a core curriculum requirement for all students of Texas A&M. Attachment B present the course syllabus.

Methodology Summary

This study began in December 2014 with a non-probabilistic purposeful sampling of the students taking the Fall 2014 ENGR410 class. The eight students enrolled in the class were invited to participate in the study and all of them accepted. A naturalistic inquiry approach was taken with the main source of data being individual interviews with the participants. To collect the data for this study, I attended the pilot class, analyzed the students' course assignments, and did two interviews with each of the eight students enrolled in the course. After each interview, I wrote a description of the person interviewed and a general impression of the experience. Those notes included details about the people, their background, their family background, their previous cultural experiences and other ethnographic descriptions.

Data collected through interviews, and document reviews were analyzed using the content analysis method, which is defined as "any technique for making inferences by objectively and systematically identifying specified characteristics of messages" (Holsti, 1969, p.14). The data collected from the interviews were transcribed, unitized,

coded, analyzed, placed into categories and analyzed again. Data unit cards were created to analyze the data. Each card was labeled and included the participant's number, interview number (whether interview 1 or interview 2), the number of the unit card and the page and line of the unit in the transcription. This allowed the researcher to find the unit in the transcription very easily when needed.

The analysis of the data involved identifying recurring patterns that characterized the data and the findings from which they were derived (Lincoln & Guba, 1985). The results presented in this chapter include detailed information of the interviewees and selected quotes from their interviews and course assignments to facilitate and illustrate the understanding of the data and allow the reader to see true responses.

Participants

Interviews were conducted with the eight students who enrolled in the pilot of the ENGR 410 Global Engineering Design course. Each student was interviewed twice. The first round of interviews took place in December 2014 and lasted for about an hour with each student. The second round of interviews took place in March/April 2015 and lasted about 30 to 40 minutes with each student. Besides questions related to their intercultural maturity, demographic data was also collected. This included age, gender, family income and year in school - this information is presented in table 4.

To keep the confidentiality of the participants, their names were removed from the data and participants were coded with numbers (students 1 to 8) and given a pseudonym. Of the eight participants in the study, six were male and two were female. Based on their background, they were divided into four groups.

Latin: Four students, two male and two female. They were born and raised in Latin America and moved to the United States later in their lives with their families or by themselves to pursue their college education.

American: Two male students. They were born and raised in the United States and had not traveled abroad before or during the time enrolled in the ENGR 410 course.

Non-traditional: One male student, who is older than the average college student, is married and has three children. He was in the Navy for six years and worked before starting his degree in nuclear engineering.

Hispanic-American: One male student, born and raised in the United States. Both of his parents are from Mexico and came to the United States to provide a better opportunity for the family.

Table 4. Participants Demographics

Participant Information											
Pseudonym	Student	Participant Category	Age	Gender	Major	Classification*	Traveled Abroad	Studied Abroad	Nationality	Family income	Marital Status
Juan	1	Latin	24	Male	Mechanical Eng.	Junior	Yes	Yes	Colombia	Above 100,000	Single
Paola	2	Latin	22	Female	Mechanical Eng.	Junior	Yes	Yes	Mexico / United States	Above 100,000	Single
Valentina	3	Latin	21	Female	Industrial and Systems Eng.	Senior	Yes	No	Colombia / United States	Above 100,000	Single
Carlos	4	Latin	22	Male	Industrial and Systems Eng.	Senior	Yes	Yes	Costa Rica / Nicaragua Spain / United States	Above 100,000	Single
Pablo	5	Hispanic-American	23	Male	Aerospace Eng.	Senior	Yes	Yes	United States	$0 to $16,000	Single
William	6	Non-traditional	N/A**	Male	Nuclear Eng.	Senior	Yes	Yes	United States	Above 100,000	Married
Jacob	7	American	N/A**	Male	Petroleum Eng.	Junior	No	No	United States	Above 100,000	Single
Nathan	8	American	23	Male	Petroleum Eng.	Senior	No	No	United States	Above 100,000	Single

** Classification when the student took the course*

*** Student did not respond the age question*

Table 4 shows the demographic detail of each student including their pseudonym, age (when taking the ENGR410 course), gender, major, year in school (when taking the ENGR410 course), nationality, family income, marital status and whether or not they have traveled abroad before. After presenting the table, below I describe each of the participants in great detail.

It is important to know and understand the background of each participant because this study aimed to identify the intercultural maturity level, as determined by the Intercultural Maturity Framework (King & Baxter Magolda, 2005), of students in the college of engineering when exposed to intercultural concepts in relation to cognitive, intrapersonal and interpersonal development. According to Bennett (1993) intercultural sensitivity is not some innate characteristic, but a learned ability (Bennett, 1993). So knowing the previous life experiences and background of each participant will help us understand how students got to where they are on their intercultural maturity level.

Juan (Student 1 - Latin Group). Male. Born in Bogota, Colombia in 1990. While in Colombia studied in a private bilingual school. He describes his family as being a middle class family. Both parents earned bachelor degrees and worked. He has a twin brother and a younger brother, who he describes as being more Americanized and speaking Spanish with an American accent. He moved to the United States when he was 7 years old with family because his father was transferred from Colombia to the United States with his job. His mom left her job to move to Houston with the family. He describes living in the United States as "it was a good experience, because we were still young, so we adapted really fast (P1, L15-15)". However, he also says that the first 6

months in the United State were tough. “(in school) ... I was just not used to the system and I was doing my own thing and wasn’t following instructions (P2, L 65-67)”.

While living in the United States, his family spoke Spanish at home not to lose that part of the Colombian culture. He also said that it was a good to get out of Colombia because at that time there was many problems with the “Guerrilla” (drug related gangs). After 6 years in the United States, Juan and his family moved back to Colombia for two years and then moved back to the United States. After graduating from high school, Juan was admitted to the mechanical engineering program at Texas A&M and he was a junior in mechanical engineering when he enrolled in the ENGR410 course.

While at Texas A&M, Juan participated in a faculty led study-abroad course in Brazil. Ethics in Engineering was the course taught in Brazil. He has traveled outside of the United States extensively on family vacations “I have gone well to Mexico. Back to Colombia. Around the States. I went to Eastern Europe two summers ago. I just traveled to nine different countries. That was pretty much it (P16, L570-572)”.

Paola (Student 2 - Latin Group). Female. Born in San Luis, Mexico and moved to Mexico City, as a baby. Both of her parents are from Mexico. She lived in Mexico City until she was 17 years old when she moved to the United States with her mom and stepfather. Her parents got divorced when she was 4 years old. She has an older sister and they lived with her mother and visited the father on the weekends. While in Mexico, she studied in all-girls private bilingual (English/Spanish) Catholic school. Her father and her older sister still live in Mexico. Her mom married an American man who was in

Mexico for a work related project. Once the project finished he moved back to Houston and Paola and her mom moved to Houston with him.

After moving to the United States, Paola went to a public high school in Katy, Texas and most of her friends were of Latin origin. She described her first year in the United States being very difficult - "I wanted to go back [to Mexico] and my mom told me - If you're that sad and if you really want to go back after graduating high school, it's up to you. I would support you in that. But then when I graduated, I was completely sure I wanted to stay because It's a different life [in Mexico than in the US] so I decided to stay and I'm glad I did (P3, L83-84)." Paola is now a United States citizen.

When Paola finished high school, she was accepted into the Mechanical Engineering program at Texas A&M. While at Texas A&M, Paola participated in the Ethics in Engineering study-abroad program in Brazil. She has lived in Mexico and visited Colombia. She traveled inside and outside the United States extensively on family vacations. She has been to Spain, Germany, Finland, UK, Denmark, and Belgium. She has also visited Russia and Estonia. She was a junior in mechanical engineering when she enrolled in the course being studied.

Valentina (Student 3 - Latin Group). Female. Born in Bogota, Colombia. Moved to Miami, Florida with her mom and stepfather when she was eight years old. For Valentina the transition from Colombia to Miami was difficult at first because despite attending a bilingual (English/Spanish) school in Colombia, she was only in first grade and therefore did not know English. After learning English, she was able to make friends and adapt to the new life.

While in Miami, Valentina attended a public school. She lived in Miami until she was fifteen years old when her family moved to Houston, Texas. According to her, the transition from Miami to Texas was hard because in Miami she was starting to go on dates and had her first boyfriend. In Houston, Valentina attended a public school in the Spring area. She had difficulties making friends and integrating to the school, so her mom suggested she join the school's IB program (International Baccalaureate program where high school students pursue college-level studies while still in high school). After joining the IB program, she became integrated into the school. She finished high school in the top 10% of her class and with that was accepted into A&M directly.

Valentina's mom is her role model. Her parents got divorced when she was two or three and later her mom got remarried. She says she has a very strong bond with her mom and that her mom is her best friend. She does not have the same bond with her father. Valentina has traveled outside the United States extensively on family vacations including, Europe after high school graduation, Colombia and several locations in the United States and the Caribbean. In Europe she went to London, Paris, and all throughout Italy - Venice, Florence, Pisa, and Rome. When she took the course, she was a senior in industrial and systems engineering.

Carlos (Student 4 - Latin Group). Male. He was born in Costa Rica and moved to Nicaragua after few weeks of life. He was raised in Nicaragua and lived there until the time he moved to the United States to pursue his undergraduate education. He has one older sister. He has several citizenships: Costa Rica, Nicaragua, Spain and United States. After finishing high school in Nicaragua, he moved to the United States to attend

college. In Nicaragua, he went to an American bilingual school. He attended the same school from kindergarten to high school and describes his school as a small school of about 1,000 students. The American school in Nicaragua is where employees of the embassies of United States and Europe enroll their children. With that, his friends from the American school are from all over the world and they continue to be in touch with each other after graduation.

His father is from Nicaragua and his mother from Cuba. Both parents completed their bachelors degrees in the United States. His father has a bachelors degree from Georgia Tech and has his own business, mostly related to agriculture. Carlos moved from Nicaragua to the United States to attend St. Mary's University in San Antonio as an industrial engineering student. He got good grades during his first semester St. Mary's University and asked his parents to transfer to a better university. His father wanted him to go to Georgia Tech, but he wanted to stay in the South region of the United States. After visiting Texas A&M for a friend's ring dunking ceremony, he decided this was the university he would like to attend. He arrived at Texas A&M as a sophomore student and with that, it was a little hard to make friends. Today he has many friends at Texas A&M, mostly of Latin origin.

He has traveled outside the United States extensively on family vacations, including several places in Central America and Europe. He has been to China on business with his father. When he was enrolled in the ENGR410 course, he was a senior in industrial and systems engineering major. During the first interview, he was much more engaged and talkative than in the second interview. When the first interview took

place, he had just finished his last final of the semester and was getting ready for the December break. During the second interview, he was more distant and gave shorter answers; he wanted to be finished with the interview.

He made an interesting comment when describing the people at his school that is worth adding here because it shows how he sees the people from the different nationalities, "[in the American school] I can say maybe it is like 90%-10% or 80%-10% being 80 Nicaraguan and American, **or like normal**. And then foreigners Chinese and Europeans like 20%. Not much but significant (P2, 33-35)." This quote has two significant meaning for the study, first it shows that this students has interacted with people from other parts of the world since he was in kindergarten. Second, his view about different people where he considers Nicaraguans and Americans to be more like him and Europeans and Asian to be different from him, the foreigners.

Pablo (Student 5 - Hispanic-American Group). Male. He was born in Brownsville, Texas, and moved to Laredo and then to San Antonio with his family. Both parents are from Mexico. He has one brother and two sisters. He refers to his family as "It was a big family, not your ordinary American family (P1, L7)". The family first lived in a small apartment, then moved to a better apartment and eventually were able to buy a house. He studied in a public 5A school in San Antonio, where he played on the football team. Besides his friends from the football team and the school in general, he also had friends from the Christian fellowship.

After graduating from high school, he was accepted into the aerospace engineering program at Texas A&M. While at Texas A&M he participated in two study-

abroad programs of the college of engineering. The first one was a faculty led program to Brazil for 6 weeks. The second study-abroad experience was a direct enrollment at the University of São Paulo in the city of São Carlos, in Brazil, for a full academic year. While in Brazil, he traveled around the country to visit different places. Pablo has also been to Mexico where he visited the border area and Mexico City. During the time of the class, he was a senior student in aerospace engineering.

William (Student 6 - Non-Traditional Group). Male. He was born in the United States and was raised by a single mom. He is Jewish, grew up in Houston, and graduated from Stratford High School, in 1995. After high school, he was accepted into the chemical engineering department at Texas A&M with academics and athletics (football and baseball) scholarships. During the spring semester of 1997, he had an injury, which ended his athletic career. He withdrew from the university and joined the Navy where he spent six years as a nuclear machinist. He is married and has three kids.

He left the Navy to have a different lifestyle and spend more time with his family. After he left the Navy he started working for Budweiser as a sales representative in Orlando, Florida. During the 2008 United States economic crisis, he left Budweiser and decided to finish his education. He started taking classes at Blinn College and then was admitted to the nuclear engineering department at Texas A&M. He was a senior when he enrolled in the ENGR 410 course, he graduated in May 2015 and is now pursing his PhD degree also in nuclear engineering at Texas A&M.

William traveled abroad extensively during his time in the navy. He visited 67 different countries, some of them several times, but was never in a country for more than

five days. Some of the countries visited included Italy, Turkey, Greece, Australia and the United Arab Emirates. He also participated on a faculty led study-abroad to China.

Jacob (Student 7 - American Group). Male. He was born and raised in San Antonio, Texas. Both parents are Americans and he has two older brothers. His mother studied at TCU and his father at Baylor. He attended the Winston Churchill High School, which is a large public school in San Antonio. Most of his friends in high school were from Texas, and as he said, "just like him". Once in college, he was exposed to a more diverse environment, and he made friends who came from different backgrounds than him and from other countries.

He never traveled outside the United States before the ENGR410 course. By being in the ENGR410 course, he learned about opportunities the college offers for students to study-abroad and the summer following the ENGR 410 class he did a research internship in Malaysia for eight weeks. During the time of the class he was a junior student in the petroleum engineering department.

Nathan (Student 8 - American). Nathan dropped the class halfway through the semester. Male. He was born and raised in Houston. He moved to Illinois when he was in 6th grade. Both parents are Americans and he is the oldest of two brothers. His mother is an accountant but decided to be a stay-at- home mom when her three sons were growing up. His father is a lawyer. During his K-12 school years, all of his friends were from the United States and lived in the same neighborhood, but he describes them as all being different. While in school, he was in a band, played football during his freshman and sophomore years and gave guitar lessons during the last two years of high school.

Nathan moved back to Texas to attend Texas A&M as a petroleum engineering student. He was a senior when he took the class and graduated in December 2014. Currently he is working in Austin. He did not need the class to graduate and decided not to take part in the final project phase of the class.

In terms of previous cultural experiences, Nathan has not traveled abroad, and said that he regrets not studying abroad before his senior year. His cultural experiences were in the United States interacting with international students. His first experience was with an exchange student from Brazil who his parents hosted for 1 year, through the Rotary Club. The exchange student was the only international student at his high school. He said that by having the exchange student in his house gave him a different perspective to things. The other international experience he had was with his brother's roommate in college, who is from China, and spent the Christmas holidays with his family for the past two years.

To add context to the data analyses and the information below, it is important to make few annotations about the students. In answering the interview questions even though students were being truthful and sharing their opinion, they were also being very polite. This is important to note because in some situations the full reality was not shared, or I had to "dig deeper" within their polite answers to extract the full reality. In addition, I noticed that for Pablo, the interviews were like a test or job interview, where he was trying to answer the questions in the correct way or the way he thought I expected him to answer. In the instances where I noticed that, I asked the question in a different way at a later time to try to get his true feeling about the topic.

The last two observations are about Nathan. First, he was the only graduating senior in the class and showed a sense of superiority. This also carried over to his interview answers. One example is his statement saying that nothing in the class was new to him since he had hosted international students in his home before: "Some of the things were interesting but like I said, for having Marco at the house, also my brothers roommate's from China and so he spends all the Christmas breaks with us so I feel like I've ... Anything I learned in this class I kind of picked up on. Not saying that's bad because some people don't have that experience. I wouldn't say anything necessarily changed my way of thought (P8, L233-238)." Second, his definition of different people. He describes his group of friends in high school and in college as being different from him because they had different life/career interests. However, his friends were from the United States and from a similar background according to his description.

Research Questions

The purpose of this study is to identify the intercultural maturity level, as determined by the Intercultural Maturity Framework (King & Baxter Magolda, 2005), of students in the college of engineering when exposed to intercultural concepts in relation to cognitive, intrapersonal and interpersonal development. The Intercultural Maturity framework from King and Baxter Magolda (2005) looks at the question of "How do people come to understand cultural differences in ways that enables them to interact effectively with others from different racial, ethnic, or social identity groups?" (King & Baxter Magolda, 2005, p.571). In the remaining portion of this chapter I will answer the research questions in an effort to understand how the participants came to

appreciate cultural differences through their participation in the ENGR 410 course in ways to enabled them to interact effectively with different others to become engineers better prepared for the global market.

Data from sixteen individual interviews was collected – two interviews with each student who took the class. The interviews were transcribed and unitized producing 1,427 data units, which are "the smallest piece of information about something that can stand by itself" (Lincoln & Guba, 1985, p. 345). There are 868 units from the Latin group, 212 units from the Hispanic- American group, 129 units from the Non-Traditional group, and 209 units from the American group. All data units were sorted into categories and sub-categories and gathered into themes. Six themes arose from the data analyzes. The first three themes are 1) Cultural Differences; 2) Description of Self; and 3) Interactions with Different Others. Those three themes are related to the Intercultural Maturity framework. These themes are important because according to King & Baxter Magolda (2005), they are related to the three pillars to understand how people come to appreciate cultural differences in ways that enable them to interact effectively with others from different racial, ethnic, or social identity groups (King & Baxter Magolda, 2005). Those pillars are: understanding and appreciating cultural differences; knowing their own culture and values; and knowing how to adjust to interact with the different others.

In addition to those three themes, three other themes arose, where I found very interesting information going beyond what is given by the framework choosen for this study. Students identified barriers that affected their interaction with their teammates

when working in multicultural and virtual teams. Identfying, understanding and overcoming those barriers is what will prepare students for the global job market. The fourth and firth themes that arose from the data analyses were 4) Barriers to Intercultural Interactions; and 5) Learning from the Experience. The last theme that came from the data analyses was about how students define a global engineer, including the chacteristics that one must present to be one.

Under each theme there are categories and subcategories that were used to answer this study's three research questions, as well as to understand how students come to appreciate cultural differences to interact effectively with different others. A list of all the categories for this data analysis was included in the previous chapter. Besides the analysis of the data from interviews, important data derived from analysis of documents. The documents used by the researcher were the students' course assignments. A copy of those documents are included in Appendix C.

The next sections of this chapter will show what I learned from analyzing the data to answer each of the research questions. This will be followed by additional findings and a summary of the outcomes of the data analyzes

Research Question One

What is the intercultural maturity level of undergraduate students in the college of engineering as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their cognitive development?

One of the first aspects of being able to interact effectively with people from different cultures and to work well in a diverse environment is to recognize and

understand cultural differences, as well as respect and appreciate those differences. This is described as the cognitive dimension of the intercultural maturity framework. Based on the data analyses, previous cultural experiences and attitudes towards cultural differences, meaning the ability to identify what you know about the other culture and the humility to accept the unknown together with the desire to learn more about it, will influence the development of the cognitive level of the students. If students were conscious about their need to learn more about it or interested in learning more about it, both the class assignments and the project/teamwork in binational teams had a positive impact on development of their cognitive skill.

Theme I: Cultural Differences

Category: Previous cultural experiences. It is important to know the previous cultural experience of the students when trying to understand their intercultural maturity level. In analyzing the data, I could see that previous cultural experience was directly related to where students are in recognizing, accepting, and appreciating cultural differences. In the paragraphs below, I will describe the findings from the interviews in regards to their previous cultural experience and their perspectives.

From the group of eight students participating in the study, six of them had traveled or lived abroad before the class and had the chance to interact with people from cultures different then their own. William had his previous cultural experience from his time in the military and one study-abroad to China during his nuclear engineering degree. Pablo lived in Brazil for one year in a study-abroad experience. The four students in the Latin group experienced living in a country in Latin America and the

United States. In addition, they continue to live in a bicultural environment as their parents were born and raised in Latin America and make an effort to continue to have that culture alive in their homes.

With that, the four students from the Latin group had already experienced having to adapt to a new environment or new culture as they moved to the United States. This statement from Paola reflects the experiences of the four students in the Latin Group "I changed a lot. Now I feel I'm more tolerant and I accept more things. I just got used to it (P11, L 329-330). I think I've been Americanizing myself (P2, L45-46)". Furthermore, all four students from the Latin group come from high middle class families, which has afforded them the opportunity to attend American schools while living in Latin America and travel abroad with their families on vacations, including locations such as Europe and Asia. Continuing from Paola, "I think one of the main things that have changed for me that I've gone through travelling around the world is that I just became more tolerant to other people and not as judgmental as I was before (P12, L357-358)."

Category: Ability to see cultural differences. The six students mentioned above had cultural experiences before the course and were able to recognize cultural differences, more clearly than the two students in the American group who had not traveled abroad before. As said by Paola (Latin group), "They [Brazilians] express themselves differently and sometimes they would try to say something and I compare to myself. (P5, L130-131)". While Nathan and Jacob, both in the American group, said respectively, "I guess actually the biggest difference and I didn't even think about it until

now, was they [Brazilians] didn't want to work on the weekend. (P11, L350-351)". And Jacob said,

> "Between the group here and Brazil, I don't know. Other than the language difference, we didn't really spend enough time. It would've been different if we actually got to meet each other but that's not a practical option. I didn't really notice any significant cultural differences probably because we didn't spend enough time like actually video chatting or whatever (P7, L198-203)".

The quote above from Nathan also demonstrates that he did not reflect on his learning and its implications until the interview where I was asking questions. However, he was not the only one to show this characteristic; most of the students were reflecting and realizing what they learned in class as the interview took place

Category: Attitude towards cultural differences. After being able to identify the cultural differences, it is important that people develop an appreciation for those differences. The attitude students showed towards cultural differences were mainly positive, respecting the different other and appreciating the different perspectives different people bring to a discussion or project. Jacob states, "I like meeting different people to a certain extent. It's always interesting to see the way people from different places learn or live and how it compares to the way I've experienced life and things like that (P3, L89-92). From William also shows a positive attitude towards cultural differences saying, "I actually enjoy it. I like learning new cultures (P7, L203-204)"

Besides appreciating having different cultures in the class, the students also appreciated having students from different engineering majors being part of the class and

the project. Having a multidisciplinary class was also pointed out as a positive diversity aspect. Only Nathan had a different take on the engineering major diversity, stating that working with petroleum engineers in this project would had been more efficient,

> "I guess if it's a major specific class, if I was taking a petroleum engineering class and we were in a project, I think people would have a little bit better idea of where you go. Even while there were still differences in brainstorming, I think we're all close enough to get to an answer. Whereas you have all these different backgrounds on a very open-ended problem, I guess that would just take more time because you would have to take all the aspects for something completely unrelated. I guess that's my thoughts on the project, the team members anyway (P10, L320-327)."

He did not appreciate the extra time it took when brainstorming with people who came from a different engineering background, and pointed out that they brought ideas "completely unrelated" to the task.

In analyzing the data, it also became clear that the six students with previous experience abroad were on the acceptance or adaptation level of Bennett's development model, as Paola stated, "I just learned to accept the difference. I know their background is different. I just accept it and respect it, I guess" (P6, L173-175). The two students in the American group, who had not traveled abroad before and lived in a very homogeneous environment until college, are in the minimization stage. The quote below from Nathan shows that he is indifferent to where people come from when relating to them. For him, everyone is the same, and their background does not influence how they

think about engineering problems. This is the minimization view where people think they are doing well in diversity because they see everyone as the same and do not discriminate against based on their background. However, they fail to see what people's background bring to the discussion. Nathan sees engineering problems as technical problems with "black and white" solutions:

> "Well, there's a difference between intellectual ideas, and cultural differences. If we're working in a project and two people agree or disagree, to me it's not relevant whether we grew up in the same hometown, they're from a different state, a country, from literally the opposite side of the globe. That's not really a thing (P4, L105-110)". He continues, "I guess I'm indifferent, you know? Working in groups, I'm always interested to ask questions about, especially if they're from another country, kind of how things are, but that's usually small talk outside of the project while we're just sitting there. Yeah, I guess I'm indifferent really towards the actual ideas being tied to someone's specific culture. (P4, L120-125)"

Category: Interest in learning about cultural differences. Nevertheless, there is a significant difference in the attitude between the two students in the American group. Nathan has interacted with international students before, when his family hosted a Brazilian student for a year and later the Chinese roommate of his brother for two Christmas holidays. He considers these experiences to be high impact cultural experiences that other students do not have the chance to have. Moreover, because of those experiences he feels he knows all there is to know about cultural differences and

how to interact with the different others. Jacob is more conscious of his cultural knowledge and seeks to learn more. He describes the class being one of the best learning experiences he had in college. From the class he was able to see that:

> "There's actually different ways that people view the same problems, which I had no idea. I thought that engineering was just - here's a problem or a situation and there maybe multiple ways to solve it, but it's all the same solution. There's actually different ways you can view it. I didn't know (P8, L238-242)".

Accordingly, the students' attitudes influenced their classroom learning and their ability to move forward from the minimization stage. Students with previous cultural experience had a higher level of cognitive development. However, what was learned from analyzing the data is that for the intervention (the class) to have an impact on the student's development, even more important than having previous cultural experiences is students' humility to accept what they do not know about cultures and their desire to learn more about it.

Category: Cultural knowledge learned during class. Regardless of where they started on their cultural experience and knowledge, all of the students, except Nathan, described the class as having a positive impact on their knowledge about cultural differences. Even those six students who had a great deal of multicultural experience before the class, and their cognitive level in intercultural maturity was higher than other students because of those experiences and not just the intervention of the class. The statements below from Pablo and Carlos respectively, illustrates the perspective of those students in regards to their learning. Pablo: "It [cultural assignments] makes you more

open to see how the world works and all that. That's the way I saw things from that perspective, from the cultural side of things. (P10, L311-314)". Carlos said,

> "Those type of things, I think that for a global engineering class, it helps because I think it was the videos that made me realize that culture is so big. Because I know, culture is big because I come from a 100% different culture than the U.S. I come from dirt roads basically. Like, in my country maybe 10% of the roads are paved you know. Over there, every road is like dirt roads. So you know, "carretas" do you know what "carretas" [a simple two-wheel oxcart pulled by a horse or similar animal used as a mean of transportation and cargo carrier in Central America] are? Over there you see one every 10 minutes. So, my culture is different, but I didn't know that much different than in the videos. (P19, L565-572)"

Students 1 to 7 learned about cultural differences from both the videos and assignments as well as from working with the Brazilians in the class and the project. Therefore, the cultural assignments and the experience of taking the class with the Brazilian students had a positive impact on the cognitive development of students who were interested in learning more. Even though students learned from the class and now can see and appreciate cultural differences better than before, they were not able to use that learning during the class to better work with their Brazilian counterparts.

Even though the half of the assignments were specific to the Brazilian culture asking students to look into Hofstede's dimensions and to have interviews with the Brazilian students, the other half of the assignments were related to comparing the Asian

culture to the American culture. Those assignments confused students causing them to limit their view to the difference between Eastern and Western culture and as a separate aspect from the project and teamwork they were involved. Jacob stated:

> "The videos showed mainly the difference between Asia and US. I'm not sure because most of the assignments had to do with differences between United States cultural and Asia or East Asia or West Asia cultures. I'm not sure how I'm going to apply that to US versus South America".

Valentina said, "No, I mean for the project it [the cultural assignment] had nothing do with it. For life, I thought they [cultural assignments] were interesting. (P14, L461- 465)".

Category: Impact of cultural differences in engineering problem definition. After the class, students 1 to 7 could see that the background of the person can influence how they see engineering problems. Some students were able to describe well this new knowledge, while others were still reflecting on the learning experience and alluded to learning this concept. This learning was not influenced by previous cultural experiences as Jacob was able to elaborate very clearly what he learned in this regard, even better than other students with several cultural experiences before the class:

> "I'm able to see that there's other ways to do it, even though I still do it the same way. I see that there's other ways that people from other cultures are going to see it (P7, L222-224). It opened my eyes a little bit to realize that there's not just one perspective for engineering (P8, L236-237)".

Along those lines William added,

> "Americans have a tendency to be very brutish with their ideas and concepts. Having the ability to have the input of other technical people who think about problems in a different way, really kind of opened my eyes to the fact that we are trying to accomplish the same goal but from a different perspectives (P12, L374-378)."

Juan and Pablo also had a similar gain from the class. Below I present it in their own words respectively "I think so yes. It was real interesting to learn to how everything was all different from one side to the other, the different cultures (P2, L33-35)."

> "Like I said, even working with people internationally, or even working with just people with a different mindset is a good way of practicing your problem solving because you're basically killing every single possibility with working with a different problem mindset (P9, L246-250)".

The impact of cultural differences in engineering problems was an important gain from the class as it opened the students' minds to consider other perspectives as valid points of view.

Research Question Two

What is the intercultural maturity level of students in the college of engineering as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their intrapersonal development?

To answer this question above, we need to understand student's identity including ways they use their values and beliefs to make life choices and decisions and how they view and interpret their social identities based on factors such as race,

ethnicity, class, sexual orientation, and religious affiliation (King & Baxter Magolda, 2005). This means that to be able to identify, respect, and appreciate cultural differences, it is important for students to also know their own culture and to feel confident about who they are. This allows students not only to identify what is different from them, but also to adjust themselves to effectively interact with different others without losing their identity.

Theme II: Knowledge/Description of Self (Intrapersonal dimension)

Category: Relation between student's background and experience to knowledge of own cultural values before the course. Since I already described each participant in great detail earlier in this chapter, in this part, I will relate the student's background, experiences and description of self with their knowledge of their own culture. There are two aspects that should be considered when looking at the intrapersonal dimension on the intercultural maturity framework: first, their exposure to different cultures and second their age and life experiences. As described by Kegan's (1994) third order in King & Baxter Magolda (2005), "the resistance multicultural educators experience from some students may result not only from their reliance on simplistic cognitive mind frames that do not accommodate multiple cultural perspectives, but also from a sense of self that is largely defined by others" (King & Baxter Magolda, 2005, p. 578).

During the interviews, students shared with me their background and elaborated on how they see themselves. Besides data from the interviews, I also analyzed the ENGR410 course assignments, which asked students to watch cultural videos and define

how they see themselves as well as compare themselves to other cultures. The course assignments were analyzed the same way as the interview transcription, using the content analyses method. This method is defined as "any technique for making inferences by objectively and systematically identifying specified characteristics of messages" (Holsti, 1969, p.14). Meaningful parts of the assignments were placed in data unit cards coded, then categorized and analyzed. The analysis of the data involved identifying recurring patterns that characterize the data and the findings from which they were derived (Lincoln & Guba, 1985).

From analyzing the interview data, it became clear that the students who had been to places where the culture is different from their own – students 1 to 6 – were able to talk about their culture in a more concrete way during the interviews. This quote from Juan provides an example of those students talking about their own culture, "but I think I can consider myself right now a mixed culture because in my house we speak Spanish (P2, L58-59)". He continues talking about other aspects of his culture from Colombia and concludes, "But also here coming to the United Stated has given me the best of both worlds because I've been able to combine those traditional values [Colombia] with the openness that you have here [U.S.] (P2, L 62-65)".

The two students in the American group said they had never thought about their own culture before the interview as stated on the quote from Jacob, "That's an interesting question. I never even thought about my own culture. I don't know, (P6, L197-198). For my own personal culture, I'm a very religious person. I'm a Christian so my culture revolves around that a lot. I don't know. I've never even thought about that.

I'm now trying to define my own culture. (P7, L203-205)". Even though he had just finished a course that presented culture and cultural differences and worked with people from another culture, he had not thought about his own culture until I placed the question. With the question, he started to reflect and try to define his own culture. This shows a gap in the course that did not provide guidance for students to reflect on this important aspect of intercultural maturity. Adding a reflexive journal or reflexive assignments through the course can most likely address this issue.

These two students had never thought of their own selves in the global context before. Despite the fact that during the ENGR410 class, they were exposed to multicultural concepts and had some assignments that asked them to define their values compared to other cultures, they still see culture as being something the "other" has, external to them. From one of Jacob's written class assignments:

> "Knowing certain characteristic values about certain cultures would be helpful when trying to communicate effectively but, as we just saw, it would be a bad idea to assume that those values apply universally to everyone from that culture. So, the best way to improve future results in multinational teams would be to research and learn more about the backgrounds of each individual on the team (rather than just assuming) and then adjust accordingly. You can alter things like the team hierarchy, communication methods, decision making methods, etc. in order to facilitate better teamwork."

The four students in the Latin group, who have lived part of their lives in the United States and another part in a Latin America country (Colombia, Mexico and Costa

Rica) can describe their culture in specific terms including comparing it to the American culture. In addition, they can see the positives and negatives of each culture. Below is a portion of the interview transcription of Valentina describing the how she sees the difference between the United States and Colombia "Colombia is more, I think I mentioned this last time, family oriented. I feel like in US the culture, more in the work place, it's very strict. These are the rules, that's it. You follow them or you are out, but in Colombia its more lenient. And yeah, sure, here [US], you can for example get a job through someone you know, but you need to have the qualifications which is good. In Colombia, not always. That doesn't always happen like if you know your dad owns a company, oh, you can invite your friends, your girlfriend to join and work for that company. Yeah, in that sense it's a lot more lenient to a point it can get corrupt, but you know it can be good and bad (P4, L98-110)".

All four students consider and view themselves as Latin and they refer to their families as the most important value in their culture, which is a reflection of the Latin culture. Carlos says, "My family is really important for me. I don't know what else (P6, L178-179)". However, the three students who have lived longer in the United States – Juan, Paola and Valentina - recognize the impact of the American culture on their values as it was put by Paola, "I think I've been Americanizing myself (P2, L45-46)". These students feel comfortable and proud of both cultures. Valentina describes how she sees herself in the two cultures, "Although probably compared to the actual people living in those countries [Latin countries] I'm more individual but here [US] I'm more family. You know what I mean? (P13, 409-411)".

Pablo, who was born and raised in the United Stated by Mexican parents and has lived in Brazil for one year describes his culture and how his family and experiences has influenced his values and personality:

> "That is a good question. That mostly lies on how my parents are, taught me, or actually taught me how to grow, or taught me about decision making, because we get so many morals from our families, especially in Hispanic families like Mexican heritage (P2, L41-44).We're always about having family close and spending time with family, which is really important (P2, L46-48). I could say that I've, with the whole experiences that I've had with friends and travelling, I think my personality has grown more from those experiences. It's opening me more. It's opened my eyes to a lot of different perspectives (P3, L65-68)".

The four students in the Latin group, as well as the two students in the American groups and the one student in the Hispanic-American group can be defined as traditional college students. The traditional undergraduate student as defined by the U.S. Department of Education is "one who earns a high school diploma, enrolls full time immediately after finishing high school, depends on parents for financial support, and either does not work during the school year or works part time" *(U.S. Department of Education, National Center for Education Statistics by Susan Choy , 2002, p1).* Considering their age, life experiences and responsibilities, these students are still defining their lives and developing who they are as they go through college. In some ways, they are still developing their sense of identity. One example of this developing sense of identity is their relationship to their families; the traditional students describe

their families as being their parents and siblings, while the non-traditional student describes his family as his wife and his three children.

The difference between the students in the American group and the four students in the Latin group as well as the one student in the Hispanic-American group is that the students in the American group recognize the legitimacy of the other cultures, while the other students are able to consider social identity in a national and global context. This means that even though the students in the American group might be on the intermediate or mature level in the cognitive dimension, in the intrapersonal dimension they are still at the initial level when considering them in the global context and on the intercultural maturity development model.

William, the non-traditional student, besides having traveled all over the world during his time in the military and later in college, had a variety of life experiences including being in the military, working in the "real world", and having and supporting a family – a wife and three children. A quote from him shows the impact of one of those experiences in his life, "I spent six years in the Navy as a nuclear machinist mate. And I really re-found myself, the discipline the military provides kind of changed my attitude towards everything (P2, L35-37)." Texas A&M defines the non-traditional student as anyone whose over the age of 25, married or partnered, having dependents, who served in a branch of the Armed Forces, who is financially independent, who works full-time, who is enrolled part-time (Office of the Dean of Student Life, 2016). William reflects all of these characteristics above, except working full time and being a part time student. He is in a different stage of his life when compared to the other students in the class and the

traditional students, and at a different maturity level. At this point in his life, he uses his values not only to make his decisions but also to educate his children.

> "Right and wrong in making my decisions...there is no real right answer to that. One of the things I keep telling my children as they are approaching, one of them is 13 now and the hormones are just raging through his little head. The only thing that you have in this life, that is yours that nobody can take from you, is your integrity. I tell him that my definition of integrity is doing the right thing even when you think no one else is looking. That is a philosophy that I've had my whole life. (P6, L161-169)"

Category: Impact of course in knowledge of own cultural values. In analyzing the interview data along with the course assignment, I could define that the class had two main impacts on students. First, it increased students' knowledge about themselves including self-awareness of their intercultural development. Second, and probably the most visible and powerful impact, was that it improved their self-confidence and comfort level for socialization.

Increased knowledge about themselves. Some of the ENGR410 class assignments included describing themselves within Bennet's Intercultural Sensitivity Model, answering questions and reflecting on whether their answers are aligned with the Eastern or with the Western views, discussing with the Brazilian counterparts their views of organization within Hofstede's (2001) cultural dimensions (Hofstede G. , 2001), and reflecting about humor and insults in different countries. These assignments were given to students after they watched a video or lecture related to the topic. Students completed

those assignments writing about their knowledge. I provide below a sample of those answers from each student from different assignments showing their learning from the course in regards to students' increased knowledge about themselves.

Juan: With the assignment of Bennet's Intercultural Sensitivity Model, Juan reflected on his cognitive knowledge and his own culture and identified where he fits into that developmental model. The quote below shows that with the cultural experiences he had, and the learning from the class, he is now able to connect the theory to the practice and consciously adapt.

> "After watching the video on the DMIS [Developmental Model of Intercultural Sensitivity] model, I am now more aware of what this is. I would consider myself to be in the stage of Ethnorelative and specifically in Adaptation with a little bit of the integration aspect. I say this because I have had the opportunity to travel over the years and learn from different cultures. Throughout these years, I have tried my best to understand other cultures and try to put myself in their shoes. I grew up in Colombia and now I am living in the United States. I feel I have adapted adequately to the culture but still hold my cultural roots."

Paola: On the assignment about humor and insults in cultures, Paola demonstrates that she can identify the cultural differences between Mexico and the United States, the two countries she has lived in. The idea would be to use the knowledge she gained from watching the video and reflecting on it, to recognize the cultural values of other countries, besides Mexico and the United States, as she interacts with people from those countries.

> "According to professor Safdar, one way for understanding culture is through dimensions of variation in cultural values (individualism/ collectivism). Insult and humor, she mentions, are the two aspects in which communication plays a role in social interaction. In terms of insult, professor Safdar says that examining verbal abuse reveals cultural values of a person because we know what aspect of the person is highly emphasized in the culture, and if denied it is considered impertinent and insulting. This depends if the society is individualistic or collectivistic. I agree with professor Safdar because each society is unique and values different things. When I moved to America, I realized the difference in culture in terms of insults. In my country, insults are targeted not only to the person but to the close relatives too, which emphasizes the importance of family in my society. In contrast, in America, I believe insults are more targeted to the individual itself".

Valentina: In describing if her way of thinking is closer to the Eastern or Western way of thinking, Valentina said that her answers fit half with Eastern and half with the Western way of thinking. This puzzled her because she has lived all of the life in the Western hemisphere. She failed to recognize how her Latin upbringing might have influenced that. She was enlightened by the assignment on two aspects, first that the Western culture tends to categorize things and she can relate that to how the classes are taught in the United States. Second, that she can use this knowledge – easterners relationship and westerners categories – to communicate better with the difference cultures.

> "In the questions, I answered half of them like an "easterner" and half like a "westerner". After watching the video I realized the reasons behind each choice, however I have lived all my life as a westerner and did not see any special trend regarding my answers. I simply picked them because it was the most logical thing to do. Now knowing that easterners are more likely to associate things based on relationship, I believe it is now easier for me to communicate with an easterner if I ever had to explain something to them. Knowing that westerners are more likely to categorize things (which I had noticed that in the past) makes it easier for me to explain something and understand it as well. I have also noticed that even in the way of teaching here in the United States, professors seem to teach according to categories whenever they can"

Carlos and William: The assignment segment below is about questions related to Hofstede's cultural dimensions. Carlos and William answered the questions of the assignment but missed the reflection point on the cultural component behind their answers and the answer of their Brazilian counterparts. This shows a gap in the course assignment that could be more explicit on the cultural reflection requirement.

> Carlos asked the *Brazilian student* "Do you prefer centralized or decentralized leadership? [*The Brazilian student* answering the question] Centralized. It is easier to understand your roles and responsibilities and to whom you should report. [The reflection of Carlos] I have to disagree with the *Brazilian student* [named removed to ensure privacy] because I believe that a decentralized government is better because the way checks and balances control the separate

entities of the government prevent them from having too much power and for being corrupt. By having the checks and balances between the different areas in the government is harder for one branch to pass a law that the other branches does not believe in. It is harder for corruption to occur."

William: "The first topic in the interview was the relation to authority. This topic had four questions asked. The first question was whether he [*Brazilian student* paired for this assignment] preferred centralized or decentralized leadership? *Brazilian student's* answer was that he preferred centralized leadership because of the increased uniformity on decision-making and the reduction of task duplication. I believe that this is a valid point; however, I also believe that the purpose of leadership is to provide structure and support to a community in order to enhance the community dynamic. This can be best achieved with a working and intimate knowledge of that community through local, or decentralized leadership."

Pablo: Pablo completed the assignments, but did not reflect on his answers, which limited his gains about his own culture from the course. One example is the "East versus West" assignment. In this assignment, students had to answer four questions, watch few videos about "East versus West", and reflect on how their answers compared to people surveyed in the eastern or western world. The last part of the assignments was to give an example on how students could use this knowledge about eastern and western cultures to improve the communication between people from these cultures when working in a technical project. In completing this assignment, Pablo was able to identify

his answer aligned with the Eastern way of thinking and give the reason why. "Easterners see the relationships, so they went with my answer. The westerners saw the panda and the monkey as mammals, and didn't pick the relationship as the easterners." Even though he explained that the reason his thinking is aligned with the Eastern thinking is the relationship way of thinking, he was not able to elaborate further and describe how he will use this knowledge to work with people from the Eastern or Western culture. This demonstrates a limited understanding of his own culture as well as of the way the different cultures think.

Jacob: With the assignment of Bennet's Intercultural Sensitivity, Jacob identified where he fits into that developmental model and described why. This reflection and understanding will allow him to seek the development to the following phases. The quote below extracted from one of this class assignments shows his thought process.

> "I think I am currently in the acceptance stage of the ethnorelative side of the model because I seek out people with cultural differences rather than avoid them and because I am beginning to recognize and appreciate the values and behaviors of different people. For example, if I am assigned a project for one of my engineering classes, I would rather work on it with a group of students with a diverse background and various majors (not just engineering students) and I would value the input that each student had to offer."

Jacob is able to identify his comfort level of interacting with different people and demonstrates his desire to engage with people from different backgrounds to learn more and evolve to the other levels.

Increased self-confidence. The second, and probably the most visible and powerful impact of the course on the students was how it helped students improve their self-confidence and comfort level for socialization. From the second round of interviews, one common thread describing the impact of the class on the students was that they all felt more confident and secure about themselves. This was expressed in relation to how students now can relate to people better or in the context of the project. A few quotes support and illustrate this finding. From Jacob, "I guess, I mean I am sort of more social this semester than I was last semester, so I suppose it [class] did impact that. (P6, L178-180)". He continues at a later part of the second interview:

> "Just I guess a lot of my attitudes and things about the way I just feel about people and kind of social behavior, like I said earlier, I'm a lot more social now. Like a stereotypical engineer, like antisocial things, that's what I used to be, didn't spend a lot of time with people but now I like hanging out with people. (P8, L259-263)"

Pablo says the class has helped him connect more to people "It has opened me to more people and I hope to gain that as a common trait just until whenever, whatever. It's a really good treat of making a lot of friends as well. (P10, L329-332)". Paola said,

> "It [class] made me talk and participate and say what I wanted to because that was basically my grade, so I had to do it. Even if I didn't want to. That allowed me to open up more and be more ... Express more what I thought about the project and stuff (P3, L64-68)."

Even though it seemed at first that the class had no impact on students describing their own culture, after cross analyzing the data from the assignments and the interview, it became clear that the class helped students be more knowledgeable about themselves and more confident and improve their comfort level for socialization. This increased knowledge and confidence will give them the bases to identify what is different from them, adjust themselves, and interact with different others without losing their identity.

Research Question Three

What is the intercultural maturity level of students in the college of engineering as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their interpersonal development?

Integrating the appreciation of cultural differences and the knowledge of oneself is key for interacting effectively with different others. In particular, this draws on the mature capacity to construct and engage in relationships with others in ways that show respect for and understanding of the other's perspectives, values and experiences, but that are also true to one's own beliefs and values (King & Baxter Magolda, 2005).

To answer this question, students were asked about their general interaction with society, their interaction with their classmates, in particular during the final project, and their learning from the experience. In addition, the students' class assignments were used to add meaning to the data from the interviews. Based on the data analyses, students did not make the link about the class assignments and learning about cultural differences to working more effectively with their teams during the class project. They described frustrations during the time they were working in the binational teams on the final

project. However, they learned from the experience and described what they would do differently next time they were in this situation.

Theme III: Interaction with Different Others (Interpersonal Dimension)

Category: Interaction with society. Information about the student's group of friends as well as their feelings and reactions when interacting with people that are different from them were grouped in this category. All of the students described their group of friends as being made up of people with similar cultural backgrounds to them. The students in the Latin group say they have Latin friends and American friends. In addition, they say they adjust the way they behave depending on which group they are interacting with. A quote from Paola illustrates what the students from this group said: "It depends on where you are, who are you dealing with. I know when I'm with my American friends, I act a certain way than when I'm with Hispanics (P9, L246-248)."

The two students in the American group said that during their time at Texas A&M they diversified their group of friends and people they interact with. Nathan said "Then, I worked with kids from all over the globe. A&M's got quite a bit of diversity among its students, especially in the engineering department. It's not the first time I've worked with international students. (P2, L35-37). Jacob said:

> "Here, [in college] it's definitely more diverse here because I work as a tutor at some dorms on Northgate. Most of the other tutors there are graduate students from Iran and Pakistan and different places like that. I've made friends with them. It's definitely much more diverse than what I'm used to which is pretty

cool. (P2, L36-40). The friends I have now are definitely ... it's much more diverse group backgrounds that what I had in high school. (P2, L41-42)"

All of the students in the class say they feel comfortable around people that are different from them. In addition, they say they enjoy the interaction and like to learn from them. When asked how they feel when someone presents an idea that is very different from what they believe to be true, Juan, William, and Jacob said they feel intrigued. As put by Juan "At the same time I feel very curious and I'm learning why exactly they think differently of me (P5, L173-177)". William "I'm very comfortable with people of other nationalities. I like to learn what they like (P8, L235-236). He continues "What we may take as something that is an odd way of looking at something it may be a cultural norm for them (P8, L253-256)." And Jacob said: "I usually just try to stay open minded and talk about stuff that they are interested in. I don't know. I don't ever get upset or anything. It's really interesting talking to them. What's different from their childhood versus my childhood (P2, L53-56)".

Paola, Valentina, Carlos and Pablo said they felt frustrated and/or uncomfortable at first, but try to understand the position of the other person. Carlos' quote reflects his reaction: "Of course, I hear them and their arguments and then I try to explain them and they try to explain their point, but you always feel a little frustrated because it's your point of view". However, Paola and Valentina, the two female students, say they do not show their frustration. Valentina: "A little bit uncomfortable but I don't really show it. (P4, L96-97)". Paola said, "I feel really frustrated inside. I usually don't say it, but I do feel frustrated (P7, L206-209)". Nathan, one of the students in the American group, said

he is indifferent, which can be a reflection of the minimization stage of Bennet's Intercultural Sensitivity Model. He said, "I guess I'm indifferent really towards the actual ideas being tied to someone's specific culture (P4, L120-125)".

In addition, if the discussion continues and they do not agree with the other person's opinion, all of them said that they would agree to disagree and would be comfortable with the other person holding an opinion different from theirs. From Juan, "So, like I said, just try to learn exactly why they think that way, and maybe agree to disagree [(P6, L187-189)." Only Pablo had a more radical response. Even though Pablo considers himself on the integration phase, which is the most advanced phase of Bennett's Intercultural Sensitivity Model, when asked how he reacts when someone different from him presents an idea that is different than what he believes he says:

> "basically, I'll try to even get them on the same page or maybe even persuade them that they are wrong, but not just wrong in a really bad way, just let them know that there is more out there than what they think there is or whatever and it's better to think like, for example, like I would (P4, L90-95).

This quote shows that he believes his way of thinking is the correct one, if the belief of the other person is different from his, it is wrong and it would be better if the person would think like him. During the interview after this statement, I asked a followed up question, what if the other person tries to convince you that their way of thinking is the correct one, just as you are doing to them, and he answered,

> "Then that would be something that's out of my control, and I would take as a learning experience or maybe even something I could even see in the future of

being a little more careful with people that are different background, like being able to actually identify those people beforehand (P4, L 98-102)". "For those certain types of situations, I'll feel a little bit, I'll admit that I'll feel a little bit shy just because I feel like I don't have enough words or experience to actually make some sort of claim or make some sort of factual statement or even have some sort of supporting argument, I guess you would say. Yeah, that's just kind of the thing. (P4, L110-115)"

This answer shows even further that he is not comfortable with this type of interaction. His learning from the interaction described above would be to be able to identify this type of person before the interaction. Then, he would stereotype and avoid similar people.

Category: Interactions during the class with classmates. Four subcategories emerged in analyzing the data regarding how the students interacted during the class: (1) at the beginning of the semester students felt that the class was divided into two sides, the Brazilian side and the U.S. side. (2) Throughout the semester the professor changed the teams several times and with that, it was difficult to establish a connection with the group. (3) Frustrations in working in the virtual binational team. And (4) the positive impact of having a multidisciplinary class.

Class felt divided into two sides. Despite the fact that the class had one project for the group to work jointly, all of the students mentioned that they felt that at the beginning of the semester the class was divided in two sides, the Brazilian side and the American side. It was not until the class was divided into two smaller groups with

students from Brazil and from the United States that this feeling or division was overcome. Below are quotes from Paola and William respectively to illustrate this point:

> Paola: "Actually, I hated when *Brazilian Girl [removed name]*, which was the girl in Brazil, would always tell that - My side has come up with this idea - I would always like inside my head think like, well, but this is a class that we are all working on. You might have thought of that because one of my teammates said something that made you feel that way or that made you design that thing or whatever" (P14, L400-404). Paola continues, "But then at the end when everything was mixed and that we had to work with the other side and at the end, we were one team, that helped a lot just to feel part of the class as a whole instead of having two sides (P14, L407-409)."
>
> William: "I don't know that kind of I kind of got the vibe that we were the outsiders at the beginning. Once ideas started to flow and once we got into the meat of it that sort of dissolved a little bit (P10, L294-297)."

Changing teams. Another common observation from the students was that the professor changed the teams several times during the semester for the different assignments and it was difficult to establish a working relationship. Juan describes his frustration representing the comments of all of the students: "It's hard to salvage a connection with somebody, and then when the groups are changing every time; it's really hard to develop a relationship and communication method with somebody that one week it changes to another (P4, L113-117)".

Frustrations: power distance and communication. For the final project, the class was divided in two groups mixing Brazilian and American students. Students described some frustrations in working together and getting the project done on time. The groups were formed by the faculty leader based on the students' schedule and availability to meet as a group rather than students' background. Group 1 was composed of Jacob, one of the students in the American group; William, the non-traditional student; two students from the Latin group, Juan and Paola; and three students from Brazil. The members of Group 2 were Pablo, the Hispanic-American student, two students from the Latin group, Valentina and Carlos, and four students from Brazil.

Group 1 was the more diverse group and students who were part of this group expressed more frustrations in working together than the students in Group 2. They described the interaction with the team in the class as being respectful but not effective. All of the students in that group mentioned frustrations especially at the end when they were working as a group on the final project with deliverables and deadlines. This statement from interview 1 from Jacob, who was in Group 1, describes the dynamic of his group and the frustrations in not working effectively:

> "There weren't any problems with respect or anything. But toward the end when we're working on the final design and product and everything, my team did have some trouble with openly communicating with everybody. I kept trying to get everybody to instead of just talking to me and me having to share everything to the rest of the team, I wanted the teammates to just share everything with everybody. I couldn't get people to do that which made things difficult. It was

just a lack of sharing in ideas and information, so people ended up with not knowing everything and that was difficult (P6, L172-180)".

Connecting the learning from the assignments to the project and being aware of those cultural differnces would have allowed the group to adjust to work better with each other. Jacob was seen as the leader in his group. In Latin America, power distance is much higher than in the United States, so the Latin Students most likely felt they had to go to the leader first before sharing with the rest of the group – centralized governance. Power distance is one the dimensions in Hofstede's cultural dimension's theory. It is defined as the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally (Hofstede , 2001). Those were some of the concepts presented in the class and it was part of the class assignments. On interview two, Jacob said it again:

"I think the biggest problem we had though was with communicating openly. A lot of what happened was, since I took on, I was the one communicating to everybody like what we needed to do and when it needed to be done, they would respond just directly to me rather than sending the response out to everybody. It would be something that everybody needed to hear. Then I would have to kind of take that response and send it back out to everybody, which was, meant there was a greater delay in communication than there needed to be. Just kind of frustrating (P3, L98-105)."

There was an asignment where students would decribe if they preferred a centralized or decentralized leadership. Even though they went through that execise, they did not implement their knowledge to be more effective in completing the class project.

Students who were part of group 2 shared the Latin culture background and they did not describe frustrations in working together. They said they met frequently using the Blackboard Collaboration tool for videoconferencing, google docs to share the documents and text messages to schedule the meeting and confirm everyone was connected to the internet to start the videoconference.

Students in Group 1 did not see until later, that people from different cultures have different communication and leadership styles and the role of cultural differences on interactions. This can be illustrated by the conflicts or frustrations described by the members of that group. From Juan, "There was ... [conflict] because we divided into two groups. There were a lot of ... For my group there was a little bit tension of, you do this that. You do that. Who's going to take care of this and that. There were some conflicts on how you divide the work (P7, L246-250)." He added, "I think the communication was ... The best thing that we, I think found to communicate was WhatsApp, was probably the best, through text messaging and that. Also email was good (P8, L262-265)". Jacob said, "No, they [Brazilians and US students] all ended up coming to me. I had to push it back out to the rest of the team. It was frustrating but it ended up working out (P7, L184-186)". And Paola added,

> "like for the group we had for the last project or for the second part of the project. I don't remember what was that. I think the design of the reactor. It was

me and Jacob, which is American 100%. Then from the other side, it was two Brazilians. When they were trying to express something, it was really hard for them to make Jacob understand what they were saying (P5, L132-137)."

This could had been due to language barrier caused by accents and limitations from the Brazilian students in expressing their ideas in English. Another reason or an aggravating agent could be the different communication styles, where most Americans are very direct and to the point, while Brazilians will indirectly make their point.

Students in group 1 said that the videoconferencing did not work so well for them as they were shy to talk on camera and used text messaging to overcome that hurdle. As described by Paola "We would just spend so much time and do not do a lot of things because we would be shy to talk to people and looking at the camera and everything. Text messaging worked better and emailing (P7, L176-178)."

***Multidisciplinary work*.** The last observation in this category was the fact that students 1 to 7 enjoyed the fact they got to work with students from other engineering areas. The multidisciplinarity aspect of the course was a topic that came up as a positive feature of working in the diverse teams. Below I share a quote from Juan and Valentina respectvelly. "I think it was good, especially the addition of nuclear and petroleum, because this [the project] was really something complete directly with petroleum [engineering] (P12, L428-430). Having that was I think really helpful (P12, L430)." Valentina: "I find that really cool [working with engineers from other majors] because after I finished my core curriculums of my physics, chemistry I didn't get to interact

with any other engineers. I'm always with industrial engineers and it's always industrial engineering (P9, L237-276)."

Category: Learning about teamwork/interaction from the class. The students learned from this experience. All of them stated that they improved their teamwork skills recognizing that patience, tolerance, and clear communication are key when working with people from different cultures. In addition, they all expressed the need for more interaction with the group and the desire to know their teammates better.

Below I share some quotes to provide their perspective on what they learned from the class. Interestingly enough these four items: patience, tolerance, clear communication and more interaction with the team were mentioned by all of the students as things they now know are key when working with people from different cultures.

The quote below from Jacob and Paola respectively, supports the points made above and describes how they learned that listening and being tolerant is important when working in diverse teams. Jacob said, "I learned that patience is really, really important when you're working with that many people that are spread out across two different continents (P2, L45-53)".

Paola, "I think I learned to just be really tolerant with other people because the teamwork, there were several opinions (P1, L27-28)". She continued, "People just think different. Especially working with people from another country, which they thought of things different as we did (P1, L27-29)". "I just learned to be really patient and listen a lot and try to understand what they meant. Just like trying to figure out how it worked best for all of us, because there were several opinions (P2, L32-34)."

Carlos, Valentina, and Jacob respectively said that if they were to take the class again knowing what they know now, they would interact more with the teammates to get to know them better in order to work better as a team. Carlos said, "I think is that maybe talk more to the students. I think that the communication between the students has to be more (P20, L591-595)". Valentina said, "I would want more interaction because it is global engineering and maybe an assignment of a recorded conversation. That would be interesting, just to actually get to know the people in Brazil (P14, L441-444)". In addition, from Jacob,

> "I would probably start out by getting to know everybody on my team a lot better, because throughout the whole class, I never really made an effort to reach out to the people on my team and kind of get to know them so that we could kind of, I don't know, work with each other better, because the way it ended up as we each kind of did our own thing and then submitted our parts to the final project to put it together, I think it would have probably worked better if we all kind of helped each other on our own parts. (P5, L142-149)"

Pablo in the quote below helps illustrates what he and the other students said about communication:

> "It's always really important to be more precise and more clear about the design concept, and it's really tough because if you don't have any sort of drawing to it, for example, if you're really far away, even with the video camera you have to be a little bit more prepared. Preparation was always the frustrating topic, I guess you could say (P10, L299-304)."

Based on the data analyses to answer the third research question, I identified that the students in the Latin group adjust their behavior depending on the group of friends they interact with; however, they and students in the other groups describe frustrations when people present ideas that are very different than what they believe is true. This was transferred to class interaction as they were implementing the project in smaller groups. Students did not make use of the learning from the class assignments about cultural differences to work more effectively with their teams during the class project. They described frustrations during the time they were working in the binational teams on the final project. However, they learned from the experience and said that they now know that patience, tolerance, clear communication and more interaction with the team are very important when working with people from different cultures.

Additional Results

The finding from the data analyses provided insights that went beyond the three research questions. The additional results allows us to understand further the impact of the class on student's intercultural maturity and to look at how students come to understand cultural differences in an engineering setting. Students learned from this experience. During the interviews, they described some of the barriers they faced in working with a binational team in a virtual environment and they explained what they would do differently next time they are in this situation. Identfying, understanding and overcoming those barriers will prepare students for the global job market. The fourth and fifth themes that arose from the data analyzes were 4) Barriers to Intercultural Interactions; and 5) Learning from the Experience. The last theme that came from the

data analyses demonstrated how students define a global engineer, including the chacteristics that one must present to be one. Below I present the findings under those themes.

Theme IV: Barriers to Intercultural Interactions

Students recognized some of the barriers they faced when trying to work with people from a different country in a virtual environment. The students described them often as frustrations and I am calling them barriers to a more effective interaction with the group. The barriers students mentioned were the virtual environment, time, and communication. Below I present each category and describe them demonstrating how students viewed those barriers.

Category: Time. Students mentioned time as a barrier in two ways: time difference and time crunch. Time crush was referred to the very tight deadlines to finish the project at the end of the semester, which could also be described as notion of time as the students left the majority of the project to be finalized towards the end. Juan, Paola, Carlos and Pablo shared the feeling described by Juan below:

> "I felt like 80% of the whole class, the whole project was in the last two weeks. I think I would have set different parameters, type parameters throughout class, to be able to achieve those things, throughout the whole semester and not completely at the end (P14, L499-503)."

Time differences between Brazil and the United States was a barrier mentioned by all of the students except William. Students said the time difference prevented them

from having more interactions among the group. This is illustrated by the quote below from Pablo:

> "We actually did try to interact the most we could with students and definitely the things that affected it were the time differences and other classes that we thought were more were of like a time holder, I guess you could say. Then I guess that was the only thing that was major impediment for the interaction of students with Brazilian students and the students here (P9, L261-266)."

Students realized that time difference and the time change is an issue that needs to be accounted for when working with people in another country. During the semester due to summer time in both countries – Brazil going into summer time and the United States going out of summer time - made the time difference go from 2 hours to 4 hours. Paola describes how time was a barrier that she now understands needs to be considered:

> I learned that, and I learned also the importance of communication and being in contact and being in touch to get things done because I was part ... Like my group. We had a lot of conflicts with meeting online and everything because of the time change and everything (P2, L35-38).

Category: Communication. Communication was another barrier mentioned by the students. This category includes the students' ability to communicate with people from different cultural backgrounds and language barriers. The communication issues were described briefly in the section above under theme III: Interaction with Different Others (Interpersonal Dimension). However, it is worth mentioning in this section in

more details to emphasize that communication was a barrier identified by the students in this binational virtual team project.

All of the Brazilian students who took the class spoke English; this was one of the requirements on the Brazilian side for students to enroll in this class. However, some students spoke English better than others did. Therefore, in regards to language barrier, only two students found language to be a barrier, Paola and Nathan. Paola said "I think the language because they [Brazilians] were trying to translate things to English the wrong way so Jacob wasn't able to understand what they were saying and of course the accent was really strong, too (P6, L145-148). In addition, Nathan said, "Yeah, I guess there was kind of a language barrier at times which can be difficult talking about pretty technical matters (P7, L195-196)."

The majority of the students felt there was no issue in that regard. Juan said "As far as the language barrier, I didn't really feel it was a problem (P8, L 265-266)". Even Jacob, who Paola thought was having trouble understanding the Brazilians said:

> "Yeah, no there wasn't, initially I thought there would be a little bit of a language barrier, because I had no idea how. I mean, I've never traveled outside of the United States, so I feel like my kind of perspective of people in other countries, like I have no idea how well they know English. I know that in other countries people speak their local language plus English, but I don't know how well they know English, so I feel like with a lot of kind of engineering language, I wouldn't know, I don't know how well they would understand it. (P4, L116-122). A lot of the stuff I was trying to say in English, I didn't know if they

would understand it better in their native language or what, but it ended up not being a problem at all. (P4, L123-125)"

The ability to communicate with different others was a larger barrier for effective communication than the language. Students described the communication being awkward with uncomfortable silence in front of the camera. In analyzing student's comments, it looks like students did not recognize the impact of cultural difference in the communication styles and with that, were not able to adjust their own communication style to work more efficiently with each other. One interesting comment from group one was that to overcome the communication barrier, they found text messaging to be a great tool. Juan said, "I think the communication was ... The best thing that we, I think found to communicate was WhatsApp (free international text messaging app), was probably the best, through text messaging and that. Also email was good (P8, L262-265)". Paola added along those lines, her group was shy to use the camera and chat and text messages worked better.

Category: Virtual environment. One of the main barriers mentioned by the students was working within the virtual environment. Considering this generation is always connected on their phones and computers, I was surprised to find out that most of the students said they did not like or found it difficult to work in a virtual environment. However, they recognize how important it was to have this experience as they realized, it is a reality they will face once they join the workforce. They took it for granted at the beginning of the class. These students are used to using text messages as a mean of communication, and computers to learn, shop and to connect to people; however, with

the class they realized it is not so trivial when you are trying to accomplish a project with technical discussions, a deadline and people you never met before. The selected quotes below illustrate show students viewed this barrier.

With the virtual meetings, Juan found it to be difficulty to connect to people since he could not read the body language. “A lot of communication is perceived by body language. It’s hard to have that, whenever you have a virtual communication, or you try to communicate with another class (P11, L 380-383).” And he added on interview 2, “because that is [online meeting] just another barrier that you have to cross. If you have the people here, on campus is much easier to be able to have those meetings face-to-face (P4, L142-145).”

While Paola and William, respectively, had to adjust to have the class with a virtual component, “I was just expecting to memorize everything, I don’t know, but I never wrote anything. I was just really distracted with my phone or just seeing myself in the camera or something like that (P21, L645-647)” and Willian, “We experienced a lot of pitfalls. Issues with video and sound and communication was often difficult and we had to resort to other means of communication through some of it rather than face to face. I think we learned a lot. We got through it (P1, L14-17)”. Jacob had a more positive spin to the virtual aspect of the class: “It was fine. We communicated with the What’s app, texting app, and also through email and through I guess, well it wasn’t Skype, but it was Google Hang Outs or something. We did that, I don’t know, once a week or something. All three of those methods combined worked out pretty well. (P4, L109-113)”.

Valentina expanded her knowledge about virtual collaboration and said, "Also, the whole aspect about the web class with the people in Brazil and having to work with them. I had never done anything like that before. (P1, L 18-20). The whole collaboration, virtual collaboration, I had never thought about doing any project like that (P7, L227-228)". For Nathan, the difficulties with the virtual environment was one of the reasons he dropped the class: "This one was rough, that's part of the reason I dropped the class. It was just too complicated trying to get everyone together. With the time gap and the technology never worked, you know what I mean, like every week it was something, I mean even on Google Hangouts. I mean, the communication in the class, it was just difficult. (P6, L179-183)"

Besides recognizing that it is not so easy to establish rapport in a virtual environment to work with people you have not met before and that are different from you, students realized that a good infrastructure and internet connection is needed to work on technical projects with people in a different location. For William and Carlos respectively having the virtual environment as part of the class opened their eyes to how important a good quality connection is. William said, "It had its challenges, as part of the course, I learned a lot about virtual communication that I've never had to really experience like that before (P10, L323-326)."

Carlos uses the virtual communication tools to communicate with his friends and stay connected to his family very often. He mentioned he talks to his parent via FaceTime (the IPhone videoconferencing tool) almost every day. However, with the experience of working with a group of people he had never met before remotely on an

engineering project, he realized that a good infrastructure is important. Good internet connection, and tools to share screen are important in the technical setting. In his words,

> "I have never had that we needed a good place to meet with someone from Brazil. Now I understand that it is not as easy as I thought, as it would be to have the conversation. We also had to meet outside the class and it was the same, everyone was in their house but it was also like conflict of understanding everyone (P9, L245-250). He adds, "Before this class I had never taken any type of class or any type of assignment that needed conversation between two countries with 5 hours difference. And also, whenever I was somewhere else, I used skype, or FaceTime. But I am talking to my friends or my parents. I didn't see the necessity of good quality or good video. I didn't see it as important as now (P8, L233-239)".

Even though it sounds negative, identifying the barriers is the first step to overcome them and be more efficient in the future. With the barriers identifyed also came the learning from this experience and that is described in the next theme.

Theme V: Additional Learning from the Experience

Some of the learning from this experience was mentioned within the previous themes. Two examples are the students' learning about teamwork described under the Interaction with Different Others (Interpersonal Dimension) Theme and the learning about the impact of cultural differences in engineering problem definition under Theme I, Cultural Differences. However, there were other important learnings, beyond the three research questions, that are worth mentioning in this study. The additional learning

includes realizing the global workforce and global and virtual projects is a reality of today's industry; the importance of communicating clearly when working in a virtual environment and with people from other cultures; and the need to be better prepared for group meetings in the virtual environment.

Category: Realizing the engineering industry today is globally interconnected. Even though working with international people in a virtual environment was one of the main barriers students stated, they now appreciate the experience and the learning that came from the challenges. Particularly, as they realize the multicultural and virtual environment is part of the corporate world they will face once graduating. As Valentina and William said respectively:

> "But now that I think about it, and that I talk to my mom because she used to work [at] HP and managed all the HP stores in Latin America, she's like, 'Yeah, that's all the time and is very common' so it's like wow, we're doing it in college for a grade when people are [doing this] all the time and it's getting even more common, like less traveling and more virtual (P7, L229-233)."
>
> "There isn't anything that is strictly based especially here in the U.S. anymore. When people get out of college, people are going to have to know how to work, at least in some capacity, with someone from another culture, another country. Even if you never leave the continental U.S., you are still going to have coworkers from different cultures (P14, L447-451)".

Juan and Paola also recognize the value of the experience as demonstrated in the quotes below. Paola in interview one expressed her interest in the class by saying

"Because I believe every engineer is going to have to deal at some point with foreign people (P9, L262-263)". Juan in interview one said,

> "It's supposed to be a challenge to be able to work with another culture, which ultimately at one point in your life, in your work. You're going to have to do that. I think that. The fact that we had problems was a good thing, because it gave you ideas on how you could do better to work with those problems" (P11, L391-398).

In interview two Juan added, "I like to be more face-to-face, but it was also that something ... A work environment that I would have to be at some point faced with, with Skype or virtual communication (P1, L23-26)."

Nathan, who during interview two had already graduated and was working for a company in Austin, said, "Well, as far as the, you said virtual environment, I haven't used anything like that yet at my job, or at previous internships. I guess it was beneficial to kind of see how you can, if you have to work with people that are halfway around the globe, how you can do it. Although there were technical difficulties with some of the programs. I guess that was beneficial (P1, L30-34)"

Category: Clear communication. One important learning students took from this experience was realizing the importance of clear communication and developing the skills for doing so. Within this frame is also the importance of not assuming you know or understand what the other person is trying to say, especially when working with people who are different from you. Students started to realize that as people come from different backgrounds, their assumptions might be different from yours. Students talked about the

importance of communicating clearly in the context of better understanding the project as well as in working better within their groups.

To illustrate the students' perspective in relation to clear communication I present a couple of quotes from Paola describing what she would do differently next time she is in this type of situation. "Just don't assume something but ask her [Brazilian girl] (P14, L439)". In addition, she added,

> "Yeah, I think communication is a main factor because we didn't have a clear communication when we were trying to understand what we needed to do. It was just a general idea. We didn't specify what we needed or what was required for the project. I think being detailed or being more specific about what needs to be done, being really clear about what you expect from the other person. I think that I would do that (P14, L422-428)".

Category: Be well prepared for the group meetings. Another learning from this experience stated by the students was how important it is to be prepared for the virtual meetings. They mentioned preparedness in two aspects, getting the equipment ready before the meeting and researching more about the topic early on in order to discuss it during the meetings. All of the students mentioned these two aspects in one way or another. Paola said about the equipment,

> "Okay, yeah. This class, well we had a lot of trouble always like trying to get to set up all the equipment and everything. That was funny always because I mean we just have one hour a week to meet and it was always like we ended up meeting for 40 minutes at the end because we're going to have the equipment set

up at the right time (P13, L382-386). I would say that as a student, if I was to take the class again ... For the faculty part, having I think the equipment ready before class because I think that took a lot of time every time (P20, L614-616)".

While Jacob talked in regards to the project, "I would probably research more, read more research papers early on in the class, so that I could participate more early on and ask more questions early on (P10, L311-314)". Pablo referred to the preparation in working with the group,

> "It's always really important to be more precise and more clear about the design concept, and it's really tough because if you don't have any sort of drawing to it, for example, if you're really far away, even with the video camera you have to be a little bit more prepared. Preparation was always the frustrating topic, I guess you could say (P10, L299-304)".

The additional learning students had from the class that went beyond the research questions were very relevant to identify the students' intercultural maturity level and to understand how to better prepare students for the global market. The analyses above also supported the fact that even students with previous cultural experience were positively impacted by the class in regards to their intercultural maturity level and in being better prepared to join the global engineering industry.

Theme VI: Student's Definition of Global Engineer

The last theme that came up from the data analyses was the students'definition of a global engineer. As seen in chapter 2, the literature shows diferent definitions and skills needed for a global engineer. One of the question I asked students was in their

perspective what is the definition of a global engineer or the charateristics of a global engineer. Their answer became the last theme of this study and presents the student's view and understanding about global engineers.

The students generally agreed on the characteristics, which includes being open to or interested in working abroad, able to adapt, knowledgeble of other cultures, flexible and tolerant, open minded, and good communicator. Only two students, Jacob and Pablo mentioned, being able to speak another language. As Pablo put:

> "What I think, personally, is being able to speak the language, too. That is also something that we can be more of some sort of like advantage, advantage of being more globally interactive. Because if anyone, for example, an engineer from the US were to go to Mexico, he'd be able to speak Spanish and just present the project and any sort of presentation of some sort of project system or project concept in that language makes it much more interactive and easier, and especially for the flow of ideas because you're talking about other engineers as well. I think that language is a really good advantage to that (P16, L479-786)."

This question was asked to see from the student's perspective, after having to work in a global project and a global team, what they thought were important skills for a global engineer. The skills mentioned by the students overlap with some of the characteristics presented in recent literature about the global engineer, which leads me to think those students are developing a good understanding of what is needed to succeed in this global engineering industry.

While the literature shows broad and different definitions of global engineer with different skills, there is a coordinated effort to develop an inclussive and standard definition of the skills needed for the global engineer. In 2015, the American Society for Engineering Education (ASEE) Corporate Member Council's (CMC) Special Interest Group (SIG) for International Engineering Education developed, presented, and vetted with its stakeholders a series of attributes representing the desired competencies and characteristics needed by engineers in order to effectively live, work, and perform in a global context (Hundley, 2015).

The framework defined by this group includes five broad categories needed for global engineering effectiveness: 1) Technical: Engineering-related knowledge, skills, and abilities needed for success. 2) Professional: Workplace related competencies for global performance, which includes the ability to communicate effectively in a variety of different ways, methods, and media to both technical and non-technical audiences. 3) Personal: Individual characteristics needed for global flexibility. 4) Interpersonal: Skills and perspectives to work on interdependent global teams. 5) Cross-cultural: Society and cultural understanding to embrace diverse viewpoints. This includes possessing an international/global perspective and fluency in at least two languages and embracing interdisciplinary/multidisciplinary perspective (Hundley, 2015). More detail about those five categories is presented on chapter 2.

Not only the characteristics described under the five categories of Hundley 2015, are aligned with what students described as needed skills to be a global engineer, it also reflects some of the appreciation and learning students got from the class such as the

apreciation for working in a diverse and multidisciplicary team, good communication skills, flexibility and tolerance and the ability to embrace different view points within engineering.

Concluding Thoughts from the Students

In one of the final assignments, students were asked to reflect about the cultural differences and write about their experience in the class. I share below a passage from each of the students, except for William, where I did not have access to his assignment, describing the impact the class had on them. I corrected some common grammatical problems to make it easier to read.

The following statement from Juan and Paola respectively shows that they now understand culture beyond the tourist activities they had done in the past. They understands the importance of culture in the workplace. They also understand the danger of stereotypes, the importance of clear communication, patience and flexibility. *"…This basically means that the idea of stereotyping a culture is not really valid because in each "culture" there are many factors that affect a person's cultural context. This class has really helped understand differences in culture in the workplace. From the initial problems that we had when trying to communicate during our class time, to finding a good time to communicate after the time change, this has all been a great learning experience. Also there is a slight language barrier which magnifies the idea of being extremely clear and vocal when expressing ideas so others can understand. Also humor can be very different and even during our time interacting with Brazil, we at times when things that were funny to us were not funny to them and vice versa. In order to improve*

results, when working internationally, I will make sure to have the best communication technology available to me so that understanding each other can be easier. Also being flexible with time management and scheduling is a must. By having this experience and further understanding about other cultures in the workplace will help me to become a better and more efficient engineer. I will now know to be patient and understanding when scheduling conflicts occur, arrive early to the scheduled conference so that all the communication devices are available, and be clear when presenting technical information. Patience has been key during this whole project because without it, the project would not have been possible. At times, we were clueless on what was expected from us, but after effectively communicating with our peers, the relevant information was presented to us and we were able to progress through with the completion of each specific task."

Paola wrote, *"It is difficult to conclude from these scores [score table presented for the assignment] if individuals behave the same as their cultural group since every person comes from a different culture, especially students from A&M. It can be said that there exists a pattern in some categories because when living together people start adapting to one another (in the case of A&M students, all start to "Americanize"). The UFRJ cultural dimension scores are more consistent as it can be said that most students come from the similar cultural groups. Since many factors affect the way a person behaves and acts, the idea of "stereotyping" a culture is not valid. Many persons could be part of one culture and have different backgrounds. America is a great example that shows how people from several different cultures come together to form one American*

culture. I had the chance to learn more about culture and cultural differences in this class and now I understand the importance of good communication when working in a multinational team. To improve the results in the future when being part of an international meeting, I will make sure to take into account the time zones of the countries involved. It is also very important to speak clearly, since language is a big barrier and miscommunication can arise. Being flexible with scheduling is a big factor that can help obtain better results as well as using all available tools and technology such as google hangouts and doodle. Knowing what I know about cultural differences will help me be a more efficient and an effective engineer because I will be able to solve problems faster when working with people from other cultures. As an engineer, I will most likely be working with people from other countries and will be traveling around the world. I will always have in mind that there are going to be cultural differences and miscommunication, but being patient and communicating myself clearly will help me achieve better results and will help me understand other engineers."

Valentina's main take away from the class was understanding different cultures may have different points of view that are also valid as she wrote, *"To a certain extent with the exclusion of some data (students) we can say that individuals behave the same as their cultural group. It is only logical since culture is a mental programming that we develop unconsciously. Knowing this much about cultural differences will now help me understand much more people from other cultures that I may have to work with in the future. Maybe what I think is not correct for them it is, or something that may not be*

rude to me may be to them. I will now mold my way of thinking to also understand and see the point of view different cultures have to bring".

Carlos linked his experience of moving to the United States and having to adapt to a new culture to the learning from the class. He states that now he feels more confident to work openly with all different cultures and does not want the cultural differences to be a barrier for working together. "*I am from Managua, Nicaragua located in Central America and 3 years ago I moved to Texas for my undergraduate studies. My parents are in Nicaragua and everything is back there. Coming here was a big change for me, and a lot of things happen and the way that I thought of things changed, the culture here was different and I had to adapt and find common ground with other friends. It was easier for me to become friends with Latinos because I just speak to them in Spanish and we clicked very fast because most of us are alone here in College Station with parents far away from College Station area. I believe that the knowledge I gained in this class and the experience I have been getting thru my undergrad career will help me a lot to be a successful engineer. It has open my eyes to see the world different, not just as I thought it was. There are many other cultures many beliefs many other people around there as same as you just that with different beliefs and languages. That shouldn't be a barrier we should break that and be able to do business with other cultures as freely as possible. I believe that the knowledge that I have learned in this class has prepared me to overcome those barriers. Now I know how to approach to different cultures. Now I think that I can make a better impression to them. It has also become more natural for me to do it because I have lost that insecurity of what will they*

think or say. We are all learning so the more we learn from each other the better the communication will be between the parties. I believe I will be a more effective engineer because if they put me in a multicultural group environment I would know how to approach and get everyone to work together for the same cause. It will not take us months to meet each other and start working together it will take me almost no time to communicate with the others and try to reach common ground."

Pablo's answer showed his passion for understanding and working with different cultures, "*As an undergraduate, I've experienced other cultures and strengthened my intercultural sensitivity. I know what I am capable of, as far as learning and growing with other cultures. Now my plan is to involve myself with the potential cultures of my work industry and professional venture. I would like to successfully connect myself with the European culture and become the most global aerospace engineering professional there could be. That's my drive, that's my goal, that's who I am. I have several years to shape that compromise. After graduation from A&M, I plan on going back to Brazil and work in their aerospace industry as well as connect with the different other global aerospace partners on the most upcoming projects."*

Jacob, as Paola and Juan, wrote about the danger of stereotyping. He also learned from the class that he should adjust his communication style and decision making process depending on whom he is working with. He believes this knowledge will make him a more valuable engineer *"... From this graphic, you can tell that individuals certainly do not behave the same as their group, and stereotyping is a grossly oversimplified perception that is often false (as it is in this case). Knowing certain*

characteristic values about certain cultures would be helpful when trying to communicate effectively but as we just saw, it would be a bad idea to assume that those values apply universally to everyone from that culture. Therefore, the best way to improve future results in multinational teams would be to research and learn more about the backgrounds of each individual on the team (rather than just assuming) and then adjust accordingly. You can alter things like the team hierarchy, communication methods, decision-making methods, etc. in order to facilitate better teamwork. Being a petroleum-engineering student, I am likely to end up working for a large energy company in another country at some point during my career. Knowing what I know now and being able to effectively apply this knowledge when working in multi-cultural teams will have a great impact on my ability to get along with engineers and coworkers from other cultures. This will also help me to be a more valuable asset to my company if I have experience working in diverse teams and am capable of doing it well."

The essay pieces above are important because they show from the students' perspective their overall learning from the class towards the end of the semesters. It also serves as a short summary of the impact of the class on the students as it repeats some of the data presented earlier in this chapter. Some of the important points stated above by the students include the importance of clear communication and flexibility and the fact that different cultures may have different point of views that are also valid, even in engineering. In addition, from the class, students learned about Hofstede cultural dimensions and country norms. However, they also learned that not everyone from that country fall within that country norm and they understand the danger of stereotyping.

One important learning that can be noted from the statements above is that these engineering students now understand that learning about cultural differences and working with people who are different from them is not “fluff”, but something that will in fact impact their careers and make them more effective engineers and members of the company they work for.

The assignment pieces presented above are a great summary of the students’ view of their learning and a good transition to the final chapter of this study where I will present the concluding thoughts that resulted from analyzing the data. In this next and final section, I will analyze the data from various perspectives in relation to the research questions and present a summary of the findings. I will end by presenting the implications and recommendations of the study.

CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Introduction

This study was designed to identify the intercultural maturity level of students in the College of Engineering at Texas A&M as determined by the Intercultural Maturity Framework (King & Baxter Magolda, 2005), when exposed to intercultural concepts in relation to cognitive, intrapersonal and interpersonal development. In doing so, my objective was to understand how students came to appreciate cultural differences and to interact effectively with different others in the context of a global engineering course. Through the analyses of the data collected from the 16 interviews, two interviews with each of the eight participants, and their course assignment, I was able to draw a number of important conclusions, which are shared below. The ultimate goal of the study was to add to the body of information on what helps prepare engineering students for the global job market they will enter once they graduate. In this final chapter, I present the summary of the findings and the conclusions drawn from the results. In addition, I present the limitations of the study, the implications of the results for educators and conclude with the recommendations for administrators and for future studies.

Summary of Findings

This study focused on questions regarding the intercultural maturity of students in the College of Engineering at Texas A&M who enrolled in the Global Engineering Design course. Answering the three research questions helped in understanding how the participants came to appreciate cultural differences through their participation in the

Global Engineering Design course in ways to enable them to interact effectively with different others and to become engineers better prepared for the global market.

A summary of the findings related to each research question is provided below. To start this summary section, I refer to table 5 below. This table shows my assessment of the Intercultural Maturity Level of the eight students on the three dimensions of the framework: cognitive, intrapersonal and Interpersonal. The results were born from the data analyses from the interviews, course assignments and my interpretation of those answers based on the intercultural maturity framework. As part of the table, I also included student's self-assessment on Bennett's Intercultural Sensitivity model from one of the course assignments.

Table 5. Summary of Intercultural Maturity Based on the Interviews

Summary of Intercultural Maturity Based on the Interviews				
Group/Students	**Cognitive**	**Intrapersonal**	**Interpersonal**	**Self Assessment Intercultural Sensitivity**
Latin Group				
Juan	Mature	Intermediate to Mature	Intermediate to Mature	Adaptation
Paola	Mature	Intermediate to Mature	Intermediate to Mature	Adaptation
Valentina	Intermediate to Mature	Intermediate to Mature	Intermediate to Mature	Adaptation
Carlos	Mature	Intermediate to Mature	Intermediate to Mature	Adaptation
Hispanic-American Group				
Pablo	Intermediate to Mature	Intermediate	Intermediate	Integration
Non-Traditional Group				
William	Mature	Mature	Mature	Integration
American Group				
Jacob	Initial to Intermediate	Initial to Intermediate	Intermediate	Acceptance
Nathan	Initial	Initial to Intermediate	Unable to properly assess	Did not complete the assignment

Research Question One

What is the intercultural maturity level of undergraduate students in the college of engineering as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their cognitive development?

Based on the data analyses, I could identify that previous cultural experiences and attitude towards cultural differences, meaning the ability to identify what you know about the other culture and the humility to accept what you do not know, together with the desire to learn more about it, will influence the development of the cognitive level of the students. When students were exposed to new cultures, either through an abroad experience or through the class exercises (cultural assignments, readings or working in teams with other cultures) not only they learn a new aspect of a culture, but also they realize their need to learn more. This is consistent with the fact that in cultural self-assessment, it is common to have students self-assess higher on the pre-experience assessment than on the post-experience assessment. After the experience, students start to realize they do not know as much about something as they thought.

The six students who had cultural experiences before the course were able to recognize cultural differences more clearly than the two students in the American group who had not traveled abroad. The students in the Latin and the non-traditional group had several cultural experiences before the class, which combined with what they learned in the class helped them be at a higher level of the cognitive dimension. Even though they knew about cultural differences before the class, the assignments and activities of the class enhanced their knowledge. Introducing assignments and discussions about cultural

differences facilitated students to further understand and respect cultural differences while broadening their knowledge of different cultures.

The humility to recognize and accept the unknown is the first step towards moving to a higher cognitive development level in the intercultural maturity. This was noted in the process of identifying the student's cognitive level. Regardless of where they started on their cultural experience and knowledge, all of the students, except Nathan, described the class as having a positive impact on their knowledge about cultural differences, even those six students who had a great deal of multicultural experience before the class. This conclusion about the positive effect of the class on students' cognitive dimension is not only based on students' self-assessment, but on the course assignment and how they answered some of the interview questions.

Nathan showed an attitude of knowing a lot about other cultures, but said he did not see cultural differences between the American and Brazilian students. This is reflective of the minimization stage described by Bennett, the last stage under the ethnocentric side of the Intercultural Sensitivity framework. As said by Bennett, It is very hard to move people from this stage because they think they are doing fine as they do not judge and do not see people differently (Bennet, 1986).

In analyzing the data, I was able to identify that the six students with previous experience abroad are on an intermediate level moving towards the mature level, or at the mature level in the cognitive dimension of the Intercultural Maturity Model. The mature level is marked by the ability to have multiple perspectives in multiple contexts and to use multiple cultural frames (King & Baxter Magolda, 2005). The ability to

consciously shift perspectives occurs because judgments derive from personal experience and evidence from other sources and experiences. While William, Juan, Paola, and Carlos demonstrated to be at this level at end of the course, Valentina and Pablo are evolving into it, but still show some characteristics of the intermediate level. In the intermediate level of the cognitive trajectory, views about knowledge shifts from seeing knowledge as certain to increasingly acknowledging the uncertainty associated with making a knowledge statement (King & Baxter Magolda, 2005). Increasing uncertainty shows that a person is more open to different ideas and accepting the view that different people can hold different views for legitimate reasons (King & Baxter Magolda, 2005).

The two students in the American group who had not traveled abroad and lived in a very homogeneous environment until college, are in the initial stage. In the initial level of the cognitive domain, knowledge is certain and statements are judged as right or wrong based only on one's own values, and it is difficult to accept differing points of view or concepts. This is aligned with the ethnocentric reasoning of Bennett (1993); more specifically, the minimization stage of Bennett's model. As said by Bennett, it is very hard to move people from this stage because they think they are doing fine as they do not judge and do not see people differently (Bennet, 1986).

However, with the knowledge developed during the class, Jacob started to show characteristics of the intermediate level described above. His views about knowledge shifted and he demonstrated more openness to different ideas and accepting the view that different people can hold different views for legitimate reasons (King & Baxter

Magolda, 2005); even in engineering problems. He recognizes that he came from a very homogeneous environment, and that in college meeting people that are different from him has changed him and made him see several situations differently.

Table 5 shows the cognitive level of each student individually and reflects the finding that students' previous cultural experiences have an impact on how they see cultural differences. However, what makes a difference for students to gain from the class and to develop their cognitive skills, is the attitude of the students towards learning about cultural difference.

Research Question Two

What is the intercultural maturity level of students in the college of engineering as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their intrapersonal development?

After analyzing what students shared with me about their background and how they see themselves, as well as students' answers to the course assignments, I identified two aspects that shaped these students' intrapersonal dimension level in regards to intercultural maturity. First, their previous cultural exposure and second, their maturity to know and to feel comfortable with who they are. In addition, the ENGR410 course had two main impacts on students: First, it increased students' self-awareness in regards to intercultural development; and second, and probably the most visible and powerful impact, it improved their self-confidence and comfort level for socialization.

In regards to shaping students development, it became clear that the students who had been to places where the culture was different from their own – Juan, Paola,

Valentina, Carlos, Pablo and William – were able to talk about their own culture in a more concrete way during the interviews. This is because they had been to places where they felt different from the other people, which in turn, allowed them to know more about themselves. The two students in the American group said they had never thought about their own culture before the interview. These two students had never thought of themselves in the global context before. Despite the fact that during the ENGR410 class, they were exposed to multicultural concepts and had some assignments that asked them to define their values compared to other cultures, they still saw culture as being something the "other" has, external to them. This shows a gap in the course that did not provide guidance for students to reflect on this important aspect of intercultural maturity.

The maturity level to know and feel comfortable with who they are, is the other aspect in shaping students' intrapersonal level. Considering the age, life experiences and responsibilities of the four students in the Latin group, as well as the two students in the American group and the one student in the Hispanic-American group, it became clear that they are still defining their lives and developing who they are as they go through college. In some ways, they are still developing their sense of identity. However, due to previous cultural experiences these students have different intrapersonal levels in the intercultural maturity developmental model.

Whereas the students in the American group recognize the legitimacy of the other cultures, the other students are able to consider social identity in a national and global context. This means that even though the students in the American group might be on the intermediate level in the cognitive dimension, in the intrapersonal dimension

they are still at the initial level when looking at themselves in the global context. Jacob and Nathan are in the initial moving towards intermediate level in the intercultural maturity development model. In this initial level, there is a general lack of awareness about one's own social identity. Juan, Paola, Valentina, Carlos and Pablo are in the intermediate to mature level. The intermediate level is characterized by an intentional self-exploration allowing for simultaneous examination of one's experiences in one's own cultural contexts and an examination of that culture in broader social contexts (King & Baxter Magolda, 2005).

William, the non-traditional student, besides having traveled all over the world during his time in the military and later in college, had a variety of life experiences including being in the military, working in the "real world", and having and supporting a family. He is in a different stage of his life when compared to the traditional students, and at a different maturity level. He uses his values not only to make his decisions but also to educate his children. He is considered to be in the mature level of the in intercultural maturity development model. This level is characterized by a sense of self in which various aspects of one's identity are integrated in ways that provide a culturally-sensitive and well considered basis for making decisions about intercultural interactions (King & Baxter Magolda, 2005).

During the triangulation of data from the assignments and the interviews, I was not only able to define the intrapersonal level of the students in the intercultural maturity development model, but also see that the course had a positive impact on the students. At the initial stage of analyzing the interview data, my first thought was that the course had

little impact in helping the students define their own culture. It looked like the students who were able to describe their culture already knew that before the class and the others just started thinking about their culture as I asked them the question during the interview. However, after reading the students' answers to the class assignments (only available from students 1 to 7 because Nathan dropped the class), and then going back to the interview data, I saw that the course did provide opportunities for students to look at their own cultural values and better define their culture.

With the constant comparison data analyses, I found that the course had a positive impact on students in recognizing their cultural values and in improving their self-confidence and comfort level for socialization. Table 5 summarizes the intrapersonal level of each student individually and reflects the finding that the course, assisted students to be more knowledgeable and confident about themselves as well as to improve their comfort level for socialization. This increased knowledge and confidence will give them the bases to identify what is different from them, adjust themselves, and interact with different others without losing their identity.

Research Question Three

What is the intercultural maturity level of students in the college of engineering as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their interpersonal development?

The interpersonal dimension is where the knowledge of cultural differences and the knowledge of who they are come together to effectively interact with others. In analyzing the data, three categories emerged providing information to answer this

research question. The first category was a description of how those students interact with society in general. The second category was the interaction of the students with their classmates while working together on the project. The third and final category was learning about teamwork/interaction from the class.

In their general interaction with society, students in the Latin group said they have Latin friends and American friends. In addition, they said they adjust the way they behave depending on which group they are interacting with. The two students in the American group said that during their time at Texas A&M was the time they diversified their group of friends and people they interact with.

One positive aspect that emerged in this category, was that all of the students demonstrated to feel comfortable around people that are different from them. Students said they enjoy the interaction, and like to learn from those different from them. However, not all of them are comfortable handling a situation when someone presents an idea that is very different from what they believe to be true. Juan, William, and Jacob said they feel intrigued, while Paola, Valentina, Carlos and Pablo said they felt frustrated and/or uncomfortable at first, but try to understand the position of the other person. Nathan, one of the students in the American group, said he is indifferent, which can be a reflection of the minimization stage of Bennet's Intercultural Sensitivity Model.

The second category that emerged from the data analyses was the interaction with their classmates while working together on the project. The students raised four important points regarding their interaction during the class: (1) at the beginning of the semester students felt that the class was divided into two sides, the Brazilian side and the

U.S. side; (2) throughout the semester the professor changed the teams several times and with that, it was difficult to establish a connection and a good workflow with the group; (3) frustrations in working in the virtual team; and (4) the positive impact of having a multidisciplinary class.

With regard to the frustrations of working in the virtual team, Group 1 was the more diverse group and students who were part of this group expressed more frustrations in working together than the students in Group 2. Students in Group 1, described the interaction with the team in the class as being respectful but not effective. All of the students in that group mentioned frustrations especially at the end when they were working as a group on the final project with deliverables and tight deadlines. Different views in regards to power with centralized or decentralized leadership and direct and indirect communications fueled those frustrations. Those were some of the concepts presented in the class and were part of the class assignments. Connecting the learning from the assignments to the project and being aware of those cultural differences would have allowed the group to adjust to work better with each other.

Even though students expressed frustrations and did not use the learning from the course to work more effectively within their groups, they identified the frustrations and said they learned from this experience. This was the third category - learning about teamwork from the class. All of the students stated that they improved their teamwork skills recognizing that patience, tolerance, and clear communication are key when working with people from different cultures. In addition, they all expressed the need for more interaction with the group and the desire to know their teammates better.

Considering students' interaction with society and in their teams and their learning from the experience, I identified Jacob and Pablo to be in the intermediate level of the intercultural maturity model. At this level of the interpersonal domain, individuals tend to be less judgmental, acknowledging the legitimacy of multiple perspectives (King & Baxter Magolda, 2005). I classify the four students in the Latin group to be in the transition to the mature level, which is described by heightened awareness and capacity to engage in intercultural interactions that are interdependent, respectful, informed by cultural understanding, and mutually negotiated (King & Baxter Magolda, 2005).

William is in the mature level demonstrating this type of understanding, which is reflected in Bennett's (1993) stage of Integration, where an individual can integrate distinct aspects of one's identity as one moves between cultural perspectives (King & Baxter Magolda, 2005). While I would consider Nathan to be in the initial to intermediate level, I was not able to properly assess his interpersonal development level as he dropped the course before the phase where the two groups were created to complete the final project. Table 5 above shows the interpersonal level of each student individually at the end of the course and reflects their learning from this experience.

Additional Considerations

The information that emerged from the data analyses went beyond the research questions. Three additional themes arose from the data analyses that were very relevant to understanding students' intercultural maturity and their preparation for the global market. The three additional themes were (1) Barriers to Intercultural Interactions; (2)

Additional Learning from the Experience; (3) Student's Definition of Global Engineer. I summarize below these findings.

All of the students identified barriers they faced during the progression of the class. Even students who had several previous cultural interactions – traveling and living abroad – had a hard time identifying deep cultural differences and using that knowledge to work more effectively with people. The students who traveled abroad before appreciated cultural differences, however, did not know how to use it in the engineering context. In summary, the barriers students identified for more effective intercultural interaction were, time (time difference and time crunch); communication (students' ability to communicate with people from different cultural background and language barrier); and the virtual environment.

Even though it sounds negative, identifying the barriers is the first step to overcome them and be more efficient in the future. With the barriers identified also came the learning from this experience. With this experience, students realized the global workforce and global and virtual projects is a reality of today's industry. As well, they identified the importance of clear communication and developing the skills for doing so; especially when working with people from a different country and from a distance. The language barrier encountered by the students was due to different level of English proficiency, accents, and different ways people express their ideas, especially in a second language. Speaking clearly, asking for clarification and avoiding assumption were some of the learning students got from this experience.

Another learning experience stated by the students was how important it is to be prepared for the virtual meetings. They mentioned preparedness in two aspects, getting the equipment ready before the meeting, and researching about the topic to discuss it during the meetings. Finally, students realized the impact of cultural differences in engineering problems. This is an important gain from the class as it opened the students' mind to consider other perspectives as valid points of view. Identifying, understanding and overcoming those barriers will prepare students for the global job market. Students could start to realize how global competency is linked to their engineering careers.

The last theme that emerged from the data analyses was the students' definition of a Global engineer. This question was asked to see from the student's perspective, after having to work in a global project and a global team, what they thought were important skills for a global engineer. The skills mentioned by the students overlap with some of the characteristics presented in recent literature about the global engineer, which leads me to think those students are developing a good understanding of what is needed to succeed in this global engineering industry. The students generally agreed on the characteristics, which includes being open to or interested in working abroad, able to adapt, knowledgeable of other cultures, flexible and tolerant, open minded, and good communicator. Only three students, Jacob, Valentina and Pablo mentioned, being able to speak another language.

To close this section on the summary of the findings, I refer to the last column of table 5 above - The students' self-assessment of their intercultural sensitivity. Even though student's self-assessment is a little higher than my assessment, it closely matches

how I assessed them. The only student with a large discrepancy between his self-assessment and my assessment is Pablo. He assessed himself to be at the highest level of Bennett's development model. Based on the information that emerged from the six themes, I would classify him in early acceptance, which represents the first stage in the ethnorelativism scale (Bennett, 1986).

In summary, not only did the students improve their global competency during the Global Engineering Class, but they also developed an understanding of their development level in these skills and its relevancy to their engineering careers. As mentioned under research question 1, having the capacity, humility and maturity to understand and accept what they know and do not know about a culture is the first step to developing their intercultural maturity level.

Conclusions

After analyzing the data from the two interviews and students' class assignment, I concluded that the class had a positive impact on all of the students' intercultural maturity except Nathan who dropped the course. It is difficult to determine if the lack of impact from the class on his learning was due to him being at the minimization stage of Bennett's development model or because he dropped the course. The class had a low impact on Pablo, who lived in Brazil for one year and felt he knew a lot about the Brazilian culture. From the interview questions, where he was answering what I "wanted to hear", to his class assignments and engineering project, where he did not dedicate the necessary time and effort, it was clear that his gains from the class were limited.

Nevertheless, this type of course is valuable to engineering students today and did have a positive impact in the majority of the students. From the results of this study, I conclude that it helped students be better prepared to work in a diverse and global work environment. This is because the course helped students realize the superficial and more practical tangible aspects of working with other countries - language and time zones. In addition, it gave them initial knowledge of interacting with different others in an engineering context by improved their self-confidence and comfort level for socialization the different other. Furthermore, it opened students' mind to the need of such knowledge for their engineering careers and the different approaches that different cultures bring to the table.

This is significant outcome considering this was one-semester class offered to engineering students in Texas. According to Astin (1993), compared to other fields, students majoring in engineering are less interested in graduate school, foreign languages, writing, listening, and in cultural awareness (Astin, 1993). As a contrast, engineering students are more likely to hold conservative political views and to belief that the principal purpose of college, is to increase one's earning power (Astin, 1993).

Research Question One

What is the intercultural maturity level of undergraduate students in the college of engineering as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their cognitive development?

In answering research question one, I concluded that the student's ability to identify what they know about the other culture and the humility to accept what they do

not know, together with their desire to learn more about it influenced the development of their cognitive level. Gaining knowledge from another culture can be achieved by traveling, studying other cultures and interacting with people from other cultures. Another conclusion reached was that students with previous cultural experiences, more specifically traveling abroad, before the class could relate the theory they were learning in the class to those previous experiences.

Research Question Two

What is the intercultural maturity level of students in the college of engineering as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their intrapersonal development?

Defining their own culture was not an easy task for most of the students during the interview. Most of the students are developing their level of comfort with who they are, and this is not something they had explicitly thought about before. However, knowing oneself is really the base to be able to recognize the cultural differences and adjust those differences to interact with "others" in a more effective and respectful way. The activities in the course allowed students to learn about cultural values, but more important, it improved their self-confidence and comfort level for socialization. Requiring students to keep a reflexive journal or having reflection exercises through the semester would have helped the learning in this area.

Research Question Three

What is the intercultural maturity level of students in the college of engineering as determined by the Intercultural Maturity Framework when exposed to intercultural concepts in relation to their interpersonal development?

In defining the students interpersonal developments, I concluded that the main reason for their frustrations in working in the binational teams were the different views in regards to power with centralized or decentralized leadership and direct and indirect communications. Those were some of the concepts presented in the class and were part of the class assignments, however students did not connect the learning from the assignments in regards to these deeper cultural differences to the project. Students did not use the learning from the course to work more effectively within their groups. However, in identifying their frustrations with the course and in working together in the virtual binational team, students learned from this experience. All of the students stated that they improved their teamwork skills recognizing that patience, tolerance, and clear communication are key when working with people from different cultures. In addition, they all expressed the need for more interaction with the group and the desire to know their teammates better. Being aware of those cultural differences would have allowed the group to adjust to work better.

Additional Conclusions

The engineering project provided by the company linked the cultural learning to the engineering workplace reality, exemplifying that this situations and these skills are relevant to today's engineers. The cultural assignments and the work with the Brazilian

students were important parts of this course as it awakened the global interest of the students who had not traveled abroad and it deepened the understanding of the students who traveled abroad before. These two components are unique features in engineering courses. By having them imbedded in an engineering course, helped students see that this type of knowledge will affect their engineering careers and that it is not just "fluff".

My conclusion is that the experience did have a positive effect on students' intercultural maturity development. I believe that this gain was due to imbedding the global competency needs to an engineering project and allowing students to experience this reality and link to the success of their engineering careers. As stated by Astin, engineering students are interested in their career and see college as a way to get better jobs. Linking the global competency skill set to their jobs and opportunities in their careers is one way to get engineering students interested in cultural differences.

With this experience, students were able to see the more superficial cultural differences. The class did not allow them to understand the deeper cultural differences. This could be due to few reasons. First, there was not enough opportunities for students to reflect on their learning. This can be addressed by requesting students to keep a journal during the semester or having several reflection prompts through the semester. Second, the class is just one semester and the students met officially for class just once per week. This is not enough time to interact and understand deep cultural differences. Prompting students to interact more with the students from the foreign university in meaningful ways as part of the class can facilitate this learning outcome.

To address this and other matters, there were some aspects of the course that could have been done differently in order to have a deeper impact on the students. Some of the gaps identified in the course were:

- The need to provide more opportunities for students to reflect about oneself in the global context. Requiring students to keep a reflexive journal or adding reflection exercises through the semester would have allowed students to take the time to deepen their knowledge about themselves and the cultural differences.
- The need to make more explicit the link between the cultural assignments and the group project. Explaining how to the knowledge being presented in the assignments are to be used in working in the binational teams. This includes the communication styles and addressing the language barrier students encountered when working with people from different countries. The language barrier can be cause by different levels of English proficiency and accents. As well as the different ways people express their ideas, especially in a second language.
- Start the course with the cultural concepts and its importance to implementing the project well, rather than starting the course with the project description would have allowed student to get the tools to work together in the project and build the working relationship before starting the engineering project.

- Allowing students to build a deeper connection with their teammates by keeping the same team from the beginning to the end of the class and by having “ice break” and team building exercises as part of the first few sections.

However, even with some of the limitations presented above, the ENGR410 class enabled students to see the importance of global competency in their engineering careers, develop and appreciation for different cultures, and realize that people from different cultures/background may see engineering problems differently and arrive to different but valid engineering solutions. In addition, the participation in this class, allowed students to improve their self-confidence and comfort level for socialization, and to develop some important skills such as teamwork and communication.

Considering the experience was for engineering students from a conservative state such as Texas, this mindset change is significant. To provide some context on the current views of the Texas A&M Engineering students, I would like to share the results of an annual survey conducted by the Student Engineering Council (SEC) of Texas A&M. There were almost 8,000 students out of about 14,000 students who completed the Fall 2016 survey. Eighty percent of the students who completed the survey were undergraduate students. The results of this survey related to globalization showed, that 22% of the students do not have a passport, which is lower than expected. However, 70% have not traveled abroad. What is surprising is that even though they have not traveled abroad, 70% said that they fell extremely or somewhat comfortable interacting with people from another country. This result confirms the need for providing

opportunities for students to develop their global competency, as at this point they are not even aware of their intercultural sensitivity development, and believe they are ready for the global engineering industry.

Limitations of the Study

The sample of the study presents four limitations to this study. First, the population of the pilot ENGR410 Global Engineering Design course does not represent the population of the college of engineering. In the college of engineering, 97% of the undergraduate population are traditional students from the United States. In this class, only three students out of eight students (37.5%) represented the majority of the college population. Second, seven out of the eight students come from high-income families. Third, six out of the eight students had traveled abroad extensively before the course. And last but not least, this is an elective class, so students self-selected themselves and the ones who signed up for the class, did so because they were already aware and interested in global engineering, and showed an interest in the globalization aspect of engineering and the importance of it in their future careers.

This can influence the results of the study, as these students may show a higher intercultural maturity than the general population of the college as they may have started at a higher level before the intervention – ENGR410 class. However, maybe the impact of the class would had been even greater with more students who represent the population of Texas A&M Engineering – student who come from a more homogenous environment and that have not traveled abroad.

Implications

The results of this study will support educators in building courses or programs to develop the global competency of engineering students. It confirmed the pillars of the Intercultural Maturity Frameworks in the sense that developing student's cognitive, intrapersonal and interpersonal knowledge will allow them to work more effectively with the different other. It also appears that presenting the concepts related to global competency and allowing students to engage in a project where they work with people from different cultures, allowed students to put the theory to practice and see the global competency skill set important for their engineering careers. In addition, it allowed students to realize that this knowledge is needed for their careers and valuable to the companies they will work for.

The knowledge gained during this study is already affecting the programs in the college of engineering. Not only has this study allowed us to make changes to the two additional versions of the Global Engineering Design course offered in Fall 2015 and Fall 2016, but it also provided insight on how to make the study-abroad programs a richer experience for students in regards to global competency learning.

Implications for the ENGR410 Global Engineering Design Course

From the preliminary data analyses, few changes were made to the ENGR410 course offered after the pilot course:

- The course accounted for the changing time difference between Brazil and United States from the beginning. While the Brazilian group always had their class time be at 12pm Brazilian time, the students at Texas A&M started the

semester with the class time being at 10am, a month into the course it changed to 9am, and after another month it changed to 8am. This is due to the summer times in both countries.

- The teams that worked on the project were defined by the faculty member on the first week of the course and remained the same for the whole semester, not only for the project, but also for all other assignments. With that allowing students to develop a working relationship with their group and get accustomed to the different communication styles and accents.
- The first two lectures of the course were about the global competency and the virtual collaboration tools. This allowed students to learn about some of the tools needed for the class and start to develop a working relationship with one another before diving into the engineering project.
- The professor made the link between the cultural assignments to work effectively among the team more explicit. In addition, the company providing the project made a statement in that regard as well.
- Some of the assignments about global competency required more reflections so students started to think about the implications and not just completing the assignments.

Implications for the Study-abroad Courses

Based on my experience, most of the students who return from a study-abroad experience say it was a life changing experience, but when they talk to potential employers about this experience, they talk about the superficial “touristy” things they did

while abroad. In contrast, after the ENGR 410 class, students talked about this experience in a less "life changing" context, however, they are able to talk about what they learned and what they will bring to the work environment from this experience. With the knowledge acquired through this study, two requirements were added to students participating in study-abroad programs:

1. A workshop called Raising Your Cultural IQ before traveling abroad. This workshop was developed by the Engineering Global Programs Office jointly with the Global Outreach Office of Texas A&M. It became mandatory for all students participating in a study-abroad program of the college of engineering and linked to their scholarship. The goal is to prepare students for the global experience so they are aware of their global competency learning and its implication to their engineering careers.
2. A pre and post reflection paper. Students are now required to do a pre and a post reflection paper as part of their participation grade for the study-abroad course.

Recommendations

Recommendation for Administrators

Developing global competencies in engineering students is not only important to prepare them to the job market and support companies in their endeavors. It is also important for a more inclusive world where differences are respected and appreciated. Considering that, administrators should develop ways that would allow engineering students have a global experience and develop those skill sets. This includes addressing the issues that are preventing students from affording these experiences: cost, curriculum and culture. The findings from this study support advancement in these three areas:

First, cost can be addressed by using technology and the international partnership universities and faculty members already have a course where students get to interact with a group of students from another country is possible. Without the travel cost, students can afford having this initial experience. I do not think study abroad program should be substituted by the virtual experience. However, the virtual experience can can be an alternative to students who cannot travel, or enhance the learning for students who have already participated or will participate in a study abroad program.

Second, the second barrier is culture, which means students seeing the value of such experience and creating a culture where global competency is part of the undergraduate experience. By imbedding global competencies to a real engineering project and linking those skill sets to the success of their engineering careers, it will be possible develop a global culture in engineering. The third obstacle is curriculum, which can be addressed by integrating classes with global experiences to the engineering curriculum so there is no graduation delay if a student choose to partaken in a global experience. Another area for curriculum improvement is to be mindful of the study abroad experiences created for engineering students. Those programs should allow students to realize the implication of global competencies on their personal and professional development. Add more engineering work to study abroad programs.

Based on the results of this study the recommendations for administrators and educators is to have the goal of global preparedness courses be to take students passed the minimization stage of Bennet's Intercultural development model. Once they are passed this level, they can identify and respect cultural differences and include

themselves in the global context. These are the tools needed to enhance their global competencies with future experiences and be ready for the global job market. Once students pass the minimization stage, they have the capacity and humility to understand and accept what they know and do not know about a culture, an important step to develop their intercultural maturity level.

In addition, as mentioned above, engineering students tend not to be interested or see the value of cultural awareness. Therefore creating programs that link global competency to engineering jobs and career success in crucial in creating the interest and developing the attitude that will allow them to gain from such experiences.

In conclusion, administrators should put policies in place to integrate global competencies development as part of the engineering curriculum that goes beyond just sending students abroad. Engineering courses with a global component that do not require travel should be part of the engineering curriculum of the XXI century. Likewise, meaningful programs that go beyond academic tourist should be the requirement for engineering global programs.

Recommendation for Future Research

This study contributed to the body of knowledge on how to prepare students for the global engineering industry they will face. Continuation on research in this field is important so the exercise of using research to improve our practice as higher education educators continues. Some of the suggested future research includes:

1. Doing a pre-intervention interview and a post intervention interview to better understand the student's development throughout the intervention.

2. Doing the study with a larger number of participants to reflect better the demographics of the college of engineering at Texas A&M.

3. Doing a comparison between students with previous international travel experience and student without previous international travel experience.

4. Doing a comparison of global competencies gained from a study-abroad program and the ENGR410 course.

5. Doing longitudinal studies. To identify if these students are more interested in international companies. And how this experience has affected their careers.

6. Add to interview protocol: If students would be more curious and interested after the class or study abroad experience about working abroad.

7. Study whether the ENGR410 course enhances the study-abroad experience; in what way? This combination, study-abroad experience and the ENGR410 is part of the engineering international certificate.

8. Understand why most of the students, when they return from a study-abroad experience, say it was a life changing experience, but when they talk to potential employers about this experience, they talk about the superficial "touristy" things they did while abroad. In contrast to students after the ENGR 410 class, who talked about this experience in a less "life changing" context, however, were able to talk about what they learned and what they will bring to the work environment from this experience

Closing Thought

In developing programs to enhance the global competency of students, an outcome I would like to have is students with the humility or the maturity to understand

that not all cultures are the same, and that there is no right or wrong culture. Even if a student becomes an expert in a culture, they cannot generalize or stereotype that culture. The goal is for students to interact with people following Kohlberg's (1984) description of Post-conventional reasoning, where moral criteria (such as respect for human rights) have primacy over social conventions (such as roles or contracts) in making moral decisions (King & Baxter Magolda, 2005). At this level, individuals acknowledge that there are many possible social arrangements, so members' duties and rights should derive from the moral purpose of the arrangement, not from its existence per se (King & Baxter Magolda, 2005).

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APPENDIX A

INTERVIEW GUIDE A AND B

Round 1 Interview Guide: December 2014

Opening Question:

1. Please tell me / describe to me how did you grew up

Cognitive

Level 1) Assumes knowledge is certain and categorizes knowledge claims as right or wrong; is naïve about different cultural practices and values; resists challenges to one's own beliefs; views differing cultural perspectives as wrong. Level 2) Evolving awareness and acceptance of uncertainty and multiple perspectives; ability to shift from accepting authority's knowledge claims to personal processes for adopting knowledge claims. Level 3) Ability to consciously shift perspectives and behaviors into an alternative cultural worldview and to use multiple cultural frames.

2. How different or equal was the application of engineering skills to solve the engineering problem in this global team compared to teams in your other classes?
3. How do you determine what is right and what is wrong when making decisions?
4. In your view what is a global engineer?
5. How do you define what is true in the world?

Intrapersonal

Level 1) Lack of awareness of one's own values and intersection of social (racial, class, ethnicity, sexual orientation) identity; lack of understanding of other cultures; externally defined identity yields externally defined beliefs that regulate interpretation of experiences and guide choices; difference is viewed as a threat to identity. Level 2) Evolving sense of identity as distinct from external others' perceptions; tension between external and internal definitions prompts self-exploration of values, racial identity, beliefs; immersion in own culture; recognizes legitimacy of other cultures. Level 3) Capacity to create an internal self that openly engages challenges to one's views and beliefs and that considers social identities (race, class, gender, etc.) in a global and national context; integrates aspects of self into one's identity.

6. Can you please describe your personality?
7. How do you feel around people from backgrounds very different from your own?
8. How do you react around people from backgrounds very different from your own?

9. How have the activities in the class changed the way you view/define problems?

Interpersonal

Level 1) Dependent relations with similar others is a primary source of identity and social affirmation; perspectives of different others are viewed as wrong; awareness of how social systems affect group norms and intergroup differences is lacking; view social problems egocentrically, no recognition of society as an organized entity. Level 2)Willingness to interact with diverse others and refrain from judgment; relies on independent relations in which multiple perspectives exist (but are not coordinated); self is often overshadowed by need for others' approval. Begins to explore how social systems affect group norms and intergroup relations. Level 3) Capacity to engage in meaningful, interdependent relationships with diverse others that are grounded in an understanding and appreciation for human differences; understanding of ways individual and community practices affect social systems; willing to work for the rights of others.

10. What cultural differences did you notice, if any, among the people you worked with?

11. How was the experience of sharing ideas and completing the project with the members of your team?

12. How was working and interacting with your teammates?

Closing Question:

13. What would you do differently in the class?

Demographic Questions: *if not answered from earlier questions*

Gender _____ Nationality _____

Traveled abroad before: yes no If yes: Purpose_____ from how long_____

Studied abroad before: yes no If yes: Where_____ for How long_____

Round 2 Interview Guide: February/March 2015

1. What classification were you when you took the class (freshman, sophomore, junior, senior)
2. What prompted you to sign up for the ENGR 410 class?
3. What did you expect to get from the class?
4. What did you actually get/learn from the class?
5. How being in that class has impacted your current activities, classes and circle of friends?
6. If you were starting that project in that binational team, what would you do differently now?
7. Describe to me your feelings and reaction when you are interacting with someone different from you or with a strong opinion that if different from yours.

APPENDIX B

CLASS SYLLABUS LISTING ASSIGNMENTS

ENGR 410 - Global Engineering Design

Instructors:

- Dr. Jorge Leon, ETID & ISEN, Texas A&M; +1 (979) 845-4993, jleon@tamu.edu.
- Dr. Marcelo Savi, Professor, Mechanical Engineering, Federal University of Rio de Janeiro (UFRJ), Brazil , savi@mecanica.ufrj.br.
- Alan Labes, Innovation Manager, South America Technology Center, FMC Technologies, Brazil.

Course Description: A study of intercultural models and their application to engineering design in diverse, multinational and multidisciplinary settings. Students carry out an engineering design project working in international teams of students, faculty and industry experts. In addition to applying engineering skills in the project, topics also include the study and application of intercultural models, global enterprise fundamentals, and remote collaboration technologies.

Learning Outcomes: To learn to work effectively (professional, productive, culturally sensitive) as an engineer in multicultural and multidisciplinary work environments. The student will learn to:

- Integrate and apply skills required to solve an engineering design problem (Design and cognitive competence).
- Be aware of intercultural differences and similarities, and their relevance to effectiveness in the workplace (Cognitive competence).
- Apply intercultural knowledge for self-improvement (Intrapersonal competence).
- Apply intercultural knowledge for effective teamwork (Interpersonal competence).
- Apply synchronous and asynchronous technologies for remote and web-based collaboration (communication competence).

Course Activities:

- A challenging design project serves as the common application context for the class.
- Students will organize in international teams.
- Topics relevant to work in intercultural/international settings will be covered in parallel and integrated with the project.
- The course content will be delivered combining traditional face-to-face, video-conference, and web-based lectures and readings.
- Routine structured and unstructured meetings will provide opportunities for routine interactions between the international participants; students will be required to document these interactions in weekly journals.
- Invited guest speakers.

Grading:

	Weight
Attendance and Participation	20%
Assignments	40%
Final Project	40%
TOTAL	100%

%	Letter Grade
90.00-100.00	A
89.99-80.00	B
79.99-70.00	C
69.99-60.00	D
Less than 59.99	F

Attendance is as per university regulations: http://student-rules.tamu.edu/rule07; absences from any graded activity require a medical confirmation note containing the date and time of the illness and medical professional's confirmation of needed absence. ***Your participation in remote collaboration activities, online lectures, online discussions, and related tasks will count as part of your attendance and participation grade***.

Course Website:
The course will use eCampus, http://eCampus.tamu.edu as the course website. Within eCampus, students will be able to locate reference materials, communicate with the instructors, and submit electronic assignments. To access eCampus go to, http://eCampus.tamu.edu, click the login button the left side of the screen and then enter your TAMU credentials. If you have problems login in or using eCampus, please contact support at itshelp@tamu.edu or 979-458-3417.

Reference Materials:
The following is a list of reference materials for the course. These materials and additional links will be provided within eCampus.

A. Project related references:

1. Technical references to be provided by the instructor.
2. Kelley, T. and J. Littman, *The Art of Innovation*, Random House, 2001.
3. Video: "The Deep Dive," ABC News, July 13, 1999.
    a. http://www.youtube.com/watch?v=JkHOxyafGpE
    b. http://www.youtube.com/watch?v=pVZ8pmkg1do
    c. http://www.youtube.com/watch?v=nyugyrCQTuw
4. Video: Creativity by Catherine Courage: http://www.youtube.com/watch?v=01Y7qlPFpqw
5. Teamwork: Scholtes, P.R. et al., *The Team Handbook*, P.R. Sholtes, B.L. Joiner and B.J. Streibel, 3rd edition, Oriel Inc., 2003.

B. Global engineering & culture :

6. M. Bennett
    a. Hammer, M.R., M.J. Bennett and R. Wiseman, "Measuring intercultural sensitivity: The intercultural development inventory," *International Journal of Intercultural Relations*, 27 (2003), 421-443.
    b. Video: Bennett's Developmental Model of Intercultural Sensitivity (DMIS): https://www.youtube.com/watch?v=6vKRFH2Wm6Y
7. Geert Hofstede
    a. Geert Hofstede, Gert Jan Hofstede, Michael Minkov, *Cultures and Organizations: Software of the Mind.* 3rd Edition, McGraw-Hill, USA, 2010.
    b. Video: culture model: https://www.youtube.com/watch?v=wdh40kgyYOY
    c. Video: World map with dimensions: https://www.youtube.com/watch?v=U-XdlbgFxZo
    d. Dimensions per country: http://geert-hofstede.com/countries.html
    e. Sample applications: http://geert-hofstede.com/applications.html
8. Deborah Swallow
    a. Video – Intercultural Communication Adventure with Little Pilot: https://www.youtube.com/watch?v=PSt_op3fQck&list=UU5Fhj5TFtvGw2fqGI3rlo5Q
    b. Video – what is cross cultural communication?: https://www.youtube.com/watch?v=nT3Adjs3rGM&list=UU5Fhj5TFtvGw2fqGI3rlo5Q
9. King, P.M. and M.B Magolda, "A Developmental Model of Intercultural Maturity, *Journal of College Student Development*, Volume 46, Number 6, November/December 2005, pp. 571-592.
10. C. Acosta, V.J. Leon, C. Conrad and C.O. Malave, *Global Engineering; Design, Decision making and Communication*, Taylor & Francis, 2010.

C. Remote collaboration and virtual meetings:
Within ENGR 410, instructors and students will use a variety of technologies to interact with each other. These technologies include:

1. Bb Collaborate
    a. Collaborate will be used as the official communication between instructors and students within the course. Collaborate can be accessed within the eCampus website, under the

Bb Collaborate link located within the menu on the left. Before the first collaborate session, you will need to visit http://blackboard.force.com/publickbarticleview?id=kA770000000CbIW to check your system requirements.

b. Here are some tips for using collaborate for these virtual meetings:
    i. Join Early – get in habit of joining your session at least 10 minutes early, which gives you a chance to make sure that your computer configured correctly
        1. Run the Audio Wizard as soon as you join the session to ensure that your audio is working correctly.
    ii. Ensure that there are not other programs running in the background while using Collaborate. This not only helps you focus at the task at hand, but using websites with large bandwidth like YouTube, Facebook, and other websites can interfere with the Collaborate session.
    iii. Ask questions within the chat box or virtually raise your hand if you have any questions during the virtual session. There will be times when the instructors will call on participants during these sessions.

2. Google Drive & Hangouts:
    a. If you have not already authorized your Google Apps for Education account, please go to http://google.tamu.edu/.
    b. Groups will have a Google Drive folder created for them by the instructors (using your @tamu.edu email address), which will allow groups to interactively work together on assignments and projects. Groups can create any type of drive document (i.e. document, presentation, spreadsheet, etc.) as well as use this as common document storage for all team assignments and projects. If you do not see the folder within your Google drive folder, click on "Shared with me" in the left hand menu. Here are some tips for using Google drive:
        i. File Sharing – any document that is uploaded or created into the group folder will be shared with the group. Make sure that you are uploading content to the correct drive folders.
        ii. Be considerate of others work – determine how the team would like to handle corrections and revisions to Google files. Google tracks the history of the document, but some may not be done with their thoughts when exiting the document. Determine what works best for everyone in the group.
        iii. Multiple users – when multiple users are in the same Google files, you will see different colored cursors indicating the area in which that user is editing. When using Google Spreadsheets, the cell will be grayed out when another person is editing a cell.
    c. Google Hangouts can be used to communicate with group members, this will not be used to formally communicate with instructors within the course. Additional information about Google Hangouts can be found at https://www.google.com/+/learnmore/. Feel free to use other technologies to communicate with your groups and share your experiences with your classmates and instructors.
3. Managing a remote workforce: http://thefutureofwork.net/assets/Managing_a_Remote_Workforce_Proven_Practices_from_Successful_Leaders.pdf

Important Policies:

Academic Integrity Statement & Policy:
"*An Aggie does not lie, cheat or steal, or tolerate those who do.*" For more information on the TAMU academic integrity policies, please visit http://aggiehonor.tamu.edu.

Americans with Disabilities Act (ADA) Policy Statement:
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu.

COURSE CONTENT – Please check eCampus for updates and assignment details.

Topic	Readings, meetings & assignments
L1. Course introduction • Description • Procedures	• Check remote collaboration technology (web based audio- and video-conferencing)
• Remote collaboration technology	• Read articles on remote collaboration, "Five Tips for Better Virtual Meetings" • Complete practice assignments
L2. Intercultural maturity • Bennett's intercultural sensitivity developmental model o Ethnocentric developmental phase o Ethnorelative developmental phase	• View video on Bennett's model. • Complete written assignment
• Intercultural maturity model o Cognitive dimension o Intrapersonal dimension o Interpersonal dimension o Examples	• Read King, P.M. and M.B Magolda, "A Developmental Model of Intercultural Maturity, *Journal of College Student Development*, Volume 46, Number 6, November/December 2005, pp. 571-592 • Complete written assignment
L3. Culture • Hofstede cultural dimensions	• Read Hofstede's handouts • Watch Hofstede's videos • Complete written assignment
L4. Selected topics in global engineering • Global engineering framework • Global supply chains • International trade and agreements • The effect of foreign exchange • Global human resources • Property and IP rights	• Read Global Engineering Model chapter (Acosta *et al*., 2010) • Experts talk about similarities and differences in cultures (Brazil & USA) • Student SCHEDULED self-study by watching short videos and readings on each topic • Scheduled online discussions • Complete written assignment

Course content (continued)

P1. Project description • Problem description • Expected deliverables	• Read reference articles

P2. Individual research	• Assignment:
	  o Research topic of interest related to project (Individually)
	  o Write 1-2 page summary; sketch ideas

	• Presentations of main topics learned by individual students
Design Process **P3. The voice of the customer**	• View Deep Dive videos • Form International Market research GROUPS • Groups get the "voice of the customer" o Write 1-2 page summary; sketch ideas

	• Groups report what users/customers say (all)
	  o Write 1-2 page summary; sketch ideas
	  o Large meeting prioritize customer/user needs
	• Complete written assignment

P4. Idea generation	• Virtual brainstorming meetings (2x, or as needed) (All) • Team ranks top ideas • Complete written assignment

P5. Synthesis of best ideas: design solution	• Virtual Team meets as necessary
	  o Discuss merit of top ideas
	  o Integrate into solution
	• Complete written assignment

P6. Prototyping: students organize in teams to build prototype, additional research/engineering, and documentation – prototype must be built in 4 weeks	• Virtual team meetings as necessary:
	  o Organize in teams
	  o Working meetings as necessary
	• Complete written assignment

P7. Final Report and presentations (industry, faculty, users)	• Prepare presentations and reports to stake holders o Working meetings as necessary • Give presentations and gather feedback