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Preparing Engineering College Students for a Culturally Diverse Global Job Market

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PREPARING ENGINEERING COLLEGE STUDENTS FOR A CULTURALLY DIVERSE GLOBAL JOB MARKET

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 and society. The literature shows a broad agreement in the sense that global competency is needed for the engineers entering today's job market and society. However, less agreement exists as to what this skill is about, what to call it, and how to prepare our students. By identifying the intercultural maturity level of students in the College of Engineering enrolled in the ENGR 410 Global Engineering Design course during Fall 2014, this study contributes to the body of knowledge of how students come to appreciate cultural differences to interact effectively with different others is important.

This qualitative study used the Intercultural Maturity Framework developed by King & Baxter Magolda (2005) and followed the Naturalist inquiry paradigm using the interpretive method relying on information from interviews, documents and reports. The results of this study showed that this global course had a positive impact on students' intercultural maturity development. The course had three key components (engineering project; global competency concepts and the virtual participation of Brazilian students) that together, seemed to positively affect the intercultural maturity of the students. 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. Overall, after the Global Engineering Design class, students were able to articulate, when describing the experience, their learning and what they will bring to the work environment and lives from this experience.

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 [1]. Engineers need to have a global mindset to be prepared for the global job market [2]. 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 [3]. 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" [4].

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 [5]. 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 [5] . 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 [6].

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 [7]. There are studies showing that study-abroad alone may not improve cultural understanding [8]. Maddux et al. (2013) stated that the exposure to new cultures alone is insufficient to bring the benefits associated with multiculturalism [9]. 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 [10] in [9].

Whereas industry and academia agree on the need for cultural humility [11], 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 [1] in Groll, 2013. This study 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.

Literature Review:

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 [11]. 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) in [11]. Taking a politically and emancipatory driven approach, multicultural education requires a commitment to

cultural diversity (Finkelstein et al., 1998; as cited in [11] . 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 [12]. Below I present some of the terminologies and frameworks being used today in this filed including the one chosen as the framework for this study – 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 [13]. 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) [3]. 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 [14]. 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 [11]. 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 [15] as cited [11].

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 [15]. 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 [15]. Below I show one of them, which is in the shape of a pyramid.

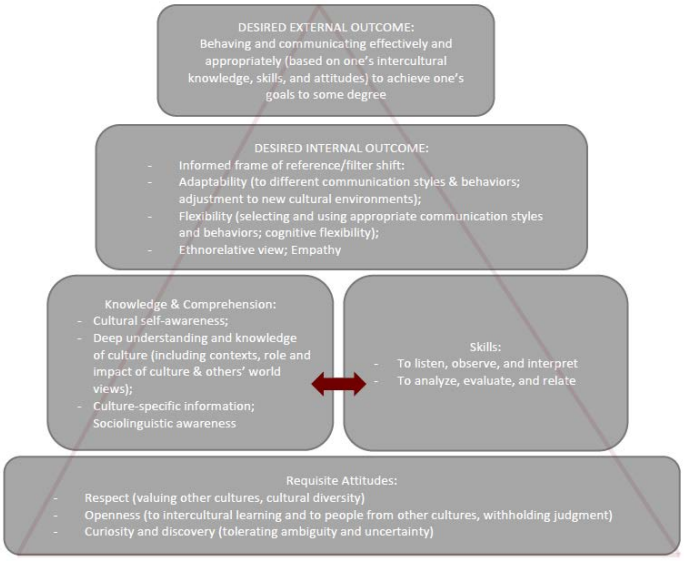

Figure 1. Model of Intercultural Competence in Pyramid Format. Adapted from Deardorff, 2006

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 [15]. A conclusion from Deardoff's 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 [15]. 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 [15]. 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 [15].

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 [11]. 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 [11]. 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 [11]. 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.

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 [11]. 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 [11]. Cultural empathy is one of the components of cultural humility [11]. 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 [11]. 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 [11].

Cultural humility is more than a sum of the components of technical knowledge, professional skills, and attitudes and relationships between individuals [11]. 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 [11]. 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 [11]. 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 [11]. 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 [11].

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 [16]. 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 [16] 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 [17]. 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 [17]. 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 [17].

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 [12]. 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 [12]. 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 [12]. 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 [12]. 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” [15] 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 [15].

This section of the literature review presents 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 [15]. Her review shows one more time that there has broad ways on how intercultural competence is 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 [15].

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 [18]. 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 [18]. 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.

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 [15]. 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 through the ENGR410 Global Engineering Design course. 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 and society.

Problem Statement:
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: 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 [12], of students in the College of Engineering at this large university in the South of the United States 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.

Research Questions:
1. What is the intercultural maturity level of undergraduate students in the College of Engineering at this large university in the South of the United States 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 this large university in the South of the United States 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 this large university in the South of the United States 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 [13]. For this study, the theoretical framework 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 [14] 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" [15]. Figure 2 illustrates the interdependency of the three dimensions for achieving intercultural maturity.

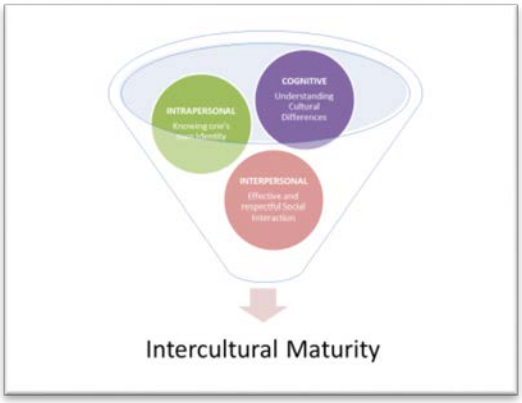

Figure 2. Three Dimensions of the Intercultural Maturity Framework

This framework is relatively new and has not been empirically tested. However, this framework was chosen because it explores how intercultural development occurs and articulates the developmental steps involved in achieving intercultural sensitivity, competence, and effectiveness [14]. 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?" [12] p.571. 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 better 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.

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 [12]. 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" [12] p. 573.

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

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 large university in the South of the United States 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 included the study and application of intercultural models, global enterprise fundamentals, and remote collaboration technologies. In 2014, the class was co-taught with a Brazilian University. There were eight students from the College of Engineering and seven from the Brazilian University. Students did not travel but met and worked together virtually. The same content was taught to the two groups of students.

The course was taught by a faculty leader from this large university in the South of the United States and a co-faculty member from the Brazilian University. Students from this large university in the South of the United States and from the Brazilian University were part of exact the same course. Students from the Brazilian University were granted access to e-campus, the teaching platform used by this large university in the South of the United States, and had access to all of the assignments, lectures and were part of the same industry project. The course was designed 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 a Brazilian University 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 this large university in the South of the United States 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 this large university in the South of the United States.

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 states 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 [1] in [11]. This study contributes to the body of knowledge on how to and what prepares engineering students to be ready for the global job market and society they will face once they graduate by understanding how students come to appreciate cultural differences to interact effectively with different others 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 [16].

Methodology:

This study began in December 2014 with a non-probabilistic purposeful sampling of the students taking the Fall 2014 ENGR410 class. Only the eight students enrolled in the class in the large University in the South of the United States 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" [17]. 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 [18]. 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 [18]. 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 [18].

The full range themes that emerged started from the selected the 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 [18]. Besides the six themes described above, eighteen categories and thirty subcategories emerged from this data analyses. The complete list of the categories is listed in appendix 1.

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 2. 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.

Group 1: 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.

Group 2: 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.

Group 3: 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.

Group 4: 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 2. Participants Demographics

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

Results:
Through the analyses of the data collected from the 16 interviews, two interviews with each of the eight participants, and their course assignments, 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 and society they will enter once they graduate.

Table 3below 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 3. 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?

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.

Table 3 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?

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.

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 3 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 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.

In addition, 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.

To close this section on the summary of the findings, I refer to the last column of table 3 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.

Even though based on a small sample, I make the preliminary conclusion that this type of course is valuable to engineering students today and did have a positive impact in the majority of the students who enrolled in the class. 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 a small town in the South of the United States. 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 [19]. 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 [19]. So having the positive impact with the one semester course, proves worthwhile developing such a course for our engineering students.

Additional Conclusions:
The three components of the class appeared effected in helping students develop their intercultural maturity. The engineering project provided by the company attracted the students to signed up for the course, and 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 (1993), 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 show the value and 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. Third, cultural understanding processing requires time and I believe some of the learning from this experience will continue to take place as students are in intercultural situations.

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.

Limitations of the Study:
Besides being a very small sample size, the sample of the study presents four other limitations to this study. First, the population of the pilot ENGR410 Global Engineering Design course does not represent the population of this 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 (38%) 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 this large university in the South of the United States 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 endorses the pillars of the Intercultural Maturity Frameworks in the sense that developing student's cognitive, intrapersonal and interpersonal knowledge will better prepare students 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 influencing 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 large university in the South of the United States started the semester with the class time being at 10am, 2 months 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. In the future, to prevent the students in the American University from blocking such a large block of time in their schedule, the class will meet twice a week from August

to October (before the time changes is in effect) and two more times from October to December. From October to December, students will meet in their small groups to work on the project.

- 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:

One change was 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 this large university in the South of the United States. 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. The second change was 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. Another change that is being implemented is a pre and post assessment for all of the global programs engineering students participate.

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 to 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 preliminary findings from this small study and the literature review, supports different ways to look at and try to address these three areas:

First, cost can be addressed by using technology and the international partnerships universities and faculty members already have to create a course where students get to interact with a group of students from another country. 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 be an alternative to students who cannot travel, or to 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. The study with this small group showed that imbedding global competencies to a real engineering project and linking those skill sets to the success of their engineering careers, could help to 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 chooses 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.

Even though based on a small sample, the results of this study suggest that creating programs that link global competency to engineering project and career success in important in creating the interest, value and developing the attitude that will allow them to gain from such experiences.

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:

- Doing a pre-intervention interview and a post intervention interview to better understand the student's development throughout the intervention.
- Doing the study with a larger number of participants to reflect better the demographics of the college of engineering at large university in the South of the United States.
- Doing a comparison between students with previous international travel experience and student without previous international travel experience.
- Doing a comparison of global competencies gained from a study-abroad program and the ENGR410 course.
- Doing longitudinal studies. To identify if these students are more interested in international companies. And how this experience has affected their careers.
- Add to interview protocol: If students would be more curious and interested after the class or study abroad experience about working abroad.
- 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.

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Appendix 1

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

	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

	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