THE PERCEIVED VALUE AMONG EMPLOYERS OF COLLEGE STUDY ABROAD FOR ENGINEERS

Christopher H. Heiden, B.A.A.S., M.S.

Dissertation Prepared for the Degree of

DOCTOR OF EDUCATION

UNIVERSITY OF NORTH TEXAS

August 2012

APPROVED:

Marc Cutright, Major Professor
Ronald Newsom, Committee Member
Matthew Traum, Committee Member
Janice Holden, Chair of the Department of Counseling and Higher Education
Jerry R. Thomas, Dean of the College of Education
Mark Wardell, Dean of the Toulouse Graduate School

Heiden, Christopher H. The Perceived Value among Employers of College Study Abroad for Engineers. Doctor of Education (Higher Education), August 2012, 81 pp., 30 tables, references, 34 titles.

Engineering graduates of the twenty-first century must be worldly and understand how to work with professionals from many cultures on projects that cross international boundaries. Increasingly, employers are finding that prospective employees who have studied abroad make better, more rounded candidates than those who have no life experience outside of their home region. The objective of this study was to determine whether engineering students who participate in a major-specific, study abroad experience are more desirable as candidates for employment than those who only study at their home institution. This descriptive study surveyed the membership of the combined Industrial Advisory Boards of the University of North Texas College of Engineering (n=90) which is a focused group of skilled managers and directors that represent various businesses, industries and organizations. The survey yielded a 58% response rate. The evaluation was validated by a survey that searched for a perceptual trend among representatives from business and industry who are in a hiring capacity for engineering graduates, evaluating a major-specific study abroad experience as part of a graduate's employability and career growth. Statistical Analysis was made on Companies whose scope of business is domestic and international comparing the perceived value of study abroad as a characteristic for hiring new engineers, as well as comparing the perceived value of foreign study or work experience on the career development of engineers. These

tests indicated that at the 0.05 level there was no statistical significance in the findings. Additional analysis was made on groups of employees that either had foreign experience (work or study) and those that did not. These tests indicated that there was no statistical significance in the findings. Analysis of the data indicates that although having a major specific study abroad experience may not be important at the entry level, it becomes more important as an engineer progresses into mid-career. It could also indicate change in the business climate and a growing need for global awareness. Additional observations show that other co-curricular activities, such as internships and grades weigh more in the hiring of a new engineering graduate.

ACKNOWLEDGEMENTS

For Mary and our parents who instilled in us a love of learning and had faith in my abilities. And to our family and friends who provided moral support along the way.

I wish to express my gratitude to my dissertation committee, Dr. Marc Cutright and Dr. Ron Newsom from the University of North Texas and Dr. Matt Traum from Milwaukee School of Engineering for their guidance and patience in completing the degree requirements. I would also like to thank the University of North Texas College of Engineering for their support in this project.

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CHAPTER 1

INTRODUCTION

Orientation and Background

In the first few decades following World War II, American industry largely ruled the international marketplace. This was largely because the world's industry had worn itself out providing materials needed to win the war, leaving the U.S. in a strong position to be the supplier of goods to rebuild post-war commerce. The old ways of one country being able to design and manufacture its own goods would give way to a global marketplace where, in more recent decades, large international corporations might design goods in one country, to be assembled from component parts manufactured in other countries, with a final consumer in a third location. Products and services of these international corporations are developed, designed and produced by engineers and technicians who, while trained domestically, find themselves in key roles in a global economy.

Traditional engineering methods and technologies are no longer sufficient to meet the demands of the global marketplace of the twenty-first century. American engineering graduates will need an understanding of these methods, technologies, and the world community in order to compete and collaborate with engineers from foreign countries. Because of their limited or non-existent understanding of cultures outside the restricted scope of their locality, their life experience and education does little to prepare them to

assume this role. Most envision a career that will not take them far from home. Few have learned a second language (Oakes, Leone & Gunn, 2012).

As the current population of engineers ages, it must be replaced with a new generation, a technical workforce of engineers that will be prepared to evolve in their profession. Engineering and technical foundation skills will no longer be enough for success in the global marketplace. The new generation engineer will need to have strong customer service and business skills in a global context (McMasters, 2004).

Increasingly, employers are finding that prospective employees who have studied abroad make better, more rounded candidates than those who have no life experience outside of their home region. As a result, they actively seek out candidates who have made an effort to enhance their employability by going beyond the standard degree plan to include options that will meet the skill-set needed by future employers. In their 2005 report, *Global Competence and National Needs: One Million Americans Studying Abroad*, the Commission on the Abraham Lincoln Study Abroad Fellowship Program stated:

> It is no secret to anyone that the United States is buffeted by international forces. Our economic, military, and diplomatic challenges are global in nature. Modern technologies, communications, and transportation systems have remade manufacturing and distribution on a global scale. American corporations understand the importance of these issues. Increasingly business leaders recognize that they must be able to draw on the people with global skills if their corporations are to succeed.

Continental AG (a global leader in the automotive industry) and prestigious engineering schools from around the world started the Global Engineering Excellence initiative. The goal of this initiative was to highlight the importance of engineering to the

world economy as well as the need for future engineers (Continental AG, 2006). The major findings of this initiative were (1) that global competence needs to be a key qualification of engineering graduates and (2) that transnational mobility for engineering students, researchers and professionals needs to become a priority.

In the past ten years, the Institute of International Education revealed in its Open Doors report that the number of students (all majors) from the U.S. who participated in a study abroad experience rose over 200 %. While this growth is encouraging, the total is less than 300,000 students nationwide. Of that number only 3.2 % are identified as engineering students (IIE: Open Doors Data – U.S. Study Abroad, 2011). This total should be compared to the more than 670,000 international students, of which 17.7 % majored in engineering. It should be noted that many international students stay for an extended time (IIE: Open Doors Data – International Students, 2011).

Program Development

In the aftermath of World War II, many visionaries began to realize that there was a need to increase mutual understanding between the people of the United States and the other countries of the world. Through programs such as Fulbright and Marshall, opportunities for students to study in another culture became available to citizens of the United States and selected foreign countries. While a step in the right direction, participation in these programs is very limited.

Traditional study abroad programs are typically grounded in the liberal arts. Students wishing to study abroad enroll in courses that fill mandated core requirements or for personal enrichment. Under the general University of North Texas (UNT)

international exchange structure, all students wishing to study abroad must identify a host university, then propose a schedule of courses to UNT and the host university. This is often a difficult task because of scheduling classes and examinations. As a result, only lower-division, general education courses taken at host international universities are currently considered for transfer back to UNT's College of Engineering. Thus, upper division UNT engineering students are essentially barred from study abroad experiences, and cannot accentuate or enhance their engineering education through coursework in areas of specialization and strength at the host international university.

An additional barrier for engineering students to participate in an international engineering student exchange is the lack of assurance that engineering courses taken at host universities will satisfy elements of the home college's engineering curricula. Engineering students wishing to study abroad must identify an approved host university that has an engineering program. They must then wade through confusing terms and courses of study to propose a schedule of courses at the host university, afterwards securing their home university's assurance to accept those classes toward their degree. This process requires a considerable amount of time from faculty advisors to review the proposed class schedule and confirm that its content is significantly the same as courses the student would take if he/she stayed at the home university.

A perception exists that if a student decides to add a study abroad experience to his/her education experience it will add both time and unnecessary hours to their degree plan, equating to added cost. This is largely because traditional study abroad programs are designed for liberal or fine arts degrees. Additionally, due to the rigorous nature of

engineering programs, there is little room for a student to study a foreign language. While many foreign universities teach courses in English, it is difficult to navigate daily life without the benefit of a working knowledge in the language of the country.

These barriers limit the engineering student's ability take advantage of a study abroad opportunity. If they can only take lower-division, general courses at host universities, they will undoubtedly not graduate on time. By developing a plan that will accept upper-division engineering courses, a student could enhance his/her engineering education through coursework in areas of specialization and strength at the host international university.

A study abroad program was developed and implemented to eliminate or minimize many of the barriers that traditionally prevented engineering students from including this as part of their educational experience. The intention of the program was not only to remove the barriers but to expose the students to engineering methods and practices of other countries, as engineering standards have evolved based on global needs. Additionally, by the nature of living in another country for an extended period of time, a student will gain from making new friendships and experiencing the culture of the host country. Additional information about development of this plan can be found in Appendix A.

This student exchange program allows students from the UNT College of Engineering and selected UK universities to study for one academic year in the opposite country. As opposed to typical study abroad programs, this model will allow students to fully exchange engineering coursework from a host institution to their home institution's

program. Students are required to be academically prepared for immersion in advanced coursework in their major, with the possibility of participation in an internship or research in the host country.

Statement of Problem

The objective of this study was to determine whether engineering students who participate in a major-specific, study abroad experience (one or two terms in length) are more desirable as candidates for employment than those who only study at their home institution. This appraisal was validated by a survey that searched for a perceptual trend among representatives from business and industry who are in a hiring capacity for engineering graduates. This trend evaluated a major-specific study abroad experience as part of a graduate's employability and career growth.

Questions that stem from this statement and guided the research were:

1. How desirable for employers is having a study abroad experience as a characteristic for hiring an engineering graduate?
2. Would having a study abroad experience positively affect the career development of an engineer?

Significance of Study

Engineering graduates of the twenty-first century must be worldly and understand how to work with professionals from many cultures on projects that cross international boundaries. This fact is evidently so critical that Rensselaer Polytechnic Institute (RPI), one of the nation's top engineering schools, has made the international exchange

experience mandatory for its engineering students (National Society of Professional Engineers, 2008).

Undergraduate programs in engineering disciplines are rigorous and have limited flexibility for deviation from the prescribed course of study for students who wish to graduate in four years. The Accreditation Board for Engineering and Technology (ABET) requires, at the bachelors degree level, adherence to a strict regimen of courses to secure and retain engineering program accreditation. Because of the restrictions placed on an engineering curriculum, it is nearly impossible for UNT engineering students to take advantage of the benefits of a study abroad opportunity and complete their degrees on time.

Definition of Terms

- Major specific -- Courses directly relating to the degree requirements of the engineering major.
- Study abroad -- An educational program of study, where coursework performed outside the home institution earns college credit towards degree requirements. In the context of this study the length of the experience must be one or two long semesters.
- Home institution -- The degree granting institution from where the student originates.
- Host institution -- The foreign institution where the student visits and takes courses towards their degree requirements.

Limitations and Delimitations

Limitations of this study are (1) that the source of the data gathered was restricted to the members of the advisory board of a single institution and (2) the possibility of bias from the responder. These findings are a generalization which might not be able to be replicated at other institutions. Concerns about bias are minimized because the subject of the survey has not been presented to the advisory board as an item of discussion. The delimitation was that this study was based on the perceptions of the business professionals who are members of a board of advisors from a single college of engineering.

CHAPTER 2

LITERATURE REVIEW

Introduction

In the 18th and 19th centuries many upper-class Americans sent their children (mostly males) on organized "tours" to Europe to learn culture and to be exposed to the British upper-classes. This experience also included traveling to centers of culture such as Paris and Rome. The "Grand Tour" format helped shape expectations of study abroad into the 20th century.

As a result of lessons learned in World War 1, programs were developed that would place emphasis not only on languages but on cross-cultural understanding in an effort to not repeat the mistakes that lead to war. Most notable was a plan developed and implemented by Raymond. W. Kirkbride of the University of Delaware, who was a veteran of World War 1. He realized that there was value in traveling and understood the value of learning about other people and their cultures. His plan was to send students abroad for one year to gain the language skills and cultural awareness to become future leaders. With the help of University of Delaware President Walter S. Hullihen the plan was endorsed by Herbert Hoover (then Secretary of Commerce) and supported through philanthropic efforts of businessmen such as Pierre DuPont. In 1923 the first group of students traveled to France. Other European countries were added until the outbreak of the Second World War (University of Delaware, n.d.).

After World War 2 the emphasis of study abroad focused on foreign languages and solutions for social problems in the interest of national defense. Since this was now in the best interest of the country funding became available and study abroad, while still largely a liberal arts experience, became available to a wider section of the student population and was no longer restricted to the upper class (Chen, 2007).

The Servicemen's Readjustment Act of 1944, more commonly known as the G.I. Bill of Rights, put returning servicemen into college to help prepare them for the future. Before the war, rapid advances in technology and the idle years of the Great Depression had created the need for a knowledgeable workforce. Visionaries, such as Senator William Fulbright, saw the need for the people of the world to have a greater understanding of each other. Much like Kirkbride there was a belief that face-to-face contact would help one understand the problems of others. Fulbright introduced a bill in the U.S. Congress that would promote “international good will through the exchange of students in the fields of education, culture and science” (U.S. Department of State, n.d.). This bill passed in 1946.

Awakened by the launching of the first satellite, *Sputnik*, by the USSR in 1957, the U.S. found itself in a position that was, at least in appearance, technologically behind the Soviets. Driven by this and the developing Cold War, Congress passed the National Defense Education Act of 1958, which provided funds to help improve the teaching of math, science and foreign languages, as well as financial assistance for students majoring in these subjects (Federal Education Policy History, 2011).

Students majoring in foreign languages and other areas needed for national security could take advantage of bills like these and perfect their international skills by studying abroad. Because of the rigidity of engineering programs it was difficult for a student to interrupt their studies to participate in such an opportunity (Commission on the Abraham Lincoln Study Abroad Fellowship Program, 2005).

Importance of an Engineering Study Abroad Experience

The business of the 21st century will continue to become more international in scope than anything known in the past. No longer will there be large countries dominating the design and production of products and goods.

As an example one only needs to look at the new Boeing 787 Dreamliner. This aircraft represents a product that was globally developed and manufactured. Many of the major subassemblies were manufactured in the United States, Canada, Italy, Korea, Australia, Japan, England, Sweden and France, with materials gathered from around the world (Parkinson, 2009). Similar examples can be found in electrical, chemical and civil engineering.

The engineers of the future will become leaders, managing activities around the world. As such they will need a proper skill set that allows them to be globally competent to take over these responsibilities.

National Interest

While the United States ranks as one of the most advanced countries, it is possible that the number of its native born scientists and engineers will decline to a level that cannot sustain a competitive edge. It is imperative that steps be taken to not only increase

the number of U.S. students completing degrees in these fields but to have them globally competent to retain our standing on the world stage (Wainwright, 2009).

The governments of many countries identify the need for their citizens, and particularly their workforce, to be globally competent. There are various reports from governmental, educational and commercial sectors calling for having a work force that is culturally aware or globally competent in their employment outlook. When reviewing these reports they all reveal similar reasons for placing emphasis on encouraging the public to become acquainted with the world they live in. The reasons range from economic strength and growth to international leadership and national security (Kemp, 2010; Bond, 2009; UK/US Study Group, 2009). When one looks at the number of foreign students that come to the U.S. to study this is evident. According to Open Doors Data, over 690,000 foreign students study in the U.S. each year and in 2009/10 over 18% came here to study engineering. Most were degree seeking students (IIE: Open Doors Data – International Students, 2011). As a result these students already have a cross-cultural advantage over U.S. engineering students.

As we face the problems that confront a global society, exposure to other people and cultures of the world are vital to the national interest of the United States. Global and economic competitiveness, national security and retaining world leadership are all areas that require active engagement in the international community (Commission on the Abraham Lincoln Study Abroad Fellowship Program, 2005).

Increasingly U.S. economic, military and diplomatic challenges are being influenced by worldwide forces. The very way business is conducted inpacts all three of

these areas. Manufacturing and distribution networks rely on being able to draw from people with global skills to successfully operate. They also rely on the government to diplomatically (if necessary backed by the military) and actively maintain a leadership role on the world stage. To do this the U.S. must encourage more students to study abroad, not only to listen to and learn about other people and cultures, but to serve as goodwill ambassadors (Commission on the Abraham Lincoln Study Abroad Fellowship Program, 2005).

Currently being considered by the U.S. Congress is the Paul Simon Study Abroad Foundation Act. Its intent is to: "increase the number and diversity of United States undergraduate students studying abroad, particularly in non-traditional study abroad destinations and the developing world, with the goal of having one million U.S. students studying abroad for credit per year within ten years of enactment" (U.S. House of Representatives, 2007). It provides access to study abroad to a wider spectrum of students while promoting longer-terms of study to maximize language and cultural understanding, particularly to countries that typically are not considered as destinations for U. S. students. This bill has been under consideration since 2007 (Lewin, 2009).

According to NAFSA: Association of International Educators, American students, as compared to students from other advanced countries, are consistently lacking in knowledge and awareness of the world we live in (NAFSA, *Senator Paul Simon Study Abroad Foundation Act,* n.d.). In the eyes of the world, this general lack of knowledge and understanding in world affairs, especially in global trade, business and interdependence, indicates a negative perception and declining reputation of the United

States. In the post 9-11 era the lack of global competence is a national liability, and if the U.S. is to remain in a leadership role it must educate more worldly citizens. This education must include an international element. An effective way of developing a more globally literate public is through a study abroad experience as it has a proven track record of developing cross-cultural competence.

Senator Simon's vision was to enable a broader section of U.S. students to study abroad with the goal of making the citizenry of the U.S. "more understanding of the rest of the world" (NAFSA, 2003). Out of this vision the Commission on the Abraham Lincoln Study Abroad Fellowship Program was created as part of the Constitutional Appropriations Act of 2004. This commission was established to research and advise on a program that would increase the number of U.S. students studying abroad. The goals set forth were to:

1. Increase participation in quality study abroad programs
2. Encourage diversity in student participation in study abroad
3. Diversify locations of study abroad, particularly in developing countries
4. Make study abroad a cornerstone of today's higher education (NAFSA, n.d.)

Originally introduced in 2007, the bill has been passed by the House of Representatives and has broad bi-partisan support. It has been attached to other bills during the 110th and 111th sessions of Congress but failed to pass in the Senate. In November 2011, prior to the winter recess, co-authors Senator Dick Durban (Illinois) and Senator Barbara Mikulski (Maryland) announced their commitment to the legislation by planning to reintroduce the bill (NAFSA, n.d.).

Corporate Interest

The report *Global Competence & National Needs: One Million Americans Studying Abroad* (Nov. 2005), prepared by the Commission on the Abraham Lincoln Study Abroad Fellowship Program, discusses how the United States is internationally affected by diplomatic, military and economic issues that influence our way of life. Business is being conducted on a global scale and the companies that flourish in this economy understand the significance of these forces on their livelihood. They also recognize the importance of employing people with global skills in order to succeed. The report makes the following salient points which highlight the importance of a globally competent workforce:

1. Fully one in six American jobs is now tied to international trade.
2. Corporate leaders rank international curricula high on their priority list of what is important in higher education.
3. Texas recently reported a nearly six-fold increase during the 1990s in specifications of international experience as part of the skill set for senior level positions – from a requirement of four percent of senior positions to twenty-eight percent.
4. There is near unanimity among American personnel officers that job applicants with international experience are likely to possess desirable skills in cross-cultural communication, cultural awareness, leadership and independence, according to a 2004 survey completed by the German Academic Exchange Service.

Students who graduate and expect to succeed in the modern world must leave college with a strong understanding and appreciation for the different ways of this world. The Commission strongly recommends that study abroad should become the norm rather than the exception for American undergraduates and be a hallmark of a well-educated student (Commission on the Abraham Lincoln Study Abroad Fellowship Program, 2005). Graduates who prosper in this new environment will be those who leave school with an appreciation of global issues and cultures and an introduction to the new ways of the world.

Advanced technologies such as computer-aided engineering make it possible to instantly communicate with engineering and manufacturing organizations anywhere in the world via internet. This enables people from various work groups around the world that are involved with bringing a product to market to share designs, manufacturing plans and other technologies. Parkinson also adds to this by including the world's political climate since the fall of the USSR and the warming of relations with many former communist countries. These countries are eager to participate in the world's economy. The third component is the development of the World Trade Organization, the World Bank and the International Monetary Fund. These organizations have changed the landscape on how the international flow of money is handled, making it easier for global commerce (Parkinson, 2009).

What has evolved from this trio of technological, political and economic developments is the growth of multi-national business with a multi-national workforce. Of the top 100 economies in the world, 51 are corporations, representing 70% of world

trade (Parkinson, 2009). Summing up the importance of an engineer having an understanding of global competence, James Duderstadt, President Emeritus and University Professor of Science and Engineering, University of Michigan, said in *Engineering for a Changing World*:

> It is important to stress the importance of a global perspective for engineering practice. Key is not only a deep understanding of global markets and organizations, but the capacity to work in multidisciplinary teams characterized by high cultural diversity, while exhibiting the nimbleness and mobility to address global challenges and opportunities. (Duderstadt, 2008, p.45)

Personal Growth

One purpose of study abroad is to expose students to other cultures. Understanding the world outside of the normal circle of influence that students have is important to the personal growth of the student and helps them understand the career significance of global awareness. In his book *The World is Flat*, Thomas Friedman discusses aspects of culture that are relevant to the need for success in modern society. Being open to foreign influences and ideas becomes a two-way street where each needs to be able to gain from the experience. He calls it "Glocalization," that is, "the more your culture easily absorbs foreign ideas and best practices and melds them with its own traditions – the greater advantage you will have" (Friedman, 2005, p. 324). With openness and acceptance one starts appreciating the talents and abilities of other people making their racial, ethnic, or religious background less important.

The value of gaining insights of another culture to the American student can immediately influence the student by developing practical skills that are reflected in their classroom learning such as improved problem solving, analytical skills, tolerance for

ambiguity and cross-cultural competence. Additionally, studies have shown an increase in GPAs of students who participate in a study abroad experience. Long term benefits show increased global awareness, sensitivity and capacity to work effectively with people of other countries. (NAFSA, *Senator Paul Simon Study Abroad Foundation Act,* n.d.).

Many students are hesitant to leave their comfort zone to participate in, and benefit from, the study abroad experience. While many have been pushed by parents and educators to excel, they have done so in a protected environment. One result is that they are blocked from the opportunity to define their own paths to success. Study abroad can offer the environment for an individual to grow and gain essential life skills (Curran, 2007).

Oakes, Leone, and Gunn (2012) discuss the need for students to plan ahead to better position themselves for a global career. Learning a foreign language and becoming familiar with the cultural differences of other countries will go a long way to start this process. English is widely used in business around the world and many countries teach English as a second language to prepare their own workforce to compete on the world stage. Oakes does point out that an American engineer's ability to speak other languages and have a sense of cultural differences indicates a sensitivity and willingness to work together as partners. Moreover, the experience is magnified the longer one stays in the foreign country.

From the changes in environment and perspective, students will benefit from the study abroad experience by expanding their problem solving abilities and through the application of new language skills. Exposure to individuals and groups that might process

information differently than oneself enhances the student's understanding of their culture. A side benefit is the establishment of professional and personal contacts. The student also comes away with a new confidence level and direction in the career for which they are preparing (Oakes, Leone & Gunn, 2012).

Students must approach study abroad with the right perspective. The perception is that a study abroad experience automatically adds to their career potential. In fact the student must not only be able to demonstrate that they gained cross-cultural skills but they must also show how the knowledge, skills, abilities and overall experience they acquired enhances their initial employability and career development possibilities (Curran, 2007).

"Educating Engineers as Global Citizens: A Call for Action" (Grandin & Hirleman, 2009) points out the importance of attaining soft skills for those engineering students considering international study and work for professional growth. These skills should not be limited to economics and competitiveness, but should also include cultural awareness of other countries. Once they are employed, many engineers will be involved with designing products and services for the global marketplace (Continental AG, 2006).

A student may gain many benefits from a long-term study abroad experience, such as subject expertise from faculty at foreign institutions which promotes a global exchange of knowledge. They will start developing international professional networks with other students (from the host institutions and other exchange programs) that empower students to succeed in a competitive market. The experience also helps students stay engaged in their studies. Finally, a student can return to the students and faculty of

his/her home institution with cutting edge technologies to enhance the learning experience for all (Wainwright, Ram, Teodorescu, & Tottenham, 2009).

Barriers for Engineering Students

There is a perception among engineering students that there are barriers that keep this group of students from partaking in a study abroad experience. These barriers may or may not be real but the perception remains and students from engineering and other STEM (science, technology, engineering and mathematics) disciplines are hesitant to take advantage of study abroad opportunities while completing a bachelor's degree (Klahr, 2000).

Klahr (1998) and Klahr and Ratti's (2000) research identified barriers or obstacles that may be unique for engineering and other STEM students wishing to study abroad. These barriers center around curricular issues, lack of support by the higher education community, culture and language, and lack emphasis of placing value on the study abroad experience.

From the commercial point of view, Continental AG (2006) in their *Final Report on the Global Engineering Excellence Initiative* agrees that many of the barriers need to be addressed and removed. This report identifies three groups that are responsible for working together to remove these barriers and help make it easier for students to participate in study abroad. Continental AG points out that the barriers that hinder a student's ability to study abroad can be resolved at the following level:

1. Universities and colleges – institutional issues such as the student's ability to find acceptable coursework that will transfer to the home institution's curriculum. Transfer of credit and quality of education from host institutions are also at issue.
2. Industry – needs to get involved and use their influence as future employers of graduates, with advisory board members advising and promoting global preparedness in engineering programs.
3. Governments – can adopt policies, programs, and help provide funding that will promote incentives to participate in a foreign educational experience to help prepare a global workforce. Additionally, governments need to reduce restrictions on visas for research, study and work for both students and faculty (Continental AG, 2006, pp. 36 & 52-53).

From the report culminating from the National Summit Meeting on the Globalization of Engineering (Grandin & Hirleman, 2009), Janet Ellzey from the University of Texas Austin identified sixteen obstacles and hurdles that needed to be overcome for engineering students to participate in a meaningful study abroad experience. Ellzey's list clearly defines the major barriers or obstacles, but each falls into one or more of the categories discussed by others in this review.

Open Doors Report

In academic year 2000/2001, over 154,000 U.S. students traveled to a foreign country to study. Only 2.7% were engineering students. By 2008/09 the number of study abroad students had increased to 260,327 with 3.2% of them engineering students. Less than 50% of all students stay for a length of time equal to one semester, and only 4.3%

stayed for one academic year in 2008/09. Countries of choice were United Kingdom, Italy, Spain and France, totaling 39% of all students studying abroad in 2008/09 (IIE: Open Doors Data – U.S. Study Abroad, 2011).

An interesting comparison is the student demographics of a U.S. student who participates in a study abroad experience vs. the typical U.S. engineering student. There is a noticeable difference in gender and race between the typical student who studies abroad and one who majors in engineering. This undoubtedly will affect the number of engineering students who participate in study abroad.

Table 2.1

Comparison of Study Abroad Demographics

	Study Abroad	Engineering
Male	35.8%	81.4%
Female	64.2%	18.6%
White	80.5%	66.5%
Asian or Pacific Islander	7.3%	11.9%
Hispanic or Latino(a)	6.0%	9.1%
Black or African-American	4.2%	5.9%
Other	2.1%	6.5%
(IIE Open Doors) (ASEE)		

Internationalization of Engineering Education

Important in the context of this study are efforts made in Europe to aid in the acceptance and standardization of higher education for foreign students. Early efforts had limited success, primarily due to resistance of the education systems and national territorialism. Later efforts were successful in removing many of the barriers that still exist for U.S. students attempting a study abroad experience.

In 1987 ERASMUS (European Region Action Scheme for the Mobility of University Students) was initiated. This program was designed increase the number of European students who study in a host country, to ease the restrictions on their experience, and to increase the bond between institutions (Bond, 2009). ERASMUS gives college students the opportunity to study or work in an on-the-job training agreement for 3-12 months in a European country. With over 2.2 million participants since its inception in 1987, the ERASMUS program has become one of the most popular European Union programs, providing the vision of a European Higher Education Area (Tauch & Teter, 2010; De Wit, 2009).

In 1999, twenty-nine education ministers from European Union countries signed an agreement that would form a university community with the purpose of increasing European students' competitive edge by promoting competitiveness and mobility. This agreement would become known as the Bologna Process, named after the city where it was signed. The logical progression of Erasmus, it also marked a reversal of previous thought that having diverse European higher education systems was a strength (Wächter, 2010).

With global competition for students as its motivation, the purpose of the Bologna Process is to make it easier for students to move between academic systems and provide a degree structure that would make it more conducive for foreign students to study in Europe, thus opening the door to compete for students on a global basis (Continental AG, 2006). Now that it is a decade old, the Bologna Process appears to be meeting expectations (Wächter, 2010). It and ERASMUS are not limited to engineering education but in general show that there is great concern in the EU for its member countries to prepare their workforce to be a major player in world market.

An engineering-specific call for action was the result of a 2008 summit meeting in Newport, Rhode Island, supported by the National Science Foundation (NSF), on the globalization of engineering education. The primary charge was to determine the challenges and changes that need to be taken by U.S. engineering educators to prepare graduate engineers to take their place in the future. Participants represented prestigious engineering colleges from across the U.S. The group reviewed the reasons for including study abroad into engineering programs and explored why the U.S. generally was slow to respond to this need. The resulting document was a set of recommendations called the Newport Declaration, which is a call to action to funding agencies (such as the NSF) and to members of the engineering profession (Grandin & Hirleman, 2009).

The following three studies (Klahr, Bond and Continental AG) are examples of previous research performed on the importance of study abroad experiences. From three different perspectives – higher education, general public, and business – these studies indicate that there is a need for global awareness for current and future engineers.

Research on design of various models of United States and European Union exchange programs was performed by Klahr (1998) and analyzed to what extent they removed the barriers encountered in study abroad. The intent of Klahr's study was to provide recommendations to remove or minimize the barriers of study abroad opportunities for engineering students. The findings revealed that to be successful a program must:

1. Be promoted by the college and/or department of engineering
2. Be offered in English speaking settings
3. Award equivalent credit at home institution for courses taken at host institution
4. Provide scholarships and financial aid for program participation
5. Require students to complete second year of required coursework prior to participating in the program
6. Be flexible with curricular design and sequencing of courses

The population surveyed was restricted to coordinators of international engineering programs. Klahr's "Recommendations for Future Studies" should include students' perceptions of study abroad as well as engineering faculty and administrator perceptions on the barriers placed on study abroad participation. She also discussed the need for a study of graduated engineers and the benefits gained from an international experience (Klahr, 1998).

World of Learning: Canadian Post-Secondary Students and Study Abroad Experience (Bond, 2009) surveyed students, employers and the general public to determine the prevailing attitude toward the importance of study abroad. By its own

admission it is believed to be the first Canadian study and one of few studies carried out in a Western context. Ninety-one percent of the employers surveyed in this study thought that the importance of a study abroad experience would potentially be of value to the prospective employee. It should be noted that the survey was distributed to the members of the Canadian Association of Career Educators and Employers, which is a national organization of employment recruiters and career services professionals, and not to those actually making hiring decisions. The results pointed out that it was the foreign experience alone that was the benefit and not the field of study that was the important factor. This finding was echoed by the results of students and the general public that were also surveyed (Bond, 2009).

The *Final Report of the Global Engineering Excellence Initiative* (Continental AG, 2006) study is an industry sponsored study on Global Engineering Excellence regarding the education of the next generation of engineers who will take their place in a global workplace. This initiative was a collaboration of representatives of eight universities from six industrialized countries from around the world. This one-year study focused on engineering in a global context, preparation of global engineers, and recommendations based on their findings.

Their research defined four critical challenges that face the preparation of tomorrow's engineering workforce (Continental AG, 2006):

1. Global competence needs to become a key qualification of engineering graduates.
2. Transnational mobility for engineering students, researchers and professionals needs to become a priority.

3. Global engineering excellence is critically dependent on a mutual commitment to partnerships, especially those that link engineering to professional practice.
4. There is an urgent need for research on engineering in a global context.

Their detailed recommendations call for higher education, government and industry to work together to provide a theoretical foundation for the development of models and organizational procedures that would facilitate the education of an increased number of qualified engineers to take their place in a global workforce.

Summary

The purpose or goal of study abroad in a college education is to add dimension to the education experience and growth of the individual as a person. It exposes the student to life beyond the confines of their comfort zone. These experiences can make changes that will affect them for life, both personally and professionally. Employers often seek out individuals that have global competencies as they have exhibited a level of self-sufficiency that is needed for a business traveler.

CHAPTER 3

RESEARCH DESIGN

Overview

The University of North Texas is a publicly funded, regional, comprehensive, student-focused, emerging research university. The University of North Texas' vision is to be nationally recognized for its high quality education in the professions and in the humanities, arts and sciences, and for its distinctive core curriculum. The College of Engineering is a key element to attaining this status. The college has evolved to meet the changing needs of business and industry and to prepare its students to become leaders in the workforce. According to UNT-International's mission statement, internationalization is one of the main themes of the University of North Texas and supports initiatives that "facilitate the internationalization of the curriculum; enhance the intercultural awareness, experiences and learning of all students, both domestic and international; and increase the overall quality of the academic enterprise by attracting a diverse and rich multicultural mixture of students, faculty and academic partners to the University of North Texas" (University of North Texas – International, Mission Statement, n.d.). Through UNT International initiatives, global awareness and promoting cultural appreciation have been at the forefront of preparing tomorrow's leaders.

In an effort to facilitate study abroad opportunities for engineering students that would apply towards their interests and academic major, a plan was developed to eliminate many of the barriers that typically prevent engineering students from

participating in study abroad opportunities. With the cooperation of faculty from the mechanical and energy engineering department, a pilot plan was implemented in the fall of 2010 that allowed the exchange of UNT undergraduates with students from selected universities in the United Kingdom. An initial group of three upper-division students traveled to the United Kingdom. Two went to the University of Birmingham and studied for both fall and spring semesters. The third student went to the University of Strathclyde for the spring term only. All three students studied only engineering courses that would apply towards their major requirements, experienced no delays in their studies, and graduated with 3.3+ GPAs in spring of 2012. Their experience has inspired other students to investigate major-specific study abroad with another group planning to travel to the UK in academic year 2012-2013. This plan has also inspired engineering students from the United Kingdom to attend UNT. Details of this plan can be found in Appendix B.

The intention of the study was to survey a sample of employers that hire new engineering graduates, in order to determine 1) whether students who participated in an engineering-specific study abroad experience would make more desirable candidates for employment and 2) whether having this experience would enhance their career opportunities once hired. Specifics of the program are detailed in Appendix B of this report. Additionally, the results of the survey could support the need for global competence in the skill set needed for the careers of the 21st century.

Research Questions

The objective of this study was to determine whether engineering students who participate in an extended, major-specific study abroad experience are more desirable as

candidates for employment than those who only study at their home institution. This assessment was made by a survey that searched for a perceptual trend among representatives from business and industry who are in a hiring capacity for engineering graduates. This trend would evaluate a major-specific study abroad experience as part of a graduate's employability and career growth.

The primary questions to be answered were:

1. How desirable for employers is having a study abroad experience as a characteristic for hiring an engineering graduate?
2. Would having a study abroad experience positively affect the career development of an engineer?

Data and Analysis

According to Gall, Gall and Borg (2007), descriptive research is one of the more basic quantitative research methods that utilize descriptions of phenomena to understand what people think or understand about a subject. This is an important objective of qualitative research as well, so in planning a descriptive study one needs to select methods that best suit the study. "Researchers whose purpose is description will employ one of two types of research design: *descriptive*, if the intent is to study phenomena as they exist at one point in time; and *longitudinal*, if the intent is to study phenomena as they change over time" (Gall, Gall & Borg, 2007). Since this study was a snap-shot in time, the research was centered on the first type.

A descriptive study is based on information or data that comes to the researcher through either direct observation of the subjects, through interviews, or through the use of

a survey instrument that reveals information related to the study. The researcher must process or otherwise make sense of the data to determine and understand the findings of his observations and to answer the guiding questions of the study. The descriptive study offers insight into the situation as only a moment in time but makes the assumption that the findings are normal and would reflect the findings if the same observations were made at another moment in time.

According to Paul Leedy in *Practical Research: Planning and Design* (1993), the characteristics of a descriptive survey are:

1. The descriptive survey method deals with a situation that demands the technique of observation as the principal means of collecting the data.
2. The population for the study must be carefully chosen, clearly defined, and specifically delimited in order to set precise parameters for ensuring discreteness to the population.
3. Data in descriptive survey research are particularly susceptible to distortion through the introduction of bias into the research design. Particular attention should be given to safeguarding the data from influence of bias.
4. Although the descriptive survey method relies on observation for the acquisition of the data, those data must then be organized and presented systematically so that valid and accurate conclusions can be drawn from them (Leedy, 1993, p. 187).

Sample

Representatives were selected from the UNT College of Engineering industrial advisory board which consists of approximately 100 participants. Members of the advisory board were selected by College of Engineering administrators because of their position within industry and the contributions that they could make to the college. The Industrial Advisory Board membership is composed of a cross-section of individuals from business, manufacturing and engineering with companies that range in description from small local to multinational corporations and have varied business interests. It is believed that this group provided a broad spectrum of employers, providing insight from various levels of management on what is valuable to the employers of engineers.

This sample of employers has high potential to be the hiring authority for engineers within their organization. It is felt that demographic information pertaining to gender, race, national origin, etc. had no bearing on the findings of the study. The sample was not involved in the design of the model and their input or advice was not solicited in advance of this study. It was anticipated that there would be a high percentage of response as the survey was administered with the cooperation of the College of Engineering.

Data Collection Method

Data collection was made through a survey of engineering professionals and constituted the basis of this study. This study queried the sample population through the administration of a survey that collected data through the use of a questionnaire. The questionnaire was administered via email to the sample population of representatives

from the business community who would potentially hire engineering graduates. The sample population was sent an email announcing that they would receive a survey and outlining the importance of their response. The survey, with a cover letter and instructions, followed in two days via email. The cover letter explained the importance of the study and how the information would be used in future planning of study abroad programs for engineering students. Timing of the mailing was approximately four weeks prior to a College of Engineering Industrial Board quarterly meeting. Ten days after the original mailing a follow-up email was sent reminding the participants of the survey and its significance.

The survey asked both open and closed-ended questions. The intention was not only to answer the research questions, but also to determine if there were variances in the perceptions of the value of the major-specific study abroad experience, and whether these variances could be attributed to influences such as the educational background of the responder, the size and nature of the business, and career development.

Open-ended questions were used to determine trends in perspective along with biases toward adding such an experience to one's educational experience. These questions were related to the responder's own experiences (or not), to the value of a study abroad experience in their own career, and the perceived value of this experience to the employability and career development of a candidate to an engineering position.

Closed-ended questions were used to determine whether respondents either agreed or disagreed with statements made regarding the importance of an engineering major-specific study abroad opportunity in the employability and career development of

an engineering graduate. Additional closed-ended questions were used to categorize the academic and professional background of the survey participants. Questions that pertained to demographics of the responder and information regarding the businesses they represent could be tabulated, thus a quantitative method was best suited. This information was needed to establish the type and size of businesses that would hire engineering graduates. It might also identify which majors should be recruited into a major-specific study abroad experience, as well as ones for whom the experience would not affect their employability.

To determine the questions' content validity, three representatives from the business community, who were not participants in the survey, were asked to review and comment on the questionnaire. These representatives all have degrees in engineering, represent early, middle, and end points of their career, and hold or have held positions at various levels of administration within their organization making them knowledgeable in hiring practices.

Instrumentation

The survey was designed to gauge the business group's perceptions of the desirability of an employee having a foreign study abroad experience and how it would affect the employee's career development. Included were perceptions regarding survey respondents' perceptions of their own career if a major specific study abroad program had been available when they went to college.

The proposed survey can be reviewed in Appendix B. The survey instrument was divided into three areas. Part I asked questions related to employer perceptions on the

value of study abroad for the employability and career development of a new graduate engineer. Responses from Part II identified the scope of the organization's international influence/operations. In the final section, Part III evaluated the responder's qualifications and involvement in the hiring process.

CHAPTER 4

PRESENTATION OF DATA

The participants for this study were comprised of the membership of the combined Industrial Advisory Boards of the UNT College of Engineering**.** The Advisory Board is a focused group of skilled managers and directors that represent various businesses, industries and organizations. As such they are uniquely placed to provide valuable perspectives on what employers view as important for the employability and career development of engineering graduates.

There is one board for the college and separate boards for each of four departments within the college. While the college has five departments there is currently no active advisory board for the material science and engineering department. The board member lists were combined and duplicates were removed so that a person would only receive one survey. This left a list of one-hundred individuals.

An initial announcement email was sent to each contact. Any returned emails were checked for correct email addresses and resent. A total of ten could not be contacted because of retirement, job change or other reasons that would preclude their further participation in the industrial advisory boards.

Two days later the survey was sent to the remaining ninety through the use of Qualtrics survey software. Table 4.1 below shows the timeline for administration of the survey.

Table 4.1

Survey Timeline

April 23	Sent out survey announcement
April 25	Sent out survey with letter (via Qualtrics)
May 1	Sent reminder to those who had not responded
May 3	Sent 2nd reminder to those who had not responded
May 4	Target deadline
May 8	Extended deadline for re-send to corrected email addresses
May 9	Re-administration of survey to those who had not responded
May 16	Target deadline for 2nd administration

After the established deadline a total of 52 responses were received. Forty-eight had completed the survey, one had opted-out, and three opened the survey but did not respond. This reflects a 57.7% response rate (52 responses out of 90 surveys).

The results of the survey are presented in four sections: answering the research questions; presentation of employer's perceptions of the importance of study abroad when compared to other curricular or extra-curricular activities, and possible outcomes of study abroad; describing the types of organizations represented by the respondents; presentation of background information that validates the respondent as an authority on what characteristics are desirable in the employment and career development of engineering personnel.

Questions 1-2

Questions 1-2 (Q1-Q2) present the research question data.

Q1. How desirable is having a study abroad experience as a characteristic for hiring an Engineering graduate? Twenty-seven percent found having a study abroad experience a desirable or very desirable characteristic for hiring an engineering graduate, 67% were neutral, and 6% didn't find it desirable.

Table 4.2a

Desirability of Study Abroad Experience

#	Answer		Response	%
5	Very Desirable		1	2%
4	Desirable		12	25%
3	Neutral		32	67%
2	Not Desirable		2	4%
1	Not Desirable at all		1	2%
	Total		48	100%

Table 4.2b

Desirability of Study Abroad Experience – Analysis

Statistic	Value
Min Value	1
Max Value	5
Mean	3.21
Variance	0.42
Standard Deviation	0.65
Total Responses	48

Analysis was made on companies whose scope of business is domestic and international, comparing the perceived value of study abroad as a characteristic for hiring

new engineers. Additional analysis was made on groups of employees that either had foreign experience (work or study) and those that did not. These tests indicated that there was no statistical significance in the findings with respect to the variables tested.

Q2. Within your organization, how would a study abroad experience affect the career development of an employee or a candidate for employment? Sixty-five percent felt that a study abroad experience would affect the hiring and/or career development of a candidate. Thirty-five percent believed that it would have no effect.

Table 4.3a

Effect of Study Abroad on Career Development

#	Answer		Response	%
5	Positively Effect		7	15%
4	Somewhat Positive Effect		24	50%
3	No Effect		17	35%
2	Somewhat Negative Effect		0	0%
1	Considerable Negative Effect		0	0%
	Total		48	100%

Table 4.3b

Effect of Study Abroad on Career Development – Analysis

Statistic	Value
Min Value	3
Max Value	5
Mean	3.79
Variance	0.47
Standard Deviation	0.68
Total Responses	48

Analysis was made on companies whose scope of business is domestic and international comparing the perceived value of foreign study or work experience on the career development of engineers. Additional analysis was made on groups of employees that either had foreign experience (work or study) and those that did not. These tests indicated that there was no statistical significance in the findings with respect to the variable tested.

Questions 3-5

Questions 3-5 were related to employers' perceptions of the importance of Study Abroad when compared to other curricular or extra-curricular activities and possible outcomes of Study Abroad.

Q3. In retrospect, would you have participated in a major-specific study abroad program when you were in college? Forty-eight percent responded that they would have participated in a major-specific study abroad program if it had been available when they

were an undergraduate. Forty percent responded “Not likely.” The remaining 13% didn’t know if they would have participated or not.

Table 4.4a

Retrospect of Participant on Study Abroad

#	Answer		Response	%
5	Very Likely		6	13%
4	Likely		17	35%
3	Don't know		6	13%
2	Not likely		19	40%
1	Definitely Not Likely		0	0%
	Total		48	100%

Table 4.4b

Retrospect of Participant on Study Abroad – Analysis

Statistic	Value
Min Value	2
Max Value	5
Mean	3.21
Variance	1.23
Standard Deviation	1.11
Total Responses	48

Q4. Consider the following co-curricular involvement that a new employee may have had in college. In your opinion, how would these activities compare with study abroad experience?

When compared to other co-curricular activities, over 66% of the respondents chose internships, earning good grades, student organization leadership, and undergraduate research over study abroad.

Table 4.5a

Perceptions of Co-Curricular Involvement

#	Question	Less important than study abroad	Somewhat less important than study abroad	About the same as study abroad	Somewhat more important than study abroad	More important than study abroad	Responses	Mean
1	Student organization leadership	0	3	10	16	19	48	4.06
2	Varsity athletics	14	13	14	6	1	48	2.31
3	Under-graduate research	1	2	13	27	5	48	3.69
4	Community volunteer work	3	13	17	12	3	48	2.98
5	Internship or co-op education	0	3	7	8	30	48	4.35
6	Study and concentrate on grades	0	7	4	17	20	48	4.04

Table 4.5b

Perceptions of Co-Curricular Involvement – Analysis

Statistic	Student organization leadership	Varsity athletics	Undergraduate research	Community volunteer work	Internship or co-op education	Study and concentrate on grades
Min Value	2	1	1	1	2	2
Max Value	5	5	5	5	5	5
Mean	4.06	2.31	3.69	2.98	4.35	4.04
Variance	0.87	1.20	0.64	1.04	0.91	1.10
Standard Deviation	0.93	1.09	0.80	1.02	0.96	1.05
Total Responses	48	48	48	48	48	48

Q5. The following characteristics have been suggested as possible outcomes of study abroad. How important is it to you that a new employee has these characteristics, regardless how it was acquired?

Of the five characteristics listed as possible outcomes of study abroad, maturity and personal growth, critical thinking skills, and gaining a different perspective on engineering placed high as an outcome of a study abroad experience. Understanding of a foreign culture and communication in a foreign language, while important, were ranked last.

Table 4.6a

Perceptions of Possible Outcomes of Study Abroad

#	Question	Not important	Somewhat important	Very important	Essential	Responses	Mean
1	Communicate in foreign language	10	29	9	0	48	1.98
2	Experience a foreign culture	14	24	10	0	48	1.92
3	Maturity and personal growth	0	7	28	13	48	3.13
4	Critical thinking skills	2	6	19	21	48	3.23
5	Gain a different perspective on engineering	2	20	24	2	48	2.54

Table 4.6b

Perceptions of Possible Outcomes of Study Abroad – Analysis

Statistic	Communicate in foreign language	Experience a foreign culture	Maturity and personal growth	Critical thinking skills	Gain a different perspective on engineering
Min Value	1	1	2	1	1
Max Value	3	3	4	4	4
Mean	1.98	1.92	3.13	3.23	2.54
Variance	0.40	0.50	0.41	0.69	0.42
Standard Deviation	0.64	0.71	0.64	0.83	0.65
Total Responses	48	48	48	48	48

Questions 6-9

Questions 6-9 provide descriptions of the scope of business, size, ownership and purpose of operations of the organizations represented by the respondents.

Q6. Describe the scope of your business operations.

Fifty-eight percent of the respondents indicated that the scope of their business operations was international. The remaining 42% was domestic.

Table 4.7a

Scope of Business Operations

#	Answer		Response	%
1	Local or regional		10	21%
2	National		10	21%
3	International		28	58%
	Total		48	100%

Table 4.7b

Scope of Business Operations – Analysis

Statistic	Value
Min Value	1
Max Value	3
Mean	2.38
Variance	0.66
Standard Deviation	0.82
Total Responses	48

Q7. Describe the main emphasis or purpose of your business operations.

Seventy-nine percent are involved with engineering (53%) or manufacturing (26%).

Table 4.8a

Main Emphasis of Business Operations

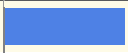
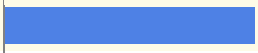
#	Answer		Response	%
1	Manufacturing		12	26%
2	Sales and service		4	9%
3	Engineering		25	53%
4	Government		2	4%
5	Consulting		3	6%
6	Research		1	2%
	Total		47	100%

Table 4.8b

Main Emphasis of Business Operations – Analysis

Statistic	Value
Min Value	1
Max Value	6
Mean	2.64
Variance	1.50
Standard Deviation	1.22
Total Responses	47

Q8. Does your company have operations in a country outside the United States?

Sixty-nine percent had operations outside the U.S.

Table 4.9a

Operations in Foreign Countries

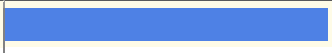
#	Answer		Response	%
1	Yes		33	69%
2	No		15	31%
	Total		48	100%

Table 4.9b

Operations in Foreign Countries – Analysis

Statistic	Value
Min Value	1
Max Value	2
Mean	1.31
Variance	0.22
Standard Deviation	0.47
Total Responses	48

Q9. Is your business owned by a foreign concern?

Eighty-four percent of the businesses are owned by U.S. companies.

Table 4.10a

Business Ownership

#	Answer		Response	%
1	Yes		7	16%
2	No		38	84%
	Total		45	100%

Table 4.10b

Business Ownership – Analysis

Statistic	Value
Min Value	1
Max Value	2
Mean	1.84
Variance	0.13
Standard Deviation	0.37
Total Responses	45

Questions 10-14

The answers to these questions provided background information that validated the respondent as an authority on what characteristics are desirable in the employment and career development of engineering personnel. While the number of participants was low, the position and background of each respondent indicated that the survey participants were knowledgeable, decision makers, and responsible for the hiring of engineering personnel, making them an ideal authority. Questions 10-14 were asked to identify the background of the participants and to determine if they were in a hiring

capacity for engineering graduates. Of the respondents 69% had engineering degrees, 94% worked in business and industry and had no university or college teaching or research responsibilities, and 73% had over 16 years work experience as an engineer. Additionally, 67% were in a position that has hiring authority for entry level engineering graduates. When asked about their personal exposure to foreign work or study only 39% responded that they had such experience.

Q10. Do you have an engineering degree?

Table 4.11a

Engineering Degree Achievement

#	Answer		Response	%
1	Yes		33	69%
2	No		15	31%
	Total		48	100%

Table 4.11b

Engineering Degree Achievement – Analysis

Statistic	Value
Min Value	1
Max Value	2
Mean	1.31
Variance	0.22
Standard Deviation	0.47
Total Responses	48

Q11. Do you hold a teaching or research position at a college or university?

Table 4.12a

Academic Positions

#	Answer		Response	%
1	Yes, full-time		2	4%
2	Yes, part-time		1	2%
3	No		44	94%
	Total		47	100%

Table 4.12b

Academic Positions – Analysis

Statistic	Value
Min Value	1
Max Value	3
Mean	2.89
Variance	0.18
Standard Deviation	0.43
Total Responses	47

Q12. Are you in a hiring capacity for entry level engineering graduates?

Table 4.13a

Hiring Capacity

#	Answer		Response	%
1	Yes		32	67%
2	No		16	33%
	Total		48	100%

Table 4.13b

Hiring Capacity – Analysis

Statistic	Value
Min Value	1
Max Value	2
Mean	1.33
Variance	0.23
Standard Deviation	0.48
Total Responses	48

Q13. Please select one of the following that best describes your experience:

Only 2% had participated in a Study Abroad experience. This is lower than the 2001 national average of 2.7% for engineering students. Thirty-seven percent had foreign work experience.

Table 4.14a

Study Abroad Experience

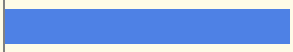
#	Answer		Response	%
1	I have participated in a study abroad experience.		1	2%
2	I have had foreign work experience.		17	37%
3	I have no foreign (work or study) experience.		28	61%
	Total		46	100%

Table 4.14b

Study Abroad Experience – Analysis

Statistic	Value
Min Value	1
Max Value	3
Mean	2.59
Variance	0.29
Standard Deviation	0.54
Total Responses	46

Q14. How many years of engineering experience have you had since earning the bachelor's degree?

Table 4.15a

Engineering Experience

#	Answer		Response	%
1	1-5		3	7%
2	6-10		4	9%
3	11-15		5	11%
4	16+		33	73%
	Total		45	100%

Table 4.15b

Engineering Experience – Analysis

Statistic	Value
Min Value	1
Max Value	4
Mean	3.51
Variance	0.85
Standard Deviation	0.92
Total Responses	45

CHAPTER 5

CONCLUSION

The original research questions were centered on the desirability of a new engineering graduate participating in a study abroad experience, and whether it would it affect his/her career development. While 27% of the respondents found having a major-specific study abroad experience desirable or very desirable (Q1), the perception of 65% was that it would have a positive impact on the career development of an engineer (Q2).

When reviewing the responses regarding whether the respondent would have participated in a major specific study abroad experience if it had been offered when they were an undergraduate (Q3), 48% replied that in retrospect they would likely or very likely have done so. Seventy-three percent of respondents had 16 or more years of engineering experience (Q14). The fact that, while only 27% of these respondents felt that it was important at entry level, the percentage increased to 65% for career development would indicate that while having a major-specific study abroad experience may not be important at the entry level, it becomes more important as an engineer progresses into mid-career. It could also indicate change in the business climate and a growing need for global awareness.

When compared to other co-curricular activities (Q4) the respondents chose work experience through internships or co-operative education, grades, evidence of leadership through student organizations, and undergraduate research experience over study abroad.

However, varsity athletics and community volunteer work were not perceived as being as important as study abroad when it came to skills or qualities of a new employee.

Traditional thought has been that gaining an appreciation and understanding of a foreign culture and language was a primary outcome of study abroad. When asked about possible outcomes of study abroad (Q5), the findings indicate that critical thinking, maturity and personal growth, and gaining a different perspective on engineering are more important to the employability and career development of an engineering graduate. Understanding of a foreign culture and communication in a foreign language, while important, were ranked last.

The business operations of the companies represented by the respondents were, by a small majority, international in scope (Q6), with engineering and manufacturing being the main purpose of their operations (Q7). A majority of the companies have operations outside the U.S. (Q8) but are domestically owned (Q9).

The position and background of each respondent indicated that the survey participants were knowledgeable, decision makers, and responsible for the hiring of engineering personnel, thus making them an ideal authority. Of the respondents, 69% had engineering degrees (Q10), 94% work in business and industry (Q11), and 73% had over 16 years work experience as an engineer (Q12). Additionally, 67% were in a position that has hiring authority for entry level engineering graduates (Q13).

From the literature there is support for engineers at the national, business and personal levels to gain global knowledge and skills. Based on the data, however, it was observed that internships, grades, leadership, and research experiences were of more

importance to an employer than study abroad. Another significant observation was that, counter to traditional thought, the outcomes of gaining an understanding of a foreign culture and language were ranked less important than critical thinking, maturity and personal growth, and gaining a different perspective on engineering.

The perceptions of two-thirds of the respondents indicated that they were neutral regarding a study abroad experience when hiring engineering graduates. An additional 6% perceived that a study abroad experience was not desirable when hiring engineering graduates. This combination indicates that most survey respondents did not perceive study abroad as a valuable characteristic for hiring engineering graduates.

The perceptions of two-thirds of the respondents indicated that a study abroad experience would positively affect the career development of an engineer. There were no negative responses, but 35% were neutral. This indicates that having a study abroad experience would have a positive impact on the employee's career development.

It can be concluded from the perceptions of the participating employers that having a major-specific study abroad experience may not be important at the entry level, but it becomes important as an engineer progresses into mid-career. From the student's perspective one can conclude that there is value in participating in study abroad over the course of their career.

Recommendations for Future Research

The results of this study were based on the perceptions of members of the UNT College of Engineering's combined industrial advisory boards. This population is representative of the employers who would hire UNT engineering graduates. As the

global economy evolves it is recommended that a study be performed in five years with a group of participants that would be representative of a larger geographic area and that have a larger representation of international companies and businesses. This study should also seek out the perceptions of younger employees who may not yet be in management positions. Participants should be informed of the intended benefits of an engineering-specific study abroad program and the questions asked should be designed to determine the value of such a program to the employee as well as to the employer.

In the long term it is recommended that a study of the students who participated in the UNT Engineering study abroad program be performed to determine if the program had an effect on their job placement and career development. Questions in this study should provide information regarding how a major-specific study abroad helped the student in his/her job search and career development.

As this study indicated there are areas that employers would like to see as part of the overall curriculum that would prepare students to take their place in the workforce. A study of engineering and technical staff managers that would research the qualities that employers are seeking, and how they might be incorporated into the engineering curriculum, would be beneficial. This research on “other curricular issues” would have potential for adding value to a graduate’s resume and should be given more consideration.

APPENDIX A

MODEL DEVELOPMENT

Introduction

To be designed is a model that will lay the foundations for formal international exchange agreements between UNT and partner schools in the United Kingdom (UK). The resulting partnerships will be formalized through memoranda of agreement negotiated by the UNT International Office. An engineering course reciprocity catalog will be established to complement the partnerships and will define paths whereby engineering exchange students are assured that courses taken abroad will transfer back to their home institutions.

A key component of these partnerships is that they will be specifically designed for engineering students to remove barriers that have traditionally prevented engineering students from study abroad opportunities. As an instrument of change the model should address all barriers that can be identified as internal, or ones that can be addressed at the institutional level. Barriers such as visas or other political issues will not be addressed in the model:

1) Acceptance of courses completed at host institution as equivalent to courses taken at home institution. As with any transfer issue, courses at the host institution need to be proven as substantially equivalent to those of the home institution. Acceptance of transfer courses by the home institution insures that the course is significantly the same, which has a direct impact on the student's progression towards graduation. The second part of how courses are accepted is the issue of accreditation, and do the courses meet the required standards set by the home country's engineering accreditation organization.

2) Lack of support for study abroad by university administration and faculty

3) Inflexible curriculum that allows little room for variation.

4) Perception of slowing the process of degree completion

Selection of UK Institutions

The United Kingdom was chosen to be the host country to implement the model for numerous reasons:

1. First is a common language. While there are differences, it is possible to attend and understand lectures and communicate freely with the public.
2. UK universities have established and recognized engineering programs.
3. Many students at UK institutions come from commonwealth countries, adding additional cultural exposure to the study abroad experience.
4. As home of the Industrial Revolution and engineering practices there is a large quantity of historical aspects of engineering that add to the overall educational experience.

Potential UK target schools, including institutions with which UNT already has an established relationship through the International Student Exchange Program (ISEP), will be identified. One of the project's intents is to strengthen existing relations with these schools and create engineering-specific exchange tracks with these partners. In addition, it is UNT's desire to be more self-directed by creating partnerships with top-tier UK research universities.

It is understood that all College of Engineering majors may not be offered at all selected UK institutions. Efforts will be made to insure that students will have a selection to choose from for their particular major. Final decisions will be made on the analysis of:

1. Size and course offerings of UK engineering department to closely resemble those of UNT College of Engineering
2. Utilizing USAS (http://www.ucas.com/) course search tool to find UK programs that reflect UNT programs
3. Consulting with the British Council Guide to UK Education
4. Institution must meet Engineering Council accreditation so that ABET will recognize the transfer credit. See "Accreditation" below.
5. Providing a choice of locations for the student

Selection Criteria

A pool of approximately 25 potential UK universities that offer compatible engineering programs will be selected for initial consideration. The guiding qualifications for this selection will be:

1. Size and course offerings of UK engineering department to closely resemble those of UNT College of Engineering.
2. Utilizing USAS (http://www.ucas.com/) course search tool to find UK programs that reflect UNT programs.
3. Consulting with the British Council Guide to UK Education.
4. Institution must meet Engineering Council accreditation so that ABET will recognize the transfer credit.

5. To provide a choice of locations for the student.

Three quantitative evaluation metrics will be applied to down-select a new pool of candidate schools:

1. Engineering program similarity with UNT
2. National ranking from the 2009 UK University League Tables
3. Assessment of research and teaching quality from the British Council on Education

Qualitative evaluation metrics were also used to create a pool with a diversity of UK geographic location and a range of student populations.

UNT's mechanical & energy engineering (MEE) department hosted six University of Strathclyde engineering students through ISEP in the last two academic years. Thus, the relationship with Strathclyde was established adequately to include in the final list.

For the selected schools, the model student exchange is envisioned as a full academic year, targeted to students at the junior or senior levels. Full year exchanges are necessary because these schools have only one final exam period at the end of each academic year.

Selected institutions will be contacted by e-mail with an overview of the proposed exchange program and an invitation to participate. Both a representative from the school's international office and a representative from the school's engineering program will be identified and included on initial communications. Institutions that respond that

expressed interest in working with us will be further down-selected based on their stated interest to provide a subset to continue dialog to establish working agreements.

Site Visit

A representative will travel to the identified UK universities to visit counterpart faculty and staff to establish interest in international engineering student exchanges with UNT. The main purposes of these visits will be to 1) establish personal relationships with these partner universities to promote collaboration; 2) visit each site to observe their engineering facilities and assess whether they are equipped to serve UNT engineering students; and 3) provide a conduit for further dialog and additional cooperation, such as research collaboration and international faculty exchanges.

At each university, the UNT representative will make a presentation introducing UNT and the College of Engineering. It is hoped that in turn each university will present an overview of their programs and give a tour of their facilities. The goal of these visits is to foster good will and to facilitate study abroad opportunities for engineering students.

Implementation

Student exchange agreements between UNT and the host institutions must be in place to establish guidelines before students can travel abroad. These agreements either exist through the International Student Exchange (ISEP) program or will be drafted. Once academic programs have been approved, ISEP member institutions can start accepting engineering students. Initiation of agreements with non-ISEP institutions broadens the number of engineering schools that UNT students can study at. This process

is often lengthy, however the potential for partnership of these institutions outweighs the effort.

Course Reciprocity

The primary component to inducing engineering student interest in international exchanges is the course reciprocation catalog. This in-progress database will enable each institution to identify courses at potential host institutions that meet degree requirements of the home institution. The plan will create a course reciprocation catalog as a first step before sending students abroad. Before a student leaves their home university, their faculty advisor will create a list of courses that the student should take at the home university to stay on track toward timely graduation which is then sent to a faculty advisor at the host university for review. When a student arrives at the host university, they meet the host faculty advisor who identifies courses reciprocal to the curriculum identified at the home institution. These course matches are then cataloged in the course reciprocity catalog, which can be accessed by faculty advisors and students in the future to see which classes have previously transferred. Thus, the catalog grows organically as needed instead of coming into existence all at once and then requiring continuous updating.

Since the UNT MEE Department has a two-year history of hosting students from the University of Strathclyde, MEE is now piloting the course reciprocity catalog using Strathclyde courses. Other UNT College of Engineering programs will follow in the coming academic year and more of the UK partner schools will be added to the catalog as exchange relationships initiated by this grant are finalized. To seed this effort, UNT

requested syllabuses for each engineering course offered by our partner schools, which are now arriving. UNT will reciprocate by sending similar information to each university for their evaluation. As engineering student exchanges begin, these documents will provide a base of reference to identify course reciprocity.

Establishing a Cross-Reference Manual

The key document that should come out of this project is the establishment of an on-line course reciprocation catalogue. Due to the variable magnitude of evaluating courses/modules for all majors within the College of Engineering, the project will be limited to catalog courses/modules within mechanical & energy engineering.

Under investigation is the possibility of a common course system of determining transferability of courses within UK. If such a system exists, and we can establish equivalent courses/modules, other majors may be added to the initial project.

Academic Preparation – HS and Beyond

Student preparation prior to attending university in the UK differs from the US in that British students have already mastered math and science, and have no required core curriculum courses. Upon arrival at university they start their major work. Based on the differential in student preparation it appears that the target UNT student population for an engineering study abroad experience should be students that are starting their upper-division courses. This would ensure that they are academically prepared to succeed at the UK universities.

APPENDIX B

EMPLOYER SURVEY

The intention of this survey is to evaluate the value of study abroad on the employability and the career development of the student as perceived by employers.

In this study the term, “study abroad,” is defined as an educational program of study, where the coursework is performed outside the home country and earns college credit towards degree requirements.

Part One: Perceptions on the value of study abroad on the employability and career development of a newly graduated engineer.

1. How desirable is having a study abroad experience as a characteristic for hiring an Engineering graduate?
   _____ Very Desirable
   _____ Desirable
   _____ Neutral
   _____ Not Desirable
   _____ Not Desirable at all

2. Within your organization, how would a study abroad experience affect the career development of an employee or a candidate for employment?
   _____ Positively Affect
   _____ Somewhat Positive Affect
   _____ No Affect
   _____ Somewhat Negative Affect
   _____ Considerable Negative Affect

3. In retrospect, would you have participated in a major specific study abroad program when you were in college?

   _____ Very Likely

   _____ Likely

   _____ Don't Know

   _____ Not likely

   _____ Definitely Not Likely

4. Consider the following co-curricular involvement that a new employee may have had in college. In your opinion, how would these activities compare with a study abroad experience?

	Less important than study abroad	Somewhat less important than study abroad	About the same as study abroad	Somewhat more important than study abroad	More important than study abroad
Student organization leadership					
Varsity athletics					
Under-graduate research					
Community volunteer work					
Internship or co-op education					
Study and concentrate on grades					

5. The following characteristics have been suggested as possible outcomes of study abroad. How important is it to you that a new employee has these characteristics, regardless how they are acquired?

	Not important	Somewhat important	Very important	Essential
Communicate in foreign language				
Experience a foreign culture				
Maturity and personal growth				
Critical thinking skills				
Gain a different perspective on engineering				

Part Two: Scope of responder's business

6. Describe the scope of your business operations:
    a. Local or regional
    b. National
    c. International

7. Describe the main emphasis or purpose of your business operations:
    a. Manufacturing
    b. Sales and Service
    c. Engineering
    d. Government
    e. Consulting
    f. Research

8. Does your company have operations in a country outside the United States?
    a. Yes
    b. No

9. Is your business owned by a foreign concern?
    a. Yes
    b. No

Part Three: Responder background information

10. Do you have an engineering degree?
    Yes
    No

11. Do you hold a teaching or research position at a college or university?
    Yes, full-time
    Yes, part-time
    No

12. Are you in a hiring capacity for entry level engineering graduates?
    Yes
    No

13. Please select one of the following that best describes your experience:
    a. I have participated in a study abroad experience.
    b. I have had foreign work experience.
    c. I have no foreign (work or study) experience.

14. How many years of engineering experience have you had since earning the bachelor's degree?
    a. 1-5
    b. 6-10
    c. 11-15
    d. 16+

APPENDIX C

CORRESPONDENCE RELATING TO SURVEY

UNT

UNIVERSITY OF

NORTH*TEXAS

DISCOVER THE POWER OF IDEAS

COLLEGE OF ENGINEERING

April 23, 2012

(Name)
(Address)

Dear _____:

I am conducting a survey that examines the importance of engineering students having a study abroad experience during their undergraduate studies. This survey is a critical research element for my doctoral dissertation and will be sent out to members of the combined UNT College of Engineering Industrial Advisory Boards.

In a few days you will be receiving an email requesting that you take a short survey that will ask you questions about the value of an engineering study abroad experience in the employability and career development of newly graduated engineers. I request that you assist in this study by completing this internet survey. Because of the relatively small number of members, your response is particularly important.

This study is not expected to be of any direct benefit to you. All responses are kept confidential. You are not required to participate in this study and have the option of simply not completing the survey.

If you have questions regarding this survey or participation in it, please feel free to contact Dr. Marc Cutright, Associate Professor of Higher Education at the University of North Texas. He can be reached at marc.cutright@unt.edu or by telephone at 940-369-7875.

Thank you for your time and your contribution to this study.

Sincerely,

Christopher Heiden
Director, Academic Services

This research study has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT IRB can be contacted at (940) 565-3940 with any questions regarding the rights of research subjects.

1155 Union Circle #310440 | Denton, Texas 76203-5017 | TEL 940.565.4300 | FAX 940.369.8570 | TTY 940.369.8652 | ceng@unt.edu

UNT

UNIVERSITY OF
NORTH*TEXAS
DISCOVER THE POWER OF IDEAS

COLLEGE OF ENGINEERING

April 25, 2012

Dear (Name):

I request your assistance in completing a short survey that examines the importance of engineering students having a study abroad experience during their undergraduate studies. This survey is an important element in my doctoral dissertation and has been sent out to members of the combined UNT College of Engineering Industrial Advisory Boards. Because of the relatively small number of members, your response is particularly important.

This study is not expected to be of any direct benefit to you, but we hope to learn more about the value of a study abroad experience in the employability and career development of newly graduated engineers. There are no foreseeable risks involved in this study. Participation is voluntary with no compensation and you may stop at any time. All information will be kept confidential and will be restricted to this study.

If you have questions regarding this survey or participation in it, please feel free to contact Dr. Marc Cutright, Associate Professor of Higher Education at the University of North Texas. He can be reached at marc.cutright@unt.edu or by telephone at 940-369-7875.

This questionnaire can be taken on-line and returned via email. Completing the fourteen question survey will take approximately twenty minutes of your time. **Please return the completed survey by May 4, 2012.** You may contact me if you have questions or need clarification. Thank you for your time and I look forward to receiving your completed survey.

Sincerely,

Christopher Heiden
Director, Academic Services

This research study has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT IRB can be contacted at (940) 565-3940 with any questions regarding the rights of research subjects.

155 Union Circle #310440 I Denton, Texas 76203-5017 I TEL 940.565.4300 I FAX 940.369.8570 I TTY 940.369.8652 I ceng@unt.edu

Dear ___,

You may recall receiving a request to participate in a brief survey, concerning the potential benefits of having undergraduate engineering majors experiencing study abroad.

The opinions of the combined UNT College of Engineering Industrial Advisory Boards are important on this matter. First, it will help inform our curricular directions in Engineering. The survey is also an important element of my doctoral studies in Higher Education Administration.

The survey is available here: (hotlink).

It will take about 10 minutes to complete. All responses will be received without personal identification. Because of the relatively small number of people on our advisory boards, a high response rate is particularly important. Please complete this survey, if at all possible, by **Tuesday, May 15**.

Thank you. I will be pleased to answer any questions, and I will be pleased to share the result of the study with you upon your request.

Sincerely,

Christopher Heiden
Director, Academic Services

NOTE:

The research study has been approved by the UNT Institutional Research Board. The IRB can be contacted at (940) 891-565-3940 with any questions concerning the rights and protection of those participating in research.

Questions may also be directed to my supervising faculty member, Dr. Marc Cutright, at marc.cutright@unt.edu, or (940) 369-7875.

APPENDIX D

INSTITUTIONAL REVIEW BOARD APPROVAL

UNT
UNIVERSITY OF
NORTH TEXAS
Discover the power of ideas.

OFFICE OF THE VICE PRESIDENT FOR RESEARCH AND ECONOMIC DEVELOPMENT

April 5, 2012

Dr. Marc Cutright
Student Investigator: Christopher Heiden
Department of Counseling and Higher Education
University of North Texas

RE: Human Subjects Application No. 12-164

Dear Dr. Cutright:

In accordance with 45 CFR Part 46 Section 46.101, your study titled "The Perceived Value Among Employers of a Collegiate Study Abroad Program for Engineers" has been determined to qualify for an exemption from further review by the UNT Institutional Review Board (IRB).

No changes may be made to your study's procedures or forms without prior written approval from the UNT IRB. Please contact Jordan Harmon, Research Compliance Analyst, ext. 3940, if you wish to make any such changes. Any changes to your procedures or forms after 3 years will require completion of a new IRB application.

We wish you success with your study.

Sincerely,

Patricia L. Kaminski, Ph.D.
Associate Professor
Chair, Institutional Review Board

PK: jh

1155 Union Circle #310979 | Denton, Texas 76203-5017 | TEL 940.369.7428 | FAX 940.369.7486
TTY 940.369.8652 | www.research.unt.edu

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