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Mexico Engineering Study Abroad: Assessing the Effectiveness of International Experiences on Teaching Global Engineering Skills

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MEXICO ENGINEERING STUDY ABROAD: ASSESSING THE EFFECTIVENESS OF INTERNATIONAL EXPERIENCES ON TEACHING GLOBAL ENGINEERING SKILLS.

by

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ABSTRACT

MEXICO ENGINEERING STUDY ABROAD: ASSESSING THE EFFECTIVENESS OF INTERNATIONAL EXPERIENCES ON TEACHING GLOBAL ENGINEERING SKILLS.

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Globalization is a rapidly increasing trend in many industries, including civil engineering. This paper defines the skills engineers will need in an increasingly international industry. It also describes an engineering study abroad program designed to teach some of those skills to students and presents a survey used as an assessment tool to evaluate the effectiveness of the program. The program, called Mexico Engineering Study Abroad (MESA), is taught at Brigham Young University (BYU) in Provo, UT. MESA is a project-based extended field trip format class that couples hydrologic modeling with cultural awareness as students work together with Mexican students on water resources modeling projects in Mexico. The aforementioned survey shows that MESA affects a positive change in the student development and importance of global engineering skills such as leadership, teamwork, cultural sensitivity, and language. The importance of these skills in the workplace was also measured.

The data shows that MESA is effective at developing global engineering skills in students. The data also suggest that other schools could use MESA as a model for their own efforts to prepare students for a more global industry. They show that non-technical skills can be measured and the results used to improve the course and the assessment methods. In particular, the MESA course could be improved by involving more faculty and increasing parity between the BYU and Mexican experiences in the course. The survey can be improved by conducting pre-class and post-class surveys instead of just one post-class survey. A special effort should be made to develop symmetry of experience for Mexican and BYU students, including extending the survey to the Mexican students.

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Chapter 1

Introduction

In recent years, more and more industries have recognized the need to work across national and cultural boundaries to be successful [23]. Advances in communications media and the Internet allow instant communication to nearly anywhere on the planet [3]. The net effect has been to shrink the perceived size of the world and significantly reduce the technical difficulties and complexities associated with forming international project teams. Consequently, companies in many industries now face a need to cooperate and work with people from other cultures and value systems in order to remain competitive. This is especially true in engineering as more technically advanced nations partner with less developed countries to remain competitive. Engineering along with many other industries is experiencing a trend of rapid globalization [27].

Although most of the physical challenges related to globalization have been overcome, social challenges such as communicating in foreign languages and socio-political differences remain. The soft skills for dealing with such challenges have generally been overlooked by traditional engineering education, which has focused primarily on teaching the technical skills necessary for students to be successful engineers. Communication and other soft skills are part of a global skill set that has been identified by the engineering community as necessary for new graduates; therefore, many institutions have modified existing courses or created new ones to develop these skills in their students [22].

The research presented in this paper discusses globalization in the context of civil engineering and describes an idealistic global engineer. It also defines a program currently underway at Brigham Young University (BYU) to help students develop the traits of the global engineer. Before defining the program, however, a review is given of the different kinds of programs currently used around the country to develop global engineering skills in students so that a context of currently accepted practices may be established.

The objective of this paper is twofold:

- Describe a successful engineering study abroad program that can be used as a model to develop the required soft skills for engineers to work globally.
- Provide an assessment tool for evaluating the program.

While finding research on the need to prepare for globalization is relativey easy, not much research has been done on the short term and long term impacts of courses designed to teach global engineering skills. Assessment tools are needed to evaluate the effectiveness of current programs and discover what improvements can be made.

Chapter 2 defines and discusses specific attributes of a global engineer and reviews the kinds of courses currently offered in educational institutions around the country to develop those attributes in new graduates. The program that will be described is currently functioning at Brigham Young University (BYU) and is called Mexico Engineering Study Abroad (MESA). The details of the program will be presented along with a discussion of how each aspect of the class prepares students for the globalization of civil engineering in chapter 3.

In order to assess how well the class meets its objectives, a survey was developed and used as an evaluation tool to modify future versions of the course. The results are presented in chapter 4, and chapter 5 discusses conclusions and suggested improvements.

Chapter 2

Globalization

2.1 Defining Globalization

What exactly is globalization? According to the Carnegie Endowment for International Peace, "Globalization is a process of interaction and integration among the people, companies, and governments of different nations, a process driven by international trade and investment and aided by information technology [3]." While there are other definitions, this one is consistent with what is observed in the engineering industry today. In civil engineering, globalization refers to the increasing cooperation and competition between countries and cultures to accomplish civil engineering projects. Globalization in civil engineering can be observed within individual firms, such as Washington Group International which has offices in North and South America, Europe, and Asia [4]. It is also manifest as cooperation between firms from different countries such as in the building of the Ghana Temple for the Church of Jesus Christ of Latter-day Saints. In that project, Ghanaian architects worked with a construction company from Europe to construct a building for a church headquarted in the United States [5], and a Northern Ireland company installed the mechanical and electrical systems [34].

The Encyclopedia Britannica describes globalization as "the process by which the experience of everyday life, marked by the diffusion of commodities and ideas, can foster a standardization of cultural expressions around the world [17]." Globalization will therefore lead the engineering industry toward worldwide standards of

practice, procedure, and quality. Engineering educators have realized the impacts of globalization and have already started working to prepare the engineers of the 21st century for a more global industry. Indeed, Jones and Oberst claim that "engineering is probably closer than any other profession to converging worldwide on standards of educational quality [27]."

The American Society for Civil Engineers (ASCE) is also aware of recent trends and has a vision to "position engineers as global leaders building a better quality of life." ASCE pursues collaboration with civil engineering societies all around the globe in order to advance civil engineering practice and encourage greater information sharing among civil engineers [10].

One of the reasons for the rise in international cooperation in engineering has to do with the recent development of previously under–developed countries in Asia and South America. Currently, China is producing about three times more engineers than the United States, and the quality of their engineers rivals that of U.S. engineers [16]. Other Asian countries and Latin America have experienced recent industrialization while European countries have a long standing tradition of producing high quality engineers. The worldwide availability of high–quality engineers allows engineering work to be done all over the globe. According to the McKinsey Global Institute, engineering ranks as one of the occupations most amenable to outsourcing [26]. If U.S. engineers are going to compete or cooperate with the engineers of the rest of the world, they need to understand their cultural and political environments, speak their language, and be able to work closely together with them. Consequently, employers are seeking graduates with experience and an international mindset [36]. They are looking for global engineers to be leaders in a global industry.

2.2 The Global Engineer

The global engineer is an engineer who has mastered many of the skills and attributes that have been defined as necessary for an engineer to succeed in the 21st century. The global engineer is an ideal that can be used as a goal for educational institutions in developing their engineering curricula. Of course, it is unreasonable to expect that any student will become a global engineer by graduation. Very few students will be able to achieve the required lingual, cultural, and technical proficiency in such a short time. However, it is entirely reasonable for a student to have the mindset and training necessary to enable becoming a global engineer after graduation through experience and continued learning. Evidence of this line of reasoning is seen in the Engineer In Training (EIT) exam also called the Fundamentals of Engineering exam. Engineering graduates generally must pass the EIT before they begin to work as engineers, but it is only after gaining work experience and passing another exam that they can become licensed Professional Engineers.

At the Third Workshop on Global Engineering Education, T. Hederberg described a "Renaissance Engineer" [22]. In 2004, the National Academies of Engineering wrote a report in which they describe the characteristics of the engineer of 2020 [31]. Using those two articles and others mentioned below, a list of attributes for the global engineer was generated:

- high technical and scientific competence,
- creativity,
- practical ingenuity,
- mastery of business and management roles,
- leadership,
- high ethical standards,

- ability to take responsibility,
- strong sense of professionalism,
- dynamism, agility, resilience, flexibilty
- lifelong learner,
- group/team work skills,
- cross–cultural communication skills for multiple audiences,
- competence in at least one foreign language,
- understanding of the relationship between technology and social development

Most of these attributes are self-explanatory, but with the exception of technical competence not assessed as part of engineering curricula. Dynamism, agility, resilience, and flexibility refer to the constantly changing technical landscape and socio-political world in which engineers will work. They need to be quick learners and be able to apply new techniques to new problems and contexts [31].

These attributes can be seen in other engineering literature as well. "On Realizing the New Paradigm for Engineering Education [40]" emphasizes the need for communication, teamwork, and group problem-solving skills. The accreditation criteria for engineering Programs lists the abilities that engineering students must attain. A partial list includes many of the attributes of the global engineer [13]:

- an ability to function on multi-disciplinary teams
- an understanding of professional and ethical responsibility
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- an ability to function on multi-disciplinary teams
- a recognition of the need for, and an ability to engage in life-long learning

According to Hederberg, the engineering graduate is a product of his or her university [22]. Therefore, the only way to produce global engineers is within global universities, i.e. universitites that emphasize the importance of a global mindset and offer courses designed to equip students with the tools and attitudes they need to become global engineers.

2.3 Engineering Education

Many educational institutions in the United States have developed programs intended to help students develop some or all of the attributes of the global engineer. All of these programs follow either a seminar format or a study abroad format, but there are several different implementations of study abroad. Each will be discussed in this chapter, but more time will be spent on the study abroad strategy because it can offer a wider range of experience and because the BYU MESA class mentioned in the introduction is a study abroad program.

2.3.1 Seminar

The seminar strategy is one wherein the students attend a class that is designed to increase their awareness of other cultures, but does not involve travel. An example of one such class is International Dimensions of Engineering at the University of Illinois–Urbana-Champaign. Guest lecturers from education, business, and industry give an overview of global changes that may place students in foreign countries in their career by sharing their perspective on global changes and how they should prepare for the future [37].

Seminar courses can be effective at raising the global awareness of the students. However, many institutions may wish to provide a richer experience, or teach skills that are not covered in a seminar course. Culture and operational procedures of other

countries are often best learned by experience in a study abroad course rather than by lecture.

2.3.2 Study Abroad

Parkinson's paper "Engineering Study Abroad Programs: Formats, Challenges, and Best Practices" describes engineering study abroad programs from around the country and groups them into the following categories [35]:

Dual Degree: students obtain degrees from the home university and the abroad university (2 degrees). This format is often used for graduate–level work. A substantial amount of study is done at the abroad university in the abroad language. Such a program may develop technical competence, language proficiency, and cultural sensitivity.

Exchange: students from each institution exchange places and take regular courses in the university's language. A parity of exchange is maintained so that neither institution incurs net expense. The students are immersed in another culture for a substantial period of time. The global engineering skills developed are similar to those of the Dual Degree program.

Extended Field Trip: a one– to three–week tour to various countries, companies, or universities. The intent is to give the students brief, broad exposure to many places. The state-of-the-world view offered by this kind of course can give students motivation to participate in other kinds of study abroad courses.

Extension: The home university maintains a pseudo-satellite campus in the country abroad with courses taught in English by faculty of the home university. This kind of course may not provide in-depth exposure to the culture, but scales easily. Depending on the types of courses taken, technical and communication skills may be improved. There is some exposure to the culture so cultural

awareness may be heightened, but it is typically random and student-driven. Language and other culture classes may possible be offered.

Internship or Co-op: students work abroad for a foreign company or international branch of a U.S. company. Arranging these types of internships can be very labor-intensive. Internships can offer many opportunities for informal, practical learning such as teamwork, language and communications skills, leadership, and responsibility.

Mentored Travel: the format for many traditional study abroad programs: students travel to the abroad country under the supervision of a faculty member for a number of weeks. This provides less immersion in the culture than other formats such as dual degree or internship, but may be more comfortable for students. Often these kinds of trips motivate students to continue learning about the abroad country in some way and contribute to them becoming lifelong learners.

Partner Sub-contract: the home institution partners with another university to provide courses for its students; there may or may not be an exchange of students with the abroad institution. The interaction with students from the abroad country provides the opportunity to gain technical competency, language proficiency, enhanced communication skills, and an appreciation for another culture.

Project Based Learning/Service Learning: students travel abroad to participate in projects that connect technology with the abroad society. They may work with an abroad university, companies, or both. Worcester Polytechnic Institute (WPI) has one of the most successful programs in this format. Engineers Without Borders provides service learning via humanitarian projects and falls into this category [6]. This kind of program typically teaches technical skills, leadership, teamwork, cross-cultural communication skills, and creativity.

Research Abroad: students travel to an abroad laboratory and engage in guided research. Typically, one or two students at a time are placed in these programs. Massachusetts Institute of Technology (MIT) is one school that has this type of program. Many of the same skills as project based, dual degree, and exchange programs are developed.

Most, if not all, study abroad courses fit into one of these categories, and each one has its pros and cons. For example, a dual degree program may be too expensive or time–consuming for most students. On the other hand, an extended field trip may not give students the depth of experience they are looking for. Therefore, it is wise to have different kinds of courses available so that the greatest number of students may have an opportunity to develop the skills of the global engineer. Table 2.1 was created to summarize which skills are provided by the various types of programs. The assignment of global engineering attributes to the various study abroad formats is somewhat arbitrary and may be different to individual programs. The table is subjective, so individual programs may teach more or fewer skills than those listed.

2.3.3 Challenges

Although many universities recognize the need for engineering study abroad programs, implementing them presents various challenges, some of which are listed below [35]:

Language The majority of U.S. students do not speak a foreign language and have not had an immersion experience in another culture. Students in several universities are required to study a foreign language, and it increasingly becoming a requirement; however, some schools are substituting Math for language.

Expense Study abroad classes often require additional tuition.

Table 2.1: Skills taught by study abroad programs

Study abroad program	Dual Degree	Exchange	Extended Field Trip	Extension	Internship or Co-op	Mentored Travel	Partner Sub-contract	Project Based Learning	Research Abroad
High technical and scientific competence	X	X		X		X	X	X	X
Creativity								X	X
Practical ingenuity					X			X	X
Mastery of business and management roles					X				
Leadership					X			X	
High ethical standards									
Ability to take responsibility					X			X	X
Strong sense of professionalism					X				
Dynamism, agility, resilience					X			X	X
Lifelong learner			X		X	X			
Group/team work skills					X			X	X
Cross–cultural communication skills for multiple audiences	X	X		X	X	X	X	X	
Competence in at least one foreign language	X	X			X		X	X	X
Understanding of the relationship between technology and social development				X	X			X	

Time to Graduation or During Semester A semester abroad may delay graduation. Other programs may require students to miss class time during the semester.

Leaving Community of Family and Friends Some students may be reluctant to study in an unfamiliar place with different customs.

Parental Reluctance Parents may be reluctant for their children to travel to countries with lower standards of health and safety.

Hard to Scale Exchange and field trip programs often have an upper limit on the number of students who can participate due to resource and staff limitations.

Recruiting Faculty It is often difficult to recruit faculty to participate in study abroad programs because they often pull them away activities such as research, necessary for career advancement within an academic setting.

Assessment for Accreditation Purposes Engineering programs are required to evaluate how well they meet their objectives. Study abroad programs are often difficult to assess and therefore difficult to integrate into an engineering curriculum.

It would be very difficult for one program to overcome all of these challenges. It would also be unlikely that one program could develop every desired attribute of the global engineer. Having multiple programs is the best idea because one program's strengths can compensate for another's weakness and students can chose the most appropriate one for their situation.

At BYU, the College of Engineering and Technology offers several study abroad classes to various parts of the world including Europe, Asia, and Mexico. It offers an extension format course that involves a trip to Nanjing China. The mechanical engineering department offers a course in the extended field trip format to expose their students to manufacturing processes used in Asia. Engineers Without Borders

provides a multi-discipline engineering class that prepares students to participate in engineering projects around the world. The civil engineering department also offers the MESA course which is a combination of project-based learning and research abroad. The rest of this paper will focus primarily on the MESA course as a tool for developing global engineers because it addresses many of the challenges and teaches many of the global engineering skills listed above.

One of the challenges MESA addresses is the need for assessment. Many study abroad programs are not assessed because of the difficulty of quantifying the soft skills taught; however, all accredited engineering programs must assess their classes to make sure the objectives are taught. After discussing MESA and its procedures in detail, MESA's assessment tool will be presented along with how well MESA meets its objectives and student expectations.

Chapter 3

Mexico Engineering Study Abroad

MESA started out and evolved separately from BYU engineering college initiatives of the past few years to develop global engineering skills classes. The course has its beginnings in mentored environment grants that allowed some students to travel to Egypt and Chile to train civil engineers in the use of water modeling software developed by the Enviromental Modeling Research Laboratory (EMRL) at BYU. In March of 2005, one such trip to Mexico was received with much interest and led to an ongoing relationship with the University of Zacatecas (UAZ). Because of the many benefits reaped from the mentored environment grants, an official study abroad class was established to gain access to more resources and allow more students to be involved at their own discretion.

The professor responsibile for the development of MESA at BYU is Dr. E. James Nelson, Associate Professor and specialist in hydrology and geographic information systems (GIS). He is also one of the principal members of the Environmental Modeling Research Laboratory (EMRL) that has developed computer modeling applications for hydrology, groundwater, and surface water modeling [1].

3.1 MESA Class Description

MESA is a project–based class that couples hydrologic modeling with international communication and collaboration. It is a hybrid of Parkinson's research abroad and project–based learning categories and is facilitated by the large number of stu-

dents at BYU with Spanish language ability. Many of the the projects are tied to ongoing research for students at BYU and Mexico. It is taught each winter semester as a three–credit technical elective in the Civil and Environmental Engineering program at BYU. Near the beginning of the semester, professors from partner institutions in Mexico meet with the MESA professor at BYU to determine a handful of projects of Mexican local interest that are good applications of the hydrologic modeling software initially developed by the EMRL, although some projects expand beyond the use of this software. Some of the types of projects from previous years are listed here [7]:

- runoff and flood plain models for risk assessment in various communities
- water quality studies to assess the affect of community activities in a closed basin
- development of a hydrologic modeling database to enable dam assessments on a large river basin
- water quality management studies for a major new reservoir
- flood studies for a small community
- implications to water resources management for areas of greater urban expansion.

3.1.1 Overview

Due to the specific technical nature of the projects, students wishing to participate in MESA must have taken an introductory class in hydrology. In order to contribute and have a more meaningful experience, they also must either be concurrently enrolled in the hydrologic modeling class or have Spanish language experience. Each project is designed to meet a specific, current Mexican need; many of them are port of on-going research. Some are ongoing research projects led or mentored by graduate students here and in Mexico. So far, these students have come from three

different Mexican schools. The University of Zacatecas (UAZ) has been active in MESA since its inception as a mentored environment. The University of Guadalajara (UDG) participated in 2006 when MESA first became an official study abroad class. In 2007, the Instituto Técnico de Estudios Superiores Occidental (ITESO) replaced UDG in the program.

Once the projects are identified, the students at all the schools are divided into teams. At BYU, typically the teams consist of two or three students who are then assigned to work with one of the Mexican teams on one project. The Mexican teams usually decide on specific project objectives. The BYU students help train the Mexicans in the use of the modeling software. Together, through electronic communication such as e-mail and instant messages, they develop the best solution and discuss strategies for accomplishing it. The teams continue their electronic communication during the semester to request additional information or clarification as they work toward accomplishing their goals. Near the end of the semester, BYU students travel to Mexico to work alongside their Mexican teammates and ultimately present their results in Spanish to each other, the professors, and other interested parties such as university and government officials who sometimes are sponsors of project work.

MESA is very different from other three credit-hour courses at BYU. Most three credit-hour classes meet about three hours per week throughout the semester. The MESA class is organized naturally into two main phases: preparation and travel. During the preparation phase, the class meets about once a week for an hour to discuss class level issues and logistics. Individual groups can meet on their own or with the professor as often as necessary to work on their projects. The seemingly lost class time is regained during the travel phase which usually lasts for no more than ten days. Each day is filled with class activities including site visits, international teamwork on the projects, presentation of results, and cultural activities.

3.1.2 Preparation

One of the first assignments for each group is to draw up a project plan which serves as a contract between themselves and the professor to provide a basis for determining grades. Minimally, the project plan must describe the objective of the the project, specific tasks required to accomplish it, deadlines for each task, and a description of the qualifications and duties of each group member. Along with the project plan, each group is required to document the way they plan to work together (e.g. assign each member certain tasks or work cooperatively on everything) as well how they plan to handle conflicts when they arise (e.g. vote, leader decides, etc.) [39]. Each group is expected weekly to submit a memo to document their progress and identify questions and problems.

The memos and the project plan are posted to a website created and maintained by the students so that everyone involved, including those in Mexico, can stay informed and assist as necessary. Copies of the final reports, presentations, and posters are also posted on the site at the end of the semester [2].

Logistics of the trip to Mexico are handled in large part by the students during the preparation phase. Each student helps take care of some of the details of the trip such as finding hotels, arranging transportation to/from the airport and within Mexico, meals, purchasing gifts for Mexican colleagues, and determining the itinerary for cultural activities. Obviously, many of these tasks require communication and cooperation with the Mexican students. One student is designated official photographer and is responsible for producing a DVD slide show of important or interesting highlights of the class.

As mentioned above, the whole class meets together about one hour per week during the preparation phase mostly to discuss logistics issues, give progress reports, and ask questions. In addition to the project work and logistics, there is also a small amount of homework related to some reading designed to help the teams work

together more effectively as well as some Spanish vocabulary and readings to improve communication abilities. The light homework load and infrequent meeting schedule allows the students to spend time working on their projects. It also allows them to get ahead in other classes since they will miss a week of class and homework time during the trip to Mexico.

3.1.3 Travel

The class usually travels to Mexico in the last half of March so there is enough time to develop the projects beforehand and still prepare for final exams afterward. In a way, the trip represents a culmination of the work done previously, but it also is a time of discovery as students work face-to-face with teammates who speak another language and have to deal with a new set of sociopolitical constraints.

Typically, the class spends three to four days in the city of each participating school with a couple days allotted for travel and cultural visits for a total of about ten days. The specific details are a little different each year. For example, one year the group was invited to attend a statewide conference on water resources and to participate in a poster session in Zacatecas (Día Del Agua). Representatives from each BYU team were given an unexpected opportunity to explain their work in Spanish to a group of professional engineers from both government offices and private firms as part of the poster session.

Although the itinerary varies from year to year, the trip is always rich with both academic and cultural activities. The main academic activities include visits to the project sites, project presentations, and group work time. The site visits reveal important weaknesses in the models and the approaches taken to develop them. Discovering these weakness and correcting them is a valuable education experience as each group learns from its mistakes. Usually the teams will have some time to work

together to refine their model after visiting the project site, but sometimes they also work together to develop the model before heading out to the field.

Presentations are an important part of the experience in Mexico. At UAZ, the collaboration with BYU is fairly well known, so university officials and representatives from interested government agencies often attend the presentations of results at the end of the collaboration. ITESO has only participated once so far, so the presentations there were given at the beginning as introductions and progress reports so that each group could decide the best way to use their time together.

The class usually returns from Mexico with a few weeks remaining in the semester. These weeks are used to finish up the projects if they did not get completed and to complete any outstanding writing assignments such as the final written report.

3.2 MESA and the Global Engineer

MESA started as a mentored environment then became a study abroad class after the college of engineering at BYU realized that it was in a unique position to enhance some of the skills of the global engineer. At BYU, many faculty members are fluent in at least one other language, and conduct research and creative works in countries other than the United States. More than 75 percent of BYU students speak a language other than their native tongue [8]. Approximately 45 percent have lived away from home for at least eighteen months serving as religious volunteers in the U.S. and abroad with many gaining fluency in a second language [8]. MESA capitalizes on the rich lingual and cultural background possessed by so many students to provide opportunities to apply those global experiences to engineering.

A big part of MESA's success is due to the large proportion of class members that know Spanish and are familiar with the Latin culture. At least one person with strong Spanish skills is on each team to ensure the ability to communicate with the Mexican students. Group members who may not speak Spanish well or at all can still

participate and make meaningful contributions as they communicate through their Spanish speaking teammate. Such an arrangement simulates reality. Often only one person on a professional engineering team is able to communicate with foreign clients or teammates. The other team members contribute their unique knowledge and skills by communicating through the one who speaks the language.

MESA has several objectives:

1. Increase cultural sensitivity and global awareness,
2. Build teamwork skills in a multi-cultural and multi-lingual environment,
3. Improve technical engineering skills,
4. Develop confidence in the students ability to apply their technical knowledge in an applied setting,
5. Generate research that can be leveraged by students and faculty,
6. Be cost effective.

The objectives to generate research and be cost effective are aimed at producing a sustainable program. Study abroad programs are often viewed by faculty as another interruption or distraction from their research because they do not count toward tenure and advancement like research publications; consequently, relatively few faculty members are willing to participate. An important benefit to the MESA program is that it has continually been a source of new research and thereby has facilitated participating faculty in their research while allowing them to participate in a rich educational experience. Some of the work from this program has been published in Spanish in peer–reviewed journals, and some has formed the basis for Master of Science degree projects.

Another traditional obstacle with study abroad courses is the additional cost incurred by students. The costs for MESA is about one-third of the average cost for study abroad programs at BYU [15]. When making this comparison, it is important

to realize that travel to other countries may be more expensive and the amount of time spent abroad is generally much longer than the week to ten days that are a part of this program. However, because of the early and consistent interaction with students via electronic media the course still attains a high degree of multi-cultural and multi-lingual interaction without the high costs associated with visiting for longer periods of time.

The first four objectives stem from the desire to continue the benefits that were already seen. Table 3.1 shows how the objectives of MESA relate to producing global engineers.

Table 3.1: Matching MESA objectives with global engineer aspects.

MESA Objective	Aspect of Global Engineer
Increase cultural sensitivity and global awareness.	broadminded, cross–cultural communication skills
Build teamwork skills in a multi-cultural and multi-lingual environment.	group/team work skills
Improve technical engineering skills.	high technical and scientific competence
Develop confidence in the students ability to apply their technical knowledge in an applied setting.	high technical and scientific competence

3.2.1 Cultural Sensitivity

Cultural sensitivity is developed through the combination of the preparation and trip phases. During the preparation phase, the challenges of working with people from another culture and language become evident as the collaboration proceeds from a distance. During the trip phase, the students are immersed in the culture and can come to understand the origin of the challenges previously discovered as well as have the opportunity to overcome them as they meet their colleagues and spend time with them in social and academic activities. They find that their ideas of traditional

American-based engineering problem solving often do not work because the historical, cultural, and political landscape is much different.

For example, in 2007, one group was assigned to come up with solutions to mitigate the flooding in the town of Trancoso Mexico. Trancoso residents report that serious flooding occurs two or three times per year. In recent years, flood waters have reached five feet high in buildings near the flooded stream. After analyzing the situation, the team came up with three solutions. One of the solutions was to deepen and widen the channel so the stream would not flood as frequently. Since houses were in the proposed channel, they suggested the government exercise eminent domain and tear down those houses. The Americans were quite surprised when told that particular solution was impossible because in the past, Mexican governments had forced people to abandon their flooded homes and had even provided them with homes in their new areas, but the people sold those homes, moved back to their original dwellings and refused to leave. The Americans were forced to rethink their approach.

Social activities also play a crucial role during the travel phase and complement the academic activities. It is in the social activities where friendships are solidified and personal understanding deepens.

3.2.2 Teamwork

MESA uses teamwork on at least three levels: within project teams, between BYU and Mexican project teams, and among the class as a whole. As described in the preparation phase, each member of the group is expected to contribute in a meaningful way and is held accountable for the assigned tasks in developing the projects. This level of teamwork continues through the preparation and trip phases of the class.

Teamwork between groups is also a big part of the class as the teams from both countries work together both electronically and face-to-face. Additionally, teams

with similar projects often exchange ideas and suggestions for their mutual benefit. At this level of teamwork, communication skills become very important as solutions are sought to overcome language and distance barriers. Students learn to communicate efficiently because extraneous words often lead to confusion.

The class as a whole also functioned as a team to organize and execute the logistics of the trip. Most of the details of the trip, excluding air travel, are handled by the students. Allowing them to take charge of their trip increases their sense of ownership and lightens the burden on the professors. Class members are able to practice compromise as they address individual needs and preferences.

3.2.3 Technical Skills and Confidence

Beyond broadening perspectives and developing teamwork skills, the Mexico study abroad class reinforces fundamental engineering analysis and design principles through the nature of the class projects. All the projects involve developing a water quality, hydrologic, or hydraulic model of an open-ended, real-world problem. During the projects, the basic concepts of modeling are combined with engineering judgment and standard analysis and design procedures within a complex socio–political environment that differs from their traditional view to provide an excellent culminating experience to the students' education. For some students, MESA serves as a senior design experience. For other students, it facilitates their research.

Seeing the degraded water quality conditions in Mexico during site visits has increased students' appreciation for good engineering as they realize how engineering has contributed to their quality of life. It also has shown how important civil engineers are and how much work there is to be done in Mexico and other cultural/political settings. The effect of these projects has been to augment student enthusiasm, confidence and excitement about being civil engineers while improving their cultural, teamwork, and technical skills [14]. Evidence to this effect is presented in chapter 4.

Chapter 4

Survey

Previous chapters have discussed the global engineer and the kinds of programs that have been created to mold students into global engineers. The MESA class is one such program. However, the skills developed are subjective, and a method of evaluating how well a course meets its objectives is vital to the long–term success of the course and the students taking it. Even with such an assessment, it is difficult to measure how well students develop the non-technical skills. Anecdotal evidence collected from students immediately after the class suggests that it was a meaningful experience and impacted their learning. The MESA faculty wanted to know if participating students still felt that way after they left school and started working so a survey has been developed for assessment purposes.

The survey was created after reviewing several other surveys. One given at Georgia Tech to all study abroad students at the beginning and end of the semester abroad had a particulary large influence on the MESA survey [33]. Respondents to the survey include students from all three years of MESA and students who participated in the mentored environment grants before MESA was organized as a class. No attempt was made to categorize the answers according to when the class was taken, so the whole range of four years is reflected in the answers. Those who took the class most recently had an experience more like the current program while those who participated in the early years now have broader work experience.

4.1 Survey Description

The survey carries an inherent bias because it was voluntary and limited to people who had already taken the class. Approximately 50 people were requested via e-mail to take the online survey, and about 75% responded. The ones who responded are most likely the ones who had a good experience, or already have inclinations toward global engineering. The results may have turned out differently if the other 25% of the people had responded. Also, the survey asks students to remember their past opinions and emotions and answer some questions as if they had not yet taken the class so their current feelings will undoubtedly influence those answers and introduce more bias. Therefore, the results were not tested for statistical significance. However, this survey is the first step toward gathering data about the effectiveness of the class. If the sources of error are kept in mind during the interpretation of the results, some useful data can be extracted and used at the very least to refine the next version of the survey and accompanying procedures.

The survey consists of four sections. The first section asks about whether the participant is still a student or is working as an engineer or otherwise and why they took the class. The next section asks the participants to remember their opinions and feelings before taking the class and respond accordingly to each listed skill. Students are asked to rate the importance of and their level of preparation in each skill. The next section repeats the same questions and asks the students to respond with their current feelings. The last section asks about how well MESA met its stated objectives and how important those objectives are in the respondents' current employment. Comment boxes also allow for more detailed answers or feedback about the class. The entire survey is reproduced in Appendix A.1.

In order to make sense of the results, a scoring system was developed to detect changes in how the respondents feel about things. In most questions, respondents are asked to answer on a five–point scale with 5 on the high end and 1 on the low end.

Equation (4.1) was used to compute a weighted average. It was then used as the score.

$$S = \sum_{i=1}^{5} W_i P_i \tag{4.1}$$

where $S =$ overall score

$W_c =$ the numerical value (from 0 to 1) assigned to category i

$P_c =$ the fraction of students who picked rating i

When interpreting the equation above, it is important to remember that possible responses to a question using this equation represent discrete points on a continuum from 100% to 0%. For example, the category of "Extremely Important" was assigned a weight of 1.0 or 100%. "Very Important" was assigned a weight of 0.75 and so forth until reaching "Not Important" which was assigned a weight of zero. The weighted average is an indicator of how the respondents as a whole feel about the question.

4.2 Survey Results

4.2.1 Respondent Demographics

Of those who took the survey, 61% are currently working as engineers. Another 3% are working in other careers, and 30% are engineering graduate students with an additional 6% undergraduate students. These data are illustrated in Figure 4.1.

The survey asked each respondent to rank in order of relevance several reasons why they decided to take the class. It was intended that no two reasons would have been given the same ranking by the same respondent. However, many of the participants gave identical rankings to two different reasons, indicating that the reasons were not ranked relative to each other, rather they were ranked individually on a six

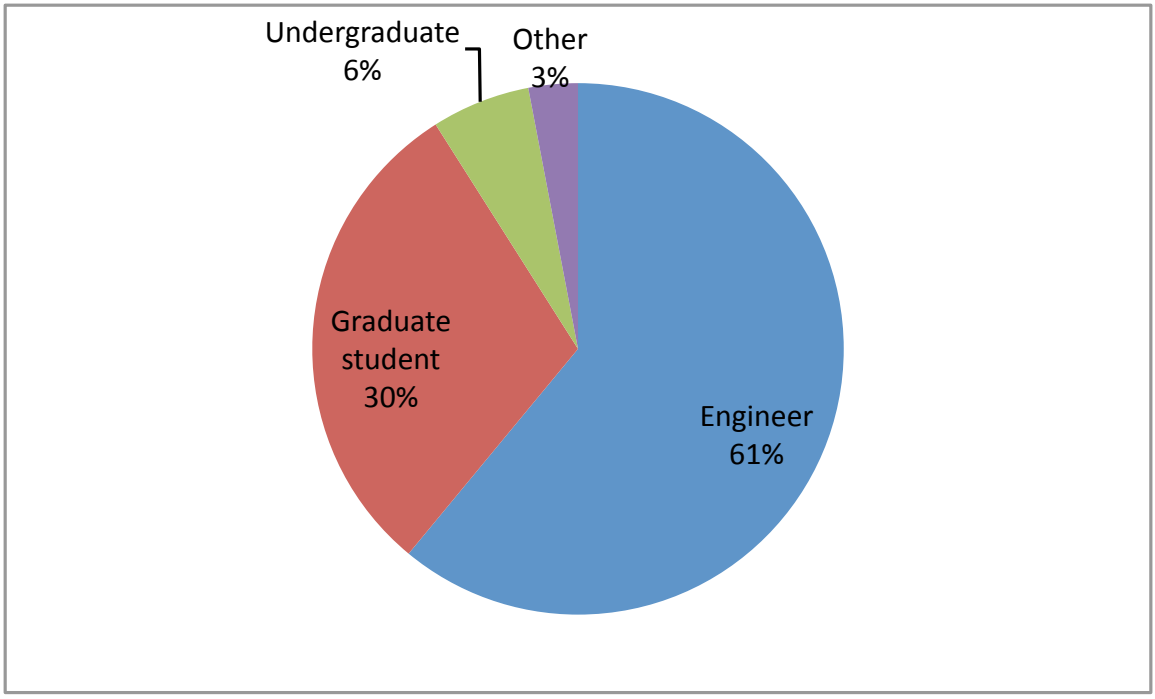

Figure 4.1: Current careers of survey respondents.

point scale much like the other questions in the survey. From the results, it was clear that the question was not answered as intended, so a relevance score for each reason was computed according to equation (4.1). Figure 4.2 shows the given reasons listed by relevance. The number one reason for taking the class was the opportunity to apply engineering knowledge to real-world problems, followed by the chance to travel to another country. Gaining experience on a multicultural team came in third place followed by the desire to learn Spanish in a technical context. The least relevant reason was being invited by a friend.

4.2.2 Trends

The before and after sections of the surveys were designed to find out what effect MESA had on students' skills and attitudes towards aspects of the global engineer. As mentioned before, these questions were taken from a survey developed at Georgia Tech. As discussed above, the overall score is useful when looking at how

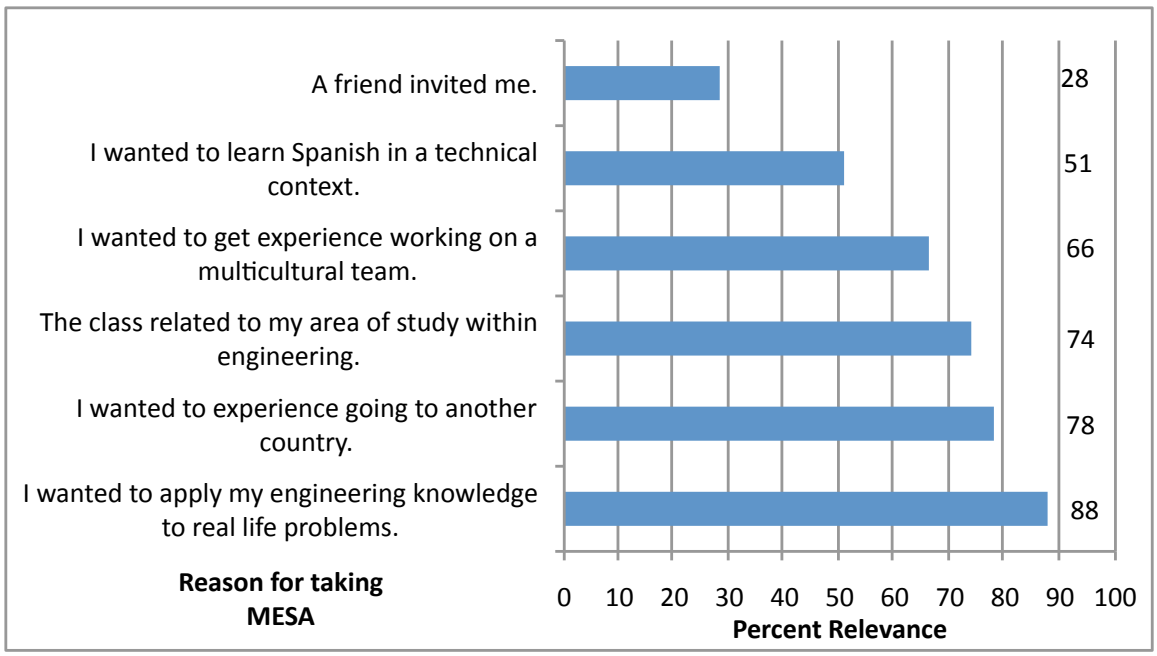

Figure 4.2: Relevance of various reasons for participating in MESA

the scores change from pre-class to post-class responses. Figures 4.3 and 4.4 show the changes in overall importance and preparedness scores, respectively.

An increase in preparation and importance was seen in every skill except for approaching problems from different perspectives which showed an increase in importance and remained the same in preparation. The largest increase in preparation (27%) was seen in the ability to practice engineering in different cultural settings. The largest increase in importance (17%) was seen in the ability to practice engineering in different cultural settings.

The next part of the survey deals with the stated objectives of MESA. The respondents were asked to rate how well the class met each objective using a five-point scale from "Completely succeeded" (100%) to "Failed" (0%). The scores reflect how successful the respondents as a whole felt the class was at meeting each goal. Figure 4.5 shows that almost all the respondents felt the class was at least somewhat successful in meeting all its goals. The highest success (94%) was reported for cultural international exposure and the lowest (56%) for learning spanish in the engineering

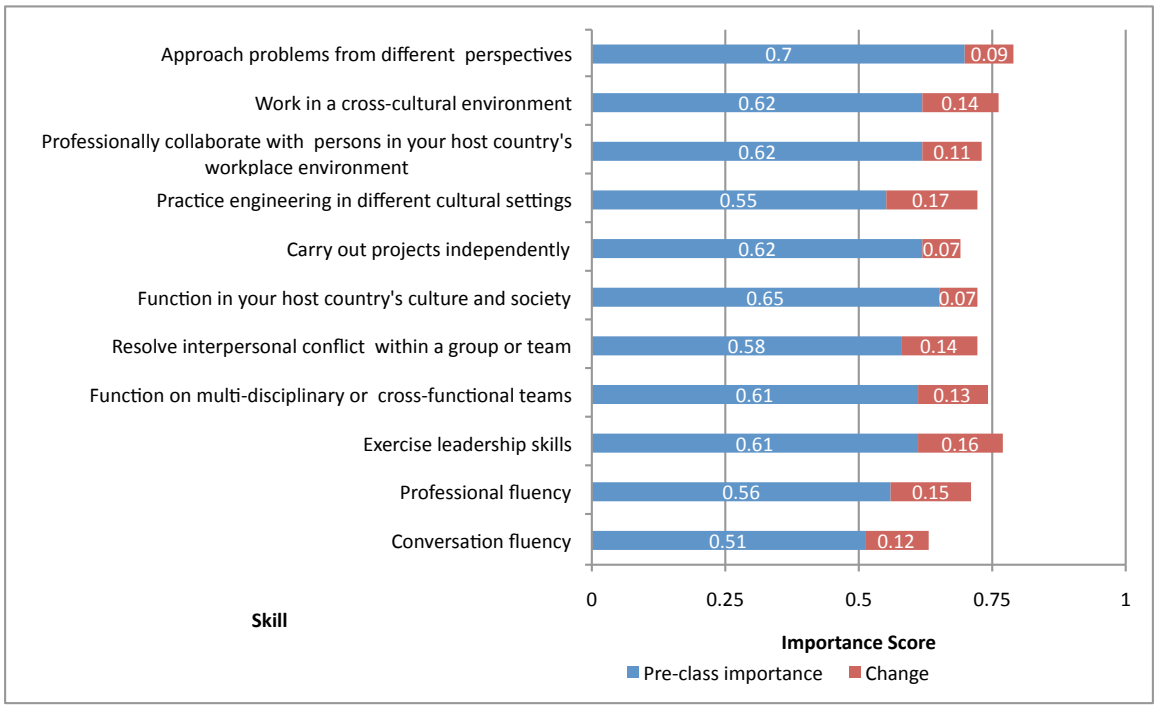

Figure 4.3: Importance of global engineering skills.

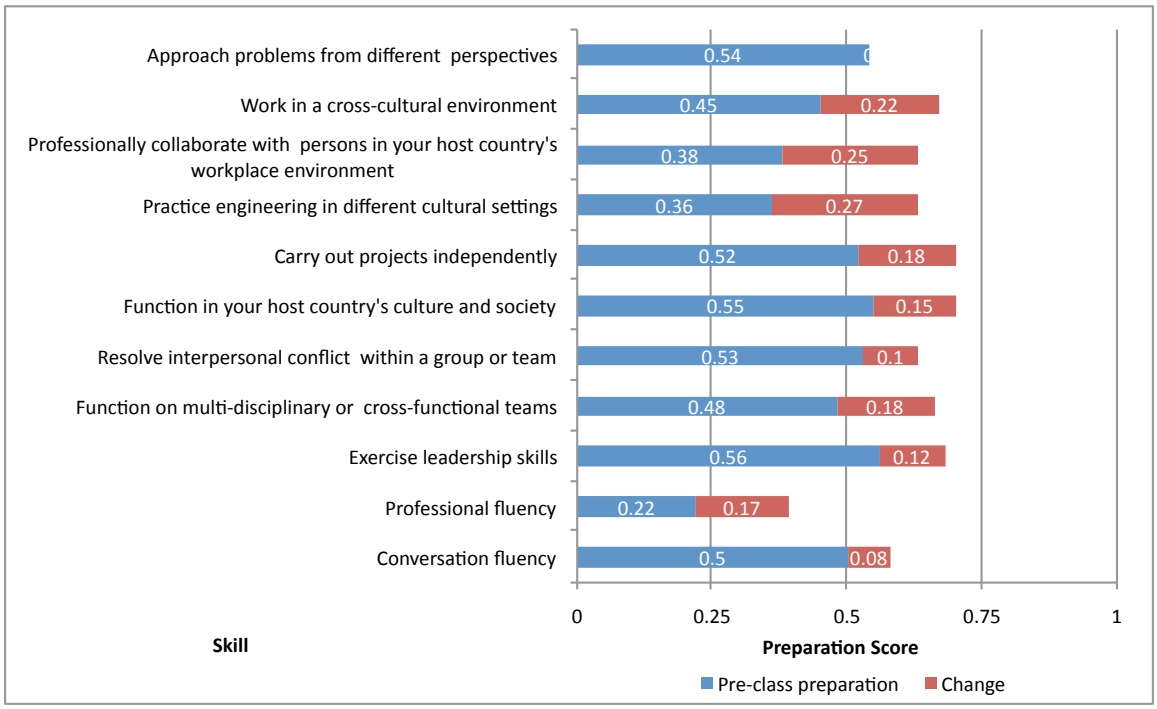

Figure 4.4: Development of global engineering skills.

profession. The low score for Spanish was surprising since that is one of the objectives of the course. However, usually about one-third of the students do not speak any Spanish because it is not a requirement. Therefore, those people were put in groups with others who do speak Spanish. This enabled those who did not speak Spanish to contribute and communicate with their Mexican teammates without having to learn the language and might explain why learning Spanish had a much lower score than the other goals.

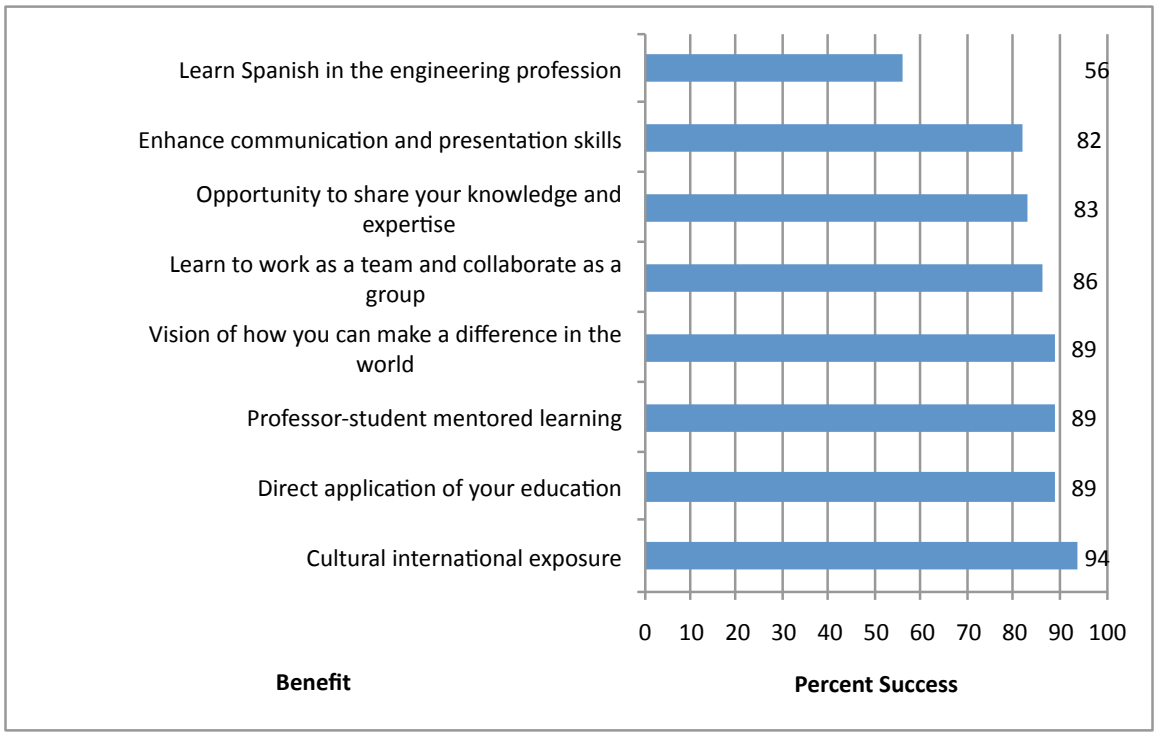

Figure 4.5: Success of MESA in meeting its goals.

The beginning of the survey requests that each respondent rank in order of highest expectation to lowest the skills that he/she expected the class to help develop. Again, this question was not answered as intended, so Equation (4.1) was used to determine an overall expectation score for each kind of skill. Later in the survey, students were asked to rank the same skills in order of most developed to least developed and again from most important in current employment to least important. The results showed that these rankings were done like the reason relevance rank-

ings, not as intended, so the same equation was used to find the overall development and importance scores for each skill. Comparing the expectation and development scores reveals whether or not the class is meeting the students' expectations. Figure 4.6 presents the expectation findings. It indicates that MESA is meeting student expectations.

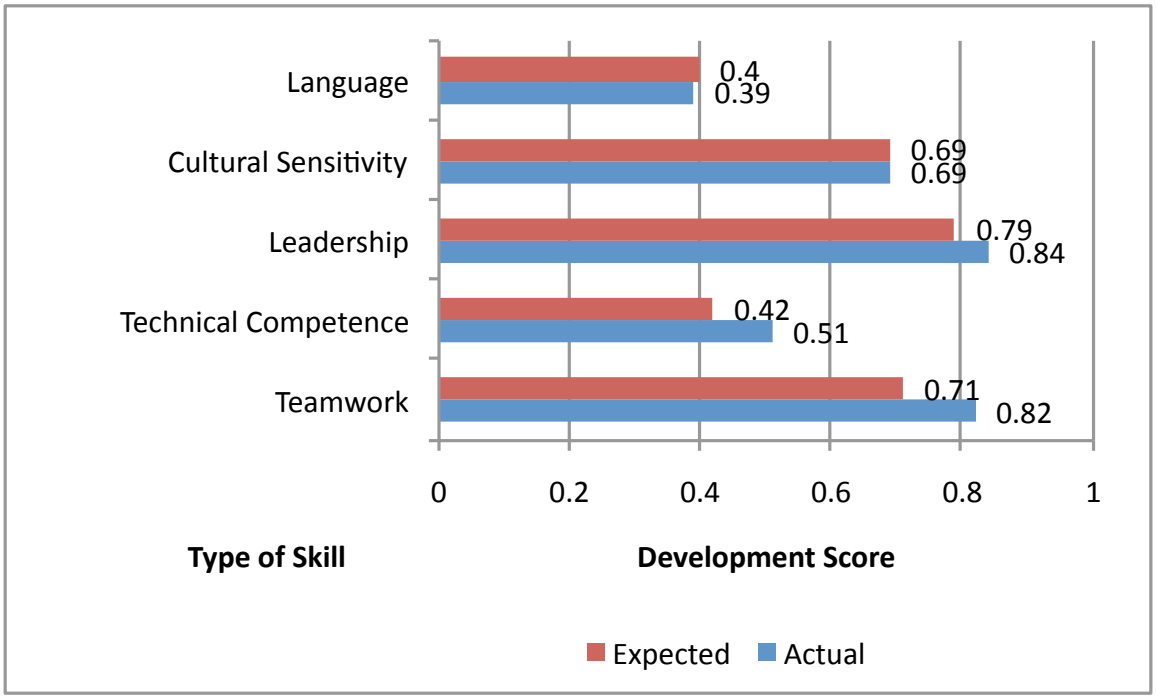

Figure 4.6: Expected skill development vs. actual skill developments.

Figure 4.7 shows how important each skill is in the respondents' current employment. Not surprisingly, teamwork, technical skills, and leadership are at the top of the list. Cultural awareness and language are ranked the lowest, but they still show significant importance.

In addition to being asked to rank each skill in importance, students were askedto rank how influential relative to other academic experiences the MESA class was on their current employment. The percentage of students who responded in each category is presented in Figure 4.8. Expectedly, no one ranked the MESA experience as more influential than any other academic experience. However, the majority of respondents indicated that the MESA experience is as influential as any

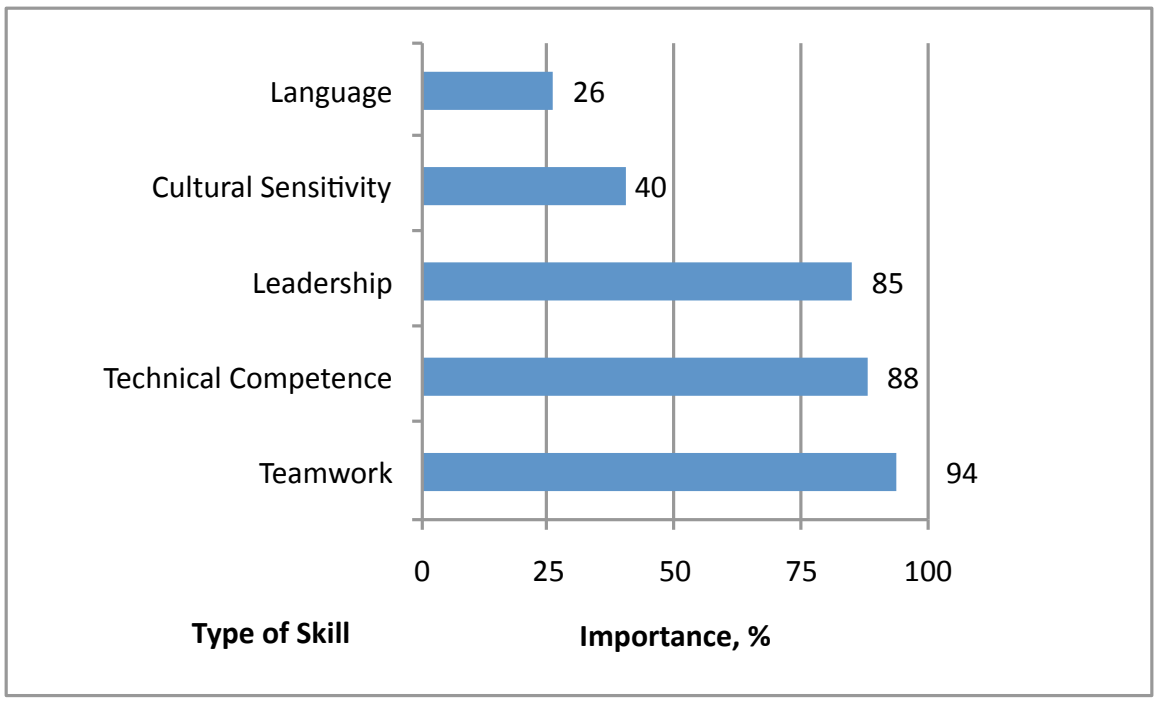

Figure 4.7: Importance of global engineering skills in the workplace.

other experience which means that MESA integrates well with their other academic and professional experiences. Another question asked if the respondents currently feel that MESA was the highlight of their academic preparation. Ninety-four (94) percent responded yes. Many also explained why they felt that way. Their comments can be found in Appendix A.2.

4.3 Discussion of Results

Due to the bias that was discussed earlier, any observed changes of less than 0.10 or 10 percent were considered not large enough to indicate a true trend. Changes greater than 10 percent were considered significant. The Figure 10% is somewhat arbitrary, and may need to be reexamined.

According to the numbers above, MESA is considered by an overwhelming majority to be the highlight of the students' academic preparation. It is successful at meeting its stated goals and raises the students' awareness of global engineering

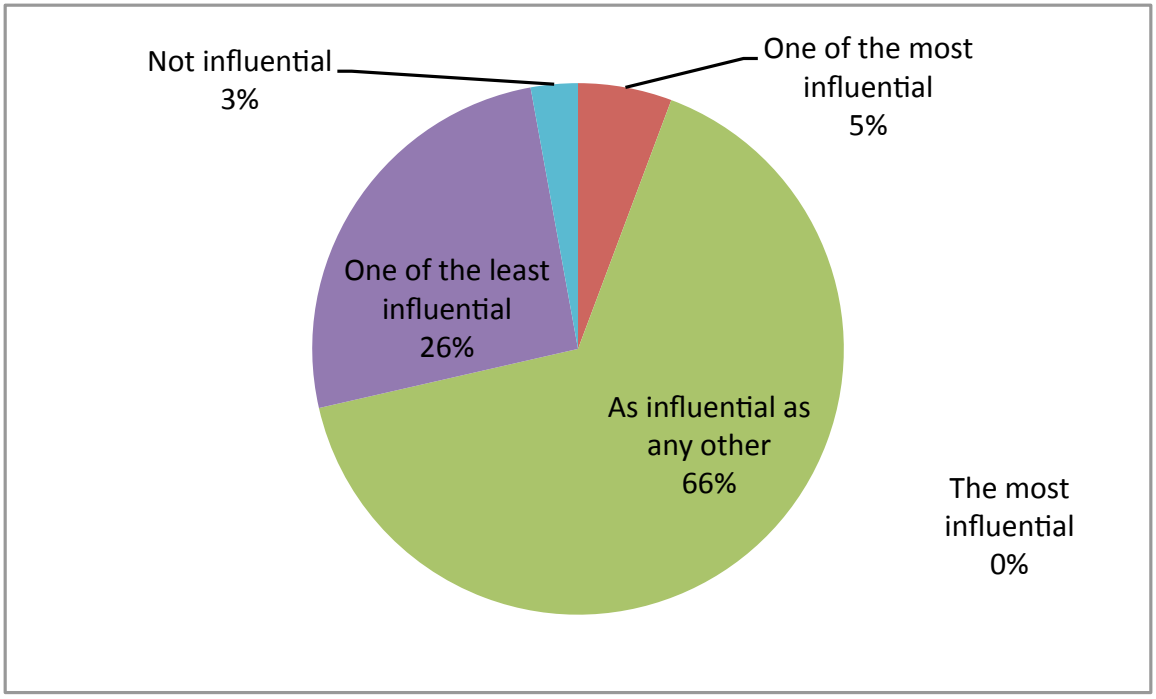

Figure 4.8: Influence level of MESA on current employment.

and prepares them work in more global environments. The low language scores in the figures above indicates that a MESA-based program may be successful at other schools without as many foreign language speakers. However, it is important to realize that at least one Spanish speaker should be in each group to facilitate communication. Based on comments gathered as part of the survey, its value also extends to those who intend to only work domestically or who do not speak Spanish. One student commented

> "... Though I don't use any Spanish at work right now, the experience out of the classroom, associating with other students, and seeing some of the real-life issues that people deal with was very educational and helpful to make the transition from school to career."

Another student who does not speak Spanish related his experience in the class:

> "I was not very prepared to communicate either socially or professionally being one of the few who could not speak Spanish. However, because of

the understanding of our group from BYU and the group of students and professors from Mexico I felt included and that I was able to contribute and develop the skills and values outlined in the survey (leadership, problem-solving, cultural understanding, and collaboration). "

The expected and observed development of the core skills of cultural awareness, leadership, teamwork, technical competence, and language were not significantly different. There was significant improvement in the students' level of preparation in most of the global engineering skills discussed in the survey as well as an increase in how important they felt those skills are. The only two skills that did not show a significant increase in preparation were conversational fluency and approaching problems from different perspectives.

The conversation fluency results may be skewed because not all the students spoke Spanish and so did not try to become fluent. Conversational fluency is also not emphasized precisely because the ability to speak Spanish is not a requirement to take to course. Approaching problems from different perspectives showed no change perhaps because the class is not multi-disciplinary. The majority of the class members are civil engineering students emphasizing water resources.

All the skills showed increases in importance except for functioning in a host country's society, carrying out projects independently,and approaching problems from different perspectives. The reasons from the previous paragraph apply here as well. In MESA, while there are some individual tasks, the majority of the work is done as a team, so the importance of teamwork would naturally overshadow that of individual work.

Respondent survey comments suggest that the class was well-liked and motivated them about engineering work. It is still considered valuable and worth the time and resources spent. Forty-seven (47) percent of the comments offering advice to people considering the class told them to "do it" in spite of the direct and indirect

costs such as increased expense, delayed graduation, conflicts with internships, and increased workload or complexity [14]. Personal interviews with students during and after the class reveal an increased appreciation for the effect civil engineers can have on individual lives and the impact of technology on society.

Chapter 5

Conclusions and Recommendations

Although Mexico Engineering Study Abroad has only existed officially for three years it has been shown to be an effective tool for developing global engineering attributes in civil engineers. Past participants praise it highly. When asked for general comments on the class, one student replied, "Every student who goes through BYU who wants this type of experience should be given that opportunity." Of course, since it is a young course, there are things that can be changed to increase its effectiveness. Some of these suggestions come from feedback via the survey discussed in chapter 4 while others come from discussions with students and faculty or from other engineering study abroad programs.

5.1 Improvements to MESA

One of the changes most discussed by students and faculty is the chance to meet with their Mexican teammates at the beginning of the semester so that they can get to know each other, form bonds, define the projects better, and make assignments. The initial meeting would allow the teams to learn a little of each other's strengths and weaknesses and help them make assignments. It would also allow them to avoid going down the wrong path early on. This could be done in either country, but it would be better if the Mexicans could travel to BYU to share the load of missed class time. Also, that would increase the cultural learning opportunities for the Mexican

students. If it is not feasible for the Mexican students to travel to BYU, many of the same benefits could be reaped via a video conference.

MESA could also be improved by developing parallel projects in the U.S. and Mexico to give students a comparative perspective on their work and allow them to discuss a common problem with convergent solutions. This suggestion is designed to improve the symmetry of experience for the Mexican and American based-schools so that students from both countries receive the same benefits.

One of the problems with extended field trip format classes like MESA is that they do not scale very well. MESA has only had one faculty member from BYU participate so far, but in 2008, more professors from BYU will be involved in the MESA class. This is an important change because it can allow more students to participate and bring added insight and diversity to the class because of the unique expertises of the faculty. This adds more credibility to the program and distributes the faculty work load to help the program be more sustainable.

One student suggested that MESA students visit a civil engineering firm in Mexico to "learn about Mexican regulations in engineering . . . [and] visit the practice side of Mexican engineering [14]." Such a trip would allow students to gain insight into the Mexican approache to engineering and the general idea that each culture may approach problems differently.In previous years, a common request has been to use more of the time in Mexico working on the projects with the Mexican students. Those who were working with the Zacatecas groups in 2007 were able to spend at least a whole day working with their group and they reported that it was very helpful and really made the project fulfilling for them. That practice should be continued in Zacatecas and expanded at the other schools visited.

Formal language training for students who do not speak Spanish has also been suggested. This is a good idea that will improve the experience for some of the students. However, since a majority of the class already speaks Spanish, a more

effective use of time would be to promote the MESA class to underclassmen early in the year so that they can plan for it and take Spanish classes on their own if they wish to do so.

5.2 Improvements to the Survey

In addition to changing the class, improving the survey will yield more accurate results and a better idea of how MESA performs. The first change will be to split the survey into a survey given at the beginning of the semester and one given at the end. Both will ask the same questions, and both will have additional questions as relevant. Conducting the survey in two parts should reduce the error associated with students trying to remember their feelings from before the class. Requiring everyone to take the survey both times will also reduce the bias associated with voluntary responses. The current survey is found in Appendix A.1. A proposed two-part survey is found in Appendix B. Basically, the new survey splits the current survey at the end of the "Before" section and the beginning of the "After" section. Language has been added to reduce the ambiguity of the questions that were not answered as intended. The next participants should answer those questions the same way as the first ones.

Another good idea would be to send out a follow-up survey in a couple years asking about the students' employment and the relevance of global engineering skills thereto. Currently, there is not much data on the impact of engineering study abroad experiences on employment and career choices.

The symmetry of experience mentioned in the previous section should be extended to survey participation. The Mexican students should also take the survey so that the faculty involved in MESA can assess their development of global engineering skills.

In the comments, a few students remarked that their desire to serve others was their primary reason for taking the class. Another suggestion is to add "I wanted

to use my knowledge to serve others." to the list of reasons for taking the class in order to find out if having service opportunities is a need most students have. The MESA projects end up being somewhat service oriented in that they primarily benefit Mexican students and stakeholders.

5.3 Summary

Many of the suggestions focused on improving communication between the BYU and Mexican students which means that the class members have realized the value of good communications and have begun to think about how to improve the quality of their communications. Good communication skills are essential for the global engineer, and the fact that the students are aware of this enables them to further develop that skill in themselves and further their progress in becoming global engineers.

Globalization will continue to affect the way civil engineering is practiced around the world. Engineers need to be prepared to work with colleagues from other countries who speak other languages. They need to be sensitive and open to different perspectives and they must be able to communicate their ideas to a wide range of audiences. This paper has shown that there are many kinds of programs designed to equip engineering students with the necessary skills. It has described one such course, the Mexico Engineering Study Abroad program and showed that it is an effective model for training global engineers which can be used by other schools. It has also suggested changes to MESA to make it more effective.

However, even if the suggested changes are adopted, a course like MESA is not a universal solution. Other forms of study abroad programs exist such as dual degree, exchange, extension, internship, partner sub-contract, and research programs that may better fill specific needs. Most institutions will want to have a variety of programs available.

While MESA may not be right for everyone at every school, it is a successful model for teaching global engineering skills. The data shows that language skills play a relatively minor role in the overall experience. Other institutions could use and adapt to MESA to their needs as long as a critical mass of foreign language speakers is present to ensure each group can communicate with its international counterpart. MESA is effective because it provides an opportunity for students to work as global engineers on technically challenging projects in a different socio-political setting. At the same time, the project experience helps them develop skills such as technical competence and confidence, creativity, leadership, responsibility, teamwork, cross-cultural communication, foreign language competence, and a better understanding of the relationship between technology and society.

In addition to outlining the MESA course, the paper has also discussed a survey used to evaluate the effectiveness of MESA. Such assessment tools are essential if colleges and universities wish to incorporate study abroad programs into their engineering curriculum.

5.4 Future Research

It would be interesting to do this same study from the Mexican point of view to find out how the Mexican engineering industry views globalization and the effects of the class on the Mexican students. Hopefully, MESA provides many of thesame benefits to the Mexican students as it does to the Americans.

A follow up study is suggested in a few years to gage what kind of effect, if any, the proposed changes have on MESA and if the measured development of students significantly changes with an improved survey methodology.

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Appendix A

Current Web Survey

The following pages in this appendix are a reproduction of the web survey that was sent out to the students who have the Mexico Engineering Study Abroad class.

A.1 Current Survey

Department of Civil and Environmental Engineering

International Engineering: Collaboration on Hydrologic Modeling Applications in Central Mexico

Survey

The purpose of this survey is to find out what effect, if any, the study abroad experience you had at BYU with Dr. Nelson has had on your preparation for professional practice. The results will be used to improve the study abroad class, which is now an official study abroad program to Mexico each year.

In this survey, no personal information required. Completing the survey will take approximately 10-20 minutes. Thank you very much for participating and helping us to make the class better for future students.

The questions below refer to your international experience either as part of the Mexico Study abroad class, or one of the previous mentor environment travels to Egypt or Chile. Ideally we would have had you take a pre/post survey and so some of the questions require you to think about your attitudes/perceptions before going. Please try to reflect and answer each question as objectively as possible.

Comment boxes follow each set of questions so that you can explain your responses further if necessary.

Please indicate your status:

◯ Engineer ◯ Non-Engineer ◯ Undergraduate ◯ Engineering Graduate Student ◯ Other graduate student

If you are not working in engineering, please list your profession/vocational area below:

(profession/vocation comments go here)

Please rank the reasons the following reasons for taking the class according their relevancy to your reasons for taking it. 1 is least relevant, 5 is most relevant. NA means the reason was not a factor at all for you.

Reason	1	2	3	4	5	NA
I wanted to experience going to another country.	◯	◯	◯	◯	◯	◯
I wanted to learn Spanish in a technical context.	◯	◯	◯	◯	◯	◯
I wanted to apply my engineering knowledge to real life problems.						
A friend invited me.	◯	◯	◯	◯	◯	◯
The class related to my area of study within engineering.	◯	◯	◯	◯	◯	◯
I wanted to get experience working on a multicultural team.	◯	◯	◯	◯	◯	◯

Before taking the class, what kinds of attributes did you expect the class to help you develop? Please rank your answers from the lowest expection (1) to the highest expectation (5)

Leadership	Cultural Awareness	Teamwork	Language	Technical Competence
12345	12345	12345	12345	12345

Before

Please indicate how important each of the following abilities was to you **before** this experience. Also, rate how prepared you were with each ability before you participated in your international experience.

The ability to	Importance					Preparation				
	Not Important	Somewhat Important	Important	Very Important	Extremely Important	Not Prepared	Somewhat Prepared	Prepared	Well Prepared	Very Well Prepared
Communicate in your host countrys language in a social setting (conversational fluency)	○	○	○	○	○	○	○	○	○	○
Communicate in your host countrys language in a professional setting (professional / technical fluency)	○	○	○	○	○	○	○	○	○	○
Exercise leadership skills	○	○	○	○	○	○	○	○	○	○
Function on multi-disciplinary or cross-functional teams	○	○	○	○	○	○	○	○	○	○
Resolve interpersonal conflict within a group or team	○	○	○	○	○	○	○	○	○	○
Function in your host countrys culture and society	○	○	○	○	○	○	○	○	○	○
Carry out projects independently	○	○	○	○	○	○	○	○	○	○
Practice engineering in different cultural settings	○	○	○	○	○	○	○	○	○	○
Professionally collaborate with persons in your host countrys workplace environment	○	○	○	○	○	○	○	○	○	○

	Importance					Preparation				
Work in a cross-cultural environment	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Approach problems from different perspectives	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

(survey comments go here)

After

Please rate your current feelings about importance and your level of preparation with respect to the same abilities.

The ability to	Importance					Preparation				
	Not Important	Somewhat Important	Important	Very Important	Extremely Important	Not Prepared	Somewhat Prepared	Prepared	Well Prepared	Very Well Prepared
Communicate in your host countrys language in a social setting (conversational fluency)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Communicate in your host countrys language in a professional setting (professional / technical fluency)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Exercise leadership skills	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Function on multi-disciplinary or cross-functional teams	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Resolve interpersonal conflict within a group or team	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Function in your host countrys culture and society	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Carry out projects independently	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

	Importance					Preparation				
Practice engineering in different cultural settings	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Professionally collaborate with persons in your host countrys workplace environment	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Work in a cross-cultural environment	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Approach problems from different perspectives	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

(survey comments go here)

The following table lists some of the benefits/goals of the program. Please indicate how well you believe the program met each goal. 1 means the program failed to meet the goal and 5 means the program was completely successful in meeting that goal.

Question	1	2	3	4	5
Learn Spanish in the engineering profession	◯	◯	◯	◯	◯
Cultural international exposure	◯	◯	◯	◯	◯
Vision of how you can make a difference in the world	◯	◯	◯	◯	◯
Direct application of your education	◯	◯	◯	◯	◯
Opportunity to share your knowledge and expertise	◯	◯	◯	◯	◯
Learn to work as a team and collaborate as a group	◯	◯	◯	◯	◯
Enhance communication and presentation skills	◯	◯	◯	◯	◯
Professor-student mentored learning	◯	◯	◯	◯	◯

How effective was the class in developing the following attributes in you? Please rank the skills from lowest (1) to highest (5) according to the relative degree the class developed it in you.

Leadership	Cultural Awareness	Teamwork	Language	Technical Competence
12345	12345	12345	12345	12345

How important are these skills in your current job? Please rank the skills from least important (1) to most important (5).

Leadership	Cultural Awareness	Teamwork	Language	Technical Competence
12345	12345	12345	12345	12345

Relative to other academic experiences, how does this experience rank in terms of influence on your job?

◯This experience is the most influential.
◯This experience is one of the most influential.
◯This experience has the same influence as any other.
◯This experience has less influence than others.
◯This experience is not influential on my job.

Many students comment that the study abroad experience was the highlight of their academic preparation. Do you still feel that way? Please comment why you chose Yes or No

◯Yes ◯No

What advice would you give to students considering participation in the Mexico Engineering study abroad program in the future?

What if anything would you recommend to improve the experience?

(survey comments go here)

A.2 Survey Comments

The comments from the survey are presented below. There are several categories of comments. No formatting or corrections have been made. All comments are as typed into the survey form.

Work Comments

Civil Engineer Land Developer, Construction, and Real Estate Structural Engineering, Engineer-in-Training

Before

The following comments were entered in the comment box in the Before section of the survey:

1. Communication is paramount in any team situation. I do not speak Spanish. However, I was teamed with individuals who were able to communicate in both Spanish and English. I wish I would have taken a Spanish class prior to this experience. I felt that I was prepared to accomplish the project.
2. As I considered the class, I felt that havingserved a mission among people who had similar customs, etc. would be very helpful to my preparation for the course. My experiences with other cultures are what, at least in part, motivated me to take advantage of this opportunity to gain technical experience with other cultures, which I feel will become more and more important as the world "shrinks" and geographical boundaries gradually fade. I really wanted to experience engineering from a different part of the world and from a different perspective.
3. Communication - it's not that I didn't think that knowing the language was important, but I didn't know the language at all and didn't place any priority on trying to learn it. Labeling the other items is difficult from that perspective because it is difficult to feel that you will be leading on a team where you can't communicate with others, etc. That is why I feel like I was only "somewhat prepared" for most of the items - it all relates back to being able to communicate.

4. I was in the class that went to Egypt. We didn't expect to or plan to learn Arabic before we went. Pretty much everyone would speak to us in English, so it wasn't much of a big deal.

5. I didn't know Spanish prior to the experience which would have helped me prepare in most of these.

6. Dr. Nelson, in the Reasons section above, I would add the following. The biggest reason I wanted to participate was for the opportunity to serve and help the people in Mexico, or latin America. I would love to be able to carry out some of the things we started just to see how it could benefit and bless the lives of the people down there who are living in such poor conditions. I am grateful to Ira Fulton who made it possible for us to go and would love to be in the position some day to do the same. I would say that the biggest reason I wanted to go was to serve and bless the lives of others.

7. I was not very prepared to communicate either socially or professionally being one of the few who could not speak Spanish. However, because of the understanding of our group from BYU and the group of students and professors from Mexico I felt included and that I was able to contribute and develop the skills and values outlined in the survey (leadership, problem-solving, cultural understanding and collaboration).

8. I think I was a little naive in my expectations or intentions for the course. I thought I would be able to do a lot more than I actually did, in terms of not only diagnosing the problem but presenting a viable and implementable solution.

9. Before the class, I was only really thinking of working with engineers from the US who spoke my language.

After

These comments were entered in the After section of the survey:

1. My experiences were very rewarding. I felt that the project I worked on was a success. I felt that it prepared me for future team projects. In my current position I am involved in team projects daily. Without experiences like my class, and trip with DR. Nelson I would not have been as well p
2. Although the program did no
3. The experience turned out to be similar to my expectations in some ways, but not in others. For example, I really enjoyed looking at engineering from the perspective of someone living outside the U.S. That was, as I expected, an eye-opening experience. However, one thing that I did NOT expect was that the level of difficulty associated with competing a project in collaboration with other people from a different country is very difficult to do effectively over the phone and through email. We were much more productive when we were able to talk fac
4. I don't remember differences between before and after - sorry.Comment for the questions below: This is how well the program met the goals for me personally. I think those that came in already knowing Spanish were able to learn Spanish in the engineering profession and were able to enhance communication and presentation skills. I was able to help in preparing the presentation (how we would present and the slides, etc.), but I wasn't able to present much.
5. Our visit to Mexico was filled with experiences that I will remember and that I believe will help me in my professional career. It helped me understand the importance of good communication, working collaboratively in teams, and seeking to understand the reasons that individuals reach the decisions or opinions that they do.

6. I realized how different it is working in a country other than the US, given the lack of governmental and societal support. When the largest concerns are helping people live day by day, solving long-term problems like water quality or ro

Highlight Reasons

This section explains why people felt that their international experience was the highlight of their academic preparation or why it was not.

1. The study abroad experience was the most rewarding college class I took. I was challenged to complete a real life engineering problem. This was one of the few experiences that I had while in college.
2. In many or most ways I would say that it was primarily because it allowed for a non-textbook problem to be solved using the skills we had learned during our years of schooling. Where some were lacking, others were able to step in and supply the help needed. With the exception of completing a thesis that has required hands on experience, this program was the only other real-life situation I was able to become involved in.
3. I feel that way because of the fact I was able to use my skills on a real world problem. There wasn't a right or wrong answer, rather good vs. better which is how the real world is. I was able to work with a lot of good people both here and there. There was a wide variety of experience and levels of knowledge. The faculty both here and there were outstanding, not just in their knowledge of the project and the technical things, but in their ability to interact with the students. Dr. Nelson is great because he is a real human with a sense of humor and life outside of school. Conversely, most professors I have dealt with here at BYU could take a lesson or two in that department. The faculty in Mexico were

wonderful as well. I felt like I put my skills to use. I didn't just do a homework problem, but I learned from this experience and put it to good use. I did as the motto for BYU suggests: enter to learn, go forth to serve. I've served a lot since I have been here, but I already knew how to do that. This was something I learned here and put to good use in making people's lives better. Anyone who has ever been around after a disaster knows what the ensuing chaos and emotions are like and to know that the work we did potentially eliminated that for some people meant a lot to me.

4. My experience in the study abroad class was incredible. First of all, Dr. Nelson did a wonderful job of putting the class and projects together and helping us to set and reach the goals that we needed to to be successful in fulfilling the overall purpose of the program this year. Secondly, I learned a lot of lessons that will be very applicable to my future career. I should say that I am probably not going to be dealing with any of the technical issues that I dealt with in the class, at least not for a long time. I am a structural engineer. However, the lessons I learned about teamwork and communication, not to mention the opportunity to see engineering from a different cultural/national perspective was very enlightening to me. I think that the experience I had in that class will (hopefully) save me a lot of time and effort down the road, simply because I have gained a better understanding of how to more effectively work in a group and communicate with my leaders and my peers. Those principles are probably some of the most important things that I think students need to learn before entering their careers. I thought that this class taught these principles in

5. It felt like a real "capstone" to the engineering curriculum. It was a good way to transition for school to the workplace. The experience helped to broaden my cultural awareness.

6. It felt like a real "capstone" to the engineering curriculum. It was a good way to transition for school to the workplace. The experience helped to broaden my cultural awareness.

7. It helped me to understand the world better, especially how engineers from other countries work and interact. This has been especially important as my graduate studies included working with many international students.

8. Because, this experience let me learn how to work as a team.

9. It was a highlight because I got to see engineering in action. We were dealing with real problems and solving them with engineering. It was also wonderful to experience another culture, even though I didn't know Spanish.

10. It was a highlight of my academic preparation. I feel it was beneficial but not crucial to my preparation.

11. We had a lot of great memories while we were there. The research, and implementation of the projects in that environment really helped me see how our work could influence our society and especially improve the conditions in other countries.

12. During the four years I attended BYU and studied civil engineering, I never had as great an opportunity to apply what I learned in my classes to the real world as I did with this class. All my other classes were focused on how to solve the problems on paper, in a technical textbook sort of way, and this class taught me how to solve real world problems (that cannot be answered using a textbook) through brainstorming and creativity based on my knowledge of engineering, all while taking into consideration cultural, monetary, and other limitations. My other classes helped me gain knowledge of engineering, and this class helped me apply that knowledge before I was thrown out into the world after I graduated.

Now that I have been working as an engineer for a civil engineering company, I already have some experience working with certain limitations like this.

13. I really appreciated the opportunity to practice engineering in a real-life setting. Doing it in the context of a foreign culture helped my understand how to relate to engineers in other cultures.

14. It's a hard choice, as there was so many great opportunities and teaching moments, but as far as one experience, to see engineering in action and a cultural experience, this tops the list.

15. This experience was much more like a real work environment. A group of engineers with different prior experience was put together and asked to solve a real problem that didn't have a set solution. It was more challenging, but at the same time, much more fun. I learned all types of skills rather than just calculating out the answer to a typical text book engineering problem. It also increased my understanding of how engineers can help people in need around the world.

16. It was definitely one of the highlights.

17. It was a highlight of my academic experience. And It would seem in the ever shrinking world that international experience in some way or another should become a requirement.

18. As I said before, it was a great opportunity to go down to Mexico and use the knowledge we have gained to help and collaborate with others so that their lives can be enriched. It was great to meet some of the kids down there and build relationships with them. We emailed back and forth for a while, which reminds me that I need to send them an email.

19. I think that this was a great opportunity that helped me become a more well-rounded individual and a more capable engineer. My only reservation, not

knowing the language, was that I wish that I could have contributed more while in the country.

20. This is real experience. Applied experience. On this trip I developed a level of confidence and excitement for my career than I have at any other time during my undergraduate work.

21. I think the Mexico trip was a highlight in that it was a chance to apply principles from class to real world situations. It was also very helpful in learning to communicate better with coworkers and it was really really fun.

22. It wasn't just another class. It was an opportunity to see real-life engineering issues, and to apply some of our knowledge to these issues. It was a very educational and fun trip that greatly enhanced my education.

23. This experience allowed for meaningful practical application of the principles I have been studying for the past few years. It also helped me realize the direct influence civil engineers could potentially have on society. The trip was also very fun.

24. It allowed a real-world outlet for our engineering knowledge, and the trip to Mexico was both fun and perspective changing.

25. There were academic experiences that followed that provided more preparation. I was lacking some of the technical knowledge at the time that I participated in the study abroad experience.

26. The international trips we went on were something I really looked forward to. I felt like I was doing something important and I hope to have more similar opportunities someday in the future.

27. I do still feel that way because it's much more valuable to accomplish something as a team, both for the sake of the product and for the sake of individual team

member development, than it is to do everything on your own. This experience taught me more about this than any other academic experience.

28. I felt that this experience gave me an opportunity to apply the knowledge that I have gained throughout my years of school. It also gave me an opportunity to work on an international project that taught me how to deal with other cultures and systems. The world is becoming smaller and being able to cross borders in a professional setting is becoming essential to being successful.

29. I think this could have been the highlight of my academic experience if their was sufficient data to complete the engineering problem selected.

30. Before taking the class, I was burned out by engineering classwork and did not know why I was studying to be a civil engineer. The Mexico class showed me how important civil engineers are in the world and renewed my enthusiasm for my studies.

31. It was a culmination of events that made this experience the highlight. There was travel, hard work, fun, groupwork, and an open-endedness that allowed the class to be what I made it. It was a class and a project, but it was a break from the monotony of four years of sole classwork. The project could have been about anything, but being able to see that project have a possible effect in other lives who may be less fortunate was what made this program special.

32. I feel that the vision of helping other people who augmented and that civil engineers are sorely needed in the international community. Visiting Mexico and learning of their cultural was a unique experience one could never learn in a classroom setting. Trying to communicate in Spanish regarding a technical subject was difficult, but as the world continues to "expand" one needs to be able to so and communicate effectively.

33. The opportunity to attend Brigham Young University was an exceptional experience in and of itself. The study abroad experience gave me the extraordinary opportunity to travel and participate in a culturally diverse teaching environment while still being part of the academic setting.

Advice

The following comments are advice to students considering taking the MESA class:

1. Understand what is required to make the project/program a success. Ask question, and take advantage of having a mentoring relationship with a professor.
2. Be open. A great amount of things can happen for you if you are open to chances and opportunities. Be willing to take a chance and do something that stretches you and makes you work harder. Study hard because you'll need all the help you can get.
3. Definately do it if the chance is there. Don't put it off because circumstances will very likely change and that opportunity might not be there next time around. Don't be shy if you don't speak spanish. The people are friendly and will help you out the best they can.
4. I would just advise the students to be prepared to have some hiccups in their projects simply due to the limited communication available, as I mentioned above. I would tell them to try and accomplish as much as possible on their own, but be prepared to make as much use of their face-to-face time as they possibly can because that is where the real progress is made.
5. It is one of the best experiences, technically, culturally, and leadership-wise that you can have at the university level.

6. They should be well prepared to learn and teach from the Mexican students. They should be humble.
7. The more Spanish you know prior to the experience, the better. I sill feel that I got a lot out of the experience, but it was small relative to those that knew Spanish because I didn't understand much of what was going on.
8. Do it.
9. Do it. If you get the chance, it is a great experience that will lead to exciting new opportunities in the world of engineering. You will have the great opportunity to see how engineering can improve the living conditions in foreign countries.
10. Money should not be a reason not to go. First of all, there are generous grants to help students pay for the expenses of the trip, but most importantly, the experience and broadened knowledge that this class will bring is worth far more than the couple hundred dollars saved by not going. This class gave me a better working knowledge of engineering and it's real world applications, as well as a hightened awareness of the culture and need for engineering work in other countries outside the U.S.
11. Make sure you learn engineering spanish.
12. Learn Spanish, learn hydrology, learn WMS, and then have fun.
13. Just be sure to do it. It is very rewarding because you learn so many things you couldn't learn in a typical class setting.
14. Do it. Its Great
15. Enjoy the time you have there, don't be shy, make friends, know your stuff, practice your presentations, study spanish engineering words.
16. I would recommend the program to anyone in the CE program (and I did). It is a unique and valuable experience.

17. Do it, and get involved as much as you can, even if your other classes need to suffer. Oh, and don't get sick in Mexico.

18. Communicate early with your Mexican team mates.

19. Do it! It's a chance to get outside of the classroom. It's fun, and very educational. It looks good on a resume. It helps develop social and leadership skills.

20. Mastery of the spanish language is not necessary; however, a basic understanding will help one get more out of both the academic and cultural aspects of the program. Establish good lines of communication with the mexican counterparts early on and deligate assignments.

21. Definitely do it!

22. Apply yourself and prepare well so that you can learn as much as possible.

23. I'd say you should do it. You will not regret doing it, but you will most likely regret missing this opportunity.

24. The biggest thing that discourages students is money. When you have so little, it can be hard to justify spending it on what may seem like a vacation abroad. But it's much more than that. The lessons you'll learn are worth it. Not only do you gain valuable experiences in global engineering, you develop priceless friendships that make you look back and think, "I can't believe I considered NOT doing this."

25. Do it! You won't regret it.

26. This is a great opportunity to apply what you have learned in a real life environment. Make sure the goals of the selected engineering problem are clearly identified up front.

27. My advice would be don't do the bare minimum. The class becomes fun when you take an interest in your project and try to do the best possible job. Communicate early with your counterparts in Mexico and start forming a relationship with them that will be strengthened when you visit at the end of the semester.
28. The program goes far beyond a project about water resources. Even if you aren't necessarily interested in water, do it anyway because the teamwork and collaboration and presentation skills can be used in any discipline.
29. Start early learning vocabulary words. This was done with only a slight emphasis. I wish I had known more hydrology related words and how to express WMS ideas in Spanish.
30. I would whole heartedly recommend it to any student. I would do it again myself had I the opportunity.

Improvements

The following comments are improvements to the course suggested by the survey respondents:

1. Coordinate formal language training with the class for those who do not speak the language.
2. More ability to contact the students on your team. It was one thing to work on the problem, but to know the situation, knowledge and level of experience of your fellow teammate in Mexico would have been very helpful.
3. It would be good to be able to meet your group at the start of the semester. If they could come here or if a video conference could be held, something to put a face to a name more than a little bio and a picture. That would make communication easier. Also, along the lines of enhancing communication, having a

project leader here as well as down there would be nice. Some structure will always help things as opposed to just writing to a group.

4. More time to work face to face with our counterparts would have been nice (maybe have them come visit us in Provo for a week in addition to our visit to Mexico).

5. Continue to expand the technical challenges of the projects.

6. I think everything is OK. However, it could be a good idea that other professors can participate in the program.

7. Being in Mexico was the highlight of this experience and I felt like everything there was extremely well done. Any recommendations would be for before going to Mexico. Communicating by email was extremely difficult. It would have also been nice to know about the students we would be working with beforehand. I think we tried to exchange that information, but I don't remember getting anything back from the other students.

8. I think that from BYU's side everything went very smooth, as far as the university with which we were working, they could have been more organized and better at communicating with us.

9. If I were to change one thing about this program, it would be to spend more time in Mexico. I understand that financing is already an issue, but if we could have gone to Mexico at the beginning of (or a couple weeks into) the semester, I think my group and I would have had a much better idea of what we were trying to do and understood more about the area in Mexico we were working with. It would have also given us the opportunity to meet our fellow students in Mexico that we would be working with on the project. Just a couple of days would suffice, I believe. That would give us enough time to do site visits and meet our counterparts there.

10. structure was great, class was great, activities were great– keep the items, planning, and events relaxed (it was when i went). I wouldn't change a thing from the trip I went on.

11. I think if I were going to do it again, I would have liked to be farther along with my coursework so I knew more about hydrology and modeling. I didn't feel like I really knew much about our work together. I would have liked to contribute more...so I would recommend a couple of prerequisites to go on the trip. Mainly hydrology and the WMS class. I think it would have been interesting to attend a lecture or class in spanish at their schools. We spent too much time doing the WMS training course.

12. I think It would be really good to go and meet with a civil engineering firm in Mexico. Mexican Engineers actually practicing. not just in academia. Learn about Mexican Regulations in engineering.. get a hold of some of their design books. and state issued regs. etc. Visit the Practice side of Mexican engineering.

13. I didn't have a group in Mexico that was working on the same project I was so there was no collabortion. I would suggest that all groups collaborated with another group in Mexico on a project. It makes the experience a little better when you get there and finally meet the people you have been working with.

14. Being one of the first groups to travel to the group that we did, some of the preparation of the projects was delayed due to the time that it took to establish a relationship. It would have been nice to do some more "hands on" work before the visit. I imagine that now that a constant link has been made that this is less of a problem.

15. I wonder if visiting the site first would help us define the problem a little better? What if it were a two-semester deal, and we went at the beginning and at the end? I felt like we could have done so much more had we understood the problem

better from the beginning, and had met and interacted with our colleagues first, so that we would have had better communication with them.

16. I really can't imagine anything better than the way it went for us (2007 trip)
17. I would have liked working on solving issues a little bit more rather than just talking about what engineering issues existed. I was in the first trip to Zacatecas, so I know we were just starting and I don't know if they really had much funding to actually resolve some of the issues, so it's completely understandable. I hope in the future that some of these projects will move forth so that students may see some of the progress of their work.
18. Visiting the sites before working on the projects would help students understand and define the parameters of each project.
19. Clearer project objectives. I think we spent too much time just trying to figure out what we were supposed to do. I guess that's part of global engineering, but for a semester class, that portion of the experience should be minimized so that by the end of the class you can feel like you delivered something useful.
20. Just make sure there is data available for the real-life engineering problems selected to do. Otherwise, the problem isn't as real-life and more of another hypothetical problem.
21. It would be great if the Mexicans could come to BYU at the beginning of the semester to start the projects so people could become aquainted and make sure everyone is on the same page with respect to the projects.
22. See if its possible for the foriegn students to come here to BYU at the beginning of the semester. It would make the trip to Mexico that much more effective having already really known them.

23. I wish the engineering problem that my group was assigned had been defined really well. My group didn't understand the whole problem of what we were to accomplish until we got to Mexico so that didn't help.

24. I would recommend that students participating in the experience do all they can to prepare beforehand.

General Comments

The following are general comments given at the end of the survey:

1. Every student who goes through BYU who wants this type of experience should be given that opportunity.

2. A great experience. Highly recommended. Besides, how often do you get the opportunity to climb to a volcano, walk the streets of a colonial town near midnight and help solve an important, and sometimes crucial, problematic situation all in one trip?

3. This was a great experience for me. I am glad the college and the department is encouraging it. I was very greatful for the scholarship I recieved as it made the trip more possible and took stress off of making ends meet financially for the trip. Thank you to those who made it possible. I am going to try to swing it again this coming year...

4. It was great! Keep it going!

5. I enjoyed the study abroad experience. Although I am not currently working internationally, I do have a desire to continue to develop some of the culture skills I learned through the study abroad class.

6. I know a lot of my comments may seem negative in respect to the language, but that was the one difficult part of the experience for me. I would do it again if I had the opportunity, though.

7. Dr. Nelson is a great mentor and professor. This program will continue to bless the lives of the students as well as the hosts as long as he is in charge.
8. This was an invaluable experience for me. I will never forget it nor the knowledge or experience I gained from it.
9. The opportunity to be mentored and work directly with Dr. Nelson was probably the best part of the whole experience. It was nice to spend so much time and really get to know classmates and a professor.
10. It was a Great Experience. thanks
11. Thanks Dr. Nelson, I had a great time, "Roomie"
12. Although I felt I could have contributed more if I could speak the language, I hope that I was able to contribute in other ways and I appreciate that I was able to participate. Dr. Nelson was a great example professionally and as a friend. I appreciate the effort he went through to provide and experience like this for me and the other students.
13. I would do it again in a heartbeat.
14. Thank you so much for the experience. Though I don't use any Spanish at work right now, the experience out of the classroom, associating with other students, and seeing some of the real-life issues that people deal with was very educational and helpful to make the transition from school to career.
15. It is a great and rewarding program
16. This kind of experience should be had by every BYU student. I have used the knowledge I gained from this class on projects in the workforce. This project helped us develop leadership and project management skills.
17. Thanks for the time and efforts to make this experience possible.

18. This was a great experience and Dr. Nelson puts a lot of time in to making this a great experience for all those who participate.Comments:
19. Great class. Keep it up.
20. This program should continue.
21. It was a great experience. Thanks!

Appendix B

Revised Web Survey

The following sections contain the pre-class and post-class survey to be given in the future to all students who take the class.

B.1 Pre-class Survey

Department of Civil and Environmental Engineering

International Engineering: Collaboration on Hydrologic Modeling Applications in Central Mexico

Survey

The purpose of this survey is to measure the effectiveness of the Mexico Engineering Study Abroad course in helping you develop global engineering attributes.

In this survey, no personal information required. Completing the survey will take approximately 10 minutes. Thank you very much for participating and helping us to make the class better for future students.

Comment boxes follow each set of questions so that you can explain your responses further if necessary.

Please indicate your reasons for taking the class by rating the following reasons for taking the class according their relevancy. 1 is not relevant, 7 is most relevant.

Reason	1	2	3	4	5	6	7
I want to experience going to another country.	◯	◯	◯	◯	◯	◯	◯
I want to learn Spanish in a technical context.	◯	◯	◯	◯	◯	◯	◯
I want to apply my engineering knowledge to real life problems.	◯	◯	◯	◯	◯	◯	◯
A friend invited me.	◯	◯	◯	◯	◯	◯	◯
The class related to my area of study within engineering.	◯	◯	◯	◯	◯	◯	◯
I want to get experience working on a multicultural team.	◯	◯	◯	◯	◯	◯	◯
I want to use my knowledge to serve others.	◯	◯	◯	◯	◯ ◯	◯	◯

What kinds of attributes do you expect this class to help you develop? Please rate each attribute from the lowest expectation (1) to the highest expectation (5).

Leadership	Cultural Awareness	Teamwork	Language	Technical Competence
12345	12345	12345	12345	12345

For the following questions, please note that each question requires **two** answers. Please indicate how important each of the following abilities is to you. Also, please rate how prepared you feel you are in each ability.

The ability to	Importance					Preparation				
	Not Important	Somewhat Important	Important	Very Important	Extremely Important	Not Prepared	Somewhat Prepared	Prepared	Well Prepared	Very Well Prepared
Communicate in your host countrys language in a social setting (conversational fluency)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

	Importance					Preparation				
Communicate in your host countrys language in a professional setting (professional / technical fluency)	○	○	○	○	○	○	○	○	○	○
Exercise leadership skills	○	○	○	○	○	○	○	○	○	○
Function on multi-disciplinary or cross-functional teams	○	○	○	○	○	○	○	○	○	○
Resolve interpersonal conflict within a group or team	○	○	○	○	○	○	○	○	○	○
Function in your host countrys culture and society	○	○	○	○	○	○	○	○	○	○
Carry out projects independently	○	○	○	○	○	○	○	○	○	○
Practice engineering in different cultural settings	○	○	○	○	○	○	○	○	○	○
Professionally collaborate with persons in your host countrys workplace environment	○	○	○	○	○	○	○	○	○	○
Work in a cross-cultural environment	○	○	○	○	○	○	○	○	○	○
Approach problems from different perspectives	○	○	○	○	○	○	○	○	○	○

(survey comments go here)

B.2 Post-class Survey

Department of Civil and Environmental Engineering

International Engineering: Collaboration on Hydrologic Modeling Applications in Central Mexico

Survey

The purpose of this survey is to measure the effectiveness of the Mexico Engineering Study Abroad course in helping you develop global engineering attributes.

In this survey, no personal information required. Completing the survey will take approximately 10 minutes. Thank you very much for participating and helping us to make the class better for future students.

Comment boxes follow each set of questions so that you can explain your responses further if necessary.

For the following questions, please note that each question requires **two** answers. Please indicate how important each of the following abilities is to you. Also, please rate how prepared you feel you are in each ability.

The ability to	Importance					Preparation				
	Not Important	Somewhat Important	Important	Very Important	Extremely Important	Not Prepared	Somewhat Prepared	Prepared	Well Prepared	Very Well Prepared
Communicate in your host countrys language in a social setting (conversational fluency)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Communicate in your host countrys language in a professional setting (professional / technical fluency)	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Exercise leadership skills	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Function on multi-disciplinary or cross-functional teams	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Resolve interpersonal conflict within a group or team	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Function in your host countrys culture and society	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Carry out projects independently	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Practice engineering in different cultural settings	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

	Importance					Preparation				
Professionally collaborate with persons in your host countrys workplace environment	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Work in a cross-cultural environment	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Approach problems from different perspectives	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

(survey comments go here)

The following table lists some of the benefits/goals of the program. Please indicate how well you believe the program met each goal. 1 means the program failed to meet the goal and 5 means the program was completely successful in meeting that goal.

Question	1	2	3	4	5
Learn Spanish in the engineering profession	◯	◯	◯	◯	◯
Cultural international exposure	◯	◯	◯	◯	◯
Vision of how you can make a difference in the world	◯	◯	◯	◯	◯
Direct application of your education	◯	◯	◯	◯	◯
Opportunity to share your knowledge and expertise	◯	◯	◯	◯	◯
Learn to work as a team and collaborate as a group	◯	◯	◯	◯	◯
Enhance communication and presentation skills	◯	◯	◯	◯	◯
Professor-student mentored learning	◯	◯	◯	◯	◯

How effective was the class in developing the following attributes in you? Please rate the development of each skill from not developed (1) to completely developed (5).

Leadership	Cultural Awareness	Teamwork	Language	Technical Competence
12345	12345	12345	12345	12345

How important are these skills in your current job? Please rate each skill from not important (1) to extremely important (5).

Leadership	Cultural Awareness	Teamwork	Language	Technical Competence
12345	12345	12345	12345	12345

Relative to other academic experiences, how does this experience rank in terms of influence on your job?

◯This experience is the most influential.

◯This experience is one of the most influential.

◯This experience has the same influence as any other.

◯This experience has less influence than others.

◯This experience is not influential on my job.

What advice would you give to students considering participation in the Mexico Engineering study abroad program in the future?

What if anything would you recommend to improve the experience?

(survey comments go here)