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Best of Both Worlds: Foreign Language Preparation for Purdue University's Undergraduate Global Engineering Education Program

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ABSTRACT

Over the years, Purdue University has drastically increased the number of engineering students studying and interning abroad from less than 3% in 2000 to more than 10% in 2010. In order to increase the capacity of global engineering education curriculum, there is a need to create different study abroad programs to suit different student interests. Yet, the need of foreign language preparation remains in question. At Purdue University, researchers and administrators observed that students often self-select into study abroad programs of varying intensity according to the varying foreign language and GPA requirements. Case studies of student participants from four different Purdue education abroad programs will be demonstrated in this paper in the following order: (1) Global Engineering Alliance for Research and Education (GEARE), (2) International Research and Education for Engineering (IREE), (3) Global Internship, and (4) China Maymester Abroad Program. These case studies will be used to illustrate the importance of foreign language preparation and the varying needs. The results will also demonstrate that the achieved level of foreign language competency impacts technical outcomes and engineering professionalism.

INTRODUCTION

The following question has been raised many times. Is foreign language fluency an absolute requirement for participants' success in their global engineering education? In other words, is communication and comprehension in the foreign language critical to global engineering work? Global competency is essential for U.S. engineers, who now compete in an international market for engineering know-how. If engineering students manage to 'get by' with minimal foreign language competency, then why is foreign language learning so important? Previous scholarship on global engineering education outlines the significance of curriculum programming and learning outcomes of student participants. This paper primarily focuses on the aspect of foreign language preparation prior to students' departure for their various global engineering education experiences at Purdue University.

LITERATURE REVIEW

Foreign Language Acquisition vs. Nature of Education Abroad Programs

Manga and Back (2007)ⁱ examined in their study the common beliefs about study abroad, focusing on whether social interaction is related to linguistic gain. They looked at living situation, amount of social contact with French native speakers and with Americans, and amount of contact with French media. Through their literature review, Coleman (1997)ⁱⁱ, Freed (1995)ⁱⁱⁱ, Allen and Herron (2003)^{iv}, and Regan (2003)^v, affirmed that it is interactions with native speakers that drive foreign language acquisition. According to Meara (1994)^{vi}, the amount of social time spent with native speakers is a good predictor of language skill improvement; whereas too much time spent with the fellow study abroad sojourners can become an obstacle of foreign language acquisition. On the other hand, Ball (2000)^{vii} found that students sometimes became dependent on other English speakers because the linguistic demands of their studies at the foreign institution are high. Allen and Herron (2003)^{viii} suggested that anxiety also might encourage students to avoid native speakers.

Based on the literature, the various forms of how to conduct study abroad activities are examined.

Increasingly, study abroad programs have evolved from the traditional year or semester-long programs to short-term programs. Short-term study abroad programs can accommodate non-traditional students' needs and also have gained popularity among the mainstream students. The creation of short-term programs is advantageous in that they: overcome the barriers of delayed graduation; allow students who have commitments during regular semesters (work, families, athletics, etc.) to study abroad; serve as a "stepping stone" for students who are concerned about cultural unfamiliarity when considering study abroad; and are financially more feasible than many semester- or year-long programs. Short-term programs are popular among students. Yet, an article in the New York Times^{ix} pointed out how U.S. students abroad are often less concerned with language learning than language instructors might expect:

Whereas the typical student once immersed himself or herself in a foreign culture, often studying the language and society for years before going, today's excursions are often quick group tours that require little knowledge or appreciation of the countries on the itinerary. (Winter, 2004, p. A 17)

What Winter (2004) described is an academic culture and programs of what is referred to here as the "American Islands" program typology. This infers that little American islands were created with students who possess little to no foreign language skills, who travel in groups, speaking English and eating at McDonalds. Short-term study abroad programs do have shortcomings. First, the brief and intense nature of summer programs can make cultural adjustment difficult for students as they "have to make a concerted effort to get significant exposure to the local culture and community" (Guerrero, 2005, p. 42)^x. Second, students have limited time to learn and reflect upon the local cultures and communities they experience while abroad, which "could lead to students acquiring a skewed or at least inaccurate perception of life in foreign countries as well as its culture" (p. 42). Finally, there are also serious curriculum concerns surrounding the numbers of credits offered and the level of student learning that can be achieved during such a short period of time.

RECENT TREND OF EDUCATION ABROAD PROGRAMS: A DECADAL OVERVIEW

In 2005 the Abraham Lincoln study abroad fellowship commission framed widespread participation in study abroad as the next major step in the evolution of American higher education. On July 26, 2006, Senators Dick Durbin and Norm

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Coleman introduced the Abraham Lincoln Study Abroad Act of 2006 (S. 3744) to the Committee on Foreign Relations. Kinginger (2008)^{xi} argued that the Study Abroad Act mirrors in scope and impact to the establishment of the land-grant university system under the Morrill Acts of 1862 and 1890 and the Serviceman's Readjustment Act, or GI Bill of Rights of 1944. The Commission's report^{xii} emphasized the significance of global skills for economic competitiveness and national security, stating that:

"... study abroad is one of the major means of producing foreign language speakers and enhancing foreign language learning... It is in the national interest of the United States to send at least one million undergraduates abroad annually to study other lands, languages, and cultures

Secretary Margaret Spellings released a U.S. Department of Education report on higher education in September 2006. The Spellings' Commission on the Future of Higher Education (FHEC)^{xiii} recommended "increased federal investment in areas critical to our Nation's global competitiveness and a renewed commitment to attract the best and brightest minds from across the nation and around the world to lead the next wave of American innovation". Immediately thereafter, 2006 was named "The Year of Study Abroad" by unanimous Senate resolution. This is a succession of the U.S. Senate's declaration that 2005 as the "Year of Languages". From this, it becomes clear that internationalization of higher education is needed in America.

These articulations of the need for internationalization directly resulted in an increase in total U.S. students studying abroad from 129,770 (1998-99) to 260,327 (2008-09) over the past decade. Despite its shortcomings, short-term study abroad programs are growing in popularity. The *Open Doors*^{xiv} 2010 data from the Institute of International Education shows that short-term programs serve the largest number of Americans studying abroad, including community college students and others whose financial or academic needs preclude a longer stay. About 41% of students studying abroad do so through mid-length programs (one semester, one quarter or two quarters), while 55% of U.S. students choose short-term programs. Seventy-four percent of students at associate degree institutions who studied abroad did so for 8 weeks or less. Participation rose slightly in mid-length programs, which allowed for deeper immersion into host cultures and increased opportunity for language acquisition. A little more than 4% of study abroad

students (approximately 11,000 this year) spend a full academic or calendar year abroad, and that proportion has remained steady for over a decade. What is interesting is the fact that *Open Doors 2010* reports a declining number of American students going to four of the top five study abroad destinations in 2008/09. The United Kingdom, the leading destination, hosted 6% fewer students than in 2007/08. In fact, while four European countries continue to lead in hosting U.S. students, the United Kingdom, Italy, Spain and France, *Open Doors* reports that fifteen of the top 25 destinations were outside of Western Europe and nineteen were countries where English is not a primary language. This is indicative of the growing needs of globalization and expertise in foreign language acquisition. Another noteworthy data is that China, as the fifth largest host country,

was the only one of the top five to show any increase in numbers for 2008/09. The Institute of International Education attributes this growth to the “new and sometimes more affordable program opportunities in these destinations, strategic partnerships between higher education institutions in the United States and abroad, and a range of fields and program durations that have expanded to accommodate the needs of an increasingly diverse study abroad population” in the previous year. Decreases were seen also in the number of students to Italy (down 11%); Spain (down 4%), and France (down 3%). The exception among leading hosts was an increase of 4% in the number of students to China, the fifth leading destination, following a 19% increase in the previous year.

GLOBAL ENGINEERING EDUCATION: A STATISTICAL OVERVIEW

During the academic year 2008-09, engineering students made up 3.2% of the total U.S. student population pursuing their education abroad (8,330 out of 260,327). This is a small rise from the stagnant value of 2.9% engineering students studying abroad every year from year 1998 to 2007. Table 1 shows the growth of engineering students, as compared to other disciplines, studying abroad per academic year over the last decade.

Table 1: Fields of Study of U.S. Study Abroad Students, 1999/00-2008/09.^{xv}

Field of Study	PERCENT OF U.S. STUDY ABROAD STUDENTS									
	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Social Sciences	20.1	20.3	21.9	21.3	22.6	22.6	21.7	21.4	21.5	20.7
Business & Management	17.7	18.1	17.6	17.7	17.5	17.5	17.7	19.1	20.2	19.5
Humanities	14.5	14.5	13.8	13.3	13.3	13.3	14.2	13.2	13.3	12.3
Fine or Applied Arts	8.6	8.5	8.5	9.0	7.6	7.6	7.5	7.7	8.4	7.3
Physical or Life Sciences	7.4	7.1	7.6	7.1	7.1	7.1	6.9	7.3	7.2	7.3
Foreign Languages	8.2	8.2	8.5	7.9	7.5	7.5	7.8	7.2	6.2	6.1
Health Sciences	2.8	3.2	3.0	3.1	3.4	3.4	3.8	4.1	4.5	4.5
Education	4.2	4.4	3.9	4.1	4.1	4.1	4.1	4.2	4.1	4
Engineering	2.9	2.7	2.9	2.9	2.9	2.9	2.9	3.1	3.1	3.2
Math or Computer Sciences	2.0	2.0	2.2	2.4	1.7	1.7	1.5	1.5	1.6	1.6
Agriculture	1.4	1.6	1.1	1.5	1.2	1.2	1.3	1.5	1.2	1.1
Undeclared	5.1	4.5	3.8	3.5	3.4	3.4	3.4	3.1	3.3	3.5
Other	5.1	4.9	5.2	6.4	7.8	7.8	7.2	6.6	5.4	8.9
Total	143,590	154,168	160,920	174,629	191,321	205,983	223,534	241,791	262,416	260,327

In the Open Door Survey 2010, campuses have noted that their students continue to show a strong interest in study abroad. Both high education institutions and study abroad providers have sought affordable opportunities for these students to gain valuable international experience. The Survey also reported

an increase of 37% in the number of students participating in practical work experiences as part of their study abroad, with 18,715 students now receiving academic credit at U.S. colleges and universities for internships or work abroad. This data is consistent with the observation at Purdue

University about the rise of international work experiences Purdue students are participating in, and with global industrial internships needs for U.S. engineering students.

In light of the global economy, many engineering schools across the nation have also increased Co-Ops and internships offerings to include international destinations and educating students on the importance of global professional practices. Over the past 20 years, a steady increase of significant literature has been gradually established in the field of global engineering education. Both scholars and practitioners continue to (1) establish the need and importance of globally educated engineers, (Grandin & Hirleman, 2008^{xvi}; Grandin, 2006^{xvii}) (2) define and measure global engineering competencies, (Downey et al., 2006^{xviii}; Parkinson, 2007^{xix}; Lohmann et al., 2006^{xx}) (3) track institutional strategies and evaluate global engineering program learning outcomes (Berka, 2009^{xxi}; Del Vitto, 2008^{xxii}), and formulate best practices for both scholars and practitioners of global engineering practices, (Jesiek, et.al., 2010^{xxiii}; Chang, Atkinson and Hirleman, 2009^{xxiv}; Groll & Hirleman, 2007^{xxv}).

While most of the scholarship focuses on the major learning outcomes of global engineering programs and describe how program design takes shape and matures, the authors think that it is important to return to the basics of international educational philosophy of foreign language acquisition. A recent discussion that emerges among the global engineering education field is the necessity of learning foreign languages as preparation for studying abroad. As globalization continues to shape our world, many engineers and businessmen are beginning to take notice of the presence of English in foreign countries.

Take China for example, travelers to Beijing and Shanghai often find English signs on the streets and shops. Most shopping malls and retailers have English-trained sales associates. It is often observed that even the Chinese street vendors learned a few words of English in order to approach foreign travelers. The majority of Chinese local college students possess conversational levels of English proficiency. With increasing numbers of Chinese people who possess English language skills, travelers question the necessity to learn Chinese before they travel to China. In specific, as engineering and technical projects can be carried out in English, engineering professionals raise the question of whether learning a foreign language is indeed necessary? Can engineering professionals and students “get by” just fine without foreign language proficiency?

RELATIONS OF LANGUAGE AND CULTURE

Not one intercultural communication specialist will doubt the necessity of language in our lives and study abroad. In fact, one of the best practices in study abroad program administration is to encourage students to get to know survival phrases and vocabulary prior to going abroad. Pre-departure orientations, whose offerings have increased across the country, will cover a certain level of foreign language, while other study abroad programs may have prerequisites of foreign language fluency before one can even apply for the program. For years, sociolinguists and intercultural specialists (Fantini, 2009^{xxvi}; Bennett, 1997^{xxvii}; Deardorff, 2009^{xxviii}) have argued the importance of language acquisition in cultural understanding. The literature stated that one would not be able to fully understand the culture without gaining access through the door of verbal communication.

The authors not only agree with the sociolinguists' standpoint, but also add that the interaction between culture and language is a “two-way street” that has an inseparable linkage, where one would not be able to fully understand language without gaining access through the door of culture. Just as culture is dynamic and ever changing with time, language changes according to its cultural and geographical context. For example, the Chinese word “Xiao Jie 小姐” means “Miss”, a respectful way of addressing an unmarried female, in Taiwan. However, the same word is used to refer to females in Mainland China, but here it implies prostitute and brothel hostess. Bennett (1997) labeled those who are fluent in language but lack intercultural depths as “fluent fools”. It is observed that foolish individuals who possess language fluency without understanding its host culture commit many cultural misunderstandings. Vice versa, one can observe even more “fools”, who do not understand the language at all.

At Purdue University, the goal is to cultivate a generation of global engineers for the 21st century, who are not only technically savvy, but also understand the relations between language and culture. The next section of this paper examines how the national data of study abroad is reflected locally at Purdue University, where faculty members and students in engineering couple foreign language learning and engineering education, and how student participants are impacted by the degree of foreign language exposure.

PURDUE UNIVERSITY: 4 CASE STUDIES OF FOREIGN LANGUAGE REQUIREMENT OF GLOBAL ENGINEERING EDUCATION PROGRAMS

RESEARCH METHODOLOGY

Different from quantitative research that follows a structured inductive method to examine limited number of variables, case study research methodology involves an in-depth examination of a research question. As a result the researcher may gain a sharpened understanding of why the instance happened as it did, and what might become important to look at more extensively in future research.^{xxix} By employing a case study research method, this paper examines the student experience in foreign languages during their study or internship abroad endeavors. The purpose of the case studies is to gain an understanding of and to challenge global engineering educational approaches toward foreign language proficiency, rather than come to a definite conclusion about the necessity of foreign language skills in global engineering work.

Besides gathering data from the students, this study provides triangulation of data sources by comparing and crosschecking the consistency of information. Specifically, this paper provides a comparison of perspectives of people from different points of views: (1) Non-engineering study abroad program directors and professionals and (2) Engineering program administrators.

In order to provide a level of standardization and comparison, four programs are chosen for their varying length of program duration and degree of cultural immersion. All four global engineering programs provide opportunities for students to travel to China, P.R.C. (See Table 2.)

Table 2. Comparison of Program Duration and Type of Four Purdue University Global Engineering Education to China

Program / Nature	Duration	Content	Setting	Travel Group Size	Language Requirement
GEARE	7 months	Study/ Work	University/ Industry	1-10	12 credits
IREE	3 months	Work	Industry	1	None
Two-way Internship	5 weeks	Research	University	1-3	None
Maymester	1 month	Study	University	30	None

To identify the need for the language requirement and its necessity for engineering students, the following five questions were asked to the a randomly selected participant of each program after their trip:

1. Do you think Chinese language is necessary for your experience in China?
2. Did you "get by" just fine without having to speak Chinese?
3. Do you think you can finish your engineering project just fine without Chinese language?
4. Do you think that learning the Chinese language helps you understand the Chinese culture?
5. Do you have any recommendation for future students going to China?

GEARE (7-MONTH IMMERSION)

The Global Engineering Alliance for Research and Education (GEARE) is a unique program originating in the School of Mechanical Engineering at Purdue University. GEARE is a high-value program comprising long-term study abroad, an international internship, a foreign language requirement, and an engineering design experience in an international context. It is one of the premier global engineering programs in the country.

Currently a total of 107 engineering students from 11 different engineering disciplines are participating at partner institutions Shanghai Jiao Tong University and Tsinghua University in China; Karlsruhe Institute of Technology, Technical University of Braunschweig, and University of Magdeburg in Germany; Universidad Carlos III in Spain; ESTACA and CPE Lyon in France; Tohoku University in Japan; Hong Kong University of Science and Technology in Hong Kong; University College London in England; University of Canterbury in New Zealand; and Royal Melbourne Institute of

Technology and University of Queensland in Australia.

Since 2003, the GEARE program has sent 31 Purdue students to China, P.R.C. These students are required to have at least twelve college level Chinese courses before they study abroad in China. When asked about the necessity of language requirement, a GEARE student expressed that:

Chinese language is not necessary to study (at Shanghai Jiao Tong University) in China, but having basic language skills definitely enhances the experience. Being able to speak some Chinese, I could interact more easily with people I encountered and I feel that I have had a more enriching experience because of it. It also made day to day life much easier because I had enough skills to buy a ticket, ask for directions, go grocery shopping, etc.

While in China, GEARE students meet up with other Purdue students participating in the Maymester program (described in the section below in this paper) as well as other Mechanical Engineering students participating in a semester-long exchange. This is interesting as the GEARE participant made comparisons about the differences in experience, impacted by the varying degree of Chinese language fluency:

Many of my friends did not speak Chinese and they seemed to have gotten by, although often I acted as a translator for them. It is possible to manage without Chinese, but it was more difficult for them. I often could get lower prices when shopping as well, merely because I negotiated in Chinese.... Although my Chinese is not perfect, I was able to communicate with more people I met on a daily basis. Language and culture are also closely tied, so understanding language patterns can give you clues to cultures. For example, in English, verb tense is very important, whereas Chinese depends much more on context. Culturally this is reflected by the American focus on time and schedules (a linear time understanding), whereas to the Chinese it is much less important (circular time understanding).

When asked about the impact of Chinese language proficiency on her engineering project conducted in a university setting, the GEARE participant pointed out that:

The Chinese teammates on my design team spoke excellent English, so we very rarely used Chinese while working. Since we had a very international team (Mexico, China, Indonesia, USA, Lebanon) English was the common language for all of us to use. Many of the teammates spoke no Chinese at all. When I did use Chinese during meetings, it was more for my own benefit to expand my technical vocabulary.

IREE (3 MONTH IMMERSION)

With support from NSF, a team from Purdue University developed and administered International Research and Education in Engineering (IREE) 2010 China. The IREE program is designed to provide U.S. engineering students with opportunities to experience the life and culture of another country, while gaining international research experience and perspectives. IREE's goal is to enhance U.S. innovation in global research and education, and enable connections between the research programs of NSF's divisions with the education of students. During 2010, the program supported 58 U.S. engineering students to conduct frontier engineering-related research in China. Awardees represented more than 40 different home universities in the U.S. Following orientation activities during May 2010, all participants traveled to China for 10-12 weeks to work in university, industry, and government labs. All of the participants also met for a 2-day re-entry meeting in September 2010.

IREE participants are not required to have prior knowledge in Chinese language. In fact, many of the IREE participants did not possess Chinese language skills before departure. During their two-week pre-departure orientation, a Chinese instructor was employed to teach survival Chinese, concentrating on oral and useful short-phrases, which IREE participants could use in their every-day life. One IREE participant conducted his internship at a local Shanghai company. He described possessing Chinese language skills as imperative to the success of his experience in China:

I think it is imperative that anyone who is going to have a GOOD experience in China have at the very minimum a basic understanding of Mandarin. Although fluency is not necessary for a good experience, knowing key phrases and responses help immensely in navigating from place to place and communicating with others in case of emergency.... I believe that knowing the language puts you in a position to get to know locals, probably the most important part of the Chinese culture. By interacting with locals in

their native language you are welcomed more and are more apt to learn more from them.

Unlike the GEARE participant, the IREE participant conducted his work in an industrial setting. When asked about the impact of Chinese language to his work environment and his relationships to his colleagues, the IREE participant pointed out that:

Fortunately, I did not need Chinese to do my engineering project because my supervisor and my advisor both spoke English fluently. Chinese language skills would have been useful to ask for help from my peers for learning how to use software. It is true that I could "get by" with miming my intentions and pointing at menus to order food. Without knowing Chinese social interactions were very limited and did not aid in making it a positive experience.

He further made recommendation to all other future participants. Informally, this participant reported that he is currently taking regular Chinese courses at his institution:

Take your time when learning the language initially and practice once you get to China! Often times by learning a few new words a day you can drastically aid your communication skills with those around you.

TWO-WAY TSINGHUA UNIVERSITY RESEARCH ABROAD (5-WEEK IMMERSION)

Purdue students are recruited on campus, and Tsinghua students are recruited at their campus. Common research projects are set up through the connections of faculty members from both institutions prior to the internship period. Purdue students will be received by their Tsinghua team members at the Tsinghua University for the first half of the internship duration, then the entire team travels to Purdue to continue their research for the second half of the internship duration. All logistical supports (e.g., travel, tuition remission, visa, and housing) are facilitated by Office of Professional Practice in conjunction with International Programs. Upon return, students will submit final reports to the academic departments at their respective universities.

Since most of the project interactions at Tsinghua University occur between the Tsinghua students and their faculty members, Purdue students find that Chinese language is not necessary for them to succeed in the program and complete their research project. In fact, a participant reported:

I do not need Chinese language to finish my project. Some days, I try to learn a few Chinese vocabularies with my lab mate. But they all giggle and then just speak to me in English instead. I find that when I want to practice my Chinese, they [the Tsinghua university students] want to practice their English with me. So towards the end, I just give up, it is much easier to just speak English.

Student participants in this program only stay in China for merely five weeks. However, the potential impact of these short-term programs on students can be significant. Connie Perdreau, the Director of the Office of Education Abroad at Ohio University, indicated:

Although to us professionals it is quite short, the impact can be substantial for a student who has hardly traveled anywhere. Spending two weeks in another country, even in an English-speaking country, can have a major impact. For some students, it is still the full year, but for others, even two weeks in Mexico or the Caribbean could be life-changing. (Cited in Dessoff, 2006, p. 23)xxx

MAYMESTER COURSEWORK (1 MONTH IMMERSION)

This program is a faculty-led study abroad course titled *Introduction of Intercultural Teamwork in China*. The program is offered annually by the College of Engineering and the College of Liberal Arts with support from the Anna Sohmen Foundation, the Purdue Confucius Institute, and in partnership with the Harbin Institute of Technology, Ningbo University, and Shanghai Jiao Tong University. In addition to visiting cultural and industrial sites in Beijing, Harbin, Ningbo, and Shanghai, students will complete individual assignments and participate in team projects focusing on aspects of Chinese cultural and social life.

Since 2005, this program has been taking approximately thirty students, predominantly from the School of Mechanical Engineering, to China. Prior to departure, four one-hour orientation sessions during Spring Semester will provide students with information on travel procedures, visa applications, and packing suggestions. Students also receive instruction on basic Chinese vocabulary, Chinese etiquette and culture. Enrolled students are not required to have Chinese language background. Most of the student interaction are conducted and monitored at Shanghai Jiao Tong University. Hence, when the administrator and students were surveyed

about the necessity of Chinese language, they stated that it is:

...certainly not necessary given that university students have good English skills. The limitations of not really having Chinese language are already built into any assignments for the course.

However, the participants recognized the value of the Chinese language and its positive impact of their overall experience in China.

Absolutely, yes. Of course I think this is true of every language and every culture--inseparable. You remain a complete outsider as long as you do not have access to the language. You are still an outsider with the language of course, but at least your own understanding is greatly enhanced if you understand and read the language in question.

When asked about whether Chinese language should be incorporated as a course requirement, the administrator offered a succinct explanation to the “trade-off” in balancing quality and access of the program:

This is a trade-off. I would like to require everyone (including myself) complete at least 4 years/8 semesters of Chinese. Actually, of course, instruction should begin in elementary school and perhaps that is beginning in a few places (Chicago? West Lafayette at least on Saturdays?). The trade-off is that I would also recommend that every ME student study in China during one semester of their BSME program. I do think it is more important to have the experience of living in China than it is to exclude students who do not meet desired language fluency... Of course, we all would wish to be fluent in Chinese--that includes all the students, and also me. The problem is how to achieve that and at the loss of what other priorities!

DISCUSSION

FOREIGN LANGUAGE DILEMMA: TO LEARN OR NOT TO LEARN?

Based on the above case studies, it can be concluded that engineering students who study or work abroad do not need to learn the foreign language of the country they are traveling to. In order to provide a well-rounded view of global engineering education, the authors furthered the scope of the cases studies

by asking the same questions to the international education community¹ at-large. These voices from the non-engineering practitioners are valuable and provide another perspective:

Most of our returned students comment in post-program evaluations that they wish they knew more of the language, especially when the language was not offered. Of course they can get by, but they feel that their experience abroad has been somehow devalued by limits on their ability to communicate.

I think that not requiring the students to learn a language not only limits their opportunities but also reinforces the impression that English is the dominant language in the world, which really is not true...One of the positives of having a language pre-requisite is that it does make curriculum committees actually integrate study abroad into the curriculum as they have to think about the language issue. While this can result in fewer opportunities being offered to students, we have found that it has resulted in opportunities that are more sustainable and better supported by the faculty.

Opponents of foreign language requirements in global engineering programs may also argue that the success and completion of engineering team projects does not require knowledge of a second language, as multi-national teams use English as the common language, and translators can be utilized in business meetings, if necessary. To this point, the non-engineering practitioners responded:

In terms of technical projects, not having 2nd language knowledge limits the students in their abilities to really take advantage of the experience. I know that so many project teams continue to discuss the project informally after hours, over a drink, etc. I can't imagine that this opportunity would be offered to someone who did not speak the host country language at least a little bit. Imagine if we always had to use our 2nd language in order to communicate with a colleague-- I doubt I would be all that eager to hang out with them once business was done. And of course it limits the students to being able to only work with students who are willing to do their entire project in English.

Yes, completion of technical project probably does not need foreign language, but if that is all a program provider is concerned with, what was

¹ Surveys were sent out electronically to SECCUSA-L

the point of doing the project overseas to begin with?

The positive impact of knowledge of foreign language is not the issue, but rather how much language is enough before students embark on their global engineering educational experience? Most of the arguments centered on the idea of “fluency”. Freed (1995)xxxii, a landmark study, explored the perceived oral fluency of two groups of undergraduate students taking foreign language classes (one abroad and one at home). The group of students who studied abroad spoke more and demonstrated significant gain in oral fluency.

But the next question is how much is enough? The GEARE program at Purdue has one of the most stringent language requirement among all global engineering education programs. It requires twelve college-level credits prior to students’ study abroad semester. Some may question whether the amount of language preparation is enough, while the abovementioned “trade-off” between access and language requirement is valid and deserves a closer examination.

For engineering students abroad, the concept of “language fluency” takes on a different connotation than it means to social science students. Not only do engineering students need to know how to ask for direction on the streets, they also need to know technical terms and jargons in order to complete their projects. It is a separate matter between ordering food in the restaurant and explaining thermodynamics to colleagues. In order for technical projects to be completed, it is argued here that even understanding how to read the instruction manual in a foreign language is not enough. Global engineers need to gain knowledge about the explicit context of what it takes to conduct business and engineering projects in the host culture. They not only have to learn the foreign language, but also the infrastructure of how to make businesses run in the foreign environment. Engineers need to establish an understanding of local markets, laws, trade unions, and regulations, etc. A 1995 article in Harvard Business Reviewxxxiii pointed out that people in powerful positions are likely to reward linguistic styles similar to their own. In the context of cross-national business negotiation and engineering project collaboration, this means that engineers can no longer afford to underestimate the power of foreign language competency, even in technical settings.

CONCLUSION

The socio-cultural function of language represents how people connect and relate with each other in a foreign culture. Foreign language is the centerpiece of cultural learning.

Kelm (2003)xxxiii discussed the balance between business content and language proficiency in study abroad programs in business.

When blending these three activities, the challenge is to balance each appropriately. If the study abroad experience contains little or no business content, students lose out on the opportunity to learn elements of international business. If the study abroad experience contains little or no language content, students miss out on the cultural integration that is essential for international interactions. And if “study abroad” becomes too loose (i.e. party on the beach) or too rigid (i.e. no different than taking classes back home), students miss the essence of studying in a foreign location.

Likewise, the same balance must be struck in global engineering programs. Based on the results of the above four case studies, it can be concluded that foreign language proficiency is not required to complete engineering work in the foreign culture. However, it is significant for students to learn elements of culture and gain “insider advantage” to business deals, after-hour events, and informal interaction that can impact the effectiveness and efficiency of global engineering work.

BIGGER PICTURE

The majority of engineering personnel do not possess the “big picture” of foreign language acquisition. Often, engineers view foreign language proficiency as a tool for them to “get the job done”. While engineers and engineering projects can be accomplished through using English as a universal language, and collaboration can be facilitated by translation services, the bigger picture is: how would monolingual engineers stay afloat in the competition within the global engineering profession? With the rising numbers of bilingual engineering graduates in countries such as China, India, European Union, how can the U.S. monolingual engineers stay competitive in the global economy? This paper argues that the underlying rationale for global engineering education is a balance between collaborative advantage and competitive advantage.

It is true that learning the foreign language is essential to students who study abroad, but it is also true that language acquisition is not an overnight task. Clearly, a well-designed study abroad program

helps students gain cross-cultural fluency prior, during and after the trip. However, in order to increase students' access to study abroad programs, stringent language requirements may act as a major obstacle to a student's desire to study abroad. At the same time, efforts must be made not only at the higher education institutional level, but also at the public policy level across the level of K through 16. Recent educational reforms and policy changes, such as No Child Left Behind Act, has significantly impacted K-12 education. The ramification of such education policy has yet to emerge. How such impact affect foreign language teaching and student learning requires further studies and support from national statistics.

FURTHER RECOMMENDATION

Another further recommendation includes global engineering education professionals to be better informed about foreign language learning process and impacts. The qualitative inquiry of this paper can be better supplemented by quantitative data sources. Student surveys and graduation statistics can fuel the following future research questions:

- Is communication and comprehension in the foreign language critical to global engineering work?
- If language learning is not essential to global internship program, how to ensure students will continue to have meaningful and in-depth cross-cultural interaction?
- Which foreign language acquisition best assist global engineering work?

- How does foreign language proficiency affect one's job search and career options in engineering?
- How does foreign language proficiency influence engineering company hiring decisions and business plans?

By a method of triangulation and examination of the current literature and external environment, this paper has established the need for global engineering programs to rethink the necessity of foreign language proficiency as a prerequisite for studying and working abroad. While it may not be necessary for one to learn a foreign language to "get the job done" and "get by" in global engineering work, one does miss the opportunities for in-depth cultural understanding in global engineering education.

From the perspective of higher education, it is up to the program administrators to portray foreign language learning as an asset that will ultimately benefit students, rather than a course requirement or a hurdle to get around. Administrators of global engineering education programs face the fact that students typically just do the bare minimum; therefore, administrators must be cognizant about the requirements that are set for education abroad programs. It is the responsibility of the administrator to make sure that the system is not abused but provides gentle "nudges" to further encourage students to pursue foreign language fluency. We cannot afford to educate "fluent fools", nor can we afford to educate "monolingual engineers".

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