2006-2562: HOW DO WE PROVIDE AN INTERNATIONAL EXPERIENCE FOR UNDERGRADUATE TECHNOLOGY STUDENTS AT REGIONAL CAMPUSES?

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Abstract

In comparison to students from other countries, American students are lacking in global skills and knowledge that would be greatly enhanced with the student having an international experience.

This paper presents the evidence that there is an overwhelming need for providing international experience for students in technical fields and evidence that American students are not receiving such experience. The lack of student participation is especially prominent at Community Colleges or regional campuses, where large number of students tends to live at home and commute to campus. The paper then presents several programs that have been attempted at various institutions and discuss their shortfalls. Finally the paper examines several programs that offer promise in providing such experience.

The need for International Experience

According to Byron Newberry, [1] and J. C. Swearengen, S. Barnes, S. Coe, K. Subramanian [2] globalization of manufacturing professions will require its practitioners to master engineering methodologies, cultures and languages from more than one country. And in an era of global manufacturing people will need cross-cultural skills and experience that will allow them to successfully deploy science/engineering/management competences in collaboration with any person anywhere in the world. In order to compete in a global industrial marketplace “people skills” will require much more than sensitivity to the needs of fellow workers. The ability to work in teams and to be able to implement strategies and manufacturing solutions across nationalistic lines will be absolutely necessary. You might be sourcing code from India, manufacturing raw materials in Beijing, China, assembling in Malaysia and distributing through other countries. Michael Valenti mentioned in [2] that the “workplace is more likely to be a global one… graduates need to know that making products and services for the world market is the key… students must be prepared to be transferred abroad if necessary”. By the year 2020, manufacturing as a process will be “multidisciplinary, multicultural and highly transient” [24]. Engineers should be able to work productively with radically different cultures, educational background, technical standards, quality standard, professional registration requirements and across the time zones.

Companies struggle to find talented U.S. graduates with international experience because “internships abroad have not entered the curriculum of very many American engineering schools… The ability of U.S. Engineering graduates to function in developing countries, and who speak another languages and appreciate professional and cultural differences will make international trade successful for U.S.- based companies” [2].

Two national ACE surveys [3] - a telephone sample of 1,006 Americans aged 18 and older, and a telephone sample of 500 four-year-college-bound high school seniors examines the international experiences and attitudes regarding the importance of international education, as well as global knowledge. The student survey tests international experience, attitudes about
international education at the postsecondary level, and intentions to participate in international education. Each survey is intended to inform higher educational institutions about the importance Americans place on international learning opportunities.

1. Asked about their ability to speak a language other than English, 17 percent of the national survey respondents claimed a working fluency in another language, while 48 percent professed to be fairly or at least somewhat proficient. Both figures are a substantial drop from the 58 percent found in a previous survey of foreign language proficiency done in 1988. Despite the linguistic interest and ability demonstrated by this group, colleges and universities nationwide continue to decrease foreign language requirements. The study found that people who speak multiple languages are more likely to travel abroad than those who do not. Young people (18 to 24 year olds) claimed the greatest facility with foreign languages. Over 85 percent of the national survey respondents indicated that knowledge of a foreign language was important—a significantly higher percentage than was found in a Gallup Poll conducted some 20 years ago. Eighty-five percent also believed that knowing a foreign language would help them find a better job.

The public was even more adamant that higher education institutions require general courses covering international topics, and nearly three out of four respondents believed it important that students study or participate in an internship abroad at some point. The preferences of college-bound high school students are especially interesting in this regard. Eighty-six percent said they planned to participate in international courses or programs, and almost 50 percent expressed an interest in study abroad. That is a substantially higher rate than the 3 percent who currently go abroad and, if these preferences materialize, even somewhat, presages a substantial increase in demand.

2. The availability of other forms of campus-based international preparation was also important. Nearly 8 out of 10 national survey respondents remarked that the presence of international programs would positively influence the choice of college or university for them or their children. Similar sentiments prevailed among the students surveyed. More than 70 percent considered it important that the institution they attend offer foreign language and international courses, study abroad programs, and opportunities to interact with foreign students. Eighty-six percent of the national survey respondents agreed that having international students on campus enriches the learning experience of American students.

3. For years, studies of Americans’ international knowledge have shown how poorly we do when compared to the citizens of other countries. To test whether an increase in interest toward international education translates into an increase in knowledge, respondents were asked a series of questions to gauge international knowledge. Respondents to the national survey were asked questions about international leaders, geography, history, and current issues, many of which had been asked in previous surveys. The results were mixed. Many responses showed an increase in public knowledge, while others showed a decrease. Education was the most important indicator of international knowledge, with college graduates correctly answering more questions than any other population group. Age and
income, though less strong, also showed a positive correlation with international knowledge.

The results showed that the level of education had the most significant impact on response success: Out of 15 questions, respondents with less than a high school degree averaged fewer than five correct answers; high school graduates, just under seven; and college graduates, nearly 10. Travel abroad had the strongest positive impact on international knowledge—a finding that has important implications for proponents of study and internships abroad.

These two surveys suggest a growing public interest in international issues and events, along with the recognition that international knowledge and skills are increasingly important to both daily life and our nation’s success in the global economy. Related to these sentiments, and strongly supported by both the student and national surveys, is the belief that colleges and universities should provide international education opportunities for all students. In particular, the public supports requirements for foreign languages and courses that include an international dimension, and believes it important that students have access to international study and internship opportunities.

High school students poised to enter postsecondary education mirror these sentiments. With significant existing exposure to foreign cultures and languages, they will increasingly arrive at colleges and universities expecting international training to be available. In this climate, institutions will need to meet their demands, on campus and abroad, or risk losing students to colleges and universities that do. It is clear that students, parents, and the public are looking to higher education to provide strong international and language programs.

These surveys demonstrate high levels of support for international education. It is up to colleges and universities to be creatively responsive to national needs and public expectations. The American Council on Education (ACE) undertook a survey [4] to examine whether public attitudes about international education have changed since September 11 and, if so, how. The survey replicated many of the questions from the previous surveys that examined the public’s attitudes about international education, international experience, and knowledge of international issues and events. Three general conclusions emerged.

- Overall public, student, and faculty support for international education and language training remain very high. Survey results indicate that the decrease in public support many feared would happen after September 11 generally has not occurred. Public support for foreign language learning is particularly strong, even when asked if they would support an increase in state funding for foreign language learning.

- The public, students, and faculty are very supportive of international course requirements, including foreign language and international course requirements.

- Not only has overall support remained strong and steady, but also the intensity of support has increased in several areas, including foreign language training. Those who
indicated that they “somewhat” support international education activities and requirements now indicate that they “strongly” support them.

However, the surveys also show that, in some areas and for some specific groups, the public has concerns. Areas of specific concern include study abroad and international students and international scholars on campus. While there is generally strong support for these activities and groups, that support decreases when respondents are asked how likely they are to encourage a family member to participate in study abroad or about international students and scholars at their local institutions. These concerns are most evident among older respondents. Higher education institutions will need to address these concerns to ensure continued support for international education opportunities on and off campus. In both public opinion surveys, minorities demonstrated strong support for and interest in international education. Given that historically, minorities have not participated in international education activities to a great extent, this could indicate that institutions will need to use new strategies to turn this interest into participation.

Institutions should consider expanding their role in educating the public about international issues. Survey respondents believe that colleges and universities have a responsibility to educate the public about international issues, events, and cultures. However, many felt that their own education did not adequately give them the knowledge to understand fully current international events. Institutions should reach out to the larger community and improve their strategies for meeting this need.

At the annual meeting of the National Academy of Engineering, 1995 the President Carles M. Vest’s addresses [6]: “U.S. corporations are increasingly purchasing goods and services from sources anywhere in the world based on quality and cost. If you want to get promoted today in American industry, you'd better gain substantial overseas experience. At MIT and elsewhere, books are being published and courses taught on the World Wide Web… We inhabit a world with a rapidly expanding population, an increasingly globally integrated economy, disparate cultural values, and one that faces varied environmental threats… Today, we are more likely to be motivated to design for low-cost, high-quality manufacturability, rapid time to market, environmental friendliness, and ease of use than we are for power and sophistication. We have to compete in all dimensions against every nation and every company in the world, not only with our products but for our materials, our labor, our manufacturing, and, increasingly, engineering… Social, political, economic, and environmental factors appear likely to dominate over technical matters”.

Several Programs that attempted to Provide International Student Experience

According to Gilles Bousquet from University of Wisconsin-Madison [9] “Demand for engineers with international experience has increased slowly over the past decades. Engineering development and manufacturing increasingly involves interactions within or between firms that cross national boundaries. Employers seek qualified applicants who are able to think in broad
cultural terms, work in culturally diverse teams, converse in foreign languages, and augment the 
company's international agendas. Internships abroad are especially valued because the student 
has proven their ability to work in another language and culture (Swearengen, Barnes, Coe, 
Reinhardt, and Subramian, 2002). Despite the apparent need for graduates who fit this 
description, the field of engineering, as a whole, has not been overwhelmingly responsive (Jones, 
Oberst, Siller, and Johnson, 2002). Most engineering schools have not systematically created the 
types of connections with overseas universities and companies necessary for exchanges and 
international collaborations. This is partly due to the difficulties in coordinating and sequencing 
curricula, transferring credits, and creating space for language and cultural training, yet few 
schools have taken large steps to overcome these obstacles (DeWinter, 1997). As a result, the 
number of engineering students studying abroad has not risen as it has in other fields. 
Engineering students account for 2.7% of American students who studied abroad in 2000-
2001(IIE, Open Doors, 2002). Some engineering programs have introduced international content 
into the curriculum, and a few have developed exemplary international engineering majors. 

However, there is no uniform movement toward internationalization in engineering and 
the constantly expanding technical requirements for the degree make adding new requirements 
difficult. An International Engineering Education forum held in June 2001 suggested "the need 
to develop these approaches in consultation with engineering education accreditation bodies" and 
"recognize best practices and models in international engineering education." (Puri, 2001, p. 5)… 
The University of Rhode Island International Engineering Program leads to a Bachelor of 
Science in Engineering, and a Bachelor of Arts in German, French or Spanish. San Diego State 
and Rhode Island require both a study and work period abroad, have substantial enrollments (185 
engineers at Rhode Island, and 750 international business majors at SDSU), and no trouble 
placing their graduates. However, these degrees require five years to complete in order to 
accommodate the combination of professional training, language training, and overseas 
experience. 

Enginnering schools have lagged behind many other professional fields in the number of 
students studying overseas. Several well developed international engineering programs provide 
models and offer ideas. Overseas study and work experience are required elements of the 
University of Rhode Island International Engineering program which offers a dual engineering 
and language degree. Georgia Tech has also created an international niche by offering a strong 
set of overseas learning options for engineers. Their web site states: Georgia Tech prepares its 
students to compete in the new, global marketplace. Our students have the opportunity to 
participate in any number of study programs in other countries. The experience gained from 
participation in these programs is invaluable to Tech students. We offer exchange, study abroad 
(at one of our campuses or at other universities), international co-op, work abroad and non 
Georgia Tech academic programs abroad. These programs are offered in more than 20 countries 
worldwide. An unusual aspect of the Georgia Institute of Technology’s engineering program is 
the Georgia Tech Loraine campus, located in Metz, France. Enrollment at Georgia Tech Loraine 
has gone from 5 graduate students when they opened in 1990, to 190 graduate students and 120 
undergraduate students in 2001. Undergraduates attend GT-Lorraine during the summer and 
enroll in engineering, elementary language, and cultural courses. 

Because students in professional disciplines often face obstacles in building study abroad
into their programs, professional schools are expanding their overseas options, tailoring programs to the needs of their students. Assessment strategies have not kept pace with the expansion of study abroad. A well-developed set of assessment strategies documenting the benefits of study abroad, including mastery of academic content, language skills, intercultural skills, critical reasoning skills, and personal growth, would help convince more professional schools that study abroad is an integral part of creating well-rounded, globally literate professionals. (Gillespie 2002, Haq, et. al. 2000)

One of the most interesting aspects of the expansion is the variety of options being offered, ranging from short-term modules and summer programs with a professional focus, to semester and year-long programs in the language of the host country, requiring substantial preparation in language and area studies. Overseas programs utilizing exchanges or partnerships with overseas institutions bring other internationalization benefits to the campus through the presence of international students and opportunities for faculty collaboration. Technology allows students abroad to maintain close campus connections and distance education can ease the problems of maintaining course content and sequences…

The professional schools have increasingly put their knowledge of cutting-edge technology to use for international purposes. Georgia Tech uses video-conferencing technology to offer their Mechanical Engineering and Electrical and Computer Engineering graduate students courses from Atlanta while they are studying at their campus in Georgia Tech-Lorraine France. MIT’s International Science and Technology Initiatives (MISTI) build on the student’s technological expertise to help translate knowledge across borders. New educational technology helps students accelerate language learning and simulate cultural immersion. The MIT-Singapore Alliance, a partnership between MIT and the National University of Singapore (NUS) and Nanyang Technological University (NTU) uses videoconferencing to enable engineering students to study simultaneously. Each student has their own PC that is connected to a fibre-based network via Internet 2, which allows students at MIT, NUS and NTU to take the same lectures and experience true collaborative and interactive learning (MIT, 2002).

Technology plays an increasing role in internationalizing professional schools at the UW-Madison as well. Continuing engineering education and technical Japanese in the engineering school, an interactive, distance learning international business course with Kazakhstan, language CD-ROMS, and environmental studies distance education courses, are just a few of the programs that have become part of the campus landscape. These technologies are tools that bring the world to the campus, infuse an international dimension to the curriculum, and enhance research and overseas partnerships.

While not a substitute for an overseas experience, technology offers many opportunities for international interaction. However, new technologies are not always reliable, can be very costly to maintain, and are not equally available in all parts of the world. Time differences make it easier to use distance technology with Europe than many parts of the developing world. We must keep in mind the “digital divide” and make sure that we are realistic about how much can be accomplished via technology and which parts of the world we focus on through its use.

It is clear that we have just begun to explore the many ways that technology can enhance
international education for professional school students, and there is a need to share our “best practices.” The Technological Innovation and Cooperation for Foreign Information Access (TICFIA) Program is a Title VI funded initiative designed to support projects that will develop innovative techniques or programs using new electronic technologies to collect information from foreign sources.”

Engineering needs to become “engineering-plus-international flavoring”[1]. By example, Mazumder and Bean [23] write: “…an engineer must possess not only technical skills, but also cross-cultural skills based on knowledge to the other culture and their own cultural biases”. They describe the University of Michigan’s development of a program in ‘global engineering’, [25] available to students in any traditional engineering major. The program requires students to complete 24 hours of coursework in languages, general and international courses and international courses with a regional focus. Most of these hours can substitute for otherwise required humanities, social science and free elective courses so as to minimize the additional work. In addition to the coursework, the students are required to have an overseas experience, which can be either a semester abroad or an internship.

What are the benefits of the Program in Global Engineering?

The Program in Global Engineering integrates courses dedicated to a specific region, language classes, and other international topics with a required overseas experience (study abroad, internship abroad) and intercultural training. The program requirements are designed to overlap with the student's regular degree program. It is a flexible program open to all engineering disciplines which can be completed without extending time to graduation. Students in the Program in Global Engineering learn about other cultures that will better prepare them to excel in a global engineering environment. Students receive written acknowledgement of participation in the Program in Global Engineering on all official University of Michigan transcripts. In addition to traditional engineering training, PGE students:

- Gain cross-cultural communication skills
- Consider the impact of American cultural values and business practices in other countries
- Understand the people, culture, practices of a specific country of interest, chosen by the participant

Is the Program in Global Engineering right for you?

The best candidates for the Program in Global Engineering are students who fit into one or more of the following categories:

- Students considering study or work abroad
- Students who have studied a foreign language (either in high school, or at the university level)
- Students interested in learning a new language
- Students who would like to add a global component to their engineering curriculum
• Students who want to set themselves apart from their classmates, and increase their marketability after graduation
• Students considering a language minor
• Students interested in a particular region of the world
• Students who would like to gain cross-cultural communication skills
• Students preparing to work in multi-national corporations.

The University of Colorado is in the process of creating a program (http://www.colorado.edu/news/releases/2002/405.html) called “Engineering for Developing Communities”[1].

Professor Bernard Amadei founded Engineers Without Borders, a nonprofit organization in which students, faculty and professional engineers are working together to help developing communities with fundamental engineering and enterprise needs. The organization's goals include providing environmentally and economically sustainable technology to communities in the developing world, leading students in developing sustainable and appropriate technology solutions to a variety of problems involving water, sanitation, electricity, disease prevention and treatment, and shelter.

"It is clear that engineers of the 21st century are called to play a critical role in contributing to peace and security in an increasingly challenged world," said Amadei. "There is a need for training a new generation of engineers who have the skills and tools appropriate to address the issues our planet is facing today and is likely to face within the next 20 years."

The Colorado School of Mines is introducing a program in “Humanitarian Engineering”, for which they provide the following description: “In the past, engineers may have asked ‘How do I generate electricity most efficiently?’ the humanitarian engineer asks, ‘How I can help to reduce poverty?’ Currently these programs are in form of minor specializations within traditional degree programs (http://humanitarian.mines.edu/program.htm).

The Engineering program at Lafayette College offers options of a semester study abroad or a five year, dual-degree track that includes study of a foreign language and culture. International Engineering Program students at the University of Rhode Island study German, French or Spanish language and culture along with engineering; in the fourth year of a five-year program they work abroad as interns [2]. The list goes on. Theses are some of the models that we can learn from.

The Engineer of 2020 Initiative [7]

“The National Academy of Engineering Committee on Engineering Education has launched a two-phase vision-casting initiative, “Engineer of 2020 Initiative”, on engineering in the future and educating engineers to meet the needs of the new era. The initiative first redefined the boundaries of engineering and the composition of the engineering workforce due to changing
trends globally, culturally and economically. It was to develop a shared vision of engineering by the year 2020 and several scenarios were developed to reflect the diversity of the future society.

Exchange programs that encourage domestic students to study abroad, conduct research and explore foreign cultures has been and continues to be an important component of the educational experience for U.S. graduates, who must be competitive with the global market. Therefore, it is necessary that articulation agreements with universities overseas be established to ensure that courses are accepted for graduation requirements. In addition, providing students with international research internships can also help them think globally. The National Science Foundation has acknowledged such needs and has offered various international programs to support students to conduct research overseas. For example, the NSF offers Summer Programs in Japan, Korea and Taiwan for U.S. graduate students in Science and Engineering, an East Asia and Pacific program (EAP), an International Research Experience for Undergraduates (International REU) program, and an International Integrative Graduate Education and Research Training (International IGERT) program”.

3. Programs proposed to be adopted at Indiana Purdue University to Provide International Student Experience

In order to build a successful international engineering program or any other successful educational program for that matter, we need to glean the good and the applicable from all working models and then implement it. Three key ingredients for success:

1. Students who understand the importance and benefit of understanding and interacting with other international cultures.

2. Educational and corporate involvement and commitment.

3. International Program Implementation.

The International Student Collaboration project will provide an intensive program of study and work for the students from Indiana University – Purdue University (IPFW), during the summer of 2006.

A small group of students from the Electrical and Computer Engineering Technology will team up a similar group of students from University of Kuala Lumpur (UKL) in Malaysia and work on an assigned design project. The make up of each group will be one student from IPFW and two students from UKL. The teams will work approximately six weeks on the assigned project; however it intended that the students from IPFW will be in Malaysia for about eight weeks to allow some time for them to adjust to the local culture before starting the work on the project and some time at the end to use for additional cultural experiences.

The advantage that this program provides is that students from both IPFW and UKL have the opportunity of working with each other one-on-one during the summer period, students can also visit local companies who are related to the electrical and computer engineering technological fields, this is invaluable experience that cannot be obtained through any other means. This kind of intensive period of working together on projects along with visits to local
technologically related companies will provide students with a good working knowledge of what to expect upon graduation, working in an industrial setting. Because of the evolving of the Global/International markets we need to foster a culture of inclusion and friendship with other nations and races. This kind of synergy allows us to be greater the sum of our parts. Students participating in the program would be awarded four credit hours of credit for ECET 499, Special Projects.

This project will be mutually beneficial for all involved, the university, students and corporations alike. This kind of information exchange for many of these students, who will eventually work for international corporations like General Electric and International Truck and Engine, will open a door to the future for even greater international educational and technological exchanges.

Bibliography


