

## **Study Abroad: Preparing Engineering Students for Success in the Global Economy**

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“International education prepares our citizens to live, work, and compete in the global economy, and promotes tolerance and the reduction of conflict.” – Secretary Colin L. Powell

“For me it’s really important that we do what we can to get more young Americans, particularly engineers to go abroad.” – D. Howard Pierce, President & CEO, ABB, Inc.

### Abstract

Leading officials of educational institutions, government agencies, and/or multi-national corporations often extol the benefits of study abroad exchanges for both the students and the institutions that are involved. While this is certainly laudable, in order for an exchange to be successful, there are a myriad of details that must be handled correctly. The better prepared the student and the institutions are, the better the experience will be.

Academic matters, logistics such as visas, and important cross-cultural awareness issues are key components to an engineering student’s preparation for studying overseas. In this paper, these details are reviewed by professionals with many years experience involving hundreds of US engineering students who have participated in engineering study abroad programs.

### I. Introduction

During the 1999-2000 academic year, 143,590 American students studied abroad. Of that number, just 4,139, or 2.9% were engineering majors.<sup>1</sup> Although this represents a 1 % increase over the last few years, it is still a remarkably low number. Historically, study abroad programs were designed for students to acquire or hone foreign language skills as well as gain cultural understanding. For students of liberal studies the credit earned overseas often fulfilled graduation requirements. Because the curricula at engineering programs in United States (US) institutions require few liberal studies and foreign language requirements, studying abroad was regarded as an interruption in an engineering student’s education. In recent years many US institutions with engineering programs have created exchange, or study abroad agreements with overseas engineering institutions. This has led to an increase in participation (in study abroad programs) among engineering students, however, the US remains far behind its international counterparts with respect to the quantity and quality of international education for engineering students.

The following criteria, among the ABET criteria for accrediting engineering programs, are skills that are directly enhanced by participation in study abroad:

- Engineering programs must demonstrate that their graduates have:
- d) an ability to function on multi-disciplinary teams
  - g) an ability to communicate effectively
  - h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
  - i) a recognition of the need for, and an ability to engage in life-long learning
  - j) a knowledge of contemporary issues<sup>3</sup>

Anecdotal reports from students, faculty, and administrators make it clear that engineering students who have participated in a study abroad program are better problem-solvers, have strong communication and cross-cultural communication skills, and are able to work well in groups of diverse populations and understand diverse perspectives. In addition, experience living overseas creates graduates who are more adaptable to new environments, have a greater understanding of contemporary issues, as well as engineering solutions in a global and societal context. Industry representatives and recruiters confirm that graduates with significant international experiences are highly sought after because they believe cultural mobility does sharpen the skills they're seeking in new employees.

Study abroad programs for engineering students have grown in appreciation and participation due to the recent economic downturn in the US. At this moment, engineering campuses in the US are experiencing a 40-50% cut in recruitment of students/graduates for both internships and permanent placements. The job market for engineering graduates has changed dramatically in a period of one year. Now more than ever, students are looking for experiences that will give them unique advantage over other candidates. Many current students are also looking for positive, productive ways to extend their time until graduation rather than compete for employment in this difficult job market. Participation in an international academic program can accomplish the goals of these strategies.

Once it is agreed that international understanding and study abroad is an important segment of a US engineering student's education, it becomes a matter of implementation. Many engineering schools in the US now have their own international engineering departments or programs. Others rely on the central, university-wide study abroad office to assist with the recruitment, placement, and preparation of the engineering students who will study abroad. Yet other institutions do not have an office that occupies itself with the promotion and implementation of study abroad programs but rather rely on a single faculty member to coordinate study abroad. In this paper, we will provide information for all situations.

Well-planned programs coupled with well-prepared students create successful experiences. Successful experiences lead to greater participation and even more successful programs.

## II. Academic Matters

Planning a study abroad experience begins with assessing the individual student's academic situation at his/her home institution. Both the advisor (whomever is helping to arrange the placement) and the student should have a clear understanding of what degree requirements the student has yet to fulfill as well as what the student expects, academically, from participating in a

study abroad program. (Engineering faculty can expedite this process by reviewing course curricula, and indicating which courses the department feels *must* be taken on campus, and which courses could be taken elsewhere.)

The next, and arguably the most important step, is selecting an appropriate host university. Many factors must be taken into consideration. What part of the world is most interesting to the student? What foreign language skills does the student possess? What is the language of instruction at the prospective host university? What are the admission requirements and what services are provided by the prospective host institution? A crucial consideration is whether or not the prospective host institution offers courses that are compatible with the student's academic needs. In some countries, engineering is taught at technical schools/universities, or engineering schools and these institutions do not offer liberal studies courses. Since US engineering curricula generally have a semester's worth of liberal studies classes, students often hold the idea of taking a combination of liberal studies and engineering classes while overseas. In that case, the student should plan to attend a university overseas where students have similar choices in course selection as they would in the US.

Once an appropriate host institution is selected, the most prudent step to take it to review the courses they offer during the specific period that the student plans to be overseas. Again, it is important to recognize that educational systems vary from country to country. Academic calendars and, consequently, course offerings do not often match with those in the US. For example, the UK system is one of trimesters, with courses often being taught throughout the entire academic year. Thus, it becomes more complicated when a student wishes to attend an institution in the UK for one semester. It is sometimes difficult to obtain course syllabi and timetable information, however, with the advent of ECTS (European Credit Transfer System), European engineering schools' course details are becoming much more accessible. After obtaining course descriptions/syllabi, the student, along with his/her advisor, should review possible course selections. The student's home institution needs to review all course descriptions/syllabi and determine how each course will fill the student's degree requirements and/or the course equivalent. One tool that was recently established to assist faculty and advisors is the on-line course databank created by the Global Engineering Education Exchange program at: [http://www.iie.org/pgms/global-e3/COURSE\\_DATA\\_BANK.xls](http://www.iie.org/pgms/global-e3/COURSE_DATA_BANK.xls). Although limited at the moment, time this site will encompass a full listing of courses American students have taken overseas through this program and the credit they were assigned on their return to their home institution. By providing this listing of overseas courses and their US equivalencies, it is hoped that faculty will be able to use this databank as a reference, and will not need to spend as much time reviewing syllabi for equivalencies.

The process for assessing course equivalencies will vary depending on the home institution, but regardless of the process, the end result is that the student should know, in advance, how the courses taken overseas will fulfill degree requirements in the US. It is also necessary for the student to understand the system of assessment at the host university, and how grades from work done overseas will (or will not) impact their US GPA. Most universities in the US have an established system of evaluating international grades, so it is a matter of learning and implementing the set policies.

Grading systems around the world may be confusing to American educators, but each has strengths and weaknesses, seeking to train students in the skills deemed to be most important in that country. American students studying abroad should always be encouraged to bring home any course work done for credit (papers, exams, and other projects) which may be reviewed by faculty at the home campus to determine whether or not it meets requirements set by the US university. US university policies on transfer of credit can range from giving non-graded transfer credit to incorporating the overseas grade as is into the student's GPA. If your university does not have a policy, we recommend that courses taken overseas be counted as pass/fail, but not incorporated into the GPA. (If a student fails, but believes s/he should have passed, for example, in the case of a student not having enough time to complete an exam due to language difficulties or a misunderstanding of the course expectations, we recommend offering that the student take an exam at home that would allow him/her to demonstrate knowledge learned.)

### III. Logistics

(This section, which addresses logistics, and the next section, which addresses cultural preparation, are important to all study abroad students, not only those in engineering. However, it is the experience of the authors that quite a few schools of engineering do not have a study abroad advisor to assist with these factors, leading at times to confusion and in some cases, danger and significant added costs. These sections are directed to those campuses where the primary study abroad advisor is a faculty member or an administrator who, among many other responsibilities, must also cover study abroad, although the person may not be a study abroad expert. These sections will also benefit faculty members who would like to know the kinds of advice that study abroad advisors impart.)

The first step in the paper trail to study abroad is submitting the study abroad application for the study abroad program, as well as all of the relevant paperwork (such as transcripts, recommendations, etc.). Additional paperwork will likely be required for the on-campus study abroad office. Next, at least four to six months prior to departure, the student should begin applying for his/her passport and about two to three months before departure should check with the consulate of the host country to determine what kinds of paperwork will be required to obtain a student visa. This may be as simple as completing a form, attaching a copy of the acceptance letter, and paying the visa fee, or it may be as difficult as requiring an in-person interview in the consulate office or submitting medical documents, such as proof of immunization. Visas can take one day to two months to process depending on the destination country. Few countries allow students to study for over three months without a student visa, so it is imperative that students put together their visa application materials and apply for their visas in time. (If they arrive in their host country without a student visa, they will be required to depart, visit a third country, and possibly return home to apply for the visa.) Students and their parents/guardians should have copies of the front page of their passports (the page with their picture) and their visas, in case the passport is lost while the student is traveling. This will help to speed the issuance of a new passport. About one to three months prior to departure students should begin to look into booking their plane tickets. (Some programs arrange flights for the students, so they should clarify this before booking their own tickets.)

The process of arranging accommodation in the host country will vary greatly depending on what type of assistance is offered by the host institution. In many cases, the student will complete a housing application at the time of application to the program, and housing will be arranged by the campus housing office. Other programs do not offer any assistance with securing accommodation, and therefore it is up to the student and their program advisor to find suitable housing. This process should begin several months prior to departure and will require time and patience. The Internet is a good resource for finding accommodation and, in most cases, agencies in the host country will help secure accommodation.

Healthcare and health insurance are areas of preparation that students frequently overlook in planning their study abroad. Students should look carefully to see what is and isn't offered in terms of healthcare. In some countries, nationalized health care will provide basic care for the student *in country*, but, if the student is traveling (for example, students in Europe frequently travel to other countries on the weekend), they may not be covered. Students may (often mistakenly) believe that their parents' HMO coverage or their American university's insurance will cover them. Strongly advise them to do their research on this. There are many insurance companies that provide basic and emergency healthcare coverage to travelers and students abroad. All students should be required to purchase some type of basic medical healthcare coverage.

Students may find that they can receive supplemental insurance coverage in unexpected places. For example, plane tickets booked through certain travel agencies or credit cards may provide some degree of insurance for canceled flights, lost luggage, or accidents. We strongly recommend that students purchase the International Student Identification Card. Not only is this card widely accepted for discounts at many museums, public transportation, theaters, and other useful places, but, this modestly priced card also provides emergency medical insurance and including evacuation and repatriation in the case of death overseas (this is something few people ever want to consider, but, it is costly).

Students with medical conditions should carry copies of their medical records in case they need to see a physician overseas. Records should be written or typed clearly to minimize confusion. If a student needs prescriptions, s/he should check in advance to ensure that their medication is offered overseas (and is affordable), and if not, should purchase enough to cover their time overseas. Prescription medication may not be mailed overseas. Students should check with the Centers for Disease Control website ([cdc.gov](http://www.cdc.gov)) to determine if there are medical risks in the areas they will travel. Students may need to take medication or receive vaccinations in advance of their travels to some parts of the world (for example, in areas with malaria). Students should keep records of all medications/vaccinations taken in preparation for their visit. In rare cases they may be asked for proof by customs. Parents/guardians should also keep copies of all medical and medicinal records.

It is important to investigate personal safety issues in the host country. The US State Department maintains a website with general safety information and travel warnings for all countries. This information is updated frequently, and immediately when the State Department feels that US citizens may be at risk in a particular country or area. ([http://www.travel.state.gov/travel\\_warnings.html](http://www.travel.state.gov/travel_warnings.html) ) We advise that students check the State

Department website for information about their host country as well as other countries they may travel through or to. Upon arrival in the host country, students should register with the US Embassy or Consulate nearest their program site. This enables US officials to quickly contact US citizens living overseas should the need arise. Students should be very familiar with the laws of the host country, as well as driving and road conditions. This information is available at the nearest US Embassy or Consulate. Female travelers in particular should exercise caution when traveling overseas. It is a good idea to ask local women (professors, classmates, university officials) about safety in the host city – to learn if there is a history of violent crimes and/or sexual assault and to know if there are areas of the city to avoid. All students should be informed not to participate, or remain in the area of political and social demonstrations. These events may become violent and may be the target of terrorist groups. At this time, we strongly recommend that US students stay away from all large public gatherings, maintain a low profile and avoid places where US citizens are known to congregate.

Finances are another area students should plan carefully before studying abroad. In many cases the study abroad period will be the student's first time living completely independently, and may require that s/he learn to be very careful in his/her spending. In some cases the cost of living in the host country may be dramatically lower or dramatically higher than at home. In nearly all cases, budgets will differ from what the student needed when s/he was at home. Students should look carefully into anticipated costs of their study abroad period. What costs are covered by the program? Plane tickets? Housing? Meals? Field trips? Tuition? Lab and computer fees? Consider what additional costs there may be that are not required at home, such as Internet/email access fees, international phone calls, public transportation fees, travel costs within the country or to nearby countries, costs of entertainment (in some countries movies may cost \$3 and in some they are \$15), and some additional funds in case of emergency. Students may select to open a savings/checkings account at a local bank in order to have easy and safe access to their funds, or they may choose to withdraw money from a US account through automated teller machines (which have become commonplace in many countries around the world).

There are many scholarship opportunities for students studying abroad that can help to supplement, or in some cases, fully cover study abroad costs. Students should begin by talking with their financial aid officers and study abroad advisors (sometimes US universities have scholarship programs for study abroad), and doing Internet searches. Federal financial aid *can* be taken overseas, and beginning in 2001, the new Gilman Scholarships offer up to \$5,000 to American undergraduate students currently receiving Federal financial aid. The US government also provides scholarships to students studying “non-traditional” languages (such as Arabic, Chinese, Russian, and others) and students studying in “non-traditional” regions, such as parts of Latin America, Africa, and Asia. Other scholarships may be offered by the host government to students planning to study in certain countries, for example, the Japanese and German governments both offer excellent scholarships to international students, so students should check with the relevant consulates. Particular funders or friendship societies interested in encouraging study in a particular area of the world may be an additional source of funding that would turn up in a websearch, or by checking with local community groups. Finally, study abroad programs may offer scholarships available only to participants on their program, such as a range of scholarships offered exclusively to students studying abroad through the Global Engineering Education Exchange (Global E<sup>3</sup>) program.

#### IV. Cultural Preparation

Students planning to study abroad should be encouraged to prepare for entrance into a new culture, a new way of thinking and perceiving the world, new food and flavors, new sounds and a different language (even if it is English, it will definitely be different), new customs, different holidays, and different celebrations. Culture shock is almost inevitable in study abroad, but it sometimes seems that the more different the perceived culture, the more likely students seem to expect difference, and often, are the least shocked when confronted with difference (though that does not mean they accept it easily or unquestioningly). For example, the student going to England may be the least expecting of “difference” and therefore the most shocked by it. Students should know to expect culture shock, and should have enough information about the culture that they can look at the situation and consider it from the perspective in the host country before making a judgment (and then leave themselves open to re-examine the issue later if necessary).

Culture shock may say as much about where you come from, and the values you bring with you, as it does about the values and attitudes in the host country. For example, American children or grandchildren of immigrants, particularly those who grew up speaking the language of their parents/grandparents may be surprised when they don't fit in as smoothly and as comfortably as they had anticipated when studying abroad in the country of their parents/grandparents. Even students who grew up in diverse environments may be confronted by attitudes and beliefs that they are not familiar with and do not agree with. Students will not necessarily like every new concept that presents itself, but they should be aware that there will be differences. In many cases, they will be pleasantly surprised to learn how things are done in other countries.

Self-reflection and a good understanding of one's self along with knowledge of foreign cultures will allow students to understand how being in a different culture may affect them. A student may experience different attitudes and treatment based on their identity – their ability/disability, gender, sexual orientation, or ethnicity. This is an important topic to think about prior to selecting a study abroad destination and to research in greater depth when the student is preparing for departure.

Students who are planning to study abroad are encouraged to learn about their host country prior to departure. The Internet and library are good places to start. Getting up to speed on local history is helpful, but students should also be encouraged to explore their areas of interest, be it music, art, pop stars, food, etc. Students should also begin to follow current events of the country so that they are aware of local issues of concern. If the language of the host country is not English, even if the student will study in English, but especially if s/he will study in the local language, it is recommended that s/he begin polishing up their language skills. If at all possible, the student should enroll in a pre-semester intensive language program. Intensive summer language programs are offered in nearly every country in the world, and are an excellent way to get adjusted in the country, while picking up the language, before the fall semester starts.

Tremendously valuable (but often under-utilized) resources are returned students (other students who studied abroad in the same country or region) and on-campus international students from

that country/region. These students can help the out-bound student in nearly every aspect of preparation, from advising about academic courses to planning budgets to helping the student practice the host language. They may also refer students to resources, helpful people, and ways to save money. Returned and international students are usually thrilled to be asked about studying overseas and even the busiest will frequently make the time to talk with students planning their trips.

## V. Conclusion

America's leadership and national security rest on our commitment to educate and prepare our youth for active engagement in the international community. I call on schools, teachers, students, parents, and community leaders to promote understanding of our nations and cultures by encouraging our young people to participate in activities that increase their knowledge of and appreciation for global issues, languages, history, geography, literature, and the arts of other countries. – President George W. Bush

The merits of international education are clear. Students returning from abroad are better students and better engineers. They demonstrate strong intercultural communication skills, an ability to readily adapt to new environments, to accept challenges head-on, and often times, highly developed foreign language skills. In addition, these students have a broader understanding of engineering as an education and a profession. Their perspectives have changed from local to global. The fact that engineering students attending US institutions of higher education are under-participating in overseas educational programs requires that engineering programs in the US take a more pro-active approach in encouraging study abroad for our students.

Not only must we promote international opportunities to our students, we must be ready and able to help students prepare for their experiences. Orientation, and/or information sharing are an essential component to the study abroad experience and without this important preparation, the experience will fall short of achieving the programs' goals. The better prepared the student is, the better the experience will be.

## Bibliography

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## Biographies



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