Science, Technology, Engineering, and Math (STEM) Students and Education Abroad

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Introduction
Let’s dispel two myths—that STEM students cannot participate in education abroad given their highly structured and tightly sequenced curriculum and that if they do study abroad it will delay their graduation. I continue to hear these myths espoused by students, parents, faculty, advisers, administrators, and, most disappointingly, by some education abroad professionals. It is true that the STEM curricula are quite structured and sequential but that is true around the world and many of the core courses are identical, or nearly so. Organic chemistry is organic chemistry no matter who teaches it or where it is taught. Sometimes the textbooks are even the same. In fact the highly structured and sequential nature of the curricula can make pre-departure academic planning easier since most universities around the world recognize, as we do in the States, that calculus should be taken before calculus-based physics, that biology had better be successfully completed before microbiology, and so on and so forth.

Study abroad does not delay graduation. UC San Diego's Student Research and Information office analyzed the time to graduation rates for UC San Diego students who started as freshmen in fall 2002, comparing those who did and did not study abroad, and found that students who studied abroad graduated at higher rates and more quickly than those who did not. This is true for all students regardless of gender, major, ethnicity, college, parental income, high school GPA, SAT scores, first- or second-generation college students, predicted first year GPA, high school quintile, or first quarter UC San Diego GPA (http://icenter.ucsd.edu/annual_reports.html). Similar studies with similar results have been conducted at the University of Minnesota (http://www.umabroad.umn.edu/ci/evaluation/index.html), Indiana (http://newsinfo.iu.edu/news/page/normal/11815.html), and in the University System of Georgia (http://www.usg.edu/international_ed/facstaff/policies/glossari_nafsa07.pdf). While none of us claim causality, the data clearly dispel the myth that study abroad delays graduation.
Here is the reality—for STEM students to participate in education abroad they need three things: motivation, opportunities, and access. These are the same three things that all students going abroad need but the STEM opportunities can be and often are different.

**Motivation**

Motivation comes easily. STEM students know that knowledge is international; that the challenges the world faces related to the environment, health care, food supply, energy, and sustainability cross all national borders; and that the solutions will be sought and found by teams of researchers, doctors, public health specialists, bioengineers, civil engineers, etc. from around the world.

If that internal motivation is lacking or insufficient, students may learn that ABET (the Accreditation Board for Engineering and Technology, Inc.) in its *ABET Engineering Criteria, 2000* ([http://www.ele.uri.edu/faculty/daly/criteria.2000.html](http://www.ele.uri.edu/faculty/daly/criteria.2000.html)), noted as one of eleven criteria that students receive “the broad education necessary to understand the impact of engineering solutions in a global and societal context.” Further, in ABET’s chapter entitled “International Mobility of Professional Engineers” in *Viewpoints, Issues of Accreditation in Higher Education 2000* ([http://www.abet.org/Linked%20Documents-UPDATE/White%20Papers/Viewpoints%20I.pdf](http://www.abet.org/Linked%20Documents-UPDATE/White%20Papers/Viewpoints%20I.pdf)), it is noted that “ABET’s role is pivotal in helping ensure that educational programs around the world are of a caliber that meets the demands placed by industry, the consumer of graduates, and by the engineering academic community.”

Some students are fortunate to have foresighted administrators in their STEM departments who value and encourage students’ participation in education abroad. For example, Dr. Gabriele Wienhausen, Associate Dean in Biological Sciences at the University of California, San Diego, is committed to having all biology undergraduates study abroad. There are currently 5,000 biology majors at UC San Diego; it is the largest major on campus.

Finally, the discerning student will quickly realize that career opportunities exist both in the States and abroad with multinational companies who value the cross-cultural skills, ability to deal with ambiguity, language knowledge, confidence, maturity, and risk taking often associated with education abroad.
One example comes from medicine. “According to a survey given to 142 U.S. medical school deans, 65.3% responded that an international study program was beneficial to the chances of being accepted into the school” (Medical School Admissions Survey, University of Notre Dame, 2001). Of the over 1,000 UC San Diego study abroad alumni who responded to our survey last fall, several students had become physicians and commented on the incredible value their study abroad experience had for them in terms of cross-cultural sensitivities and language knowledge. Here are just three of those comments: “A lot of my patients speak Spanish, and appreciate a doctor who can relate in the same language.” “I became strongly interested in the Spanish language and Latino cultures. This led to my choosing a Spanish language clinic in which to train during residency after medical school. I have used the Spanish language skills I've picked up over the years (starting with the abroad experience) in my profession as an ER physician.” “When I applied to medical school, I was asked about my abroad experience and research project at almost every interview; I believe it really set me apart from other applicants because I had an understanding of a culture and language that is very much alive in California. As a future physician, I look forward to serving California's Latino population, and I feel more confident doing so because of my abroad experience in Mexico.”

**Opportunities**

STEM students need to know that they can get access to STEM courses while they are abroad (unless they are enrolling in general education, language, and/or minor coursework instead). They also often want to participate in research or internship programs while abroad. At UC San Diego we encourage STEM students to participate in research and internship opportunities provided by the UC Education Abroad Program (http://eap.ucop.edu/our_programs/internships_+_research/), by third party study abroad program providers, and by faculty and staff at UC San Diego. An example of an outstanding research opportunity is the UC San Diego PRIME Program where students spend 9 weeks conducting research abroad at partner universities and institutes, and work with a UC San Diego faculty mentor before and after (see http://prime.ucsd.edu/). Another example is a biotech internship program in Sydney offered in partnership with Phi Beta Dingo (see http://www.phibetadingo.com/INTERNSHIPS/biotech/). One of our faculty-led programs, *Mathematical Beauty of Rome*, is especially appealing to STEM students and students are queuing up to enroll in a new program that we will be offering in summer 2010 called *Public Health in Amman* (see http://pao.ucsd.edu/pao/gs/2010/).
Finally, students can participate in programs like IIE’s Global E3 program for undergraduate engineers who wish to get critical overseas experience (http://www.iie.org/Content/NavigationMenu/Programs7/global-e3/global-e3.htm).

There are literally hundreds of programs for our STEM students to choose from and that number is growing. I recently tallied just the number of study abroad programs in the health sciences and was astonished to find almost 800 programs on the IIE Passport website.

**STEM Participation in Study Abroad is Growing**

Given the fact that physical and life science major enrollments in study abroad have held steady at about 7% of the overall number of students going abroad for the last ten years (IIE Open Doors, 2009) means that the number of STEM students going abroad is increasing by the same percent as overall growth in study abroad, about 8-9%. Similarly, health science enrollments have grown from 3.8 to 4.5%; engineering enrollments have grown from 2.8% to 3.1% over the last ten years, and mathematic, agriculture, and computer science majors make up about 3% of the total number of students going abroad. Overall, STEM students make up about 17% of the students going abroad on credit-bearing programs.

Despite the fairly large number of programs available to STEM students, there is concern among some education abroad professionals that STEM student interest will soon outstrip program offerings. This is a problem we would love to have!

**Access**

Access is perhaps the most challenging dimension of increasing the number of STEM students who study abroad. Campuses must commit to access to education abroad and the resulting international knowledge, skills, and sensitivities for all students, regardless of major, gender, ethnicity, socio-economic situation, or prior experience abroad.

This requires the institutional leadership to encourage departments to determine which programs abroad are the best fit for their students, to detail out the curricular articulation, and to encourage STEM students to consider going abroad for part of their undergraduate education. In turn, academic advisers must be equipped to answer students’ questions about pre-departure academic planning and to encourage them to follow through with their plans.
Lawrie Davidson, at The University of Western Australia, has developed the OUTWARD system, which assists universities around the world with the integration of study abroad into curriculum (http://www.admin.uwa.edu.au/ic/outward/units/default.asp). Davidson’s web-based database helps students, advisers, and faculty find equivalent courses by asking institutions to work in partnership to share course information and how those courses count at other institutions. Davidson’s system demonstrates academic integrity by sharing detailed course information, providing a record of course equivalence, and providing opportunities for faculty-to-faculty connections (CIEE conference presentation by Lawrie Davidson, November 2008).

In addition to course articulation, institutions must find more creative ways to fund students going abroad and work with their Foundations to secure additional scholarship funding. Several government programs and agencies provide scholarships, also. For example, the DAAD RISE (Research Internships in Science and Engineering) program (http://www.daad.de/rise/en/) offers outstanding opportunities for STEM students and provides substantial funding for undergraduates. The number of applicants for RISE went from under 400 in 2005 to over 800 in 2008 and the number of scholars went from just under 100 in 2005 to just under 300 scholars in 2008 (CIEE conference presentation by Peter Kerrigan, November 2008). Clearly these kinds of opportunities are appealing to STEM students.

**Summary**

STEM students are motivated to participate in education abroad but need more information about study abroad opportunities, more encouragement from their departmental faculty and departmental and education abroad advisers to participate, and more scholarship funds to level the economic playing field. Please help dispel the myth that STEM students cannot study abroad without delaying graduation. Education abroad allows our students to gain the knowledge, skills, and sensitivities they will need to work and live in our international and interdependent world. We look to our STEM graduates to help address the many pressing problems facing our world.

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