

AC 2008-1042: IN PURSUIT OF UNDERGRADUATE ENGINEERING EXCHANGES

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In Pursuit of Undergraduate Engineering Exchanges

Seventy percent or more of Union College engineering students have some type of international experience requiring travel to, and immersion in, a foreign culture before they graduate. In the Class of 2007, 23% went on a non-engineering term abroad, 34% participated in an engineering exchange, and 13% went on a three-week mini-term program. An additional 18% met their international experience requirements by taking modern language courses. Previous classes have had up to 88% of the graduates participating in some type of program that required international travel. These numbers are among the highest percentages of any engineering programs in the country. So why is Union actively trying to develop additional exchanges, both with English speaking programs abroad, and with those that require competency in the host country language? There are multiple reasons which will be discussed in the remainder of this paper.

Background

Union College is a liberal arts institution with engineering and computer science. It is located in Schenectady, NY, and was one of the first colleges in the country to offer a degree in engineering (Civil Engineering, 1845). Out of the total student population of slightly more than 2000, approximately 300, or 15%, are engineers and computer scientists. This proportion is lower than historical levels, with the target for growth being to increase the proportion to 20%.

Union has traditionally maintained an active terms abroad program. Approximately 60% of all Union students go on some form of study experience in a foreign country during their tenure at the College. Union ranks near the top of all schools in the nation in percentage of students going abroad.

Engineers have always been eligible for terms abroad, but before the Class of 1999 students were not required to complete the section of the General Education requirements that included terms abroad. Prior to 1996 Union's engineering curricula were not set up with terms abroad in mind. Since the programs are relatively small, most required and elective courses in the major are offered once a year. Therefore, it took very careful planning and advisement to allow students to go abroad without seriously jeopardizing their chances of finishing in four years. Union also bucks the national trend in that most of our students actually graduate in four years.

Students who were successful in juggling their schedules invariably came back from their foreign study saying it was well worth the effort, and many said that it was a life changing experience. However, it took the Accreditation Board for Engineering and Technology (ABET) Engineering Criteria 2000 (EC2000), and their emphasis on a global perspective, to cause the engineering programs to think seriously about requiring a foreign study experience.

A thorough curriculum review of all the engineering programs was undertaken as part of our preparations for a pilot visit under EC2000. The Dean of Engineering at the time strongly encouraged all of the engineering programs to embrace the concepts of global perspectives, and to take this opportunity to make the curriculum sufficiently flexible so students could be away for a term and still graduate on time. The engineering programs responded by realigning their

curriculums, and as a body voluntarily assumed the College general education international experience requirements. The engineering programs established the goal of having 100% of eligible students participating in some type of experience that requires international travel during their undergraduate tenure. To be eligible a student must maintain at least a 2.5 grade point average. There are also some eligible students who cannot go abroad for a term because of sports commitments or personal situations. For those students, there are other ways of satisfying the general education requirements for international experience, including taking modern language courses, or taking classes in one of the cultural diversity tracks, such as East Asian Studies, offered at Union.

Table 1 shows the way Union engineering graduates have satisfied the international experience requirements. Union is on the trimester system, so the word term is used instead of semester. A term abroad is any one of the 19 programs offered through Union’s International Programs Office. With one exception, these programs do not accommodate students taking engineering courses abroad. Term abroad (engineering) refers to engineering exchanges that have been developed, and will be discussed in detail later. Mini-terms are programs with three weeks of international travel during the winter or summer breaks. International design projects involve collaboration over the Internet with students in engineering programs overseas, with approximately one week of travel to the international university at the end for some type of design competition. These projects took a three-year hiatus, but there has been a resurgence of interest on the part of faculty for these programs in the 2007-08 academic year, which will be reflected in the data for the class of 2008.

TABLE 1: ENGINEERING STUDENTS’ INTERNATIONAL EXPERIENCES

Type of Experience	2007	2006	2005	2004	Five Year Average (99-03)
Term Abroad	23%	19%	15%	13%	19.7%
Term Abroad (Engineering)	34%	30%	31%	40%	31.1%
Mini-term	13%	23%	34%	31%	31.5%
International Design Projects				2%	4.2%
International Internships					1.2%
Other (Not involving international travel)	See Below	See Below	See Below	See Below	12.3%
Cultural Diversity Track	13%	15%	11%	6%	
Language	18%	13%	9%	8%	

The data show that the percentage of engineering students going abroad was highest during the period 1999-2003 (about 88%), and has dropped off fairly consistently in the years since. There are two primary factors that are believed to be responsible for that. The weakening dollar has made programs more expensive, so even with increasing budgets the number of term abroad slots has decreased. Then three years ago the College instituted a policy of requiring a \$3,000 fee for mini-terms. Prior to that mini-terms had been supported by grants. Union has recently committed funds to increase both the number of students going on terms abroad, and the variety of programs available. This should help reverse the trend. At the same time the

engineering programs will develop additional exchange opportunities. In the future efforts will also focus on increasing international internship opportunities.

Everyone agrees that a multilingual engineer is a valuable, if scarce, commodity. Some engineers are excellent at languages, but it seems that as a group they are less adept at learning a foreign language than a new computer language. Add to that the intensity of engineering programs, and you get a low percentage of engineering students voluntarily taking languages. Union does not require engineering students to take a second language, but it is highly recommended. Thus it is difficult to slot engineering students into international experiences for which there are language prerequisites. Flexibility is also limited by the languages being taken by incoming engineering freshmen. Sixty-two percent of the aspiring engineers in the class of 2011 at Union took Spanish in high school. The next highest was French at 19%, with a smattering of other languages totaling 8%. The admissions database indicated that 11% of the incoming engineers took no language in high school, which could mean they actually didn't take language, or that it just wasn't reported on their application. Regardless, the data show that a very large proportion of the students took Spanish in high school, which limits the pool for international programs requiring other languages. Furthermore, only 38% of the entering freshmen took four years of language in high school, with the percentage breakdown by language approximately the same as before, while about 35% took three years of a language. Thus engineering students aiming for language proficiency would have to take several classes at Union.

Union recently updated the general education requirements, which weakened the requirement for the general student population to go on an international program. However, the engineering programs are maintaining their goal of 100% participation by those eligible. The following information has been added to the College Catalog:

Engineering has become a global profession. As a graduate you will likely find yourself working on an international team in a global company, working for an organization with international clients, or being dispatched to international locations to negotiate or oversee work. Thus it is critically important that you understand the nuances of other cultures, and the proper way to communicate. One of the best ways to accomplish this is through an international experience as a student. Therefore, engineering students, except under extraordinary conditions (as approved by the student's academic advisor and department chair), are expected to meet the Linguistic and Cultural Competency requirements of the Core Components Curriculum by participating in some type of international experience. For engineering students, possible experiences include: 1) terms abroad, 2) international internships in industry, 3) mini-terms abroad, 4) collaborative international design projects, and 5) summer international experiences.

Why Pursue Additional Engineering Exchanges?

Union College presently has active exchanges with universities in the Czech Republic, Germany, France, Mexico, Sweden, and Turkey. However, only about a third of the engineering students are now going on exchanges. That is because some of our exchanges are fairly new, and do not yet have significant participation numbers. The exchanges in Germany, France, and

Mexico will probably never attract large numbers, as they require some level of language proficiency. The exchange in Sweden is very specialized, so it will not attract a large audience. Also we have found that some exchanges, although conscientiously developed and implemented, just do not work out for various reasons. However, once an exchange reaches critical mass for sustainability, it can be one of the most stable sources of international experience opportunities. Therefore, increasing the number and variety of exchanges will be an important aspect of meeting our goal of 100% eligible participation.

Engineering exchanges are an excellent way to prepare our graduates to compete in the global engineering marketplace. They will gain independence, and will be better able to understand and work with other cultures. Students will learn another culture's language of engineering, including engineering philosophy, approach, and ethics. A wide range of engineering exchanges will allow students more flexibility in finding programs that meet their personal, professional, and academic goals.

Engineering exchanges allow students more complete immersion in the host country culture, to include the engineering culture. Many international programs are conducted by special institutes that cater to students from outside the host country. Thus U.S. students may live together, take classes together, and take excursions together; producing a very shallow immersion in the culture. Exchange students, on the other hand, will interact with the engineering faculty, and will most likely take classes with other international students and students from the host country. They may live in home stays, in a dorm with other international or host country students, or in an apartment on the economy.

Engineering exchanges are approximately revenue neutral for the institution, while regular terms abroad are a financial drain on the institution, especially in times of unfavorable exchange rates. Normally exchange students pay their tuition and fees to their home institution, so the home institution sees no difference in student revenue. There may be some imbalances in exchanges for special circumstances. For example, Union incurs some net housing costs in our exchange with the Czech Technical University in Prague, because 10 Czech students come here for the full year (three terms), while we send 20 students to them for the fall semester. We also give Union students going to Prague an extra meal allowance, as our students, on average, seem to eat more than the Czechs. Larger costs can be incurred if the number of students going in either direction becomes unbalanced. This is, in fact, the reason for many exchanges being abandoned.

Union as a whole benefits from engineering exchanges. When engineering students go on exchange programs, additional regular term abroad slots open up for the rest of the Union students. Engineering has been sending students on international experiences at a higher rate than the rest of the student population. In a dwindling regular term abroad market, any lessening of impact of engineers is much welcomed by the rest of campus. Union also benefits from the exchange students coming here from the international university. These students are well accepted by the college community, offer a refreshing new perspective in class, help to enhance the global perspective of students and faculty, and are generally a delight to have around.

Developing Exchanges

Ideas for exchange partners can come from several sources. Contacts made at international education conferences, and individual faculty member contacts or collaborations with international faculty are two of the best. You can also learn a considerable amount by searching university Internet sites.

Developing exchanges takes time, and a good deal of personal effort. On site visits to coordinate, observe facilities and personnel, and develop personal relationships among administrators at both institutions are essential to developing and maintaining successful exchanges. Each host institution must provide administrative and support services to the incoming exchange students. The quality of this service can best be ascertained by talking with students who have been on programs at the institution, or with program administrators from other U.S. colleges or universities that have a relationship with the foreign university.

U.S. colleges and universities must make sure they have adequate housing and support services to accommodate international exchange students. The number of students may be approximately the same because of the exchange, but the requirements of the small number of exchange students will be significantly different than the normal student population in terms of visa requirements, housing preferences, language skills, etc.

Once an exchange agreement is signed, the program must be publicized, and students recruited to participate. Word of mouth from returning students is the best publicity any program can receive. If negative, new students will not be attracted. Thus it is important for staff at the U.S. institution to follow-up with returning students, and if the input continues to be negative, to consider dropping the exchange. Generally the language of agreements allows this. Appendix A contains a sample agreement that spells out the responsibilities of each party to an exchange agreement.

Avoid trying to develop exchanges with institutions from which students cannot afford to travel to, and live in the U.S. Many of these institutions have good quality programs, and would love to have our students go there, but want the revenue the U.S. students will provide. Thus it is no longer an exchange.

Careful consideration must also be given to the quality of courses at the international university. The appropriate engineering program should be enlisted to evaluate the courses offered. Programs must be able to demonstrate that courses given for major credit meet U.S. accreditation requirements. Some of this can be ascertained ahead of time, but much of it must be evaluated by feedback from students after they return from overseas, or by examining student work and portfolios. There are also an increasing number of international programs applying for ABET accreditation, which should relieve much of the angst for these programs.

Conclusion

Union College is dedicated to continually improving the globalization experience of our engineering graduates. Increasing the number and variety of engineering exchange programs will help in this endeavor. In the future we hope to follow-up quality engineering exchanges with

internships in industry in the host country. We also are striving to increase and enhance the language experience that our students receive in conjunction with their international programs.

Appendix A: Sample Agreement

**AGREEMENT FOR A STUDENT EXCHANGE PROGRAM
BETWEEN UNION COLLEGE
AND
XXXX**

Union College, Schenectady, New York, U.S.A. (hereafter referred to as Union) and the XXXX (hereafter referred to as XXX) hereby agree upon the following items concerning the Student Exchange Program, beginning with the Fall semester of the academic year 2008/09.

1. The exchange program shall be administered through the Office of International Programs at Union College and the Office of International Relations at XXX.
2. Each university may send up to three undergraduate students each year in a one-for-one exchange situation. While efforts will be made to keep the exchange even, the number of participants may vary in any given year, provided a balance of exchanges is obtained over the term of the agreement. The normal exchange period shall be one year. In case of shorter exchange stays, the fractions of academic year are added in such a way-that three terms at Union or two semesters at XXX form one academic year.
 - a) In the case that one of the two institutions- cannot select appropriate candidates for the student exchange program, the said institution holds the right to send exchange students to the other party the following year. The notice of sending no candidate should be given to the other party four (4) months prior to the beginning of the semester affected.
3. Both groups of the exchange students are subject to the same regulations about admission to and performance in classes as pertain to the students in the receiving institution.
 - a) The designated student(s) must have completed at least one year of study at the home institution before beginning the exchange period. Exchange students must have an overall GPA of 2.5 out of 4.0 or better at the time of application and at the time of the exchange. While students nominated by the home university will normally be accepted by the host university for exchange, the host university retains the right to review the students nominated for exchange and to make final decisions concerning admission.
 - b) The exchange students can be either male or female, the selection of whom

is fully up to the sending institution. The students, within reasonable limits, should attempt to represent their home institution and country in the receiving community, speaking-to clubs, church groups, etc.

- c) Both XXX and Union will forward to the partner institution each year by May 15 and - October 15 (for Fall and Spring admission respectively) a list of the students nominated for exchange, together with appropriate documents as required by the host institution. Host institution will inform the home institution of the final admission decision as soon as possible, and no later than June 15 and November 15 respectively.
4. Each host institution will issue the appropriate documents for visa purposes in accordance with current laws, although it is the -responsibility of the individual student(s) to obtain a visa in a timely manner.
5. Normally, each exchange student must provide for his or her own transportation to/from a port-of-entry in the country of the other party and the domestic transportation from/to the port-of-entry to/from the depot near the- receiving institution. The following expenses shall also be borne by the student: living expenses during the vacation and the period between semesters, passport expenses, excess baggage shipment and storage, independent travel and such personal expenses as telephone charges, books, etc. Exceptions to the above may be made following discussion and agreement between Union and XXX. Each institution annually, in its regular publications or in materials prepared expressly for visiting students, provides an estimate of incidental expenses normally incurred by full-time students resident on campus. Exchange students should be aware of and prepared to cover such incidental expenses.
6. Students accepted for exchange will be enrolled as full-time students. XXX students at Union may enroll in all courses offered by the college, subject to usual college regulations and policies. XXX students must be fluent in oral and written English and have TOEFL scores of at least 550.
7. Each institution will be responsible for assigning an appropriate institutional official to serve as academic and international student advisor to the exchange students to ensure that the students are properly enrolled in the appropriate courses and to offer assistance as needed in adjusting to the new environment.
8. Any academic credit that the student receives from the host institution may be transferred back to the home institution in accordance with procedures determined by the - home institution. The records of the students' academic performance will be sent directly to the home institution. It will be the responsibility of the home institution to decide how many credit units the student may actually receive for courses taken at each receiving institution.

9. The participating students shall pay normal tuition fees and room and board to their home institution, in accordance with that institution's policies. Neither university shall make charges upon the other or upon the exchange students for tuition or application fees.
10. Each host institution will assume responsibility for arranging housing and full board for the exchange students. XXX students will be accommodated in a Union dormitory with roommates selected carefully by Union. Union students will be housed in an XXX dormitory with a student roommate from the United Arab Emirates or other Middle Eastern country strongly preferred. It is assumed that each student will have paid for a meal plan at the home institution that provides (in whatever format) for the equivalent of twenty one meals per week, covering the full period -of the exchange. The host institution will therefore provide access to three meals per day for each exchange student for the duration of the exchange.
11. Minor illness may be treated in the receiving institution's health center. However, hospital and other medical expenses are the responsibility of the students. Each student must purchase insurance to cover medical contingencies in the host foreign country.
12. Each institution reserves the right to dismiss any participating student at any time for academic or personal misconduct in violation of established regulations. The dismissal of a participant shall not abrogate the agreement nor the arrangements regarding other participants.- -Violation of local law committed in the host country will-subject the student to immediate withdrawal of the immigration and academic sponsorship and to expulsion of the student from the country.
13. Upon completion of the study tour at the host university, the participating students must return to the home university without fail. No extension of stay shall be authorized unless otherwise specified by the home institution.
14. This exchange agreement shall remain in effect for an initial period of five (5) years. Thereafter it shall be automatically renewed from year to year; however, after the initial period either university may terminate the agreement by giving notice in writing of such intent. To be effective, the notice of- termination - must be received by the other party before January 31 of the year in which the termination is to become effective.

Union College
Date:

XXXX
Date:

Stephen C. Ainlay, President

President