

## **Gaining Global Perspective through Terms Abroad**

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### Abstract

Beginning with the class of 1999, all engineering graduates from Union College have been required to complete the “Other Languages; Other Cultures; Other Disciplines” portion of the College General Education program. Students can meet this requirement through completing three courses in a foreign language, completing a three course cultural diversity track (Africana, East Asian, or Latin American Studies), or participating in a variety of programs that require travel abroad. Prior to 1999 engineering students were excused from this portion of the General Education Program because of the perceived rigidity and intensity of the engineering majors. However, with the increasing emphasis on the globalization of engineering, the engineering division felt it could no longer afford to stay isolated. Therefore, the engineering programs modified their curricula to allow students to be away for up to a whole term and still graduate on time. Experience thus far has shown that almost all of the engineering students opt for actual foreign travel. This paper will describe each of the options for foreign study in some detail, discuss the curricular revisions implemented to allow students to participate, and compare present and future methods for assessing the value and impact of the foreign study experiences on engineering graduates.

### Introduction

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 70% 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 Section 4 of the General Education requirements. One of the primary ways to satisfy Section 4 is by taking a term 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 only 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 that time, Richard Kenyon, strongly encouraged all of the engineering programs to embrace the concept of global perspective 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 curriculum review committee originally proposed that the foreign experience be either some form of term abroad, or a coop in a foreign country. However, the non-engineering faculty were against giving academic credit for work experience, so the engineering programs voluntarily agreed to assume the requirements of Section 4 of the General Education Curriculum.

#### General Education Section 4

Section 4 of the General Education requirements at Union is titled "Other Languages; Other Cultures: Other Disciplines." The requirement can be met in several ways. The Foreign Language Tract requires any sequence of three courses in a classical or modern foreign language. Students can either begin a new language or be placed at the appropriate level in a language studied in high school. If a student places into higher level language, only two courses are required. The Cultural Diversity Studies Track can be completed by taking three courses in Africana Studies, East Asian Studies, or Latin American Studies. These are each degree granting programs, so they are not mere assemblages of survey courses. Although the above two options do not require foreign travel, they at least introduce the student to other cultures. They also may be the only way for certain students to meet the requirements. Union requires that students have at least a 2.3 cumulative average to participate in a program requiring foreign travel. Also, some students have family or other commitments that make it difficult for them to travel abroad for an extended period.

All of the remaining options require some period of travel to a foreign country. The Foreign Study Track is any Union Term Abroad with associated prerequisites, or equivalent foreign study (Union allows a certain number of students to travel on non-Union. terms abroad each year). Union's Terms Abroad office does everything it can to accommodate engineering students who want to take a term abroad. One problem here is that some terms abroad have language prerequisites. Unless an engineering student has four years of a language in high school, it can be difficult for him or her to meet the prerequisites. Data on the language qualifications of entering engineering freshmen are given later in this paper. Also, Terms Abroad programs require substantial monetary commitment on the part of institutions. They are not self-supporting. Therefore, it is probably not realistic to expect to have enough terms abroad opportunities to accommodate all students.

Exchange programs with foreign engineering schools seem to be an ideal way of increasing the number of foreign experiences available to engineering students. Since students are going in both directions, there is no net expense to either institution so long as the numbers are equal. Additionally, students don't have to worry about falling behind in their engineering studies, as they can take engineering courses at the foreign institution. However, there are limiting factors. Some foreign institutions offer all or a good percentage of their courses in English. Others offer only a few, or none, in English. There may be differences in curriculum or grading systems that make it difficult to mesh with the average U.S. engineering curriculum. You also have to be concerned about the equivalency of courses, especially in the design area. Thorough documentation needs to be gathered to convince ABET program evaluators that the courses are indeed equivalent to those at the U.S. institution.

Mini-terms are shorter, intense immersions in another culture accompanied by further study at Union. A series of seminars are held the term before the foreign travel. These encompass cultural expectations, technical and social issues associated with the theme of the mini-term, and pre-travel logistics. The time spent abroad is typically three weeks, and occurs during summer or intersession to avoid conflicts with regular classes. Mini-terms involve extensive touring around the host country to compliment the theme of the mini-term. The student group for a mini-term is half engineers and half liberal arts students. Interdisciplinary teams complete a comprehensive report on a topic related to the mini-term. Union has received several grants to help develop and run mini-terms. To date interdisciplinary mini-terms have been conducted in Australia, New Zealand, Brazil, Scotland, and Spain. Two of the mini-terms illustrate the diversity of themes that have been developed. In New Zealand, the mini-term studied the technology and economics of power generation, transmission, and retailing. New Zealand has a unique mix of hydroelectric, geothermal, wind, and both traditional and advanced thermal power production. They have also recently deregulated their electricity markets, similarly to what has been going on in the U.S. All of this, plus the fact that New Zealand is a beautiful country, made for a very successful mini-term. A paper describing this mini-term in more detail is published in another part of these Proceedings. An equally successful, but altogether different mini-term was conducted in Southern Spain. Its theme was the technology and cultural issues that made Cordoba the cultural capital of Europe

in 1000 AD. Visits to Roman ruins, antiquities museums, and archeological sites not yet open to the public provided a rich background for the students in their projects.

In the International Virtual Design Studio (IVDS), students interact over the Internet with students at a foreign university on a cooperative design project. The project culminates in travel to the foreign institution for a design competition. In some instances groups from the foreign institution also travel to the U.S. To date the only significant IVDS program is with the Middle East Technical Institute in Ankara, Turkey. However, faculty are being encouraged to develop other IVDS programs.

Under certain circumstances a student can get Section 4 credit, but not academic credit, for a foreign term in industry. The student has to have special permission from the Dean of Undergraduate Education, and generally must take at least one academic course at Union pertaining to the culture of the host country.

### Curricular Revisions

Each of the engineering programs approached the problem differently, but each found ways of making it feasible for students to take a term abroad while still maintaining all curricular and accreditation requirements.

The Civil Engineering Program reduced the number of required courses to a core of structures, soil mechanics, fluid mechanics, and transportation, then added a flexible technical elective structure which ensured both breadth and depth. The curriculum was designed so students could go on a term abroad during the winter or spring terms of the junior year, or the fall term of the senior year.

Computer Engineering arranged the winter term of the junior year so a student could be away and make up the major course offered that term at a later time. The course normally taken that term is not a prerequisite for later required courses. The final term of the senior year is also left open for a possible term abroad. The capstone design course is taken in the fall and winter terms.

Electrical Engineering designated any of the terms in the junior year as possible term abroad options. Any major courses missed can be made up later without violating the prerequisite structure.

Mechanical Engineering designated the fall term of the junior year as the recommended term for satisfying the foreign study experience. There are no courses in the major scheduled during this term. The catalog says that students may complete this requirement in other terms as well. They are advised to “work closely with their academic advisor to develop the appropriate plan of study that will allow them to pursue the desired option.”

## Experience Thus Far

Table 1 shows the breakdown of foreign experiences by calendar year for Union College engineering and computer science students. Computer science is included because it is part of the engineering division at the College. The data show the increase in number of foreign experiences by engineering students since the additional requirements were instituted. It also shows the distribution of experiences among the various categories.

TABLE 1  
ENGINEERING AND COMPUTER SCIENCE FOREIGN EXPERIENCES

2001-2002					
	CE	CSC	EE/CSE	ME	Total
Mini-Term	14	10	4	3	31
Standard Term Abroad	1	4	5	10	20
Exchange	4	5	6	6	21
IVDS				1	1
Total	19	19	15	20	73
2000-2001					
	CE	CSC	EE/CSE	ME	Total
Mini-Term	7	3	3	4	17
Standard Term Abroad		3	2	1	6
Exchange	3	2	2	10	17
IVDS		2	2	2	6
Total	10	10	9	17	46
1999-2000					
	CE	CSC	EE/CSE	ME	Total
Mini-Term	3	2		1	6
Standard Term Abroad	8	3	4	3	18
Exchange	2	2	3	4	11
IVDS		1	3	4	8
Total	13	8	10	12	43
1998-1999					
	CE	CSC	EE/CSE	ME	Total
Mini-Term	4			1	5
Standard Term Abroad	1	3	2	2	8
Exchange	2	2	4	7	15
IVDS			4	4	8
Total	7	5	10	14	36

CE = Civil Engineering; CSC = Computer Science; EE/CSE = Electrical and Computer Systems Engineering; and ME = Mechanical Engineering.

If computer science students are not counted, exchange programs make up 34% of the foreign experiences, mini-terms 28%, terms abroad 25%, and IVDS 13%. The low relative ranking of regular terms abroad is not because of a lack of opportunities. It can be at least partially attributed to the language requirements of several of the terms. Language study at the college level is very demanding, and engineers as a group seem to be less skilled at language learning than other students. Therefore, most of them shy away from terms abroad that require language proficiency. Future efforts to try to reverse this tendency will be discussed later in this paper.

Exchanges are the largest component of the foreign experiences. Further investigation shows that 56 of the 64 experiences result from one exchange program with the Czech Technical University in Prague. The Prague program is very popular because all of the classes are in English, and Prague is a very nice place to visit in the fall. This reveals vulnerability in the system that needs to be addressed.

The low number of IVDS experiences in 2001-02 was a result of the transfer of the principal organizer in Turkey to a new position. It is expected that this will be a temporary hiatus, but does illustrate the danger of having any program dependent on particular faculty.

#### Assessment

There is plenty of anecdotal evidence that terms abroad are valuable experiences for nearly all students. However, formal surveys are much less comprehensive. Most occur soon after the students return home, when they are still in the glow of the “experience” and haven’t had time to process the lasting impact on their lives. What are really needed are longitudinal outcomes evaluations after graduation. Although the population will initially be small, the engineering programs at Union College plan to develop long-term data on how terms abroad experiences have influenced the lives and careers of Union’s graduates. A survey to develop base-line data will be sent out later this winter. Preliminary results from that survey should be available by June and will be presented at the poster session.

#### Future Developments

It is the goal of the engineering programs at Union to have sufficient number and variety of foreign experiences available to allow all students to participate in a program that is of interest to them and meshes with their professional and personal interests. In a period of fiscal belt tightening, it is unlikely that many additional terms abroad will be developed. Mini-terms are certainly an option. However, they are highly dependent on faculty interest, as they have yet to be institutionalized in the manner of terms abroad. It is also unclear whether students and parents will be willing to shoulder the extra expense after the initial development grants run out. The Union administration has made it clear that the institution does not plan to subsidize mini-terms. There are also some influential faculty who refuse to recognize the academic rigor of mini-terms, although close examination shows the rigor is there. The IVDS program is very consumptive of faculty

time with little return other than personal satisfaction, so it will probably never contribute significantly to the increase in foreign study opportunities. The author is presently soliciting proposals from the faculty at Union on possible IVDS projects. Efforts will be made to match these up with faculty at foreign institutions.

That leaves exchanges as the most likely candidate for significant increase in the number of opportunities. To assess the potential clientele for exchanges requiring foreign language proficiency, the data shown in Appendix A were collected from entering engineering freshmen information for the classes of 2005 and 2006. The data show that Spanish is the overwhelming favorite among high school language curriculums. Prof. William Thomas, the director of Union's terms abroad program, feels that our best candidates for exchanges requiring foreign language proficiency are freshmen with four years of a language in high school. The preponderance of candidates is still Spanish, followed weakly by French, and very weakly by German, with a smattering of other languages. This gives us a pretty clear picture that our efforts would best be directed towards developing exchanges with Spanish speaking universities. We will also continue to work on developing additional exchanges with English speaking universities.

## Conclusions

The author believes that Union is unique in having such a large percentage of its students experiencing first hand the culture of another country. However, there are still many improvements that can be made in our system to maximize the benefits to our students throughout their careers as engineers or whatever related field they pursue.

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Thomas K. Jewell is the Carl B. Jansen Professor of Civil Engineering at Union College. He is the author of two textbooks and numerous technical and pedagogical papers. Prof. Jewell's primary area of interest is water resources, but he also teaches courses in mechanics and engineering economics. He is active in the Union College terms abroad program, having led three multi-disciplinary mini-terms to Australia, New Zealand, and Spain. Prof. Jewell is a registered Professional Engineer in New York, and has degrees from the United States Military Academy (B.S.), and the University of Massachusetts at Amherst (M.S., and Ph.D.)

APPENDIX A  
LANGUAGE EXPERIENCES OF ENTERING FRESHMEN

SPANISH – Class of 2005					
	1 year	2 years	3 years	4 years	Total
CE		2	3	2	7
CSC	2	5	4	6	17
EE/CSE	1		1	3	5
ME	1			3	4
ER	1	6	16	14	37
Total	5	13	24	28	70

FRENCH – Class of 2005					
	1 year	2 years	3 years	4 years	Total
CE			3	1	4
CSC		1	3	2	6
EE/CSE		1	1		2
ME		1	2		3
ER		1	3	4	8
Total		4	12	7	23

GERMAN – Class of 2005					
	1 year	2 years	3 years	4 years	Total
CE					
CSC					
EE/CSE					
ME			1	1	2
ER					
Total			1		2

18 Freshmen had no language experience

4 Other [Russian (2 yr), Italian (4 yr), Latin (2 yr), Latin (4 yr)]

7 Freshmen took Latin in combination with one of the above languages

1 Freshman took a combination of 3 yrs Spanish, 1 yr French, and 1 yr German



SPANISH – Class of 2006					
	1 year	2 years	3 years	4 years	Total
CSC	1	7	5	1	14
EE/CSE	1			2	3
ME		3	4	3	10
ER	2	7	12	7	28
Total	4	17	21	13	55

FRENCH – Class of 2006					
	1 year	2 years	3 years	4 years	Total
CSC		1	4	1	6
EE/CSE		2			2
ME			1		1
ER		5	3	3	11
Total		8	8	4	20

GERMAN – Class of 2006					
	1 year	2 years	3 years	4 years	Total
CSC				1	1
EE/CSE				1	1
ME			2		2
ER			1	1	2
Total			3	3	6

8 Freshmen had no language experience

14 Other [Russian (4 yr), 2 Italian (3 yr), 3 Latin (2 yr), 5 Latin (3 yr), 3 Latin (4 yr)]

11 Freshmen took Latin in combination with one of the above languages

2 Freshmen took a combination of Latin and Chinese (1 & 2 yr)