

Broadening Engineering Education through International Programs

Keshav S. Varde
College of Engineering & Computer Science
University of Michigan-Dearborn
Dearborn, Michigan

Abstract

In recent years there has been a rapid move to globalize engineering profession through outsourcing product development, manufacturing and service. Nowhere has this been more obvious than in automotive and computer/software industry. Realizing the need to provide some aspects of global education to engineering and computer science majors, the College of Engineering and Computer Science at the University of Michigan-Dearborn set up international programs with two institutions in Europe. The program is based on a reciprocal exchange of students and is geared towards technical education and learning. Since its inception a few years ago the program has been quite successful with outcome that has excelled in students' understanding of global issues.

Introduction

International programs, also known as Study Abroad programs, have been around for quite a few decades^{1,2}. Most of these programs attracted students from non-technical disciplines. However, in situations where such programs catered to students from technical areas most of the educational experience abroad has in on-technical disciplines. The globalization of engineering profession has provided impetus to engineering schools in the U.S. to incorporate at least some component of international flavor in their undergraduate programs.

The College of Engineering and Computer Science at the University of Michigan-Dearborn (UM-D) has been considering inclusion of international programs in technical arena for quite a while. The institution has had "Study Abroad" programs in non-technical fields but only a few engineering students have been participating in them. The establishment of an international program in engineering or computer science required a careful study of course contents and credit transfer. The College, located in a close proximity of major automotive corporations, has seen the impact of globalization of automotive industry in design and manufacturing and its impact on local employment of graduates.

Most of the undergraduates in the College are local students who come from within a 40-mile radius. Automotive companies and their suppliers have been the major recruiters for engineering graduates of the College. Consequently, it is important for the College to provide students with educational experience that meets the needs of the industry. In fact, the mission statement of the College refers to this fact. The Advisory Committee also recommended that the College consider setting up an international program that would provide students with some elements of international experience expected of current graduates³.

Guidelines were developed that would allow College administration to work with partner institutions abroad in developing international program. The guidelines focused on certain requirements, such as:

- The UM-D students be able to enroll in technical courses or design projects related to their major at the partner institutions.
- UM-D students be able to transfer credits earned abroad into their major
- The students be not burdened with additional expenses except for travel and living costs.
- The students be at least at sophomore and preferably at junior level
- The schedule at international institutions be compatible with UM-D schedule.
- There be a reciprocal student exchange arrangement with the selected institutions abroad (this was needed to address issues related to tuition and fees of international students.)

Program Goals

The major thrust of the international program was to expose our undergraduates to academic and student environment at an international institution. In addition, it was expected that

1. UM-D students would work in a team environment in a laboratory setting or on design projects with students from the host institution and students from other countries at that institution.
2. UM-D students would be exposed to and learn social, cultural, ethical, political and economic aspects of student life and of the profession, in general, in the host country.
3. UM-D students would interact with host and international students at the institution.
4. Upon their return, the participants would discuss and/or make presentation on program benefits and their learning experience to other interested students, program staff and advisors.

Institutions and Programs

After a series of discussions and exchange of information, the College developed international

*Proceedings of the 2004 American Society of Engineering Education Annual Conference & Exposition
Copyright © 2004, American Society for Engineering Education*

programs at two major institutions, one in Spain and the other in Sweden. Attempts to establish a similar program in Germany have not worked well. The most successful program so far has been at Jönköping University in Sweden. The program in Spain has had low acceptance by UM-D students, primarily because of the language problems and the limited availability of courses in engineering majors. Hence, the major portion of this paper dwells on program in Sweden.

The Jönköping University program is based on the concept of enrollment reciprocity where the number of students who go to the Swedish institution equals approximately the number of students the College of Engineering receives from that institution. This is particularly important because the financial burden of undergraduate education in Sweden is significantly different than that in the U.S. Hence, it was important not to dwell on tuition and fees for student participants from both the institutions. This was achieved through an agreed reciprocity arrangement.

Acceptance, Advising and Course Transfers

Both the institutions have a formal established process for students to participate in the program. An orientation session is held, generally in fall, for interested students. The session deals with background information, eligibility, and course selections at the host institution, typical expenses incurred by visiting students, etc. The guest students (from Jonkoping University) also participate in this session providing information on student life, details of academic programs and expectations, tours and visits arranged by the host institution, networking with local students and student societies, travel, work permits for internships or co-op education, etc. The students are then provided with further opportunities to interact with guest students (from Sweden or from UM-D) to seek more information about the respective institutions, student life, rigor of program, and opportunities to learn international aspects of engineering profession.

Once the student has decided to participate, a formal application is made and the student agrees to follow rules and regulations of the program. A meeting with the Director of Student Records and Advising follows during which the student elects courses he wishes to take at the host institution. This process involves a careful analysis of the student's academic record, analysis of course contents elected at the host institution, their equivalency in relation to required and elective courses in the student's major, transfer of credits and design content. After further review of the course elections by the student's department, the institution in Sweden receives all the information, including the student's application to the program, transcript and course analysis, preferred course elections and credit transfer that would take place upon successful completion of the courses. A similar process occurs for students coming to UM-D from Sweden. These requirements are satisfied about 3 months prior to the beginning of the semester. This allows the host institution to review the material and make decision on the student's admission.

Program Major and Opportunities

The program has been in existence for about five years. During this period of time about 20 students from UM-D and about the same number from Sweden have participated in the program.

Almost all past student participants enrolled for one semester of full-time study at the host institution comprising of courses, projects and laboratory experience in the student's major. Table 1 shows UM-D participants major field of study since the inception of the program. Representatives of both the institutions monitor the program closely. This is accomplished through periodic contacts with students, the office at the host institution that administers the program, and biannual site visits by institutions' representatives.

Table 1
UM-D Student Participants Major

Students' Major	No of Participants
Computer Science	4
Electrical/Computer Engineering	9
Industrial/Manufacturing Engineering	2
Mechanical Engineering	5

In addition to providing truly broad learning experience to engineering and computer science students in an international environment, the program has made efforts to place students in internships at international sites. Some students have gained internship experience in Sweden. The process of placing students in internships is complicated by local regulations and work permit requirements. This requires that the process be initiated quite early, a task that cannot be easily addressed due to several steps associated with the process. For these reasons the internship placement has been very limited.

Program Evaluation

From the College's perspective, the program has been very successful. Not only are the students eager to participate but they also see significant benefits of the program in their professional career. This is particularly important for the College because most of the undergraduates are local who have had little opportunity to travel and learn about cultures, social and economic patterns and understand education and learning experience in a different set of environment. A survey of participants has revealed very positive outcomes of the program. Participants were much more aware of and sensitive to issues that impact society, use of resources, regional and global economics and working in a team environment with global diversity. They were more prone to consider issues of global importance than those students who lacked international perspectives, such as:

1. Analyzing technical problems not only in the local or regional context but considering international implications.

2. An awareness of global issues including the impact of decisions made regionally by a country on economic welfare and environmental implications to other countries.
3. A clear sensitivity to the use of disproportionate resources by major industrial nations.
4. A need to design engineering products with global requirements and acceptance, high efficiency and low consumption of resources.
5. Issues related to life cycle and use of recyclable material.

Conclusions

The international program in the College of Engineering and Computer Science has provided opportunities for its undergraduates to get better perspectives on international issues. Although the program has technical focus the learning opportunities provided by the program have shaped students' views and attitudes that are more compatible with the engineering globalization trends that are underway in the world. Although in its infant stage, the program has produced clear benefits to students and has moved their education and learning to a higher level.

References

1. Teaching and Learning in a Global Community, A Report of the 2003 P-20 International Education Summit, University of Washington, Seattle, October 2003
2. Preliminary Status Report 2000: Internationalization of U.S. Higher Education, American Council on Education (ACE), 2000.
3. Global Engineering Education Exchange, A Program of Institute of International Education, Washington, D.C., 2000.

Biographical Information

Keshav S. Varde is a Professor of Mechanical Engineering and the Associate of the College of Engineering and Computer Science at the University of Michigan-Dearborn. His area of expertise is in thermal sciences with a strong thrust in automotive power systems. As the Associate Dean of the College he is responsible for the finance and management of several educational and research programs in the College, the International Exchange Program being on them.