

Chapter 4F: Internationalization of the College of Engineering

Starting Points

The profession of engineering is being transformed by the globalization of the world economy. Eighteen years ago the National Academy of Engineering¹ issued a challenge to engineering schools to:

“establish and publicize a capability for providing information on international engineering programs, and for promoting an awareness of the international nature of technology.” [Italics in original]

And

“expand opportunities for engineering students to study abroad through the pairing of U.S. schools with comparable schools abroad, and also should encourage the development of cooperative efforts between engineering schools and other campus units expert in international economic and cultural affairs.” [Italics in original]

Currently the effects of globalization are resulting in the loss of U.S. engineering jobs to overseas competition. In a recent report by the McKinsey Global Institute², they reviewed the offshoring potential of several professions related to eight industry sectors. Engineering was identified as the most “amenable” to offshoring. This conclusion is tied to the inherent nature of engineering not requiring significant face-to-face customer interaction – much of engineering can be performed without direct contact with the customer.

Globalization also has affected the practice of engineering in the U.S. Many engineering companies have become global enterprises. Engineers need different skills than what were required just ten to fifteen years ago to be successful in this emerging environment. For example, engineering teams often are multi-national in composition. This means that teamwork has become even more important and now demands the ability to work with engineering colleagues from different cultures, requiring knowledge and sensitivity of multicultural issues.

A small proportion of engineering schools across the nation have been responding to this changing market for engineers. Several engineering schools have taken leadership roles in developing internationally focused engineering programs (Table 4F.1). Programs at these schools range from traditional study abroad and international internships to dual engineering and language programs. Each institution is looking for ways to differentiate their graduates

¹ Committee on International Cooperation in Engineering, *Strengthening U.S. Engineering Through International Cooperation: Some Recommendations for Action*. 1987, National Academy of Engineering and Office of International Affairs, National Research Council: Washington, D.C. p. 68.

² McKinsey Global Institute, *The Emerging Global Market: Part I -The Demand for Offshore Talent in Services*. 2005, McKinsey Global Institute: San Francisco, CA. p. 343.

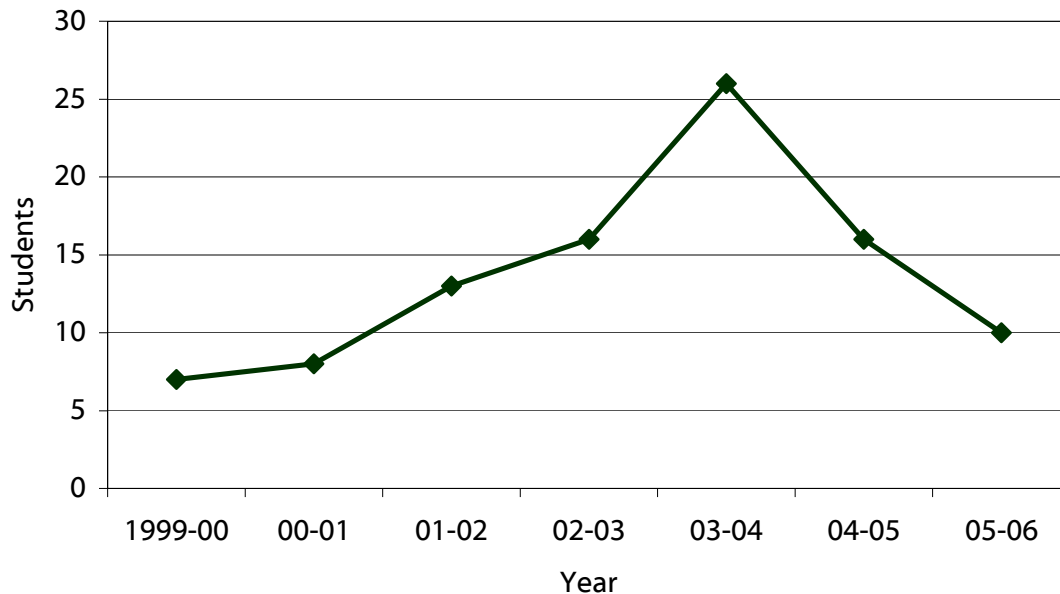
from graduates from other schools. Differentiation is also the goal of many of the students drawn to these programs³.

Table 4F.1 Example Schools with International Engineering Programs

School	Program Type
University of Cincinnati	International Co-Op program
University of Rhode Island	Dual degree program with foreign language
Georgia Tech	International internship, study abroad
MIT	International internship
Purdue	International internships, joint senior design projects
Virginia Tech	Study abroad, on campus international engineering course
Boston University	Study abroad with partner institutions, international internships

The College of Engineering at Colorado State University has a long tradition of international activities, including teaching, research, and service. The chart below shows that the number of engineering students studying abroad hit a peak of 26 in 2003-2004, and typically is in the range of 10-15. This indicates that less than 5% of engineering students are taking advantage of study abroad opportunities. In addition, since starting the International Engineering Concentration under Engineering Science several years ago, the enrollment for that concentration has only reached a total of two students. Our goal is to increase participation in these internationally-focused programs.

Figure 4F.1 Study Abroad Participants



³ Ellwood, R.J., et al., *Motivation for participating in International Engineering Programs*. 2005: Atlanta, GA. p. Speech given at the 8th Annual Colloquium on International Engineering Education

One area where there has been growth in international experience has been through the efforts of Engineers Without Borders. This student organization has participated in two international field experiences in recent years. Also, there have been several student exchange programs at both the undergraduate and graduate levels in the college. But there is considerable opportunity to expand existing programs and develop new ones.

Objectives and Goals

This time of change offers an opportunity for the College of Engineering to position itself to be a leader in the changing landscape of engineering education by providing academic programs that provide international content throughout the curriculum, consistent with the University priority being placed on internationalization. CSU has some of the infrastructure necessary to build these types of programs, including the foreign language and political science departments, the Office of International Programs, and the faculty and staff of the College of Engineering. The impetus now is on the college to forge the ties necessary to bring the resources together to create a structured response to the challenges that were stated eighteen years ago by the National Academy of Engineering.

The following goals and objectives describe areas for development of international activities in the college.

Objective: Provide the strongest four-year undergraduate experience possible to prepare students for careers in engineering that are outsource-proof.⁴
(This objective addresses university goals: 3, 8, 9, 12, 13, & 15)

Goal: Provide College of Engineering graduates with the skills and knowledge (i.e. entrepreneurial, innovation, and leadership skills) that are necessary to have long-term careers in a global engineering profession.

For students to have a long-term career in engineering, they must offer talents that differ from foreign-born engineers. The commodity aspect of engineering, i.e. the basic technical skill, will no longer be sufficient to maintain an engineering career. Engineering graduates will need to better reflect the strengths of the U.S. that continue to be unique and valued globally.

Strategies:

- ✘ Provide opportunities for students to develop entrepreneurial skills through partnerships with the existing program in business,
- ✘ Place a greater emphasis on innovation in the curriculum,
- ✘ Provide international internship opportunities through partnerships with IAESTE and other partners,
- ✘ Provide international internship opportunities through partnerships with engineering employers with connections to CSU,

⁴ In today's global economy, many of the routine analytical functions and technical jobs as well as innovation, design and manufacturing are moving overseas where the work is done by lower-salaried employees.

- ✘ Expand and modify existing professional development and field trip programs to include significant international content,
- ✘ Increase study abroad participation through renewed agreements and by creating new agreements,
- ✘ Identify a faculty/administrative champion to act as the coordinator for international programs within the College of Engineering,
- ✘ Sponsor an international engineering speaker series, and
- ✘ Align our partnerships with University targeted regions of the world.

Goal: Provide College of Engineering graduates with the skills and knowledge necessary to practice engineering in an increasingly global profession.

The skills necessary to practice engineering must accommodate the global nature of many engineering firms. U.S. based engineers will need to engage in engineering design, planning, maintenance activities with partners across the globe. This requires greater understanding and sensitivity to multi-cultural problems.

Strategies:

- ✘ Increase study abroad participation through renewed agreements and by creating new agreements,
- ✘ Provide international internship opportunities through partnerships with IAESTE and other partners,
- ✘ Provide international internship opportunities through partnerships with engineering employers with connections to CSU,
- ✘ Provide international student exchange opportunities and joint degree programs at both the undergraduate and graduate levels through partnerships with universities and external organizations such as the German Academic Exchange Service,
- ✘ Develop a Peace Corps M.S. program,
- ✘ Develop new courses with an international focus to supplement current senior design courses,
- ✘ Infuse international components into courses in each of the engineering departments,
- ✘ Offer curriculum components that include a significant international focus, for example develop an International Engineering Certificate program,
- ✘ Provide curricula resulting in a degree program (such as engineering for globally sustainable development),
- ✘ Strengthen and expand the existing international engineering degree program,
- ✘ Develop joint student/design projects with international institutions,
- ✘ Encourage/require students to take foreign language courses,
- ✘ Participate in international engineering organizations, e.g. SEFI, etc.,
- ✘ Provide an international field experience through opportunities with groups such as Engineers Without Borders and Engineers for a Sustainable World,
- ✘ Support short-term study visits to international engineering sites,
- ✘ Increase the number of international students studying at Colorado State University,
- ✘ Sponsor an international engineering speakers series, and
- ✘ Align our partnerships with University targeted regions of the world.

Objective: Build a faculty and staff cohort with the global knowledge and perspective to engage in international research, service, training, and educational activities. (This objective addresses university goals: 3, 6, 8, 9, 12, 13, & 15)

The successes of all academic programs start with the faculty and staff. Students are influenced by the activities and values expressed by the faculty and staff. To infuse international aspects into the teaching, research, service, and economic development missions of the college requires faculty and staff who have the knowledge and interest in international activities and the support of the department, college and university.

Goal: Increase faculty, staff and administration awareness of the importance and role of global engineering practice.

Strategies:

- ✘ Provide faculty and staff professional development programs,
- ✘ Support international faculty sabbaticals,
- ✘ Identify strategic partnerships for global development and training opportunities,
- ✘ Value faculty and staff involvement in international engineering activities during annual reviews, tenure, and promotion,
- ✘ Develop a visiting international scholars/researcher program,
- ✘ Support faculty international travel,
- ✘ Support faculty in the development of global-focused course materials and curriculum development projects with a global focus, and
- ✘ Align our partnerships with University targeted regions of the world.

Metrics:

- ✘ Number of students studying abroad,
- ✘ Volume of research associated with international issues,
- ✘ Number of international faculty sabbaticals,
- ✘ Number of students involved with global outreach projects,
- ✘ Number of students earning the proposed international certificate,
- ✘ Number of students with international internships, and
- ✘ Number of courses with significant international focus.