

AC 2008-964: GLOBAL LEARNING OPPORTUNITIES FOR BUCKNELL ENGINEERS

Richard McGinnis, Bucknell University

Alexandra Coleman, Bucknell University

Alex Coleman is civil & environmental engineering student in the Class of 2008 at Bucknell University.

Jacqueline Denning, Bucknell University

Jackie Denning is a mechanical engineering student in the class of 2010 at Bucknell University

Joseph Smith, Bucknell University

Joey Smith is a civil and environmental engineering student in the class of 2008 at Bucknell University

Global Learning Opportunities for Bucknell Engineers

Introduction

Global Learning Opportunities for Bucknell Engineers, GLOBE, is a student organization that was formed in October 2007 by engineering students at the university to promote and enhance global learning and study abroad experiences among engineering students. The paper describes the structure of the student organization, its mission, and how it works together with the established engineering societies on campus as well as with the alumni engineering group. First semester activities are described in full, and proposed second semester activities are described briefly. Students' reactions to the group are also covered. Discussion of the actual second semester activities and a proposed schedule for 2008-09 activities will be included in the presentation at the Annual Meeting in June.

Background

There is no question that today's engineering student must be prepared to work in a global economy. The Accreditation Board for Engineering and Technology (ABET) requires that engineering programs provide "the broad education necessary to understand the impact of engineering solutions in a global and societal context."¹ The National Academy of Engineering's report on educating the "Engineer of 2020" includes similar guidance.² Tom Friedman's recent popular book, *The World is Flat*, describes in detail the globalization of the world's economies and repeatedly shouts the need for understanding this phenomenon.³ An important part of our university's strategic plan calls for building bridges: "The University will establish bridges to bring the world to Bucknell — and bring Bucknell to the world."⁴

The American Society of Engineering Education (ASEE) also recognizes the need to increase the global competency of engineers. Since 2002 ASEE has been holding annual global colloquia to provide opportunities for the exchange of ideas on engineering education in a global venue. These colloquia have been held in Germany, USA, China, Australia, Brazil, and Turkey; and the 2008 colloquium will be held in South Africa.

Since it is clear that engineering students need more than a technical education, what is the best way to insure that engineering students get this needed understanding of globalization? Traditionally university students interested in broadening their global knowledge have spent a semester or two studying abroad at a foreign university. Overall a modest proportion of students have chosen this route, and the percentage of engineering students studying abroad for at least a semester is very low. The large number of required courses in most engineering programs and the sequential ordering of these courses make it difficult to find good course matches at foreign universities. Nationally, engineering students have accounted for 2.9% of students studying abroad for each of the five years from 2001/02 through 2005/06. For the 2005/06 year the number of engineering students studying abroad was about 6,500 or approximately 8.6% of the 75,000 students receiving engineering degrees in that year. The Institute of International Education estimates that 53% of students studying abroad in 2005/06 were in short-term

programs.⁵ Our university has done better than the national average with approximately 15% of engineering students spending at least one semester abroad.

In the last few years a number of engineering programs have begun to offer short-term study abroad programs that occur between or after the regular semesters. These programs eliminate the problem of finding course matches since they are in addition to a student's regular course load. Some of these programs have been specifically aimed at providing the global education mentioned above. Baylor University has developed a six-week program for its engineering and business students, the Baylor International Technology Entrepreneurship (BITE) program. The project-based course is multi-disciplinary and is done together with Dutch students from the University of Maastricht.⁶ We have developed a three-week program, Engineering in a Global & Societal Context, that has been offered in England and Argentina. In this program the students are exposed to many of the non-technical aspects of engineering projects that affect whether a project is allowed to go forward. Engineering and planning officials and consultants discuss these factors on the international site with the students.⁷ We have used these types of programs to give an additional 15% of engineering students a study-abroad experience. However, we still have 70% of our engineering students who do not have a study-abroad experience.

A few universities have used foreign internships and research projects to give their engineering students global exposure. Some of these programs are connected with academic course work either before or after the work/research activity. Georgia Tech has been a leader in this area, and in 2005 developed the International Plan. This program is aimed at developing a deeper global competency and includes four main components: 1) foreign language competency, 2) globally-focused courses, 3) an oversea experience of at least six months, and 4) a capstone course.⁸

Purdue University and several foreign universities have developed the GEARE (Global Engineering Alliance for Research and Education) program for mechanical engineering students. This 24-month program integrates foreign language study, cultural orientation, domestic and international internships, one semester study abroad experience, and a two-semester multinational design experience that includes one semester abroad and one at the home institution. Participating universities include the University of Karlsruhe, Shanghai Jiao Tong University, IIT Bombay, and Monterrey Tec. Over the first five years of the program an average of 11 Purdue students and 11 foreign students participated in the program each year.⁹

Service learning is another method used to enhance global learning. Tufts University, through its Engineers Without Borders student chapter, has used social challenges in foreign countries as the basis for multi-disciplinary design projects that its engineering and liberal arts students work on together to find practical solutions. One project based in the Shannan Prefecture of China involved water quality assessment, solar decontamination of medical wastes, and construction of composting latrines. A group of Tufts students spent four weeks in Tibet assessing the needs and performing pilot investigations.¹⁰

Worcester Polytechnic Institute (WPI) is a leader in international service learning projects for engineering students. The goal of WPI's Interactive Qualifying Project (IQP) is to help students understand the social and global contexts for their professional careers. "This degree requirement presents small, multidisciplinary teams of students with a problem involving both technical and societal aspects, challenging them to reflect upon the relationships of science and technology to

civic issues and community needs.” Over 50% of WPI students fulfill this requirement abroad, and about one-third of these students have projects in developing nations.¹¹

Engineers Without Borders (EWB) is becoming an effective way for engineering students to enhance their global competency. The EWB-USA has over 200 developing and established chapters working on over 170 projects in 41 countries. Its mission “is to partner with developing communities to improve their quality of life through the implementation of environmentally sustainable, equitable, and economical engineering projects. In the process of working to advance developing communities, EWB-USA promotes the development of globally aware and internationally responsible engineers, students, and professionals.”¹² Rice University has had a student-run EWB-USA chapter since 2003, and in 2006 it was the university’s largest student-run engineering organization. Their projects typically last for two to three years and involve on-campus work augmented with international site visits during winter, spring, and summer breaks. Recent projects included a Nicaragua Water and Energy project, a Nicaragua Bridge project, a Mexico Water project, and an El Salvador Water project.¹³

Part of the success of EWB chapters can be attributed to their being lead primarily by students. While professor-led programs have their place in global learning, activities developed and carried out by students can be a valuable supplement. A 2006 paper, “ASCE Student Chapters: A Contributor to Achieving Program Goals,”¹⁴ describes the many ways that ASCE chapters can have positive effects on academic outcomes. The paper points out the important impact that non-academic activities have on student learning.

GLOBE is a student-run organization that hopes to be able to supplement and enhance the faculty-led global learning activities at Bucknell University. It also plans to develop programs to provide global learning opportunities for the 70% of our engineering students who do not get the chance to study abroad.

Organization’s mission

GLOBE’s mission is to expand the global competency of our students by offering many diverse on-campus activities. GLOBE is open to all Bucknell students who are interested in bringing a global perspective to campus. Using both internal and external resources, GLOBE strives to establish on campus a global awareness among engineering students and faculty. Our organization stresses the importance of maintaining an international outlook and works to enhance global learning among Bucknell engineers.

Description of the structure of the organization

An executive board consisting of a president, secretary, and treasurer administers GLOBE. However, other members of the organization are welcome to attend the executive board meetings. GLOBE’s four committees focus on the goals of the organization. GLOBE encourages each member to participate in at least one committee. Our current four committees include advising activities, speakers, study-abroad student communications and re-entry, and large group meetings. These committees plan the major events and tasks to be completed throughout the academic year. Members of the executive board are responsible for assembling

and managing the committees. The group currently has one engineering faculty member as an adviser but will be expanding the number of faculty involved in the organization.

Coordination with established campus and alumni organizations

GLOBE will work together with many of the established societies on campus including but not limited to the following: Bucknell Engineering Alumni Association (BEAA), Bison Abroad, as well as the professional societies that represent each of the engineering disciplines, i.e., ACM, AIChE, ASCE, ASME, BMES, and IEEE. Since GLOBE is interested in hosting speakers, we intend to coordinate with the BEAA to contact alumni who are interested in speaking on global topics related to their work. These speakers may also speak to how their study-abroad experiences carried into their professional careers.

Bison Abroad is currently the established study abroad group for all students on campus so we will be working with them to help target the engineering students who have an interest in studying abroad. As for the professional societies, we want to be sure to include all of the engineering disciplines on campus in our activities. In some cases it will be helpful to organize events together to increase attendance. In this way, we will reach out to all engineering students who have an interest in global issues and studying abroad.

Description of first semester activities

GLOBE was organized in mid October, 2007. During the remainder of the Fall semester, GLOBE held two large group events and five executive board meetings. The first large group event was a meeting for all engineering students interested in global education. While liberal arts students were not targeted in the advertising for this event, GLOBE emphasizes that all students, engineering and liberal arts, are welcome to GLOBE-sponsored events. Members of the freshman and sophomore classes were the majority in attendance due to their interest in spending a semester or year abroad. We approached freshmen engineers in their classes to spark their interest in GLOBE so that they would be aware of the up and coming organization early on. Attendance totaled 35 people at this first interest meeting.

At the end of the semester, we held a “Bon Voyage” party for students who were leaving to travel abroad during the Spring 2008 semester. This party was aimed toward a theme of “last taste of American food while you can” and accordingly buffalo wings were served. This event was an attempt to gain more student interest in GLOBE and formally develop the committees. It took place during finals week and consequently had a smaller turnout of about 15 people.

Proposed Second Semester Activities

GLOBE officers worked during the end of the first semester to plan activities for the Spring 2008 semester. The schedule will include several speakers, including Bucknell professors and alumni, to discuss globalization and engineering on an international level. Our own internationally-born professors will be given the opportunity to present their unique outlook on globalization.

GLOBE will use university resources such as the engineering alumni database and the career development center to identify companies with international operations. Representatives from these companies will be invited to campus to give presentations on topics related to

globalization. These talks will stimulate global learning and at the same time expose students to organizations that could potentially provide international internships and employment opportunities. This exposure should encourage students to broaden their outlook on future career options.

We plan to coordinate with the Bucknell chapter of Engineers Without Borders to expose students to issues of developing countries as well as with Bison Abroad to encourage more engineers to study abroad. These events will peak member interest and diversify our organization by drawing students from all departments.

During the spring semester, GLOBE will welcome back fall-semester study-abroad students and help them re-enter the campus community smoothly and effortlessly. Students who have studied abroad will be given the opportunity to give presentations detailing their international experiences with others. In addition, GLOBE will work with the university's career development center, alumni, and parents to arrange international internships and possible post-graduation opportunities, while continuing to help students match courses in programs abroad.

Discussion of students' reactions to the group

GLOBE was initiated in October 2007 so we are still only in the beginning stages of development. An immediate objective of the organization was to assist the freshman and sophomore classes in planning their schedules in preparation for study abroad during their junior year. We were successful in helping the students who were present at our meetings, but it was clear that many students planning to study abroad did not attend. Students from all engineering disciplines do wish to study abroad and have global interests, so it is important to make all of them aware of the opportunities GLOBE can provide. The GLOBE officers are currently limited to civil and mechanical engineers, which presents a challenge when attempting to reach out and effectively communicate with students in the other engineering disciplines. It is evident that student interest is present, but we need to recruit a broader cross-section of students to administer GLOBE and carry out its mission.

Summary and Conclusions

Today's undergraduate engineering students need to enhance their global competency. Study abroad is one way for engineering students to expand their horizons; however, relatively few USA engineering students spend a semester or more abroad. Short-term international programs are gaining in popularity for engineering students because they do not conflict with the highly structured engineering curricula found in most USA programs. Other opportunities for increased global competency include international internships, summer research programs, and service learning projects. Still, for many different reasons the majority of engineering students do not have an international experience during their undergraduate program. Universities need to develop on-campus activities to help these USA-bound students gain a better and expanded understanding of globalization.

GLOBE, Global Learning Opportunities for Bucknell Engineers, is a new student organization at Bucknell University that is trying to help all Bucknell engineering students increase their global competency. Through a variety of on-campus activities GLOBE is bringing Bucknell to the

world and the world to Bucknell. The organization promotes study abroad, helps returning study-abroad students re-acclimate to the campus and share their international experiences with on-campus students, identifies opportunities for international internships and research experiences, invites alumni and others to come to campus to share their international experiences, and works with campus administrative offices to help foster an atmosphere on campus where students seek global learning opportunities.

Bibliography

1. Accreditation Board for Engineering and Technology, *Criteria for Accrediting Engineering Programs, Effective for Evaluations During the 2007-2008 Accreditation cycle*.
2. Committee on the Engineer of 2020, *Educating the Engineer of 2020 – Adapting Engineering Education to the New Century*, National Academy of Engineering, National Academies Press, Washington, DC., 2001.
3. Thomas L. Friedman, *The World is Flat: A Brief History of the Twenty-First Century*, Farrar, Straus and Giroux, New York, 2006.
4. Bucknell University's web site, www.bucknell.edu/x37879.xml
5. Institute of International Education web site, <http://opendoors.iienetwork.org>
6. Van Treuren, Kenneth; Steven Eisenbarth and Cynthia Fry; "The Development of a Global Worldview," *Proceedings of the 2006 ASEE Annual Conference and Exposition*, Chicago, IL, June, 2006.
7. Evans, Jeffrey and Richard McGinnis, "Short-term Study Abroad: Engineering in a Global and Societal Context," *Proceedings of the 2006 ASEE Annual Conference and Exposition*, Chicago, IL, June, 2006.
8. Gulick, Debbie; Debbie Pearson; Gayle Elliott; Jennifer Oliver; and Karl Zimmer; "Developing Globally-Minded Engineers through Education and Experience: A Panel Discussion on International Co-op/Internship Program Models," *Proceedings of the 2006 ASEE Annual Conference and Exposition*, Chicago, IL, June, 2006.
9. Groll, Eckhard A. and E. Daniel Hirleman, "Undergraduate GEARE Program: Purdue University's School of ME Contribution to Educating Globally Sensitive and Competent Engineers," *Proceedings of the 6th ASEE Global Colloquium on Engineering Education*, Istanbul, Turkey, October, 2007.
10. Freeman, Sarah; Douglas Matson; Grant Sharpe; and Chris Swan, "International Citizenship and Global Service Leadership – The Role of Interdisciplinary Teams in Engineering Education," *Proceedings of the 2006 ASEE Annual Conference and Exposition*, Chicago, IL, June, 2006.
11. Vaz, Richard F., "Preparing Engineering Students for Experiential Projects in the Developing World," *Proceedings of the 5th ASEE Global Colloquium on Engineering Education*, Rio de Janeiro, Brazil, October, 2006
12. Engineers Without Borders' web site, www.ewb-usa.com.
13. Gordon, Ross; Alex Gordon; and Philip Bedient; "Rice University Engineers Without Borders: An Exercise in International Service Learning," *Proceedings of the 2006 ASEE Annual Conference and Exposition*, Chicago, IL, June, 2006.
14. Conley, C.; Scott Hamilton; and Decker Hains; "ASCE Student Chapters: A Contributor to Achieving Program Goals," *Proceedings of the 2006 ASEE Annual Conference and Exposition*, Chicago, IL, June, 2006.