An Exploration of Faculty-Led Short-Term Engineering Study Abroad Programs Offered by US Institutions

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Abstract

Faculty-led short-term study abroad experiences, or *global seminars*, are becoming an additional option for university students interested in international travel or study abroad. Global seminars offered during strategic times in the school calendar and designed by instructors who have key learning outcomes in mind can effectively meet the multicultural education needs of engineering students. The purpose of this research project was to gain a better understanding of what global seminars are being offered for engineering students, informing professors who wish to create one at their institution. Lessons learned cover scheduling, course content, and leverage of the travel locations. A secondary objective was to initiate and grow a list of established seminars for engineering staff and faculty who desire to design an effective global seminar and connect with others who are doing the same. Readers are encouraged to submit suggestions to the website developed for this purpose.

Introduction

At least two of the seven student outcomes required of Engineering programs seeking ABET accreditation require graduates to understand the global context in which they are working. Specifically, outcome 2 is that they would demonstrate "an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors [1]." Outcome 4 requires "an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts." Arguably outcomes 3 and 5, which expect that engineering graduates demonstrate the abilities to communicate with a range of audiences and to work effectively as team members, also require a working understanding of multicultural values on the global scale.

Colleges and universities employ a variety of means for their students to be exposed to multicultural values; from study abroad for an immersion experience to recruitment and support of international students who bring their worldviews to campus. Full semester or summer study abroad or internships are often not accessible due to cost, required time commitment, or the lack of engineering credit available at the partner institution. For those students who value international travel, but are unable to afford the time or monetary commitment of longer travel, faculty-led short-term study abroad experiences, referred to as *global seminars* in this manuscript, are being offered by many institutions. Global seminars offered during strategic times in the school calendar, and designed by instructors who have key learning outcomes in mind, have the potential to produce the outcomes required by ABET.

The author is developing a global seminar for a new general engineering program at a liberal arts college. The primary objective of this project was to gain a better understanding of what other professors have designed for global seminars of interest to engineering student, with the goal of gleaning knowledge from their course objectives and the international experiences they work

into the short time abroad with the student participants. A secondary objective was to develop an accessible database for engineering faculty, students, and study abroad staff to easily search for engineering-focused global seminars offered by US institutions.

Methods

While the term *global seminar* describes different programming depending on the institution, the author has limited its definition to be a class taught by a faculty member that integrates international travel of one to five weeks in length. Seminars should include a significant academic component, evidenced by college credit; programs offered by non-academic organizations are not considered to be faculty-led. Travel of a longer length are not considered short-term. Global seminars can have on-campus components, such as pre-requisites or portions of the course taught before or after the international travel. Multidisciplinary seminars of interest to engineering majors, such as technical communication or management, are included in the compiled list but not in the primary analysis for this project.

Using a web-based search engine and combinations of key words (ex: “global seminar” “undergraduate” “engineering” “short-term” “study abroad” “faculty-led”), the author found webpages of both specific global seminars and of offices dedicated to study abroad programs at institutions that offer engineering degrees. She also found global seminars by exploring websites of universities with large engineering programs. The compilation of global seminars offered by US-based engineering programs is still in the initial stages. A website set-up at https://sites.google.com/endicott.edu/engineersabroad provides the current list of programs found, along with links to resources for faculty members and a form to submit new programs to the list [2].

Some global seminars provide details of the course online and available to the public. The author focused on learning outcomes and travel experiences from these seminars to gather information for the current project. Data compiled on the website are the name of the program or office offering global seminars, the host US academic institution, program website, range of credits that students can earn from offered seminars, sessions during which the seminars are offered, and sample seminar titles and the countries they visit.

Results

Many universities focus on full semester and summer immersion programs and do not yet publicize for-credit overseas programs for engineering students that are shorter than 6 weeks (ex:[3]–[6]), even if they do have offerings not related to engineering ([5], [6]). Those universities that offer faculty-led short-term study abroad experiences for their engineering students tend to have a good variety of options (Table 1). Courses offered include both elective and core engineering courses, ranging from introductory to upper level status. Most global seminars appear to be marketed primarily to students attending the host university, and it is often not clear if students enrolled at other colleges are welcome to participate. In the case that a significant in-country component is required, one can expect that only students enrolled at the university would participate in the overseas component.

Table 1. Examples of global seminars offered by engineering programs. For more details and a more recent listing, visit https://sites.google.com/endicott.edu/engineersabroad [2].

University Affiliation	Program Website	Example Seminars
Georgia Tech	https://atlas.gatech.edu/index.cfm?FuseAction=Programs.ViewProgramAngular&id=10176	Environmental Technology, Disaster Reconnaissance, Sustainable Transportation, Sustainable Development
Iowa State University	https://www.engineering.iastate.edu/studyabroad/	Technical Communication
Purdue Study Abroad	https://www.studyabroad.purdue.edu/programs/search.cfm	Global Design & Practice, Intercultural Teamwork, Machine Learning, Industrial Biotechnology, Finite Element Methods, Biomedical Modeling, Thermodynamics, European Transportation Systems
San Diego State University	http://go.sdsu.edu/student_affairs/studyabroad/safacultyledprograms.aspx	Fluid Mechanics, Open Channel Hydraulics, Earth Retention
Texas A&M University	https://engineering.tamu.edu/academics/global/index.html	Engineering Ethics, Engineering Economic Analysis, Software Engineering, Supply Chain Management, Thermodynamics, Drilling Engineering, Medical Devices, Materials Science
The University of Texas at Austin	http://www.engr.utexas.edu/academics/undergraduate-education/study-abroad/short-term-programs	Engineering Communication, Nuclear Science & Engineering, Project Management & Economics, Emerging Technologies, Transport Phenomena, Engineering Dynamics, Humanitarian Engineering, Engineering Statistics, Engineering Design & Graphics, Energy & the Environment, Design in Healthcare, Engineering Projects in Global Health, Career Development & Global Leadership
University of California San Diego	http://studyabroad.ucsd.edu/students/programs/global-seminars/	Business Management and Leadership
University of Florida	https://ufabroad.internationalcenter.ufl.edu/	Cross-Cultural Engineering Studies, Computer Science, Measurement and Design, International Engineering, Engineering and Arts
University of Minnesota	https://cse.umn.edu/college/global-seminars	Robotics & Machine Learning, Water Quality, Energy Production Methods,
University of Tennessee Knoxville	https://tickle.utk.edu/study-abroad/faculty-study-abroad/	Thermodynamics, Circuits, Infrastructure & Sustainability Engineering, Supply Chain Management, Lean-Reliability-Maintainability, Sustainable Energy

Universities with large study abroad programs offer global seminars during the winter and summer terms, and even during spring break. Texas A&M offers faculty-led one-credit field trips; for example, Global Entrepreneurship exposes students to engineering industries, to see firsthand the relationship between the United States and Mexico, and its impact in engineering [7]. Three required meetings prior to the trip are designed as workshops to prepare students for their experience in Mexico. Georgia Tech's embedded course program offers courses that are based in Atlanta but have a travel component. For example, Sustainable Development in Rwanda is a spring project course that includes one week on-site in Rwanda and uses web-based conferencing and email for communication with overseas partners [8].

Some short-term programs offer two classes over only a few weeks. For example, the University of Tennessee Knoxville offers Thermodynamics and Circuits over five weeks in London [9]. The traditional engineering courses are enriched by trips to Michael Faraday's Laboratory, Kew Bridge Steam Museum, Bletchley Park (where the earliest computers were developed), Greenwich Maritime Museum and Royal Observatory (home of the zero meridian), among others. Group travel facilitates scheduling a large number of contact hours within a short time frame; the trade-off is fewer recreational hours for the students to experience the travel location unsupervised. The Engineering in London program remedies this by remaining in one location where the students have easy access to experience city life.

Not all global seminar descriptions explained how the travel component enriched the course. Some descriptions were general, for example:

- CES Faculty-Led Study Abroad at SDSU offers academic programs that aim to enhance students' education by incorporating both traditional lectures with experiential learning outside of the classroom setting. Students should expect rigorous academic coursework that is enriched by both the program's location(s) and activities [10].
- The course includes a variety of field trips to locations of cultural and professional interest to enhance the course [11].

Other descriptions gave specific ways in which the seminar integrates the travel location into the learning experience:

- This course takes students behind-the-scenes to learn about the latest design technologies of world-class buildings including issues of complex geometry, digital analysis, sustainability, materials and state-of-the-art construction methods. Participants visit contemporary buildings such as the Millennium Bridge, St. Mary Axe, London City Hall, London Shard tower, Pinnacle tower, the new Stadium and Aquatics Center (host to the 2012 Summer Olympics). Students learn directly from architects, engineers and builders responsible for these buildings [6].
- For 2 weeks, students are immersed in Chinese culture and experience numerous culturally significant sites, visit local universities, meet with Purdue alumni, tour engineering based labs and production facilities, and meet one on one with Chinese peers in partner universities. Additionally, expert tour guides are utilized in Shanghai and Beijing as resources which help the students gain insights into the local culture as well as details on the locations visited. Students will study and discuss the cultural dimensions as described by Hofstede in daily small group meetings, write about their experiences in location based logs, and work in groups to complete a final project within a week of returning to the U.S. [12].
- The course provides active learning experiences to introduce students to various types of European transportation infrastructure and systems. Students will travel to German sites … to the Berlin Airshow, Airbus A380 assembly line, Mercedes Benz assembly line, Volkswagen assembly lines, BMW assembly line, Hamburg port facilities, and Munich airport airside operations. The class will end in Edinburgh where students will travel through the Falkirk Wheel and maneuver 19th-century narrow boat through staircase locks on a canal day trip. Experience with public transportation systems, bike orientation tours, and cultural experiences will be highlighted in each city [13].

- This seminar will study existing and emerging energy production methods and energy usage in Iceland, Denmark, and Norway. The program will focus on how energy production and usage patterns are linked to specific details of location; and how the issues of production, usage, and environmental concerns have created the current tensions that are driving new energy planning. Site visits will include research universities, wind turbine manufacturers, geothermal power plants, wind farms, hydro facilities, and solar component manufacturers [14].

The level of detail shared on the seminar's website was largely independent of the host university. There appeared to be a minimum requirement by each study abroad office, that was responded to either loosely or in great detail by the individual faculty member.

Discussion

The primary objective of this project was to learn from global seminars being offered through US undergraduate engineering programs. This initial exploration of global seminars provides some helpful guidelines for faculty planning a new overseas course:

- *Any engineering course can be offered as a global seminar*. Although some courses appear to be created specifically for the global experience, foundational engineering courses can be enriched by the experience. Therefore, faculty members should not feel the need to develop a completely new course in order to add a global seminar to their engineering program.
- *Faculty do not have to plan it alone.* All programs found were offered through an international or study abroad office. Staff in these offices provide support for the non-academic aspects of the course, such as travel arrangements and insurance or student recruitment and safety.
- *Valuable global experiences can be gained with any travel length.* While global seminars cannot replace the immersion experience of a full semester abroad, faculty members are able to design specific experiences into a travel trip of any length.
- *More than one course can be offered.* Some models allow students to earn credit for two courses during a single seminar. In addition to encouraging collaboration between faculty members, students receive a higher value for the travel costs.
- *The full semester can be leveraged to enhance the course*. Pre-requisite requirements are not uncommon and are sometimes paired with the travel component. Even seminars that deliver the majority of course content while abroad expect students to attend multiple pre-travel sessions outside of a regular class schedule.
- *Specific examples of on-site experiences should be presented with the course information.* Visitors to the webpage gain a much better perspective of the value added by the travel location, even if they are not specifically linked to course outcomes.

The secondary objective was to create an accessible database for educators and students searching for engineering-focused global seminars offered by US institutions. The website created at https://sites.google.com/endicott.edu/engineersabroad/ is at the initial stages of meeting this objective [2]. The author's hope is that readers of this paper would contribute to the database by submitting links to programs offering global seminars and would suggest resources to add to the site.

This preliminary exploration of global seminars offered at US institutions provides value to faculty members creating their own course by offering general guidelines and examples. A more extensive review synthesizing data from more institutions, or a closer look into the course objectives and travel experiences of seminars offered in specific countries or covering the specific topics will provide even more insights for faculty and staff involved in global programming.

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