

DEVELOPING A RENEWABLE ENERGY TECHNOLOGY COURSE WITH AN INTERNATIONAL COMPONENT

Faculty Paper
Incorporating Study Abroad in an Engineering Technology Curriculum

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The U.S. Department of State Bureau of Education and Cultural Affairs (ECA) is currently funding a program to increase opportunities for engineering technology students to participate in international education. This program, “Capacity Building for Study Abroad”, provided funds for eight faculty members from colleges across the US, including the author, to participate in a nine-day course on the design, installation, and operation of renewable energy systems in Costa Rica. The program participants are now developing courses at their institutions that include international travel, renewable energy, and sustainable technology. This program is an effort to increase the number of engineering technology students who participate in international education programs. Recognizing that science, engineering, and technology students are underrepresented in study abroad programs, this grant will fund two more groups of faculty to participate in training and curriculum development in the next two years. The goal is for these faculty members to develop new, short-term, faculty-led study abroad programs in sustainable technology, renewable energy, technical education, and related fields. The author is developing a course, to be offered in Spring 2012, which will include a two-week travel and study abroad module. This will be offered in collaboration with a non-profit group working in international development. The study abroad travel experience will complement a classroom-based course that will include geography, culture, energy and economics in the developing world, and will focus on the environmental, political, and social issues surrounding international development. This paper focuses on the course development, including how to make effective use of a short-term study abroad program in an engineering technology course.

Current Study Abroad Student Participation Rates

College study abroad programs are available to many college students in the United States. Many high school students believe they will participate in these programs when they are in college, but actually only a small percentage do. In 2000, according to David Wheeler:

“48 percent of high school students said they planned on studying abroad. But in recent years, only about 1 percent of college students did so annually. And while enrollments in

study-abroad programs are at a record high--reaching a total of 129,770 students at last count--stays abroad are growing shorter and the breadth of participation remains very low....” [1]

U.S. student participation in study abroad has more than doubled over the past decade. According to the Institute of International Education (IIE), 262,327 students (about 2.3% of all full-time college students in the U.S.) studied abroad for academic credit in 2007/08. Approximately 3.1% of those students were engineering majors. [2]

While the number of students studying abroad has grown, the duration of their stay has decreased. Currently, more than 50% of all study abroad programs are short term (defined as less than eight weeks during the academic year), with approximately 40% lasting one or two quarters or one semester, and less than 5% lasting an academic or calendar year. [2]

Educational International Travel at Maine Maritime Academy

At Maine Maritime Academy (MMA), students in Coast Guard Unlimited License programs (listed in Table 1) participate in two training cruises of at least 60 days in length. These cruises stop in Caribbean and European ports, giving students the opportunity to visit several foreign countries. Unlimited license candidates also spend their sophomore summer cadet shipping aboard commercial vessels that may visit ports worldwide.

Maine Maritime Academy Academic Programs	Coast Guard Unlimited License Majors (Bachelor’s degree plus US Coast Guard Unlimited License)	All other majors (Bachelor’s degree programs)
MMA Majors	Marine Engineering Operations (MEO) Marine Engineering Technology (MET) Marine Systems Engineering (MSE – License Track) Marine Transportation Operations (MTO)	Power Engineering Technology (PET) Power Engineering Operations (PEO) Marine Systems Engineering (MSE – Non- License Track) International Business and Logistics (IBL) Marine Biology (MB) Marine Science (MS) Vessel Operations and Technology (VOT) Interdisciplinary Studies (IS)
Required international travel	Two 60-day training cruises One 60- or 90-day cadet shipping assignment	None
Elective courses with	TROPICAL MARINE SCIENCE - An introduction to marine ecosystems	

international travel components	in the tropics. Offered every other year; is typically taken by MB and MS majors only. Students spend ten to fourteen days in the Caribbean. IRELAND STUDY PROGRAM – Two 3-credit humanities courses in Irish history and culture; students spend three weeks in Ireland.
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Table 1. International travel requirements and opportunities by major at MMA

The short-term study abroad opportunities for MMA students outside of the Coast Guard license programs are limited to two programs, as indicated in Table 1. Students in the Tropical Marine Science course travel to the Caribbean to examine the biological and ecological aspects of tropical systems. Because of prerequisites, this course is taken only by students majoring in Marine Biology or Marine Science. The course is offered every other year.

The first Ireland Study Program trip was offered in May, 2009, and the program will run its third trip in May, 2011. This program is open to all MMA students; it combines two courses in Irish culture and history with a three week trip to Ireland.

An additional elective course may offer international travel. Auxiliary Sail Ocean Voyaging is based on an ocean voyage of at least six weeks in duration and may stop in ports in Canada and Greenland.

Capacity Building for Study Abroad

To develop an additional opportunity for MMA students to study abroad, the author applied to (and was selected for) a U.S. Department of State Bureau of Education and Cultural Affairs (ECA) program designed to develop new short-term, faculty-led study abroad programs in the target areas of engineering, renewable energy, sustainable development, technical education, and related fields. The program, called “Capacity Building for Study Abroad,” is administered by Madison Area Technical College (MATC). The goals are to expand the capacity of community and technical colleges that do not already have strong study abroad programs on their campuses, and to increase participation in study abroad among underrepresented populations and underrepresented fields of study including Science, Technology, Engineering, and Math (STEM). As part of this program, the author, along with seven faculty members from other colleges, traveled to Costa Rica to participate in a nine-day course on the design, installation, and operation of renewable energy systems. Instructors from Solar Energy International (SEI) and MATC taught the course. Other participants in the program included students from MATC who were taking the course for credit, and people who had signed up through SEI.

In Mastatal, Costa Rica, all participants attended classes and labs to design and build small off-grid photovoltaic systems, and then installed the systems at three different sites

in the region. Those faculty members who were part of the grant program also attended evening meetings to discuss course development and planning for a faculty-led study abroad course. Since returning from Costa Rica, grant program members met for a three-day workshop on international travel planning and curriculum development. Each faculty member is developing a course with a study abroad component to be offered at their institution in the 2011 – 2012 academic year

Curriculum Development for Study Abroad

To design a course that includes international travel, it is important to clearly identify the learning objectives of the program. Many questions regarding goals and intended outcomes must be considered and answered before dealing with logistics. What are the learning objectives and how will they be articulated and assessed? What can the students learn from the experience that they could not learn at their home campus? What will be done to help students understand and experience the local culture?

The benefits of travel are widely acclaimed. Travel broadens the mind. From St. Augustine's belief in the 4th century that, "The World is a book, and those who do not travel read only a page"; to IEE's vision that "Peace and prosperity around the world depend on increasing the capacity of people to think and work on a global and intercultural basis" [3], it is easy to find quotes extolling the virtues of travel. It is more difficult to list these benefits in a form that can be used for outcomes assessment. When developing a course with international travel, it is worth considering taking students outside their comfort zone, to a place they may not travel to on their own. As stated by the Italian poet and novelist Cesare Pavese, "Traveling is a brutality. It forces you to trust strangers and to lose sight of all that familiar comfort of home and friends. You are constantly off balance. Nothing is yours except the essential things – air, sleep, dreams, the sea, the sky – all things tending towards the eternal or what we imagine of it." [7] These experiences are more likely to enrich students' lives and form lasting impressions.

Several studies have quantified the benefits of study abroad participation. In one, the Institute for the International Education of Students (IES), surveyed alumni from all IES study abroad programs from 1950 to 1999. The response from the more than 3,400 alumni shows that studying abroad is usually a defining moment in a young person's life and continues to impact the participant's life for years after the experience. [5] The results reported increases in personal, academic, intercultural, and professional development that lasted for many years after returning to the US.

Once the character of the international travel experience has been defined, the logistics of traveling abroad with students must be considered. Many colleges have centers for international education; these centers have policies and procedures in place to assist in the development of a new course with a study abroad component. In colleges without existing international education programs, policies will need to be developed regarding logistics including travel arrangements, costs and payments, housing, language issues,

recruiting and selecting participants, and ensuring the health and safety of all participants. Organizations that can assist with the development of these policies include NAFSA, an international association whose mission is to advance international education [6], and IEE.

Course Development

The author is developing a new course, *Renewable Energy Technology: a global perspective*, to be offered in the Spring semester, 2012. The course will begin with a two-week study abroad component in Central America in early January, and then follow with a classroom-based course that will continue for the rest of the semester. Students will draw on their shared experience in the field to inform and complete the coursework. Topics and assignments will include:

- Creating and presenting a slide show to inform others of their experiences.
- Linking their experiences with additional studies of the culture of the region.
- Comparing the energy use of the region visited with energy use in the US and in at least two other countries.
- Investigating the potential for renewable energy development in the region visited, the US, and other areas.
- Studying the economic and environmental issues of the region visited, especially in areas relating to energy use.
- Exploring political and social issues surrounding energy use in the region and the world.
- Evaluating the potential contribution of energy efficiency measures to meet energy needs.

The course will be open to students in any major; Physics I will be a prerequisite so students have an understanding of the principles of work and energy.

Conclusion

There are significant challenges and benefits to developing and teaching a course with a short-term, faculty-led study abroad component. The potential benefits for students, including cultural and academic growth, increase in maturity, and impacts on career development and world outlook, are significant. A course in renewable energy technology and environmental issues, with international travel, is being developed to enable students to experience these benefits.

[1] Wheeler, David L., "More Students Study Abroad, but Their Stays Are Shorter." Chronicle of Higher Education Nov. 17, 2000, Vol. 47, Issue 12.

[2] Institute of International Education. (2010). "Fields of Study of U.S. Study Abroad Proceedings of the 2011 ASEE Northeast Section Annual Conference
University of Hartford
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Students, 1999/00-2008/09." Open Doors Report on International Educational Exchange. Retrieved from <http://www.iie.org/opendoors> on 3/17/2011.

[3]Institute of International Education. Mission and Values. Retrieved from www.iie.org/en/Who-We-Are/Mission-and-Values on 3/18/2011.

[4] Akerstorm, Lola A. "The 50 Most Inspiring Travel Quotes of All Time." Brave New Traveler March 8, 2008. matadornetwork.com

[5] Dwyer, Mary M., Ph.D, and Courtney K. Peters. "The Benefits of Study Abroad; New Study Confirms Significant Gains." Frontiers: The Interdisciplinary Journal of Study Abroad www.frontiersjournal.com/backissues.htm

[6] NAFSA: Association of International Educators. www.nafsa.org