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International Experience and Service in Developing Graduate Student Soft Skills

Introduction

This paper describes the new graduate student international experiential learning course developed at the University of Alabama College of Engineering (UA-COE) at and the tools used to evaluate learning outcomes. The course was funded as part of a 2008 National Science Foundation Graduate-K12 (NSF G-K12) grant for five years, after which time it is slated for institutionalization as an elective within the college graduate curriculum. The goals of the program are the development of an understanding through experience of engineering as a rapidly globalizing profession, the challenges facing engineers in a developing country, the development of professional “soft skill” learning outcomes not easily taught in traditional classrooms and to get first-hand experience in what engineering is ultimately about: building things that make people’s lives better. Components of the program include service learning project development, management and installation and the development of leadership, teaming and communication skills set within a developing country - Peru. The service learning component was the installation of 18 solar panels in three remote Peruvian Amazon villages. The service part of the graduate course, built upon previously established UA-Peru connections, involved the conception, planning and installation of a project in remote Amazonian villages. Students live and work with villagers on installations in accordance with the Engineers Without Borders™ model. Other components involved the student generated planning and participation in a teaming exercise and deconstruction study of the ancient engineering marvel Macchu Picchu. This involved a three day hike from 9000 ft. to around 15,100 ft in the Peruvian Andes. Internal and external evaluations of student learning were performed using Likert Scale and open answer questionnaires. Assessing the experience in a post-trip survey, students rated the development of teaming, communications, and experiential learning skills as particular strengths of the program.

Background

The International Engineering Service Learning Program at The University of Alabama was established to incorporate these opportunities for growth into the student learning experience to prepare students for the challenges of the modern engineering profession. It does this by preparing students to serve as effective, engaged, and ethical professionals by promoting and supporting student engagement in meaningful service for academic credit. The three hour elective General Engineering Studies (GES) course is offered at both the undergraduate and graduate levels, with the graduate students assuming more of the responsibility and leadership roles on planning and projects.

International Collaborators

The engineering service experience in Peru was structured within the Engineers Without Borders™ model. This program integrates interdisciplinary engineering service learning with community partners, practitioner oversight, and faculty mentoring. Strong

collaborations were established with Peruvian partners from Nature and Culture International and Programa de Conservación y Uso Sostenible de la Diversidad Biológica (Program for Sustainable Use and Conservation of Biological Diversity) in Iquitos, Peru. They provided logistical assistance and community liaison. In addition Universidad Particular De Iquitos (University of Iquitos), the local engineering college, (is it exclusively engineering or did the engineering college from the University of Iquitos join you) gave us access to field equipment and joined our students and faculty on field testing, surveys, group discussions, shopping for supplies for our upstream village projects, and evening social outings.

Service project

Our target communities were five remote Amazonian villages accessible only by boat from the city of Iquitos in the Amazon Jungle of Peru. Iquitos is the largest city in the world with no access by road. Student-generated service project ideas were developed from conversations with the community during an initial survey trip. This was followed up by two campus-based design projects. A capstone senior design team designed an observation tower to attract eco-tourism dollars, and an independent study technical elective student designed a primitive wastewater latrina (latrine) system. Two project installation trips to Peru followed. Projects resulting from this collaboration include soil, water percolation, and topographic surveys, a generator installation to hook up village lights, latrine installation, and most recently the installation of 18 solar panels in three villages. Successive groups are attempting to build upon the successes and failures of the previous team. Future teams will construct two rainforest observation towers in sensitive bio-diverse habitats. This is part of a wider effort to give local communities sustainable income from eco-tourism in order to prevent deforestation for subsistence agriculture.

Course Components

Elements of the cross-college program include revolving leadership and multi-disciplinary teaming roles in satisfying pre-, peri-, and post-trip project deliverables. Students are required to incorporate realistic limitations such as technical, economic, sustainability, environmental, cultural, ethical, and social constraints and on-site procurement, project management, and implementation into the project scope. Reflection through daily journal entries and evening project meetings reinforced experiential learning. Course outcomes and experiences were evaluated through an end-of-trip report and assessment survey.

Evaluation

Students participate in formal internal and external post-trip assessments. The internal assessment has two parts. In the first section students score elements of the experience using the five-level Likert scale to evaluate 12 course elements. In addition, the students are asked four open-ended questions that allow for both qualitative assessments and additional comments (Table 1). Students agreed strongly that the course was an effective learning experience with regard to communication, learning outside the classroom, teaming, and assessment of societal impacts and leadership. In the qualitative section, students were asked to identify five areas of learning not found in a traditional classroom categories were related to positive aspects of: communications, cultural

appreciation, teaming, ingenuity, leadership, personal growth, and the value of the international experience. Interview data supports these findings. The student assessment is consistent with feedback the faculty instructors have received consistently following similar service learning trips. Service and experiential learning has a profound effect on the graduate student educational experience, with similar rewards for participating faculty and spin-off effects on the future engineering profession.

In the external evaluation individual interviews are conducted with each participating graduate student to gauge their overall impressions of the experience. These results of this survey (Table 2) corroborate the outcomes of the internal evaluations. Students revealed that they believed they developed better communication and teaming skills because they had to work closely with each other for many weeks. They felt they developed better skills for problem solving and conveying engineering concepts to unfamiliar groups of people. Fellows identified many “people skills” that they would be useful for their future in engineering. These include having a friendly demeanor and being open-minded toward cultural differences. They noted that language differences can be a problem when working outside the US.

The students also recognized that bringing the solar panels to the Amazon communities would dramatically change the villagers’ way of life. One of the main benefits of the solar panels was that it brought light to the evening hours, allowing villagers to work and cook after dark. One Fellow felt “humbled and proud” to contribute to the villages in this way.

Table 1 Internal Likert Scale Evaluation

Specific Course Learning Outcomes	Average
This trip was a valuable learning experience with respect to:	
functioning as a member of a team.	4.6
developing leadership skills.	4.0
developing organizational and communication skills.	5.0
experiential learning without the aid of formal instruction.	5.0
examining possible/actual economic, environmental, and societal impacts of a specific, relatively constrained engineering solution.	4.8
project management in an international setting.	4.8
understanding the importance of stakeholder (village) input to project planning, scheduling, and/or installation.	4.6
professional career development.	4.8
experiencing another culture.	5.0
my own personal growth experiences.	5.0
expanding my view of the developing world.	5.0
I would recommend this trip to peers.	5.0
Overall Average	4.8
5 strongly agree, 4 agree, 3 neutral, 2 disagree, 1 strongly disagree	

Table 2 Graduate External Evaluation

Question	Collated Graduate Responses
<p>1. What were your expectations for the Peru experience in general going into it (regarding travel, culture, living conditions, the humanitarian aspect, etc.)? How was the reality different from your expectations?</p>	<ul style="list-style-type: none"> -thought location would be basic/primitive -travel was better than expected, thought it would be basic/primitive -thought people would be less civilized -thought there would be more air travel, less boat travel -knew it would be less developed than here -expected language to be an issue; more people spoke English than expected
<p>2. A trip like this requires a lot of time working with the same team of people for several weeks. How did that go? What did you learn about communication, leadership and team work?</p>	<ul style="list-style-type: none"> -became like a family -everybody worked together well, got along -successful communication -when some members got sick, everyone else stepped up -villagers became part of the team during solar panel installation
<p>3. What were some of the issues or obstacles that you think are important to recognize when working in a different culture, especially one that is so much more primitive than the US?</p>	<ul style="list-style-type: none"> -language barrier; even guides were not fluent in English -need to be careful about what you eat
<p>4. Tell me about installing the solar panels in the Amazon villages you visited. How do you think it will change the village? (for the better, for the worse, short-term and long-term effects).</p>	<ul style="list-style-type: none"> -meant a lot to the villagers; they were very enthusiastic and appreciative -we felt humbled and proud to contribute in this way -the villagers helped a lot -could not install as many as we wanted -it will make a big difference for them to be able to work and cook after dark -frees up daylight hours for other things
<p>5 Tell me about your experiences with the villagers in general. Reception Working together for a common goal</p>	<ul style="list-style-type: none"> -everyone was extremely helpful -the kids were fun to play with -positive interactions with everyone -they had things for sale that we bought
<p>6 Are there ways in which you feel that the Peru experience will be applicable to your experiences in Sumter County?</p>	<ul style="list-style-type: none"> -learning to communicate with unfamiliar groups -using the Peru experience as an example of an engineering project
<p>7 How do you think this experience will be useful to you in your future engineering career?</p>	<ul style="list-style-type: none"> -feel well-traveled -hands on engineering experience -experience with the culture; might like to work there long-term -experience dealing with unusual or unfamiliar obstacles -ingenuity and thinking outside the box
<p>8 What skills do you think it takes to work in a different culture? (communication, teamwork, leadership, appreciation for other cultures?)</p>	<ul style="list-style-type: none"> -being nice and approachable goes a long way -being accepting of differences; open-minded -communicating not only in general but communicating engineering concepts -thinking outside the box and finding alternative uses for things
<p>Tell me about your side trip to Machu Pechu? (low priority question) What was the value of looking at these ancient examples of engineering?</p>	<ul style="list-style-type: none"> -great and scary (safety issues) -interesting to see such ancient things -earthquake-proof measures are an ancient example of engineering -figuring out why different aspects were necessary structurally -amazed at the longevity of buildings built without modern technology -realizing how much of engineering is trial and error
<p>10. Other comments?</p>	<ul style="list-style-type: none"> -needed to be prepared for a lot of outdoors experiences (bugs!) -all you can do is play it by ear

