Design and Administration of Interdisciplinary Community Development Service-Learning Programs

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Abstract

Community development courses developing countries provide an excellent opportunity to provide engineering students with a relevant, hands-on, design-build opportunity that will develop their planning, team building, and leadership skills and enhance their design skills while serving a developing community. However, there are additional requirements and costs that must be addressed.

This paper presents two different models of incorporating community development into an engineering student's education. The University of Arkansas (UA) has administered an interdisciplinary service-learning summer study abroad program in Belize for the past decade. In the UA program, students spend one week meeting on campus in May and then travel to Belize for three weeks and receive course credit for both engineering and humanities during the summer. At Messiah College, community development projects are integrated into the five-semester for-credit capstone design experience and the students take optional non-credit implementation trips to the communities during the three-week January or May sessions.

Both models offer advantages and drawbacks. This paper discusses lessons learned in these programs and compares and contrasts different aspects of the programs. Course design, administration, and management challenges include combining interdisciplinary cooperation while meeting engineering educational objectives, managing students during international travel, and working with local partner organizations.

Keywords

community development, study abroad, developing countries, service learning

Introduction

Each year, over 300,000 US college students study abroad[1]

The best programs are interdisciplinary, involving students from outside engineering and involving engineers in the non-technical aspects of the project. Passino[3] says that "considering the intrinsic role of technology in extending human capability, it is inevitable that engineering will become a 'helping profession' like social work, psychology, education, and health care" and that humanitarian engineering naturally leads to interdisciplinary education and cooperation.

Community Development courses have the potential, as real-world, problem based learning courses, to address each of the eleven ABET a-k Outcomes. A team of students must understand the contemporary issue, communicate with local stakeholders to devise a solution applying their knowledge of engineering while understanding the impact of their design, and most likely they will need to expand their know through lifelong learning practices to formulate a design that takes into account sustainability, practicality, and functionality. Recent assessments of service learning (SL) studies have shown that students achieve equal mastery of technical skills compared to traditional course approaches [4,5,6]; but, the real advantage of SL activities are gains in non-technical skill development and confidence in abilities. In particular, Bielefeldt et al.[7], reviewed several studies and found that, as compared to traditional courses, project-based service learning was slightly more effective at teaching students knowledge and skills, with the greatest gains in social and moral skills.

An advantage of project-based courses, including community development courses, is that students who are better at projects than at classroom performance are given an opportunity to shine. We have observed that marginal classroom students can really rise to the occasion when they are given responsibility for projects, especially if that project aligns with their passion and purpose. Short-term service trips can be justified by the educational and life experience value to those who are traveling[8]. Kollman and Tomas-Morgan[9] observed that international service-learning trips "showed significant changes in the worldviews of student participants".

The University of Arkansas Belize Program

In 2006

The program originally included a spring semester prerequisite UA class “Community Development in a Global Context” and the summer experience was two weeks on campus followed by four weeks in Belize. The program evolved into its current form due to reconsiderations on the demands on students and faculty, an evaluation of costs of the program to the students and the institution, and the assessment that course objectives and contact hours could be accomplished with the current model.

There have been as many as 85 students in one summer in the program. Faculty members from many colleges and departments have implemented an interdisciplinary, international, service-learning experience. Faculty members have come from engineering, business, social work, public health, ecology, education, English, biology, agriculture, anthropology, and dietetics. The projects are selected by the faculty members with the assistance of an international non-governmental organization (NGO) on contract with UA. Projects have included: micro-loans, water treatment, computer education, health screenings, aquaponics system, business education,

Currently there are over 40 project teams categorized into 12 sectors: water, health, disability resources, transportation, energy, communications technology, sustainability, education, biomedical, infrastructure, economic empowerment, and advancement. Notable projects include the award-winning bridge team who designs and constructions pedestrian bridges in rural Panama. The Intelligent Water Project team developed a technology to remotely transmit real-time operating data from handpumps in rural villages to an NGO's office. They have installed 20 units in Ghana for their client World Vision and have spun off a business to manufacture and install the units. The Raptor Hand team uses 3D printing to produce low-cost prosthetics and has made prototypes for a young girl in Philadelphia who is using it.

The Collaboratory is open to students from any major, but engineering is the only major that receives academic credit for their participation, and engineering students are required to participate, so over 70% of the students active in the Collaboratory are engineering students. About 40 professionals from outside the college volunteer as project advisors.

The five semester project course sequence begins spring of sophomore year and the project courses are: Project Planning, Project I, II, III, IV. All engineering students in the sequence meet during a common project time, most teams in the 9,000 square foot dedicated project space opened in 2015. Faculty receive course load credit for overseeing the project classes. The Collaboratory operated from the late 90s until 2010 as exclusively a volunteer organization with students not receiving academic credit and faculty not receiving course load credit.

Many teams go on implementation trips for their projects during Messiah's three-week January term or three-week May term. They do not receive additional credit for these trips and the faculty who accompany them are not compensated with course load or salary.

Project partners are mostly small charitable organizations working overseas, including a number of Christian missionary organizations, and most projects have their applications in developing countries. Funding is mostly through general and project specific private donations. The large i

dollars. At Messiah, the objective is technical innovation in service to the client. At UA, early in the program we wanted to do "real engineering" including design rather than just a construction project. However, short-term trips with students don't always lend themselves to "real engineering" and some years the projects were simply construction projects. We have endeavored, however, to undertake projects that expose locals to technical innovation or new applications. In addition to the non-technical value of the study abroad experience to the students and to the community, technical innovation and new application are appropriate roles for a student engineering team. As with any new application or research, however, there is a risk that it won't work.

Common Factors Between the Two Programs

Looking at the two programs, the following observations are common to both:

- Initial period of uncompensated time by faculty.

  Although in both cases the institution was supportive of the idea of establishing the program, it took several years of faculty administration without compensation before load credit was allocated to administering the program. In some ways it was a passion or hobby before it became part of the job.

- Initial monetary investment by institution.

  Before the programs were able to sustain themselves through tuition, study abroad fees, and other funds, the institution made investments to get the project going. At UA, the Honors College made an initial investment. At Messiah College, The Harsco Corporation and a private donor made significant donations along with the College to form and expand the organization.

- It's all about the partners.

  The UA Belize program relies on their partner NGO to connect the student teams to local partners. Both the NGO and those local partners are crucial to pulling off the project. At Messiah, the Collaboratory and the students work directly with the local partners, but the partner organizations are carefully screened and vetted before students are allowed to visit them. As with UA, the success of a Messiah College project depends a great deal on those local partners.

- Imperfect success rate.

  At UA, in the months leading up to the summer program, a number of different projects are proposed and explored. Many of these are not selected and some of those projects that look promising fall through for various reasons. Of the projects selected, some are more successful than others with the major factor being the cooperation of the local partner, although there are also technical, logistical, planning, and performance reasons that projects are unsatisfactory.

The experience is somewhat similar at Messiah, although the projects and partnerships

Messiah's most famous alumnus and trustee, much of the Messiah campus holds a more traditional "publish or perish" view of scholarship. Vernaza suggests actively publishing on student projects to bridge this gap. Such publishing does require additional planning and documentation and venues for publishing these types of papers are limited.

Summary

Project-based, service-learning programs for engineering students serving developing communities are exciting for students and faculty. Well-planned programs can fulfill required engineering outcomes, provide a valuable and transformative experience for the students, and positively impact the target community. There are challenges to establishing and administering such programs and faculty who have a passion for these programs must "count the cost" before getting involved. This paper has described two different program models at two different institutions that are endeavoring to impact their students and developing communities.

The University of Arkansas has had many successes and lessons with its Belize Study Abroad Program. The successes include over 400 students who have participated in the program. The lessons include a number of improvements that have been incorporated into the program. The lessons have made the program stronger and contributed greatly to the overall success of the program. Anonymous student surveys at UA have shown that the students felt that the courses have contributed to their global understanding, improved their communication skills, enhanced their team building and leadership skills, and improved their understanding of how to design to meet the client's needs and capabilities. The University of Arkansas has made the commitment to continue the Belize Community Development Program and expand to other countries with similar programs (Mozambique and Vietnam).

At Messiah College, applied research projects with developing communities have been integrated into the engineering curriculum. This program distinctive is attractive to students and highlighting the program has helped Messiah to double the size of their engineering student population in the past decade. The program continues to evolve and grow as we continue to learn how to improve.

References

1 NAFSA, (2015) Trends in US Study Abroad http://www.nafsa.org/Explore_International_Education/Advocacy_And_Public_Policy/Study_Abroad/Trends_in_U_S__Study_Abroad/, accessed 7 Oct 2016

2 Institute of International Education, http://www.iie.org/en/Research-and-Publications/Open-Doors/Data/Fast-Facts#.V6IZLtj6taQ , accessed 7 July 2016.

3 Passino, K.M., (2015) *Humanitarian Eng-5(n).15 Ti3CID r2 ()10ptu2 Tw 3s*

7 Angela Bielefeldt, Paterson, Kurtis, and Christopher Swan, "Measuring the Value Added from Service Learning in Project-Based Engineering Education," International Journal of Engineering Education 26, no. 3 (2010), 535-546.

8 Johnson, P., "Direct and Indirect Benefits of an International Service-Learning Design Project: Educational Effects on Project Members and Their Peers", International Journal for Service Learning in