Design and Administration of Interdisciplinary Community Development Service-Learning Programs

T. Soerens, F.G. Edwards, and A. Farmer
Messiah College/University of Arkansas/University of Arkansas

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] and many more go on short-term service trips. Participation in study abroad courses by students from US universities has been on a dramatic rise for more than 30 years[2]. The ethic of using engineering skills to serve developing communities abroad is strong in the engineering field. Community development integrated into engineering courses provides 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 benefiting the partner community. These programs have impacted students profoundly, often changing the life course of a student.

© American Society for Engineering Education, 2016

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 University of Arkansas (UA) initiated new type of study abroad program, the Belize Study Abroad Community Development Program with multiple departmental course offerings. The Belize Program is open to any college or program at the UA and has a two-fold mission statement:

- To enhance the educational experience of students by allowing them to apply their acquired theoretical knowledge, gaining practical experience in their career field of interest in a unique and challenging global context.
- To encourage, support and engage in sustainable global development through multifaceted community collaborations.

The Belize Program is conducted in the summer and involves a one week academic preparatory course on the UA campus followed by a three week study abroad service project in Dangriga Belize. Students are able to gain the cultural experience of working with locals, and they are given responsibilities to create projects, generate innovative solutions to a vast array of difficulties that arise, and take leadership roles that students are rarely given to students.

© American Society for Engineering Education, 2016

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, building public structures, water management plan, coastal erosion evaluation, fitness and sexual health workshops, documentation of flora and fauna, home hospice visits, and work with special needs children. Students are responsible for successful completion of the projects in their area of study; but, are highly encouraged to work with other groups to gain a broader perspective of the community and learn how the other groups are working to address the community's needs.

For the first five years of the UofA Belize Program, a faculty member was the administrator for the program; but, was not compensated for their efforts. The workload was significant; but, no administrative financial support was allocated to program. When a similar program for Mozambique was added, the university administration appointed the faculty member as director of the two programs and allocated 15% of their nine-month appointment salary as summer pay.

The UA Belize program is facilitated by the contracted NGO who works in Dangriga ahead of the summer program to line up projects and does much of the logistics. For the first two years of the program, UA sent recent grads to live in Dangriga for the months preceding the summer program to make partner connections and help set up the program.

Messiah College Integrated Project Curriculum and The Collaboratory

Messiah College is a faith-based private institution in Pennsylvania with about 3000 students including about 300 engineering students. The engineering program incorporates an Integrated Projects Curriculum (IPC) where students receive academic credit for working on real projects for real clients in what is essentially a five-semester capstone design process. The projects are administered through an on-campus organization called The Collaboratory for Strategic Partnerships and Applied Research. The vision and mission statements of The Collaboratory are:

- To increase hope and transform lives through education, collaboration, innovation, and service.
- To foster justice, empower the poor, promote peace and care for the earth through applications of our academic and professional disciplines.
- To increase the academic and professional abilities of participants, their vocational vision for livelong servant-leadership and their courage to act on convictions.

© American Society for Engineering Education, 2016

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 NGO World Vision has been a major partner and funding source for a number of projects and student teams have performed funded research for other clients as well. Since the establishment of the IPC to award course credit to students, some college lab fees and maintenance funds are allocated to the projects.

The Collaboratory currently has three full-time positions: Director, Program Manager, and Engineering Projects Director, as well as a part-time Administrative Assistant and a student manager and assistant manager who are employed part-time during the academic year and the summer.

Finding a Place and a Purpose

This paper focuses on the faculty view of the project, its administration, and the student outcomes. Of perhaps more importance is the impact on the community. We want to do something more valuable than spending tens of thousands of dollars to send an unskilled student team in matching tee shirts to paint a school that could be painted by the locals for a few hundred

© American Society for Engineering Education, 2016

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.

© American Society for Engineering Education, 2016

The experience is somewhat similar at Messiah, although the projects and partnerships are longer term and the field applications are only undertaken when there is a specific purpose for the trip. Still there are projects and site visits that fail to achieve their objectives or that implement projects that are not sustained.

Some of the problems can be avoided by better planning and evaluations. Amadei[10] has recommended a systems approach to modeling community development projects and has also compiled a guide to planning and evaluating the types of projects undertaken by student teams[11].

Discussion of Differences Between the Programs

The primary difference between the programs in the student experience is the interdisciplinary nature of the program. In the UA program, somewhere between 40 and 90 students from widely different majors along with faculty from those majors show up in Dangriga, live together, eat meals and hang out together, party on weekends together, and circulate around town on the different projects. It's a community atmosphere. The Messiah project trips are a small team from one project who go to a place for a very specific technical purpose. At Messiah, there is a Monday night Collaboratory chapel that many students and faculty go to, and smaller Collaboratory "discipleship community" groups of students and faculty who meet together weekly, along with many social events and retreats, so there is a community atmosphere on campus, but the international trips tend to be shorter and lack that big group community atmosphere that is a great part of the UA experience.

At Messiah, the on-campus design and planning is credit-bearing, while the field experience is not. At UA it's the opposite. At UA, the in-country experience is the major thing and the planning during the preceding spring semester is extra for the students and faculty. At Messiah, the field site trip visit is seen as a culmination of the project work, but usually not all the project members can come up with funding for the trip. For the faculty, they may not be able to join the team for the trip because they may need to teach during the January term. During the May term, the faculty would have to take time away from research or other work to join the team for an uncompensated trip during their summer release time.

Common Challenge: Financing

The challenges involved in establishing and administering the two programs are similar and fall into a couple categories. The most obvious challenge is financing the program. We will first discuss the challenge to the students to finance their trip. Unfortunately, the students who can afford the trip and the students who would benefit most from it are not the same. At UA, many of the students who go on the study abroad trip have their study abroad fee and tuition paid by scholarships, especially the very generous Honors College fellowships. As mentioned previously, the students who are more project-oriented rather than classroom oriented could benefit greatly from the program, but they don't tend to have these fellowships. An interesting side-bar to that is that the Belize program was initially intended for upperclassmen, but because underclassmen are more likely to still have money in their fellowships or have not lost it due to grades and upperclassmen are more likely to have work or family obligations that prevent them

© American Society for Engineering Education, 2016

from going, it has turned out that the student cohort in the program includes many underclassmen[12].

At Messiah, the students must raise their own money for travel. Because it is not a class, it cannot be paid for by scholarships or financial aid. Like at UA, the students who have family funds or are good at raising money are not the same as those who could benefit most from the trip. The Collaboratory has started to address this by establishing a travel scholarship fund and centralizing some of the fund-raising so that a portion of the funds the individual students raise is allocated to the scholarship fund. This program has just started and it remains to be seen how the donors respond to this – whether they object to some of the money they give for an individual student going into a central fund.

Funding the faculty travel expenses and salary at UA is done through the tuition students pay for 6 credit hours, 3 engineering and 3 humanities, and through a portion of the study abroad fee. Some of the teams split the time and funding between two faculty members who each are there for half of the trip. Travel expenses are paid by UA through the NGO with the NGO maintaining a fund that can buffer some of the variable and unexpected expenses.

At Messiah, the faculty are uncompensated for the trips by either salary or course load credits, and often pay their own way or raise their own funds if the project or the sponsor cannot pay the travel. The new travel scholarship fund mentioned previously can also be used by faculty, but faculty are expected to contribute to or raise funds for much of their travel.

The three-week May term at Messiah is exclusively for cross-cultural courses, most of these overseas. These are humanities courses with specific required objectives and are not a good fit for performing an engineering project. They are three-credit classes and are officially part of the spring semester and are typically an overload for the faculty paid at the College's adjunct rate. I (T. Soerens) did form a Belize cross-cultural course and had it approved through the college, but I have never offered it because I chose instead to do research and other better paying options during May.

Common Challenge: Faculty Reward Structure

Project-based learning in general and community development in particular are not great fits for the University reward structure. These undergraduate projects are often front and center in a University's public relations, but are not considered scholarship and are not rewarded in tenure and promotion decisions. Time put into community development projects can be counterproductive to pursuing tenure and promotion and faculty who have a passion for these projects face a tough choice. There are anecdotes of chairs or deans discouraging junior faculty from joining these projects or suggesting they pull out if already involved, which is likely good advice for their career advancement.

Vernaza et al.[13] argues that such a student project should be considered as "scholarship of engagement" under the Ernest Boyer model of scholarship[14]. The engineering department at Messiah supports this assertion and further argues that if a project is well-received by the client and the community it has been "peer-reviewed". However, in spite of Ernest Boyer being

© American Society for Engineering Education, 2016

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 Engineering. Creating Technologies That Help People*. Bede Publishing, Columbus, OH.

4 Bischel, Heather N., and Eric R. Sundstrom. "5-Year Evaluation of a Course Model for Student-Initiated Engineering Service Learning." International Journal for Service Learning in Engineering, Humanitarian Engineering and Social Entrepreneurship 6, no. 1 (2011): 1-13.

5 Bielefeldt, Angela R., Mandar M. Dewoolkar, Kevin M. Caves, Bruce W. Berdanier, and Kurtis G. Paterson. "Diverse models for incorporating service projects into engineering capstone design courses." International Journal of Engineering Education 27, no. 6 (2011): 1206-1220.

6 Xiaoqi Zhang, Nathan Gartner, Oguz Gunes, and John Ting, "Integrating Service-Learning Projects into Civil Engineering Courses", International Journal for Service Learning in Engineering 2, no. 1 (2007), 44-63.

© American Society for Engineering Education, 2016

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 Engineering, Vol. 4, No. 1, Spring 2009, pp. 15 – 30.

9 Kollman, P., and R. Tomas-Morgan, "International Service-Learning in Faith-Based Contexts", in Green, P., and M. Johnson, eds. (2014), *Crossing Boundaries: Tension and Transformation in International Service-Learning*, Stylus Publishing, Sterling, US.

10 Amadei, B., (2015), *A Systems Approach to Modeling Community Development Projects*, Momentum Press, New York

11 Amadei, B. (2014), *Engineering for Sustainable Human Development, A Guide to Successful Small-Scale Community Projects*, ASCE Press, Reston, Virginia.

12 Soerens, Thomas, and Carol Gattis. "Global Community Development Village Network: An Interdisciplinary International Service Learning Model," International Journal for Service Learning in Engineering, Vol 4, no. 2 (2009): 34-47

13 Vernaza, K., Vitolo, T., Brinkman, B., and Steinbrink, S., "Service Learning as Scholarship of Engagement and Its Relationship to the Academic Reward Structure", (2013) International Journal for Service Learning in Engineering 12/2013; Special Edition (Fall 2013):84–97.

14 Boyer, Ernest, *Scholarship Reconsidered: Priorities of the Professorate*, The Carnegie Foundation for the Advancement of Teaching, 1990.

T. Soerens

Thomas Soerens is Associate Professor of Engineering at Messiah College in Pennsylvania where he works with The Collaboratory for Strategic Partnerships and Applied Research. The Collaboratory has over 200 students and 30+ professionals working on 40+ projects in 16 countries. He was previously at the University of Arkansas where he participated in the Belize program.

F.G. Edwards

Findlay Edwards is an Associate Professor in the Civil Engineering Department at the University of Arkansas – Fayetteville. He has lead College of Engineering a study abroad course in India and the Belize Community Development course for three years.

A. Farmer

Amy Farmer is a University Professor of Economics and holds the Margaret Gerig & R.S. Martin, Jr. chair in Business at the University of Arkansas – Fayetteville. She is also the Director of the Global Community Development Program which leads interdisciplinary student service learning teams in Belize, Mozambique and Vietnam. She is an applied game theorist specializing in law and economics strategy and economics of the family.

© American Society for Engineering Education, 2016