



## **A Student Review of an International Service Learning Program in Peru: Successes and Lessons Learned**

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## **Abstract**

This paper presents an “in-their-own-words” student evaluation of the value of international service to engineering education with the purpose of reconciling faculty perspectives and student perspectives. Engineering educators speak in an institutionalized language of objectives and outcomes which relate the intent of educational activities with their impact on student knowledge and preparation for the profession. Most often, this specialized vernacular is not shared by students; and their perception of the importance of various activities may depart from the perception held by the educator. Also, the international landscape experienced by outward bound millennial (and post-millennial) students reflects a much different set of world affairs than their professors would have encountered if they embarked on similar programs during their own time in college. Students who have recently returned from an international service experience in Andean Peru report their perception of the value of the trip by responding to the following prompts: 1) what was the significance of service learning to your professional development?, 2) compare the value of international experiences with the value of similar domestic experiences, 3) was service learning effective at developing technical skills? and, 4) what motivated you to incorporate international service learning into the cramped engineering curriculum? For comparison, the two faculty organizers also responded to the same prompts.

While not all student responses were the ones anticipated by the program organizers, the students’ perceptions are useful to the planning and marketing of future international service programs. By applying the evaluation and critique of this round of program participants to promoting future trips, the organizers will be able to better encourage engineering students to engage in international experiences during their college career. Summary statements are presented regarding the perceptions of this batch of students. Finally, conclusions incorporate planning choices made based on student input.

## **Introduction**

An international service club (ISC) was established at The University of North Carolina at Charlotte (UNCC) in 2009 with the intention of providing opportunities for engineering students to travel and to participate in service projects centered on international development. The club grew rapidly in membership and established relationships with a university in Peru as well as an Andean community near Cuzco, Peru. This community has twice been the destination of ISC students during summer trips. Although student interest in the program has been high because of its social, adventure and altruistic components, undertaking it as a university entity requires justification from a student development standpoint. There are many venues through which young travelers might make overseas excursions and engage in community service, however, students participating through a university would be expected to develop knowledge and skills in the process.

In planning the international study trips, the two leaders, both Civil Engineering faculty, anticipated many benefits related to professional development. Whether or not the students shared these objectives or found them to be apparent in the delivery of the program is the subject

of this paper. Students who attended the trips responded to prompts to describe: 1) how service learning helps with professional development, 2) the importance of international experiences versus domestic ones, 3) whether the trip developed technical skills and, 4) the primary motivating factors that urged them to join the trip. These responses are compared with responses from the faculty leaders.

## Background on engineering student service and international education

The professional practice of engineering has been changed by emergent 21st century challenges, which include a globalizing workforce, newly evolving disciplines and increasingly complex, multidisciplinary problems. This environment tests the traditional skill set provided by collegiate engineering programs, which predominantly focus on developing technical abilities in students. Professional development and “soft skills” are expected to be acquired through internships or co-ops or picked up on the job. Two other activities that might develop the soft skills are service learning and study abroad, both of which are less frequently found in the careers of STEM students than liberal arts and humanities students.

Service learning is an instructional technique that engages students in a community-based service activity in order to reinforce knowledge and skills learned in the classroom. The benefits seen in students from many majors can be broadly characterized as the creation of a strong foundational basis for the batch of specialized courses that constitute a student’s focus area. This has been manifested through slightly higher grades achieved in subsequent in-major classes by students who engaged in early service learning [1]. Benefits also accrue to campuses that embrace service learning through the development of a culture of service on the campus [2]. Engineering programs do not have as strong a precedent for implementing service learning within the curriculum as other pre-professional or arts & sciences programs. However, it is reasonable to hypothesize that the scaffolded structure of engineering curricula, in which students progress through a dependent sequence of basic engineering classes, would benefit from the creation of strong foundational basis, which service learning experiences tend to do. The study of service learning in engineering education research indicates that it and other active pedagogies stimulate learning and engagement [3]. Further, it is an alternative to co-ops and internships that also leads to development of professional skills that are difficult to build in the classroom [4].

Study abroad programs have consistently been associated with development of academic skills, intercultural awareness and confidence in students [5]. However, the prevalence of engineering students participating is very low. Often they require specialized formatting in order to be compatible with low-flexibility engineering curricula [6].

The presence of these two features in engineering programs may help to invite a greater diversity of students to study engineering. An increasing number of contemporary students are expecting to include study abroad and service in their college experience. These students may gravitate to majors with a stronger precedent and reputation for encouraging such activities. Already, service learning is used in high schools with the goals of exposing students to the STEM fields [7].

A 40 year history of demographics and student attitudes charted in The Higher Education Research Institute snapshot of entering freshman classes shows a rising tide of interest in service during college. In 1990 the survey found that 16.9% of students thought there was a very good chance s/he would participate in community service or volunteer work. In 2006, this proportion

grew to 26.8% and in 2011, 33.9% [8, 9]. It is clear that the orientation towards service is being rapidly embraced by all students.

Service may also be a link to attracting more students from chronically underrepresented groups. Pryor's data also shows an even stronger affinity for service in students attending historically black colleges and universities (HBCU). 79.7% of 2011 HBCU survey respondents indicated that helping others is very important or essential to them (higher than students attending religious institutions) and 54.2% state that becoming a community leader is a very important or essential goal[9]. It is possible that this tendency towards service can be used as a recruiting and retention tool within engineering programs, too [10].

### Trip overview

The education abroad experience planned by the authors was centered on an engineering course entitled, "Engineering for Development Workers" (EDW). The objective of the class was to introduce students to knowledge and skills that would assist them in engineering positions with international development or relief agencies. Students were also offered either Structural Materials Lab or Geotechnical Engineering Lab. The central class, EDW, earned students three hours of course credit, while the labs lead to one hour of credit. EDW fulfilled the curricular requirement of "Technical Elective" for civil engineering students, of which six are required for graduation. The lab classes are mandatory for undergraduates to graduate, but are typically offered during the semester at UNCC.

### Course structure

EDW was organized as a three part course. During the first week, prior to departure, a multidisciplinary seminar series was offered to cover 1) history and economics of development and underdevelopment in Latin America, 2) social capital, 3) the ethical foundation of international assistance, and 4) the role of technology in development. Each of the lectures was offered by faculty from departments which encompass the topical area. Following the lecture series, the students traveled to Lima, Peru, where the second phase of the class convened. During this phase, the group met at the campus of the Catholic University of Peru and lectures were provided in English by faculty of this school. Because the faculty of the Catholica are specialized in rural development, lectures during this phase focused on appropriate technology, technology transfer and project deployment. Finally, students relocated to an Andean community called, Paru Paru. The team worked together with village leadership and local laborers to design and construct a pedestrian bridge that linked two parts of the community which become separated during the wet season.

### Introduction to students

A total of eleven students participated in the EDW course. Students attending the international trip mostly consisted of rising third and fourth year civil engineering students. There was also one graduate student from the Civil Engineering department and one graduate student from the Latin American Studies program. The program attracted four Latino students, three of whom were Latinas, and four female students total. These demographics exceed their prevalence in the general civil engineering student body.

## Student Perceptions

Student perceptions were solicited through a post-trip focus group session, held a few weeks following return, which gave the instructors an opportunity to evaluate student perceptions of the impact of the trip on their education, professional development and personal goals. Additionally, the majority of students submitted written answers to question prompts. We analyzed the focus group responses and individual written responses in relation to the question prompts for the written responses. Responses bulleted with a “●” were given in written statements and those bulleted with “○” were given during focus group discussion. The responses are relayed exactly as transcribed and have not been edited for grammar.

1) What was the significance of service learning to your professional development?, Student responses to this prompt were largely related to development of soft skills. Specifically, students cited social skills, communication skills, appreciation of ethics and globalization. However, students also mentioned benefits to career planning and to getting hands-on experience. Responses are paraphrased below.

- As a civil engineering student, the impact that the science of civil engineering can have on a developing area is seen literally by students, instead of theoretically glossed over in classes.
- The most obvious point is service learning provides hands on experience that is not offered routinely in classes that allow students to make mistakes and learn from their experiences that can apply to their professional career. These experiences may not even be pertaining to engineering, but more from social and communication needs that arise in project planning.
- This experience obviously brought a deeper understanding to students of the ethics an engineer holds. I also feel as though it also taught us to be more aware of everything. If there is one flaw through our work than the whole project can fail.
- The opportunity to participate in service learning was, for me, an important experience in my professional development because it brought into focus the possibility of working in development work. I believe it is important for students to explore this type of work for general perspective and as a possible career choice.
- In the professional development of engineering students, service learning has lasting benefits that cannot be found in a classroom setting alone. Service learning provides students to be able to see the cultural implication of their work on a small scale as well as gain the hands on experience that is typically missing from most classroom settings.
- Experiencing the communication issues was really important. I think because you don't learn that in a classroom at all, I mean you kind of do when you're planning and designing but when it comes to limitation, you don't learn that in a lab and so you get these communication issues in a community and everything I felt like that was an important thing and I think it kind of makes you learn a lot.
- I want to comment about the kind of career thing is that a lot of large companies now have an international base and so they expect you to certain part of your career to work internationally and they would like to see you have some international experience, a lot of the work is in developing countries and just knowing that we've done something like that could help you out in your career long term, it's just another way to look at it.

## 2) Compare the value of international experiences with the value of similar domestic experiences

Themes noted in student responses to this prompt included benefits of greater self-awareness, richer learning environments, connection to family heritage and the possibility the project to have larger impact on the community. Students seemed to prefer the potential benefits of an international project versus a similar domestic project.

- International experiences force a visiting student to immediately become cautious about how they carry themselves and how they speak to people from the foreign country.
- While in Peru I have to admit there was different living experience than one that I have ever encountered. Not only do you see how their daily life is, you also get a better understanding of their culture. You take that for granted in the United States, but I feel as though there is a limit when hearing others' stories.
- The international experience was, for me, more valuable than domestic projects because of my heritage that lies with the Latin American community. I was personally motivated to participate in this project because of the similarities in the community we worked with and my own family's community in rural Mexico. I believe that there is a lot to learn from working on a service project in an international community, particularly for perspective of the engineering field. While we may work on rather large scale or very technical projects at home, the international work provides perspective into the true simplicity of engineering in small communities and the radical impacts simple engineering may have on the client.
- Comparing domestic and international service learning projects in terms of the educational value, both can provide similar benefits in terms of understanding cultural implications as well as increasing technical knowledge. When working on domestic projects the element of learning about a new culture is eliminated, but does not take away from the student's professional development.
- It was interesting too to see the difference that everyone focuses on here in the states, in our area as far as professionalism and so, the difficulties and the things they have to get over as engineers and how different it is in other countries. We're not so focused on earthquakes or adobe here, we're more focused on steel and concrete or maybe hurricanes or floods or something of that nature, but in Peru it's completely different, their focus was on different materials and different hardships, problems, different hurdles that they had to overcome, it was just interesting how much it can vary but it's still the same basic foundation, like you still need most of the same engineering skills but it applies to a completely different set of problems.
- I think you touched on something that for me was the most rewarding thing. Umm is the things that we're able to learn that wouldn't be possible inside the classroom and I think that's what for me was the most rewarding for study abroad umm for example there's so many facets involved in projects like this that you can in a classroom talk about the sociological perspective, how the political systems, economic systems, ethics and all these things, but until you get there and start encountering problems and try to figure out how to overcome these obstacles, you don't really appreciate the significance of what is really being given to you in a classroom I think you get so much more in two or four weeks studying abroad than you could do here at home.

## 3) Was service learning effective at developing technical skills?

Students indicated agreement that service learning was effective at developing technical skills. The manner in which the experience helped was related to having to perform engineering tasks with limited engineering resources. This required revisiting fundamental concepts. Students also mentioned the hands-on nature and attention to all phases of the design process were useful to their practicing technical skills.

- As previously stated, technical skills are developed quickly and sometimes on the fly because of the time crunch created from the project circumstances. (ie: designing the bridge w/o software, printers, etc). Hands on experience also developed in construction process not commonly offered in classroom exercises.
- Yes, you're not only posting ideas amongst yourselves, you are also trying to figure out which one is the best. This task placed technical, economical and sustainable challenges that can be seen anywhere around the world. After having your idea set to a certain project, you are also there to build it with your own two hands. This allowed a visual and hands on demonstration of how things function. Even though the projects can be basic, I felt as though in a classroom you can imagine the problem as much as you want but when you are building it you understand the functions better.
- I believe that the service learning opportunity we had was effective in developing basic technical skills which can be incorporated into any project. Along with the development of basic technical skills a more important aspect involved the development of soft skills and relationship perspective between a client and engineer. Through the project set up, it was easy to experience first-hand how a project must be developed in order to accommodate the needs of the client and at the same time the appropriate methods which should be taken to analyze the needs of said client.
- Service learning can be an effective method for developing students' technical skills. These projects can require a simplified design method, but students are able to understand the overall design process and how the system as a whole will work and be implemented. This system based design is uncommon in an undergraduate curriculum, as most course work, rightfully so, is focused on components of the overall system.

4) What motivated you to incorporate international service learning into the cramped engineering curriculum?

Students responding to this prompt indicated that incorporating service learning was related to a sense of duty and responsibility, desire for service, experience, enjoyment and a longing for a break from the cramped engineering curriculum.

- Absolutely necessary to apply the knowledge I've gained from school/classes/experiences to areas where these skills are needed. When this new information/technology is introduced to the area properly, it is personally rewarding. But any civil engineer has a duty to spread development when able and capable. (I gained from the experience, as well as the people in the village involved – without anyone being slighted in the process)
- Wanting to experience someone else's life and what better way than to go a different part of the world. I may be Hispanic but I only know one country out of all the Spanish speaking countries. I think what really got me to go was the wanting to know of how can we really help when just being a student. As student you're always to focus on school work that you forget how to think outside the box and take a moment to enjoy the world.

As much as I hate to admit it, this experience was a fun way to get out of my cramped engineering curriculum.

- I was motivated by the fact that the service learning opportunity involved actively meeting the needs of a rural community in a developing area. I found it very interesting that the application of engineering skills was going beyond the typical office and firm contracting. The service aspect of the project presented a new type of engineering that I wished to experience as a student in order to determine the extent of the type of work needed in these situations while planning ahead for the type of coursework I should consider if I were to pursue a more active role in this line of work.
- Wanting to use the skills and knowledge of an engineering student to help communities in developing countries motivated me to including international service learning in my education. It is my feeling that the profession of engineering has the responsibility to provide these basic needs to communities around the world.
  - It's so rewarding being able to see umm your things you implemented, you designed, you built it, and you see it implemented in the community and how much they appreciate it because the lack of needs that get met in the village and they just appreciate it so much more and you can see it and it umm it just brings a whole new worth to being an engineer.
  - I think that's important. I think that a lot of experience that we gain as students even maybe on the way to masters and however far you go with it, there's a lack of, and I don't know if this is what you mean by service, but there's a lack of emotional or social connection to a lot of the stuff that we learn and a lot of the stuff that we do, and a trip like this, a project like this, really brings together the math and the science with the social, emotional side and ties it together and it makes you really I think, for me anyway, I gained a lot from that connection and it's easier now to come back and sit through a class and then having that experience kind of continued to make that connection whereas prior to the trip I definitely wasn't I guess, if that makes any sense, I don't know if that's what you mean by service but that's kind of how I interpret it.

#### Faculty responses

Responses to the questions were also given by faculty members regarding their intended outcomes for the trip. The responses of the two faculty members are differentiated by the white or black dots.

- 1) What was the significance of service learning to students' professional development?
  - Service learning is useful for acquainting students with elements of professional practice such as communication, relationship building and networking as well as the required level of care for various tasks.
  - Service learning improves student understanding of the impact of engineering designs and solutions to real projects that can have a positive impact on different groups in society.
- 2) Compare the value of international experiences with the value of similar domestic experiences
  - Because of the regional diversity present in the United States, I believe that domestic service learning projects can provide an equally rich experience as international ones.



However, the only way to introduce an international perspective to students is to leave the country. This perspective is significant on its own because helps build greater empathy for people who are living at a distance and are members of other nations.

- Domestic service has an important value, however international service experience provides additional dimensions to students within a global context. Given the globalization of engineering and economic trade it is very valuable to U.S. engineering students to have international experiences such as the ones proposed in this program. Students are able to participate in all aspects of the engineering design process including problem formulation, consideration of alternative technologies, and design, construction, and evaluation of selected technologies that are best suited within the local cultural/societal context of the project. Furthermore, students not only learn technical aspects but also have enriching cultural and social experiences while interacting with the local community and in some occasions with local engineering students.

3) Was service learning effective at developing technical skills?

- Technical skills can be developed if the project demands rigorous application of engineering principles and has a strong quantitative element. Because of the out-of-the-classroom nature of the activities and the independence of the students as they complete their work, it is easy for the efforts of the participating students to be uneven and this may reduce the effectiveness of technical skill development.
- Students strengthen their technical skills though the whole engineering design process which includes several unique aspects such as consideration of local technologies and construction techniques, different design criteria or boundary conditions, etc. This process of having to adapt to situations outside their common areas of comfort with U.S. design methods and materials is, in my mind, one of the most enriching aspects of international service learning in rural communities in Latin America.

4) What motivated you to incorporate international service learning into the cramped engineering curriculum?

- I think very focused students are more willing to incorporate service learning when it is connected to courses that they are required to take as part of the core curriculum. Also, students may have greater interest in traveling programs when they are offered during convenient times, such as during Spring or Summer breaks. I am optimistic that a greater diversity of students will be attracted to engineering programs when these opportunities are available. Such students may be interested in pursuing a double major, may have entered from a non-engineering first major or may be planning for graduate study in a non-engineering field. These students may place less priority on completing their program in the standard timeframe.
- The global economy is requiring adaptation from the U.S work force. We need to ensure our graduates are prepared to work internationally under challenging conditions and constraints. Adding this course to the curriculum was well received in our department because it was clear that it filled an important need and also help with the ongoing paradigm shift of our engineering curriculum towards a more well-rounded engineering education.

## Summary of differences, conclusions and implications for future planning

The perceptions of students regarding the benefits of and motivations for service learning were surprisingly close to the program intent developed by the faculty. These benefits included development of soft skills, application of technical skills and formation of an international perspective. This implies that the faculty was successful at developing the itinerary and delivering the program in a way that achieved these goals.

Despite the overall success of the program, the positive impacts reported by the students were not linked to the program components as planned by the faculty. Students reported receiving the most benefit and most intense learning from their interaction in the village and not in the laboratory and classroom at the foreign university. They also preferred the rural setting of the project over the urban setting of the university. This was contrary to the expectations of the faculty. Students' responses to survey questions indicate that the concepts studied in the classroom prior to deploying to the field were very relevant to their work. These included understanding social concepts, technology transfer concepts as well as ethics and history. Although the students did not seem to value the information at the time it was presented in the classroom, it did become relevant through their experience. This suggests that they may be more receptive to the information if it is presented after the field experience, or at least revisited during the service learning phase of the project.

To improve the effectiveness of the program, the agenda for the upcoming 2013 experience has been adjusted to focus less time in the formal classroom environment, and more time in the field. However, rather than exclusively focusing the field time on construction, the concepts presented at the beginning of the class (1) history and economics of development and underdevelopment in Latin America, 2) social capital, 3) the ethical foundation of international assistance, and 4) the role of technology in development will be revisited through group discussion and reflection activities.

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