Autoethnographical reflections of an immersive development engineering program

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Abstract

Clemson Engineers for Developing Countries (CEDC) is a student-driven service-oriented program whose mission is to provide sustainable, engineered solutions to communities in the developing world. One of the most successful features of CEDC, from both undergraduate education and community development perspectives, is the structured and innovative internship experience. In addition to student participation in design, planning, and project implementation, a few students are selected annually for an internship in the host community where they also have the opportunity to enhance their technical and professional skills while engaging with a different culture. In CEDC's current internship program, Clemson engineering students live in rural Haiti for 6-12 months while designing and implementing infrastructure projects in the surrounding communities. The paper includes lessons learned and suggestions for program replication to establish similar experiences at other academic institutions, including partnering with NGOs in developing countries and establishing a study abroad framework for students.

Keywords

Autoethnography, Haiti, service-learning, engineering

Introduction & Background

Engineering problems in the 21st Century require a vastly different standard for engineers' education and practice[1]. The next generation of engineers must not only have the ability to tackle age-old problems like transportation and waste management, but also brand- new issues from renewable energy to geoengineering. With novel technologies that simultaneously encourage globalization and enable increasingly severe inequality among peoples and nations, engineers must have additional training and exposure to understand the cultural, social, and ethical ramifications of their interventions[2].

Many engineering students lack global competence[3], or the ability to operate in an international context. The advent of telecommunications, recent political events that have opened up new markets, free trade policies that promote a global economy, and the exponential growth of multi-national corporations and firms all require that future engineers possess a certain level of global competence. This competence includes the ability to communicate across cultures, a familiarity with world history, an understanding of ethics among various peoples, and an exposure to international business practices[4]. Such skills, when coupled with an individual viewpoint as being a "citizen of the world," are the first step toward developing a 21st Century engineer.

One way to teach engineering students a form of global competence is through international service-learning projects[5]. Training for humanitarian engineering in the developing world can provide dramatic life-altering solutions[6] through infrastructure augmentation and life- saving technologies. However, very little is done in the traditional engineering curriculum to provide budding humanitarian engineers with the ethical and social background[7] to work effectively in these low-resource, high-stress environments in the Global South. Furthermore, few schools offer programs that enable students to build their humanitarian engineering skill sets.

Stanford University's Global Engineers' Education (GEE) course offers undergraduate engineering students a framework by which to investigate development engineering, international humanitarian work, and global competence by deviating from a technocentric approach and teaching students how to work within a community to combat a problem such as water and sanitation access[8]. In this manner, students are not only exposed to the ethics of the problem but also its global and inherently social nature. The University of Massachusetts-Lowell also has a major a service-learning aspect[9] to its curriculum that exposes students to the international, ethical, and social implications of their engineering education. University of Pittsburgh and Virginia Institute of Technology have also provided engineering students with valuable international service experience via Engineers Without Borders[5] and Bridges to Prosperity among other educational institutions[10]. Other service learning programs, such as the Engineering Projects in Community Service (EPICs) at Purdue, allow students to serve in their local communities[11] while developing their professional skills and bridging lessons from the classroom to actual practice[12]. While these extracurricular programs throughout the country provide valuable experience to students via a theory-practice approach, they fail to provide students with an avenue to critically evaluate their projects with respect to the development profession[13,14].

Clemson Engineers for Developing Countries (CEDC) is a student-driven service-oriented program at Clemson University whose mission is to provide sustainable, engineered solutions to communities in the developing world. CEDC pairs a translation-based approach to researching and implementing engineering projects in rural Haiti. It accomplishes this by utilizing a unique organizational structure[15] that fosters continuous student involvement throughout their undergraduate experience via classwork and an internship program. By engaging students for multiple semesters, offering biannual travel opportunities, and fostering a long-term relationship with a specific community in Haiti's Central Plateau, CEDC is able to offer students an international experience while teaching them about the greater impacts of engineering on another community[16].

One of the most successful features of CEDC, from both undergraduate education and community development perspectives, is the structured and innovative internship experience. In addition to student participation in design, planning, and project implementation, a few students are selected annually for an internship in the host community where they also have the opportunity to enhance technical and professional skills while engaging with a different culture. The internship program consists of Clemson engineering students living in rural Haiti for 6-12 months while designing and implementing infrastructure projects in the surrounding communities. While many other development-oriented engineering programs attempt to provide these teachings in a classroom or curricular setting, this program's project-oriented framework more closely mimics the experiences they will face in a professional setting, in addition to

providing the teachings in a global framework by allowing them to live and interact in another country. Many international service-based organizations, such as Engineers Without Borders, design and implement projects through annual trips that first evaluate a problem and then install a solution[17]. While these programs see some success, the long-term viability of these interventions is difficult to measure accurately[18].

This paper provides one student's autoethnographical account of the CEDC internship program. It discusses the unique perspectives and skill sets gained from the internship, including an increased sense of accountability; a new respect for engineering standards in the developing world; and the ability to engage with people and a community across cultures and backgrounds to achieve a common goal. This paper presents qualitative data from other interns in the CEDC program to provide additional evidence towards CEDC internship program's ability to enable undergraduate engineering students to fully immerse themselves in a true cross-cultural engineering experience and enhance their global competence through service-based, community-focused development.

Method

An autoethnography is a method of investigating a personal experience within a different culture in order to gain a better understanding of that culture. This analysis has become increasingly common on the past few decades as researchers describe their individual epiphanies within the established literature of their topic rather than maintaining a paternalistic relationship to their work[19]. Autoethnographies have been penned on a variety of topics including the effect of STEAM on student education[20] and by a variety of authors, including students[21,22]. The autoethnography presented in this paper was authored by an undergraduate civil engineering student who participated in the CEDC internship program from January 2015 to August 2015 and is the lead author on this manuscript.

The autoethnography is supported by data from a survey of former CEDC interns. The questions cited for this study are listed in the Appendix. Nine of the fourteen previous interns participated in the survey. The data was analyzed quantitatively, words were counted for thematic consistency, and several quotes were used to reinforce themes identified in this paper.

Autoethnography Overview

When asked about lasting memories of their internship, one former CEDC intern respondent wrote the following:

Two things - personal memories with people I met in Cange and with the interns. I got to travel and spend the night in remote villages with interns and meet new people, I got to attend funerals of locals in Cange, and got to spend every day with the construction crew. Two, the 'professional' memories - seeing the pump-house go up, and the second pump installed was amazing, knowing that we had a role in making that happen - it was special.

For the purposes of this paper, I will divide the autoethnography into two sections just like the intern above: Personal and Professional. Even though the distinction between these two aspects of my time in Haiti became blurred, it is the easiest way to categorize the volume of thoughts I have (and others have) about the CEDC internship experience.

Personal Experience

When asked what their top three memories from the CEDC internship were, interns mentioned people, relationships, and culture eleven times, with seven interns mentioning one of these terms at least once. These memories include *"long interviews with rural village leaders," "sharing in Haitian cultural traditions,"* and *"becoming immersed in the Haitian culture and language."* Such engagement with the local community through personal relationships and shared experiences was a large part of my own internship as well. Even though I have been back in the United States for over a year now, I maintain contact with multiple individuals in the communities where I lived and worked.

This tight relationship between interns and the community is part of what makes the CEDC internship such a unique program. One of the most important aspects of humanitarian engineering at the university level is working with the community rather than working for the community[23]. In fact, community relationships are key toward establishing effective learning outcomes for the students involved; the more the community is involved, the more the students grasp their role as a development volunteer[24]. While other University programs may rely on email, Skype, or annual visits to establish and maintain community relationships, CEDC is able to foster such connections through the interns who concurrently benefit from the increase in responsibility and cultural engagement.

During my internship, my work and experience was largely influenced by the past interns. The community knew exactly who I was before I started and the individuals in the community knew what they had to do so that we could work together efficiently and effectively. CEDC's institutionalization of the internship program enabled me to start directly engaging with the community as soon as I stepped into the village. I had mutual friends with the community members immediately and they already knew where I came from. Learning the language, one of the hardest parts of the first few months of living in rural Haiti, was made immensely easier thanks to diligent and patient Haitians who have helped past interns and, most likely, will continue to help future interns.

My friendships in Haiti allowed me to acquire a new understanding and appreciation for the developing world. Many studies cite statistics about people who lack access to clean water, basic sanitation, and safe infrastructure without ever being able to cite direct relationships with the people that live there. CEDC interns, including myself, know names and faces of people who lack such simple amenities. The CEDC internship made their problems become personal problems. My thoughts are echoed by the intern who wrote that his or her "concept of the Global South - how I perceived Haiti - before my internship and after it was dramatically different."

I couldn't agree more with one intern who wrote the following:

I feel that the internship was like jumping into an ice cold river. I woke up to the reality that life does not work in the way that American society has taught me to believe that it does. The material world is fleeting and meaningless, and what's truly important in this life is our relationships with others and our character. I was inspired by the work ethic and resolve of the people I encountered, and was astonished at my own pettiness and dependence on material comforts. I saw a way of life that filled me with joy, and tried to learn from it.

In this manner, I did not feel any culture shock with the Haitian culture, I felt culture shock at my own culture of endless wealth and frivolous living. I felt ashamed of the times that I complained about being hungry and embarrassed when I traveled to Port-au-Prince, a destination that many of my friends who have lived in Haiti their entire lives have only been to a few times. These feelings lingered until I spent nearly a month living in an even more remote village, the village of Morne Michel, as we worked on repairing and electrifying a school. After that experience, living and eating with Haitians without anyone else who spoke English, when I returned to the village, everyone started calling me "Son of Morne Michel." The feeling of accomplishment after that project was dwarfed by the sudden acceptance into the Haitian community; I no longer felt like an outsider and Haiti became more like a home.

I think it is clear that all of us at some point learned the same lesson, best summarized by another intern here:

To work with a community, you need to gain their trust and acceptance, and must always respect their culture, values, traditions, and social structures.

Professional Experience

When asked what their top three memories from the CEDC internship were, interns mentioned projects and engineering success fourteen times, with eight interns mentioning one of these terms at least once. These memories include *"taking a project from concept to completion both in the classroom and during my internship"* and *"seeing the pump house operational (and working on it from start to finish)."*

Actively working on projects in Haiti was the most memorable experience for me. While other programs involve several students working on a single project, my CEDC internship involved several projects with me as the only student involved. My responsibilities were numerous and critical for the successful execution of these projects. This sense of enhanced accountability is also demonstrated by past interns; one wrote that the most important thing they learned was *"taking personal responsibility for my work."*

For me, this sense of responsibility was largely associated with the quality of the project when compared to established engineering standards. For example, at the beginning of my internship I visited the village of Bwa Joli and their brand-new church. I have sent photos of this chapel to a professor in my department who uses them as an example in a design class. The church's poor construction and design offer great examples of buckling columns, various concrete cracking tendencies, under-reinforced concrete, and foundation settlement. The real tragedy of the situation is that the church was funded by a small church in South Carolina and cost over

$80,000; it was a futile design/build effort executed outside CEDC's sphere of influence. Now the structure serves as a learning tool for American students, rather than a community center or common space for the local villagers. The Bwa Joli church haunted me and I was diligent to ensure the safety and quality of my projects for the rest of my internship.

Yet, even though I had to teach Haitians the importance of proper concrete proportioning and reinforcement bars in structural elements, I learned infinitely more than I taught. I relied heavily on CEDC's Haitian foremen when it came to organizing work crews, establishing schedules, and acquiring materials. These men have never enrolled any construction management courses but they were more competent than project managers I have worked with in the United States. Such thoughts are reiterated by past interns who note that they *remember "being humbled by the intelligence of people that western society might deem uneducated"* and now understand that *"western higher education does not make you smarter than the poorest of the poor."*

At the conclusion of my internship in Haiti, I had finished three distinct projects and was heavily involved in many others. I felt like I had accomplished as much as I possibly could during my short time there, and my mentor's feedback reinforced these feelings. However, I still felt like I did not make a difference. Poverty still crippled all the villages I worked in and most people still lacked a steady income or good health. I was weighed down by the nagging doubts that the CEDC method and my decisions in Haiti was only fortifying dependencies rather than fostering sustainable development. These fears at the conclusion of my internship are not unique among other interns. One intern even wrote the following: *"I still wrestle with whether, in the grand scheme of life, I did more harm than good."*

If the internship taught me anything, it is that engineering cannot be the only answer to the innumerable problems in the Global South. Providing clean water and sanitation, enhancing local built infrastructure, and other development engineering programs must always be paired with comprehensive economic development, job creation, and stable local governance. This epiphany about the limits of engineering technology is reflected by many other students who have had similar experiences[25]. All the interns, including myself, feel proud that our engineering successes in rural Haiti contributed, even in a small way, to addressing village problems and every intern surveyed indicated that they would do the internship again they had to do it all over again.

Discussion & Conclusion

As evidenced by the autoethnography and former intern survey responses, the CEDC internship program served as a way for engineering students to enhance their overall global competence. Interns not only highlighted their newfound language and communication skills, but also emphasized their appreciation for other cultures and the importance of understanding them before implementing any sort of engineering project. The change in perspective of the author and the other interns suggests that these students are much better prepared for careers in the 21st Century.

Beyond their new cultural sensitivity, the author and interns described engineering ethics and their personal responsibilities as project managers on projects that dramatically affect the general public. These questions concerned with project quality and safety are a huge issue in the developing world[10] and other international service-learning programs should continue to advance

this conversation. Furthermore, the interns also expressed concerns with their role as development practitioners and development engineering philosophies. Such questioning reflects significant explorations outside the traditional engineering curriculum and are manifestations of these interns developing literacies outside their technical curriculum.

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Aaron Gordon is a Senior Civil Engineering major at Clemson University with extensive experience in sustainable development, construction, and project management in Haiti. He has spent almost a year in Haiti's rural Central Plateau on projects ranging from repairing small schools, water distribution/treatment systems, sanitation infrastructure, and aquaculture programs. Additionally, he is the founding director of the Clemson's chapter of Grand Challenge Scholars Program.

Jeff Plumblee

Jeff Plumblee, PhD, MBA is a Research Assistant Professor at Clemson University. Plumblee founded the award winning Clemson Engineers for Developing Countries (CEDC) in 2009 while pursuing a doctorate in civil engineering. As the founding director, has helped to grow the organization to 100+ students per semester, including numerous interns living in Haiti year-round. The program has overseen in excess of $2 million in sustainable infrastructure and economic development projects in Haiti. He also serves as the director of Clemson's Grand Challenge Scholars Program and is exploring ways to offer engineering engagement opportunities to a wider audience.

Claire Dancz

Dr. Claire L.A. Dancz is a Research Assistant Professor at Clemson University. Dr. Dancz's research interests include developing active, experiential-learning activities on topics of NAE Engineering Grand Challenges, UN Sustainable Development Goals, sustainability for civil engineers, and assessment of student-learning outcomes and motivation towards these topics, with emphasis on online platforms for delivering these educational opportunities and service-oriented engineering programs in which students can take actions towards these topics. As a KolbeTM Certified Consultant, Dr. Dancz uses conative assessment to empower individuals with diverse problem-solving instincts to improve productivity, communication, leadership, and impact the diversity of engineers as global change-makers.