

Cultural and Academic Learning Through Project Based Initiatives

Michael Berry,¹ Paul Russo,² and Dr. Joshua Wyrick³
The Civil and Environmental Engineering Program, College of Engineering,
Rowan University, Glassboro, New Jersey

Engineers Without Borders (EWB) provides students a unique outlet to experience academia through a whole new lens, one that sheds light on global issues and the opportunity to effect the lives of others. Rowan University's EWB project, involving clean water distribution in Senegal, is one such project that has exposed our young intellect to a breadth of different learning, one that cannot be taught in the classroom setting. Traveling to Africa in March 2007 provided us with an anthropological experience in which the team was exposed to a different culture with a different set of social and cultural necessities, in addition to the fundamental needs of life. This experience brought to light the true need for potable water accessibility abroad, while at the same time proved to be influential in molding a new outlook on the participants' lives. In addition to intrapersonal growth and revival, the project provided an experience in enhanced scholastic learning through research, experimentation and professional engineering coordination. This experience has added a greater depth to the typical undergraduate experience, tying the importance of civil engineering practices to the global community.

The purposes of this paper are to:

- (1) Describe the project with respect to service learning and its implications to engineering education
- (2) Describe how EWB chapter members experienced anthropological and cultural lessons through the initial service learning trip and post-assessment coordination
- (3) Describe the University level of learning related to the project through research, experimentation and professional coordination

¹. Co-author, Undergraduate Student, the Civil and Environmental Engineering program, College of Engineering, Rowan University, 201 Mullica Hill Road, Glassboro, NJ 08028; phone: (856) 266-7050; E-mail: berrym02@students.rowan.edu

². Co-author, Undergraduate Student, (same organization); E-mail: russop30@students.rowan.edu

³. Co-author, Assistant Professor, (same organization); E-mail: wyrick@rowan.edu

Introduction

To put into perspective the great variety of learning exhibited through this unique service learning project, one must first understand the basis and current standing of our project. The water distribution project itself was presented to Rowan University's Engineers Without Borders student chapter from one of our former student member's father, whose medical practice has had a presence in the region for a few years. Ngonine is a village of 863 people spread throughout six neighborhoods about three hours east of Dakar, Senegal. It has Sub-Saharan conditions consisting of four months of wet season and eight months of dry season when it doesn't rain at all. There is an existing 10 meter high government regulated water tower which could be as far as 3 km away from any given neighborhood. The women of the village are responsible for fetching this water in 7 gallon jugs multiple times per day to provide for their families. This six hour ordeal takes time away from family, cooking and chores. Four students and one faculty member completed an assessment trip in March 2007. The multiple objectives of this trip included establishing a relationship with the people, surveying the land, testing the local water quality, surveying the citizens and discussing possible design layouts with the community. During Fall 2007, a team of undergraduate engineering students completed a preliminary design that provided a cost-effective pipe system that distributed potable water to six separate spigots throughout the community. The system was designed to meet the current and future needs of the community aimed to improve general health, economy, and social well-being of the impoverished village.

The design was submitted to the local non-profit organization in Senegal in charge of coordination between the local contractor, medical practice and EWB. The contractor determined this initial design to be prohibitively expensive, given the costs of raw material in the area; rather a three spigot design is to be more suitable for the community. The local non-profit, Mission Inter-Senegal (MIS), in conjunction with the medical practice, the primary investor on this project, and EWB have opted to go ahead with the contractor's recommendations. It will be our new role to review and make recommendations on the design that will be submitted by the contractor and to ensure proper installation of the system upon implementation. At this time, though still uncertain, we are anticipating a trip in Summer 2008 to Ngonine during the latter phases of project construction.

Service Learning with Respect to Engineering Education

The notion of completing work and assignments with a real purpose and goal in mind is the cornerstone of service learning in the classroom setting. It is no secret that, as with anything in life, one is more likely to complete the activity with dignity and thoroughness when there is some type of reward or viable outcome to their efforts. The idea of service learning is no stranger to this theology, as it embraces this mentality for mutual benefit of the University and student, not to mention the group or individual provided the particular service. In this particular case the reward, per se, is the mental satisfaction and sheer enjoyment to truly knowing that you as an individual were able to help another person, group, or community by providing basic services to supply profound needs and make a remarkable impact.

In today's society, the simple act of helping another person and impacting even just one life, often goes overlooked and undervalued. This is often true until one modifies their own mindset to accept and even embrace this ideal which ultimately brings a sense of power and accomplishment otherwise never exhibited. These concepts are especially true when it comes to service learning within the realm of

engineering education. The engineering profession, and civil engineering in particular, has such a broad spectrum of applicable knowledge and expertise in providing the fundamentals of everyday life. Not to harness the plethora of applications of the engineering curriculum to help those truly in need would be a real crime against humanity and an injustice to the engineering field.

Young engineers at the University level are at a distinct advantage when it comes to engaging multi-disciplinary projects with a broad range of application. It is during this time in our lives that we intentionally seek out ways to learn and apply the often mundane and overwhelming collection of material. There is nothing more exciting to an engineering student than to see and take part in an engineering feat that is real, ongoing, and with a true sense of importance. This fosters a sense of individual importance and an idealist notion of the true role of engineers in modern society – to solve problems for people and to promote better living standards for all walks of life.

Anthropologic and Cultural Learning through Outreach Education

The Ngonine, Senegal water distribution project is unique in how it led to a sense of cultural awareness and global needs understanding on behalf of the participants influencing both their mindset and overall demeanor. The event was an eye opening experience that truly touched our team's lives. To see this isolated and self sufficient community simply living, no more and no less, brought us back to humanity. It was as if we had peered through the modern fog of materialistic America into the essence of who we are as people, fundamentally human.

Cultural and Social Outlook

Although impoverished and afflicted with many ailments, the people are nearly autonomous and filled with abundant life. Seeing men and women with huge smiles and evident joy touched our hearts. These people were beautiful and truly exhibited appreciation for life. Their culture was flowing with community strength and unity. Even though the people were of low economic stature, they welcomed outsiders into their lives with open arms and with willingness to sacrifice and accept.

It became evident that this particular culture had unique codes of conduct and complex social hierarchy. The men were the leaders of this society, controlling the local government which consisted of elders and an elected chieftain. From our frame of reference, these elders didn't seem old but as we became aware men older than 50 are a rare commodity. The men in the community are responsible for the harvesting during the wet season that they will use to feed their families for the entire year. Their sole crop is millet, a type of small-seed cereal grass, and it used in all different fashions by the women to feed the family throughout the year. Besides being in charge of preparing food and performing household functions, women also have the daunting task of gathering water which can take nearly six hours any given day. The children in the village were primarily responsible for helping the women with their chores and watching out for one another. The young children in the village, though given responsibilities at an early age, would often be seen scattered throughout playing and laughing with one another.

Cultural Relevance and Learning Perspectives

As a student, it was humbling to engage in the activities of the community which included the daily routine of five hours of gathering water and three hours of pounding millet in the morning (for each respective woman). The drudgery of this task seemed so mundane yet so real, something quite foreign from our Western frame of reference living in the United States. When taking time under a tree in the middle of the Sub-Saharan desert you couldn't help but think "is this really the 21st century?" These people are living in a subsistence-based lifestyle simply trying to survive and enjoying life.

The people of the village welcomed us with open arms and treated us as one of their own. They were by our sides while we worked, willing to lend a helping hand. We routinely shared meals with the elders in the evening and played soccer with the children outside of their school during the day. One night, under the bright stars, we had the privilege of celebrating with the community by participating in communal dances accompanied by traditional music. We were also given traditional Senegalese names, considered a local honor, which stuck with us for the rest of the trip.

We all learned valuable lessons from the people of Ngonine, the most influential of which being the value placed on the community and their willingness to go above and beyond to help those in need even with their limited available resources. The people of Ngonine taught us how to love and how helping other people can be rewarding on so many levels. This sense of compassion reality sank into each one of the student members on the trip.

The urgency and magnitude of fundamental human needs scarcity (namely adequate provisions) and limited resource availability in a global setting became quite real as the trip progressed. It is a well known fact that water is needed to maintain and foster life, and without the availability of an ample water supply any human population would not be sustainable. On the global stage, in particular developing and impoverished countries, water availability and hygiene is a true concern. Currently, "some 1.1 billion people in developing countries have inadequate access to water and 2.6 billion lack basic sanitation".¹ This disproportion is further explained as "almost two in three people [in the same regions] lack access to clean water survive on less than two dollars a day".¹ To illustrate the true humanitarian concern, "close to half of all people suffering at any given time [are suffering] from a health problem caused by water and sanitation deficits".¹ It is not a stretch to define this problem of epidemic proportions regarding health and the availability of clean water in developing countries as it stands today. As a group we were taken aback by the needs of the global community and became resolute and determined that we as individuals and in the larger sense EWB, would make a dent on the problems facing the globe and that this fight would start by impacting lives in this community.

Impact on Society

A rather unexpected element of learning through this project came in the form of cultural analysis in an attempt to outline potential impacts in addition to fulfilling raw human needs and health related items that a proposed water project would deliver. As discussed in the proceeding sections, this community is tight-knit. They actively engaged in activities together as a community such as crushing millet and gathering water. Our team tried to determine what the impact would be of having convenient spigots and water availability on the cultural fabric of this population. Seeing as the people get much of their strength from

unity, we believe that this solidarity and, to some extent, their cultural identity might be jeopardized. It is hard to determine exactly what effect a water system might have on the cultural relations of a community, but it is our belief that this aspect should be taken into consideration. In part, our ultimate proposed design of general neighborhood spigots would tailor to more social interaction verses an individualized housing spigot design.

When analyzing a projects implications to another culture one must also take into account the role and power water brings when its availability is limited. Though not distinctly applicable to this project, the Rowan University EWB team has dealt with water politics. In 2005, Rowan University led another EWB-based trip in El Amaton, El Salvador to design a sustainable, potable water distribution system, but the project was manipulated and eventually taken over by the local government to increase their own political support. When there is a clear public concern or unified desires, one must realize that certain individuals or groups can be in a position to benefit from this ordeal given political backdrops and social acceptance play important roles. From this experience, our EWB chapter has learned that taking the political and social atmosphere into consideration can be the difference between a project's failure and completion.

Academic Learning through Service Learning

Our experiences in Senegal resonate on many spectrums of learning above and beyond the acute cultural awareness and knowledge of global issues obtained. From this experience, we as individuals have become much more acquainted with the fundamentals of engineering, coordination and presentation required to make carry a project to fruition. This being said, in our perspective as a students, this project has served to truly broaden and expand our knowledge of applied engineering and expanded my innate collection of personal and organization skills. The learning that we experienced as a member of Engineers Without Borders on this project was truly inspirational, helping mold future goals and ambitions all the while providing a valuable skill set and enjoyable experience.

International Coordination

From the onset of the project, a great deal of coordination was to be needed for the project to be completed. Our EWB group was to be partnered with a medical practice who was then intern working with a local non-profit in the region who is in contact with the local contractors and vendors. To accomplish their objectives, of service and volunteerism, the medical practice coordinated trips and services with a local non-profit Christian organization that has a broad scale presence in Senegal. For nearly the past year we have been working together to coordination for the completion of this water project in the region. It was during this time that we came to the realization that to complete even a simple task a great deal of effort was needed especially when so many players are involved. From this experience communication skills have been tested and a new understanding of project progress has been learned. We came to the understanding that in different cultures, tasks and projects can be handled differently. In the US, we have become accustomed to timely responses and quick actions to proposed plans while in Senegal this was not common practice. When in country, we realized that things move at a different pace,

a pace I would call laissez-faire in essence. This Senegalese state of mind in conjunction with the sheer busyness of the local non-profit, who concurrently organizes many other trips and projects, and lack of available funding for the project (estimated at \$40K) has culminated to a real eye-opener to reality.

An unknown for most of the project to date, was extent of the local contractors involvement with the project in the latter stages of development. As a team, we went about designing the system with little to no guidance on the issue of a local contractor. In time, it came to light that our design would be too expensive to complete given available materials, and that rather the contractor typically specifies a design for a system of this kind seeing as it is fairly straightforward and commonly done. In hindsight, it would have been beneficial to know this information beforehand and worked with a contractor from the onset of the project. We have become acutely aware that local customs can play an unforeseen role in the eventual completion of a project. This project may be uncommon in that there was five miles of proposed pipe but not in the fact that the work must be done and that in order to complete this task, coordination and possibly an outside source may need to be sought potentially bringing to light new ideas and alternatives.

What we took to heart most from the coordination aspect of the project would be the sheer resolve and willingness for all parties to work together for a common goal. When starting college who would ever think they will be working with so many motivated, intelligent and different people for a common cause. The humanitarian objective of this project combined with the sincerity of the people has inspired virtually everyone exposed to the project to get involved and help to the best of their abilities.

Having this experience has brought a new realm of realism into play with my engineering education. We now understand that in any project there will be an assortment of people and organizations one must work simultaneously with/for in order to fulfill virtually any given task. Accounting for different social backgrounds and normalities is also key when undergoing projects of any given size and duration.

Engineering Academia

With a service learning project, one of the major facets of personal development comes from the applied knowledge of course material to a real life problem. Dealing with water distribution, knowing and fully comprehending the intricacies of applied fluid mechanics was essential. Researching and understanding the mathematics and application behind pressurized flow and varied discharge characteristics brought a greater depth of learning to a core engineering course.

In order to simulate pipe network flow and determine optimum values for pipe diameters and other characteristics of the proposed system, our design team used a software program available from the U.S. Environmental Protection Agency. It was beneficial to both the project and our own edification to engage in using the software correctly, checking its accuracy, and correlating the output data into a datum that could be used for comparative and iterative purposes. It became evident that the process of designing a system would be quite cumbersome and unorthodox given any other means of design.

In general, through the scope of service learning and EWB, participants run a full gambit of educational learning in the realm of academic. As a chapter we have been involved with topics such as groundwater contaminant relation, pump and well design, geotechnical considerations, not to mention drinking water distribution and purification. As our chapter continues to branch out, we foresee additional topics being

introduced as we encounter different community needs and thus additional opportunities for advanced and extracurricular learning on behalf of the undergraduate students involved.

Presentation / Networking / Fundraising

An essential part to any project is the raising of the necessary funds. As an organization, we have completed many projects besides Senegal, through these events we have gathered more than just money but a reputation and awareness of human needs abroad. As an individual working on a project, you are exposed to many different fundraising avenues that include anything from coin drops and pizza sales to the large scale fundraisers such as writing of grants and public presentations. It was exciting to receive feedback and observe reactions from each individual or group that our message reached. Through this experience we came to the realization that people are willing to help out a just cause and support students trying to make a difference.

From an educational perspective, there is a great benefit to performing a great variety of presentations from speaking to a small portion of the portion speaking to two hundred professionals at a convention. Our presentation skills improved greatly, we became so familiar with the material that our presentations came across like a fluid conversation which the audience embraced. We discovered this was the best way to reach people; we always had good reactions and positive feedback. What we didn't expect was the amount of learning from the audience during these presentation sessions. Concluding each presentation was an open forum for questions, it was during these sessions that new perspectives on the project and the proposed design were gathered. This questioning and challenging from professional engineers truly served to be enlightening and beneficial to our project as a whole.

It was after these presentations that we would come in personal contact with many professional engineers that would be interested in helping progress our project. We partnered up with the Mid-Atlantic Professional EWB chapter located in Philadelphia which turned out to be a great outlet for networking and learning. Through the duration of the project, we came in contact with so many people that wanted to help, that we didn't even enough work to include everyone willing to volunteer. We now understand the desire for working professionals to gain the same experience we as undergrads truly embrace.

Conclusion

To fully comprehend the true magnitude of knowledge gained from any given service learning project is quite a task. In our perspective now as students, we can appreciate the experience Engineers Without Borders has provided. We have progressed in many different ways, becoming more educated students, engineers and people.

¹. United Nations Development Programme. (2006). *Human Development Report 2006: Beyond Scarcity: power, poverty, and the global water crisis*. New York.