

2006-1043: LESSONS IMPLEMENTED ON AN INTERNATIONAL SERVICE LEARNING PROJECT

Rachel Husfeld, Valparaiso University

RACHEL HUSFELD served as the 2005 student president of the Valparaiso University chapter of Engineers Without Borders. Originally from Houston, Texas, she is a senior civil engineering major graduating in May 2006. Rachel plans to pursue a master's degree in structural engineering beginning in the fall of 2006.

Carmine Polito, Valparaiso University

CARMINE POLITO is the Frederick F. Jenny, Jr. Professor of Emerging Technology at Valparaiso University, where he has taught civil engineering courses for the last five years. He serves as a faculty advisor to the Valparaiso University chapter of Engineers Without Borders.

Elizabeth Gingerich, Valparaiso University

ELIZABETH GINGERICH is an Assistant Professor of Business Law in Valparaiso University's School of Business Administration. She serves as a faculty advisor and fundraising coordinator for the Valparaiso University Chapter of Engineers Without Borders and has lead the efforts which have raised over \$140,000 to help implement the three stages of the project.

Lessons Implemented on an International Service Learning Project

Abstract

In May 2005, the Valparaiso University Chapter of Engineers Without Borders completed the second phase of a three-year water supply and irrigation project in a remote village located in northwestern Kenya. In this project phase, the lessons learned by group members during the first project phase and the May 2004 trip were implemented and new lessons were learned.

The project site is located Nakor, an extremely arid village in the Turkana region of northwestern Kenya. The project aims to establish a clean, reliable drinking water supply for the community and provide water to gardens through drip irrigation. Attaining this goal requires engineering design and planning throughout the year by students and mentors who subsequently travel to Kenya to drill wells and install windmills, hand pumps, and drip irrigation systems. Turkana natives work together with the Engineers Without Borders members to construct all aspects of the project. By partnering to develop a simple, cost-effective food source, the villagers learn how to maintain the irrigation systems and initiate new systems in an area which receives less than three inches of rainfall a year.

Two of the authors traveled to the site in May 2005 with a group comprised of 13 students, 11 of whom were engineering majors, and five adult mentors, to implement the second project phase. This phase incorporated drilling and irrigation improvements, collecting GPS data to create a topographic map of the community, performing a health survey, and teaching students at the local elementary school about the mechanics of the project. During both the design and construction phases, the lessons learned in 2004 about service engineering projects in general, and about working in a remote portion of a foreign country specifically, were implemented. The lessons implemented included a stronger focus on pre-trip planning, organization, and student training. Other lessons implemented involved strengthening the communication with the host community and within the project team, remaining flexible as plans frequently changed, and building relationships with local community members.

The second phase of the project was carried out with much less difficulty than the first. This paper will compare the results of the first project phase with those of the second, and identify how implementing the lessons learned positively impacted the second project phase. Additionally, other factors that contributed to the success of the 2005 project will be identified and analyzed.

The next project phase, which will be performed in May 2006, will continue the work completed thus far, while incorporating new system improvements as well as lessons that continue to be learned throughout the project experience. Those who aspire to carry out international service learning projects can learn from the experiences to be included in the paper.

Introduction

In May 2005, a group of students from the Valparaiso University Chapter of Engineers Without Borders (EWB-VU) returned to the village of Nakor, Turkana, Kenya to continue the water

supply and drip irrigation initiative they had begun in May 2004. Whereas the May 2004 project included numerous setbacks in its implementation, the May 2005 project progressed with fewer difficulties because the lessons learned in 2004 were applied to the second project phase. This paper will compare the results of the first project phase with those of the second, and identify how implementing the lessons learned positively impacted the second project phase.

After a brief explanation of the nature and objectives of Engineers Without Borders - USA, the EWB-VU Chapter project will be described and the lessons learned in May 2004 will be outlined. A discussion of how each of these lessons was implemented during the May 2005 project and a few additional lessons learned will then follow. It is the authors' belief that the lessons learned and implemented in the EWB-VU project could certainly be used as a template for successfully approaching other international service projects.

Engineers Without Borders - USA

The project discussed in this paper was conducted under the auspices of the Valparaiso University Chapter of Engineers Without Borders. Engineers Without Borders (EWB-USA), the parent entity, is a non-profit, non-governmental organization established to assist developing areas worldwide with their engineering needs. Headquartered in Colorado, the organization aims to partner students, professionals, and host communities to carry out sustainable projects involving the design and construction of water, wastewater, water purification, sanitation, energy, and shelter systems. EWB projects are initiated by and completed with the host community, whose residents are trained to operate the systems without continuing external assistance.

In the EWB-VU project, the EWB philosophy of sustainability has been promoted through utilizing local resources, working together with community members of Nakor in all aspects of the project, and by fostering community education. Nearly all of the project supplies are purchased in Kenya, including the windmills fabricated in the Turkana region. All aspects of the project implementation are conducted by EWB-VU members working side-by-side with community members of Nakor. Additionally, EWB-VU members have presented the project to children at the school in Nakor in order that they might understand how the systems function. EWB-VU members are currently creating an instruction manual that will utilize pictures and text translated into the Turkana language to explain how to maintain the windmill and irrigation systems initiated through the project and how to install additional systems.

EWB-VU Project

The village of Nakor, in the Turkana region of Northwestern Kenya, consists of about 2300 people dispersed over approximately 20 square miles. The village has been severely impacted by drought and on average receives less than three inches of rainfall annually. Although Nakor is located along the Kerio River, the river typically flows less than one month each year.

The drinking water supply for Nakor has traditionally been obtained from shallow, open-pit wells, which have also been used for watering goats herded by the villagers. The open-pit wells quickly become fouled by animal waste, resulting in a contaminated source of water which has

contributed greatly to the number of community members suffering from dysentery and malaria. These illnesses are responsible for the region's nearly 40% infant mortality rate recorded at the beginning of the project. The Turkana typically eat an average of one meal every two days due to the lack of available food. They subsist on palm nuts, blood and milk from goats, and an occasional corn subsidy from either the Kenyan government or a non-governmental organization.

Christian missionaries Gene and Melba Morden brought the need of the Turkana people for potable drinking water and a reliable food source to the attention of EWB-USA. EWB-USA awarded the project to EWB-VU in October 2003, and EWB-VU has partnered together with the Mordens and the people of Nakor since that time.

In March 2004, EWB-VU representatives first traveled to Kenya to perform a site assessment of Nakor. A meeting was held with community leaders who verified the village needs of clean drinking water and a reliable food source. Water testing confirmed that the water obtained directly from the sand aquifer did not require treatment. During this visit, project supplies were ordered and the locations for windmill placements were designated.

In May 2004, volunteers from EWB-VU worked together with community members of Nakor to install the first windmill in the village and a drip irrigation system for a one-half acre community garden. Prior to the group's arrival, G. Morden led the Turkana in using a mud-rotary auger to drill a well to supply water to this system. However, the auger became caught in the surrounding sand and it was necessary to dislodge the auger by digging with shovels. While in Nakor, EWB-VU trip participants attempted unsuccessfully to use the auger to drill an additional well near the school. Nevertheless, the Turkana have harvested sorghum and cowpeas from the community garden since May 2004.

EWB-VU members returned to Nakor in May 2005 to continue the project. Their work included installing three windmill bases and two windmills, drilling one well, installing drip irrigation systems for 5 one-half acre gardens, performing a health survey, collecting data to create a topographic map, and speaking about the project to children at the local elementary school.

The third project phase will be implemented in May 2006. On this trip, EWB-VU members will continue to work with the Turkana to drill wells and install windmills and drip irrigation systems. To prepare for the third project phase, EWB-VU is working to construct a rotating head windmill, improve the configuration of the drip irrigation networks, and compile an installation / maintenance manual to distribute in Nakor and in neighboring villages.

Project Phase II - May 2005

Prior to the May 2005 implementation trip, EWB-VU members worked to design a stronger drill frame for the mud-rotary auger used to drill wells, stands for elevating the water storage tanks, and the drip irrigation water distribution networks. The major challenge that arose in the design and planning process was the acquisition of site-specific information, including topographic data for each site and the flow rate of water that would be supplied by the windmills to each garden. However, project preparation and design continued using available information from G. Morden and engineering estimation.

In addition to project design, EWB-VU members carried out logistical planning, corresponded with Nakor community members via the Mordens, and accomplished a tremendous amount of fundraising. Fundraising sources for EWB-VU's implementation trips have included (1) on-campus fundraising at basketball games and other events; (2) grants from service-oriented foundations, church, and civic groups; (3) monies derived from partnering with the legal community, the VU College of Business Administration, and the VU College of Engineering; and (4) soliciting donations from personal contacts. EWB-VU has refrained from using corporate sponsorships to finance the entire project because the chapter believes that involving individual donors generates public awareness and support for the project. Over \$100,000 was raised by EWB-VU to carry out the May 2004 and May 2005 Kenya project implementation trips.

While EWB-VU prepared for the 2005 project, the Turkana in Nakor worked with G. Morden to plant crops and construct a fence around the garden established in May 2004 to prevent the intrusion of animals. The Turkana then successfully harvested sorghum and cowpeas from the garden numerous times throughout the year, assisted by the year-round warm climate. Morden also led the Turkana in an effort to continue drilling wells and installing windmills in Nakor. In one year, the Turkana progressed from never having seen a windmill to installing several windmill systems in their village.

Implementation

In May 2005, a group of 13 Valparaiso University students and five adult mentors traveled to Nakor to expand the project EWB-VU initiated in 2004, which G. Morden and community members had continued to develop throughout the year. EWB-VU was joined by the Mordens, two Turkana translators, and numerous Turkana community members. Initial project tasks included the construction of a stronger drill frame, punching holes in piping to form drip irrigation lines, and the installation of three windmill foundations. EWB-VU and the Turkana then divided into groups to work at three main sites.

At one site, a group worked to drill a well using a mud-rotary auger driven by a five horsepower lawnmower engine. Prior to drilling, the drill frame utilized in May 2004 was extended in height and a shelf was constructed. The shelf could be extended to move the auger away from the borehole in order for well casing to be driven with a drop hammer. Another change to the drilling apparatus since May 2004 was the addition of a second drill frame in order to provide more stability. Using this apparatus, the drilling group was able to successfully drill and case a 22-foot well.

At the second site, a group of EWB-VU members and Turkana set a concrete base upon which they erected a windmill. They also installed plumbing to enable the windmill to pump water from a well previously drilled by G. Morden and the Turkana. Potable drinking water was pumped from the well through the use of a hand pump. The group elevated a 3000-L water storage tank on the slope of a nearby sand dune so that when water was pumped from the windmill to the tank, it would have sufficient head to travel through the drip irrigation systems. The group then used machetes to clear garden plots and successfully installed drip irrigation systems for 3 one-half acre gardens.

The group at the third site also poured a concrete base and erected a windmill. They relocated a hand pump that had been swallowed by the rising level of the river resulting from a recent rain and connected the newly-erected windmill to the well used by the hand pump. When the system was tested, the windmill successfully pumped water to a 3000-L storage tank. The water could then be supplied to the 2 one-half acre irrigation plots established by this group.

In addition to the work performed at the three main project sites, EWB-VU members and Turkana set a windmill base at a site across the Kerio River. Fortunately for the land and the local people, it rained more than one inch during the ten-day May 2005 implementation trip, which was the most rainfall in a given storm event the village had experienced since 1996. However, due to the rising level of the river resulting from this rain, EWB-VU and local community members were not able to cross the Kerio again in order to erect the windmill. This task would remain for G. Morden and the Turkana to carry out once the level of the river receded.

Also during the May 2005 trip, EWB-VU members collected GPS data of the area in order to create a topographic map of the village for use in future projects, conducted a health survey, and gave a presentation at the local school. Through interviews of various community leaders, the health survey identified the most common illnesses affecting people in Nakor as malaria, diarrhea, tuberculosis, eye infection (conjunctivitis), malnourishment, and joint pains. The EWB-VU project will directly impact the number of people suffering from malaria, diarrhea, and malnourishment as it endeavors to make potable drinking water and water for irrigation available to the inhabitants of Nakor.

The elementary school is the only school in the village of Nakor. The group that visited the school made pinwheels with the children to illustrate the concept of a windmill and used posters to explain each aspect of the project. The children were very interested in the presentation and asked many questions, including, "Can the windmill blades rotate both clockwise and counterclockwise?" and, "What do you do if the pipe in the well breaks?" EWB-VU recognizes the importance of explaining the project purposes and goals to the local children as this next generation will someday be responsible for maintaining the existing systems and installing new systems.

Lessons Learned in May 2004

The insight gained from the project implementation trip conducted in May 2004 includes the following:

- Importance of a reconnaissance trip
- Increasing project organization
- Strengthening communication with the host community and among EWB-VU project participants
- Necessity of pre-trip education
- Importance of a diverse team
- Use of higher quality tools and materials
- Necessity of flexibility

Details of these lessons are provided by Polito and Husfeld¹, and the May 2005 implementation of the lessons learned in May 2004 is discussed below.

Lessons Implemented in May 2005

Reconnaissance Trip

The March 2004 and May 2004 trips to Nakor both served as reconnaissance trips for the May 2005 trip. These preliminary travels provided the information, data, and design criteria necessary to prepare for and carry out the May 2005 project. They also made it easier to form realistic goals for the May 2005 project and to formulate the best way to achieve these goals. The in-country contacts for travel, lodging, translators, and project materials EWB-VU developed through the first project phase were highly beneficial for the return trip in May 2005.

The positive relationships established between EWB-VU project participants, the host community members, and the local contacts represented another major benefit in May 2005 derived from previous reconnaissance trips. In May 2005, EWB-VU participants had gained the trust of the host community members due to the group's continued commitment to the community and the benefits of the clean water initiative experienced by the Turkana throughout the year. As a result of this bond, many more Turkana men and women worked together with EWB-VU group members on the May 2005 project implementation than had participated in the May 2004 first phase of the project.

The benefits of information, data, and design criteria, in-country contacts, positive relationships with community members and local contacts, and community trust can be developed through reconnaissance trips by any group working on a similar international project.

Project Organization

Prior to the May 2005 implementation trip, the preparatory work for the project was divided and allocated to chapter sub-groups, including logistics, irrigation, drilling, GPS / pipeline, fundraising, and publicity teams. Each of these teams prepared for a different aspect of the project and gave periodic updates to the other project teams.

While in Kenya, EWB-VU members worked at several different sites. Dividing the group into teams that worked at different project sites greatly increased the amount of work accomplished in May 2005 from that accomplished in May 2004. The EWB-VU members that had participated throughout the 2004-2005 academic year as a member of the irrigation, drilling, or GPS / pipeline project teams generally worked in similar capacities while in Kenya. The students were thus familiar with the aspect of the project on which they worked. All students typically remained on the same team throughout the course of the project implementation trip. As a result, students gained skills in the aspect of the project in which they worked instead of having to become oriented to a different aspect of the project each day. The teams were formed based upon students' skills and interests.

Students involved in the drilling team learned how to drill wells using a mud rotary auger, monitor the water level in the wells, and repair the drilling apparatus when problems arose. Students involved in the windmill and drip irrigation installation teams learned how to erect and install windmills, determine the appropriate fittings to use, and configure the drip irrigation systems. The problem-solving abilities of student participants were strengthened as students were challenged to respond quickly and adequately to problems that arose on-site.

Another element of the project organization in May 2005 included the partnering of each EWB-VU project participant with a host community member. Each pair worked together daily at one of the project sites. These partnerships enabled EWB-VU members and their Turkana partners to learn from each other technically and culturally while developing a friendship.

The authors recommend the division of preparatory work between chapter sub-groups, periodic project team updates, working at different project sites in the same host community (if the group is sufficiently large to accommodate this separation), allowing students to work on the same aspect of the project on the implementation trip as they did throughout the year, and encouraging individual partnerships with host community members. It has been the authors' experience that this manner of project organization has increased project productivity and also the satisfaction of project participants.

Communication

Communication was maintained with the host community via G. Morden throughout the 2004-2005 academic year in order to discuss both technical and logistical aspects of the project. Morden ordered the project supplies in Kenya requested by EWB-VU, hired translators, and invited community members to assist with the May 2005 project implementation. Communication was also essential within and among the project teams preparing for the May 2005 implementation trip. For this reason, the project teams met regularly and provided periodic updates to the entire chapter.

While in Kenya in May 2005, each team carried a two-way radio with the home station at the Morden's compound. The two-way radios facilitated communication between the teams working at different project sites. The teams often communicated to inquire about the location of tools or materials and to relay changes in the project. The radios saved team members from having to travel between the various sites in order to communicate with other teams throughout the day.

Another major improvement to project communication in May 2005 was the introduction of daily project updates. At the end of each day, the group gathered to listen to each team report the work accomplished and the challenges faced that day. Plans were then made as a group on how to proceed with the project the following day. This added communication enabled the project to progress more smoothly as team members formed goals for the work that could be accomplished the next day and collectively developed solutions to the problems encountered. Daily updates also kept project participants informed on the status of each aspect of the project and gave them a better holistic understanding of the project.

Communication with the host community was strengthened in May 2005 through individual partnerships with Turkana community members and through Turkana language lessons. The EWB-VU and Turkana partners often communicated to each other through the use of gestures. Turkana translators were available to clarify any misunderstandings and to explain project specifics. Each day at lunch, a break was taken from the physically grueling project work in order to study the Turkana language. Both EWB-VU members and Turkana community members gathered under the shade of a tree and were taught language lessons by the Turkana translators. Although the lessons were intended to teach EWB-VU members some Turkana words, they also served to teach Turkana community members some English words.

It is imperative for strong communication to be maintained within and among the project teams and with the host community contact and host community members for an international service learning project to succeed. Communication must be maintained during project preparation, implementation, and after project implementation. Communication between the project team and the host community after project implementation allows the impact of the project to be assessed and any necessary follow-up to be conducted.

Pre-Trip Education

Because EWB-VU discovered in May 2004 the importance of pre-trip education, heightened efforts to educate chapter members were employed prior to the May 2005 project implementation. A presentation on the May 2004 project and the Turkana culture was given to the full chapter membership by the first author, presentations on aquifers, well-drilling, and windmills were given at subsequent chapter meetings by the second author, and numerous grant applications incorporating the accomplishments and lessons learned during the first project phase were prepared and distributed by the third author. In addition, several Turkana words were taught at each chapter meeting and EWB-VU members received hands-on training throughout the academic year. One month prior to the May 2005 project implementation, project logistics and expectations were discussed at a training session. In an effort to prepare further for the project, EWB-VU members constructed a drip irrigation system while at the training session to irrigate a grove of trees on a local farm.

In order to maximize the use of time spent on an international project, pre-trip education is necessary for project team members to be knowledgeable regarding the type of work they will be performing abroad. Project team members can then spend as much time as possible teaching host community members about the project while abroad instead of learning project specifics themselves, although both parties will certainly learn throughout the project implementation.

Team Diversity

The importance of forming a project team with diverse interests and talents is another lesson learned by EWB-VU in May 2004. In particular, the presence of non-engineering team members proved to be extremely valuable. EWB-VU sought out non-engineering students to join the chapter and participate in the May 2005 project. These students offered new perspectives on topics such as socio-economic relations, cultural appreciation, marketing, and business strategies. Non-engineering mentors that participated in the May 2005 project implementation included a

local building contractor and a Lutheran deaconess. While in Nakor in May 2005, the non-engineering students and mentors encouraged EWB-VU project participants to take time to develop relationships with community members and offered a variety of talents, including mechanical ingenuity and physical labor skills. Relationships with community members were developed in part through conversation and by reading books to Turkana children who wanted to practice the English they had learned at the local elementary school.

Team diversity should be sought out in every international service learning project. International projects can benefit greatly from the collaboration of participants with different skills, interests, and backgrounds.

Tools & Materials

Having discovered during the May 2004 implementation trip that the quality of supplies and equipment purchased in Kenya frequently did not reach the standards of similar items sold or produced in the United States, EWB-VU brought various tools from the United States in May 2005 to accelerate the project implementation. The pipe wrenches and pipe tape brought from the United States were especially useful, as were the awls and center punches used to punch holes in the drip irrigation lines. Upon their departure, EWB-VU donated the tools they had brought to the community members in order that the Turkana could continue to use them.

Although bringing American metal fittings and valves would most likely have facilitated the project implementation, the Chinese metal fittings and valves sold in Kenya were used instead. EWB-VU trip participants found it important to use the metal fittings and valves sold in Kenya because in the event of a problem, the locally available fitting or valve could be replaced more easily. Due to having encountered problems with the poor quality of shovels purchased in Kenya, EWB-VU will consider bringing American shovels to Turkana in May 2006, although the transport of the shovels may prove difficult.

The issue of the quality of supplies and equipment purchased locally will likely be encountered in many international service learning projects. The authors suggest that international project participants find an appropriate balance between acquiring tools and equipment in the host community and importing tools and/or equipment. Purchasing project supplies in the host community is the optimal choice to support the economy of the host community and facilitate the repair or replacement of supplies. However, the authors recognize that international service learning projects are carried out over a limited time period, and it can thus be beneficial for ease of project implementation to import tools such as pipe wrenches or shovels. The importation of tools and materials should be done cautiously, and the availability of similar local tools and materials should be determined.

Flexibility

The need for flexibility was the most important lesson learned in May 2004. Working on an engineering project in a remote location with little rainfall and consistently high temperatures necessitates flexibility. Although project plans and preparation must be made prior to implementation, unforeseen complications and changes to the project will undoubtedly occur

during implementation. For instance, facing the loss of a well-drilling contractor prior to the first project implementation and losing the utility of a storage tank due to punctures from a thorny tree during the May 2004 trip warranted the re-working of plans and the reformation of goals. Therefore, prior to the May 2005 project implementation trip, EWB-VU stressed to its project participants the importance of adjusting expectations and work schedules when confronted with an unforeseen complication.

Not surprisingly, the flexibility of the May 2005 project participants was tested when they discovered upon arrival in Kenya that less than half of the project supplies ordered had actually been delivered. However, calmness prevailed and the group began to work with the supplies that had been delivered while waiting for the availability of the remaining supplies. After several days, G. Morden received word that the remaining supplies were ready for pick-up in Lodwar, a town seventy miles away from Nakor. Morden traveled with one EWB-VU student to retrieve the supplies, but due to an uncharacteristic rain, the sand roads became impassable and prevented their return. The two eventually returned with the supplies after a few more days, but their absence slowed progress on the project.

The flexibility of project participants will likely be challenged in every international service learning project. It is therefore important to discuss with trip participants project expectations and how to appropriately accommodate project changes prior to the project implementation.

Additional Lessons

Although many EWB-VU members travel to Kenya expecting to teach the Turkana how to engineer solutions to their food and potable water shortages, they leave Kenya realizing that they learned just as much or perhaps more from the Turkana than they taught. Related to the engineering of the project, the Turkana have inspired EWB-VU members to optimize the use of resources. For example, the Turkana showed EWB-VU members how to use palm fronds, which are readily available, to enable the concrete windmill foundations to cure. Also, EWB-VU members designed a stand to elevate the water storage tanks utilized in the irrigation systems in order to provide more head to the irrigation networks, however, upon arrival at the project sites, it became apparent that the water storage tanks could be positioned on the slope of surrounding sand dunes to achieve the same effect.

Another important lesson learned is the necessity of focusing not only on the engineering aspects of a project, but also on its cultural, education, and health dimensions. It is easy to emphasize the engineering tasks at hand and to neglect building relationships with host community members. However, forming such relationships is truly meaningful to both community members and visiting students and mentors. Spending as much time as possible with host community members is an excellent way to enrich the time spent working on an international project. While in Turkana in May 2005, EWB-VU members and Turkana learned about each other's cultures through discussions at midday. Working with a partner from the host community was another valuable way in which to build cross-cultural relationships.

Education is an extremely important aspect of an international service project. It is essential to find ways to promote community education in addition to working together with host community

members on the project implementation. With reference to the EWB-VU Kenya project, this aim has been incorporated by making a project presentation at the local elementary school and by reading books in English with Turkana children. Additionally, EWB-VU will introduce project installation / maintenance manuals in Nakor and surrounding communities in May 2006. EWB-VU hopes that these manuals will help guide community members in their maintenance of the existing windmill and irrigation systems and with respect to the installation of new systems.

The health assessment performed in May 2005 identified the most common illnesses in Nakor and also revealed that many community members were unaware of the causes and proper treatment of certain common illnesses. For this reason, EWB-VU hopes to incorporate community health education into its May 2006 project. A follow-up health assessment will also be performed in May 2006 in order to identify the impact of the EWB-VU project on the overall health of the community.

EWB-VU members have realized through their project in Kenya the tremendous importance of an ongoing partnership with the host community in any international service learning project. Building relationships with community members and gaining the trust of the host community takes time, and the entire project is a learning opportunity for both host community members and project participants. EWB-VU found the second phase project implementation to progress much more smoothly than the first, in part because a positive relationship had been established with the host community, and also because EWB-VU members learned immensely from the first project implementation and incorporated the lessons learned in the second project phase. For these reasons, an ongoing partnership with a host community can increase project productivity.

More importantly than project productivity, however, is the necessity of monitoring an implemented project over time. An ongoing relationship with the community enables the project team to promote awareness of maintenance issues among community members.² However, the partnership cannot continue indefinitely, as the ultimate goal is for the community to be able to maintain the system, install new systems, and teach inhabitants of surrounding villages how to install similar systems. It is thus essential to work together with host community members throughout the project and to teach them how to monitor and continue the project.

The lessons of learning from host community members, focusing on non-engineering aspects of a given project, community education, performing a health assessment, and forming an ongoing partnership with the host community are applicable to all international service learning projects. The authors suggest that international service learning project participants carefully consider each of these elements before, during, and after project implementation.

Conclusions

In May 2004, EWB-VU volunteers worked together with community members of Nakor to install the first windmill in the village and a drip irrigation system for a one-half acre community garden.

In May 2005, EWB-VU members returned to Nakor and worked with community members to install two complete windmills, drill one well, install drip irrigation systems for 5 one-half acre

gardens, perform a health survey, take data to create a topographic map, and speak about the project at the local elementary school.

Although both project phases faced numerous challenges, the May 2005 project progressed with fewer difficulties than the May 2004 project because the lessons learned in May 2004 were applied in May 2005. These lessons included the importance of a reconnaissance trip, increasing the level of organization of the project, strengthening communication with the host community and within the project team, emphasizing pre-trip education, forming a diverse project team, using the best tools and materials available, and, above all, exhibiting flexibility when responding to unexpected challenges.

It is beneficial to take into account these lessons and to focus not only on the engineering nature of the project, but also to emphasize the importance of considering the host community culture, education, and health in any international service project. EWB-VU intends to incorporate these lessons in May 2006, when the third and final project phase will be implemented, and in future projects awarded by EWB-USA to the EWB-VU Chapter.

1. Polito, Carmine and Rachel Husfeld. "Lessons Learned From An International Service Learning Project." Proceedings of the 2005 American Society for Engineering Education Annual Conference & Exposition. Portland: ASEE Press, June 12-15, 2005.
2. Harvey, P.A., P.N. Ikumi, and D. K. Mutethia. "Sustainable Handpump Projects in Africa: Report on Fieldwork in Kenya: January 30 – February 14 2003." Department for International Development, UK. Leicestershire: Water, Engineering and Development Centre, March 2003.
<<http://www.lboro.ac.uk/departments/cv/wedc/projects/shp/index.htm>>.



Figure 1: Rachel Husfeld and Turkana women punch holes in drip irrigation lines.



Figure 2: Dr. Carmine Polito, EWB-VU students Braden Katterheinrich and Jeff Travis, and local Turkana villagers work together to drill a well.



Figure 3: EWB-VU students Nick Minich and Chris Breinling, together with Turkana children, pose by a windmill.



Figure 4: Stages of sorghum growth in July 2005 following the May 2005 implementation trip.