

**AC 2008-1775: INTERNATIONAL DESIGN PROJECT EXPERIENCES:  
ASSESSING THE SHORT-TERM IMPACT ON STUDENTS**

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# **International Design Project Experiences: Assessing the Short-term Impact on Students**

## **Abstract**

In 2005, the Department of Civil Engineering at Rose Hulman Institute of Technology (RHIT) decided to incorporate an international component into its 18 year old capstone senior design projects. The advantages of international experiences for engineering students are well documented:

- Students have the opportunity to partner with local or international organizations.
- Students get exposed to international design codes and standards.
- Students get to experience the global working environment.

These are just a few of the benefits associated with international projects. However getting involved in foreign projects is not without its problems:

- Students face challenges associated with distance (e.g., site visits).
- Students have to deal with the different cultural and educational environments.
- Students experience difficulty obtaining necessary data.

Despite the associated challenges, the benefits to the students are seen as immediate and profound. To date, there is little or no information on assessing the short and long-term benefits of such projects. In 2006-2007 academic year, five Rose-Hulman civil engineering students designed an agricultural training facility in Ghana as part of their capstone design project. At the end of the project, in the summer of 2007, the student team had the invaluable experience of visiting Ghana. While in Ghana, they presented their final design report to both the local engineer as well as the local community; the primary beneficiaries of the project. Additionally, the student team visited a university in Ghana to explore the feasibility of collaborating with students on potential senior design projects. Excursions were organized as part of the trip to expand students' cultural awareness.

Prior to their visit, the Civil Engineering Department and the Office of Institutional Research, Planning and Assessment (IRPA) of RHIT developed and administered three assessment instruments in order to collect data on the short term impact of international design projects on student experiences. These instruments included a pre-trip survey, a student focus group, and daily student journals. This paper discusses the results of the data collected during this assessment process, suggestions for future improvement of the experience, and the need to assess the long-term benefits of student experiences.

## **Introduction**

Each summer, fifteen to twenty corporate or governmental sponsors submit proposals for design projects to the Civil Engineering (CE) Department at Rose-Hulman Institute of Technology (RHIT). In August each student ranks the projects, and assignments are made to maximize student preferences. Each design team includes four to five seniors, a faculty coach, the client,

and the course instructor. There is no charge for the design projects other than direct costs. These year-long, client-based projects have been the senior design capstone model at Rose-Hulman since 1988.

The four learning objectives for client-based, senior design projects include: (1) problem-based learning (of the civil engineering design process), (2) communication proficiency, (3) team-work skills, and (4) project management orientation. The year-long experience contains many key elements and deliverables to achieve these learning objectives. The design process experience is cultivated through problem identification, development and assessment of alternative solutions, data collection, engineering design, and cost estimation. Team-work and project management skills are developed through rotating group assignments. Written communication skills come from the three deliverables required of each group: the proposal, progress report, and final report. Faculty assessment of these written reports is demanding and thorough. Oral communication skills are enhanced through four major presentations: the proposal and progress presentations to the senior class and faculty, final presentations to the client and presentations at a professional venue.

Three years ago, members of the civil engineering faculty thought it would be beneficial for Rose-Hulman students to venture into the international arena. The dialog began when a faculty member participated in a mission's trip to Trinidad during the summer of 2005. Conversations with the physician in charge of the project resulted in a senior design project for Rose-Hulman students. The end result was a design report for a missionary complex complete with an orphanage, a medical facility, a home for battered women, and a soup kitchen<sup>1</sup>.

There are many good reasons to expose engineering students to international projects. For example, the explosion of knowledge precipitated by the Internet and the resulting global economy will make engineering services increasingly dependent on an international talent pool. This is very apparent to the National Academy of Engineering as stated in its report on the engineer of 2020<sup>5</sup>. Global competition from India and China is an inescapable conclusion of Thomas Friedman in his book entitled "The World is Flat"<sup>2</sup>. Engineers ignore these economic dynamics at their own peril; embracing change and competition is likely to produce satisfactory results. A new technological workforce will emerge in the 21<sup>st</sup> century according to author and futurist David Heenan<sup>4</sup> and we need to prepare for it.

Our first international senior design project (2005-2006 academic year) produced many challenges. The lessons learned encompassed all phases of the project as summarized by Hanson et al<sup>3</sup>. Examples of the primary lessons are listed below in their appropriate categories:

- Purpose (International projects should align clearly with program outcomes.)
- Project Acquisition (Personal relationships with perspective clients is invaluable.)
- Project Planning (Build a budget; site visits are just as critical for international projects.)
- Site Visit (Itemize and prioritize the objectives of the site visit.)
- Design (Information acquisition and factors of safety are important design considerations.)

We obtained our second international project (2006-2007 academic year) through the student chapter of Engineers Without Borders at Rose-Hulman (EWB-RHIT). The project involved the design of an agricultural training facility. The Obodan Sustainable Development Center

(OSUDEEC), located in Accra, Ghana will provide participatory learning experiences to promote rural development. The OSUDEEC facilities will consist of a computer training center, conference hall, caretaker house, hostel, poultry building, office space, and executive chalets. In addition, the center will need power (from the nearby grid), water (groundwater source), a fruit orchard, a vegetable garden, an irrigation pond, and a children's playground<sup>6</sup>. Key tasks include the development of floor plans and the site design along with the structural and foundation design of the center's buildings.

### **Project Setup and Initiation**

*(Anticipated Challenges - dealing with these challenges at an early stage in the process)*

Capstone projects in the RHIT Department of Civil Engineering require advance preparation by the course instructor and by likely project mentors to assure the work scope is consistent with the learning objectives. Sometimes, preparation also requires advance acquisition of resources the design team will need to be successful. In the case of an international design project, the instructor and mentor must consider the possibility that the student team may not be able to visit the project site and whether data necessary to complete a preliminary design remotely can be acquired or even exists. As a minimum, the design team should have the following relevant data:

- Information about previous and current land use, including current photos of the site
- Region-specific geologic and soil mapping information
- Site and regional topographic data
- Pertinent codes and related engineering data
- Information on local construction and design practices

The search for some of this information, if not all, is a significant feature of the international project experience, so students should be expected to conduct that search. Even so, the instructor and mentor must be confident the data can be acquired before offering the project to the students.

In addition to the above preliminary data, the specific soil conditions at the site can have a significant impact on the project for the design of foundations and wastewater systems. Remote, tentative foundation design can be a big improvement over conservative "rules of thumb" design and a significant contribution to the learning experience if regional and site-specific data are available. The design of a wastewater management system is even more highly dependent on the site-specific soils. For this design, ground water conditions are needed along with shallow soil characteristics to estimate hydraulic conductivity. Tentative ground water conditions can likely be determined through interviews and local observations by the client, but shallow hydraulic conductivity requires empirical correlation with at least index properties such as grain size analyses and soil plasticity.

Site-specific soil data are not likely to be available through literature searches or by query with local practitioners. Thus, some provisions must be made to acquire samples from the site for at least index testing to permit soil classification that can then be combined with regional soil data to permit preliminary design. Sampling and testing of soils can be achieved by (1) client sampling followed by shipping the soils overseas, (2) client sampling and in-country testing by a local lab, or (3) soil sampling by a project team member during a site visit followed by local

testing or transport of samples by the team member. Note that there are federal regulations limiting the transport of soil into the United States. For the previously referenced Trinidad project, a team member traveled to the site over Thanksgiving break and conducted local soil sampling and testing. The key is for the instructor and mentor to perform advance planning and perhaps even have the testing conducted before the start of the capstone project so that lack of local soil data does not impair the project.

### **Partnership with Engineers Without Borders (EWB)**

To address the problem of obtaining site-specific data, the CE department partnered with EWB-RHIT. EWB-RHIT was established in the fall of 2004. Since its inception the chapter has partnered with disadvantaged communities to improve the quality of life through implementation of environmentally and economically sustainable engineering projects. Currently, EWB-USA is involved in 80 projects in 35 countries around the world. To start a project, a community in need of engineering assistance applies through EWB-USA for aid. EWB-USA then evaluates the community's request for assistance by determining the feasibility of using college engineering students to solve the problem. Once this is done, college chapters, like EWB-RHIT, send in applications to volunteer to fulfill the needs of the community.

In 2004, Dr. Anthony Akunzule (client for the OSUDEC project) made EWB-USA cognizant of some of the major problems in his community, Obodan, Ghana. In response to his request, the EWB-RHIT chapter visited Obodan in the of summer 2006 to construct a brooder house. Prior to this visit, the CE Department was contacted by the client about a potential senior design project of an agricultural training facility. Fortunately, the brooder house was part of this agricultural training facility. Aware of some of the problems encountered in our first international design project, especially in obtaining the relevant engineering data, we decided to partner with EWB-RHIT. This partnership solved many of the problems encountered in our first experience with international projects. While in Ghana, EWB-RHIT was tasked to obtain the following site-specific soil data as well as pertinent design codes: previous land use, design codes, rainfall data, common building materials, local construction techniques and practices in Ghana and some site photographs. Most importantly, the group provided soil samples from specific locations of the site and these were sent to an academic institution in Ghana where laboratory testing was performed. This was extremely important because of the difficulty in bringing soil samples from another country to the United States. Through this collaboration, most of the engineering data was obtained prior to the student team working on the project.

### **Collaboration with Kwame Nkrumah University of Science & Technology (KNUST), Ghana**

As noted previously, site-specific soil data is crucial to a useful design by the student team. For the OSUDEC project, a team from EWB-RHIT planned to visit the project site the summer before the scheduled capstone design in the RHIT CE department. The instructor, mentor, and geotechnical faculty member in the department thus met with the EWB-RHIT leadership to plan for acquisition of local site data, including soil samples for testing. After extended discussion and investigation into issues with the transport of samples into the U.S., the instructor, mentor and EWB leadership concluded local soil testing should be investigated. As a native of Ghana,

the project mentor took leadership on this task. Specifically, the project mentor arranged for soil index testing with a colleague at Kwame Nkrumah University of Science & Technology, Ghana, (KNUST) located approximately 270 km north-west from the project site. The colleague, Dr. Samuel Kofi Ahiamadi who is a co-author of this paper, had expertise in geotechnical engineering and volunteered to facilitate index testing in accordance with American Society for Testing and Materials (ASTM) standards.

The RHIT geotechnical faculty member subsequently coached the EWB leadership about soil sampling, including decision-making during sample acquisition, observation of soil consistency for qualitative strength assessment, and sampling protocol to preserve natural water content. Arrangements were made by the RHIT project mentor for transport of the samples to KNUST after sampling, thus facilitating acquisition and testing of site-specific soils before the CE capstone team had even arrived on campus for fall classes. The collaboration by Dr. Ahiamadi was instrumental to the project, plus the RHIT geotechnical faculty member found the interaction with Dr. Ahiamadi professionally enriching.

The RHIT CE capstone project leadership believe that future projects will find it similarly challenging to transport soil samples to the U.S., but stress that site-specific soil data is crucial for successful design. Consequently, future project planning will consider local soil testing first. Development of a protocol for non-engineers to conduct sampling, make on-site observations, and secure samples for local shipping is under way by the RHIT geotechnical faculty member.

## **Survey Results**

Student perceptions and attitudes are an important part of the capstone design experience. Therefore, questionnaires were conducted with the seniors in 2005 and 2006 during weeks 7 and 14 of the 30 week project. Table 1 presents the results of the first survey. Overall satisfaction of students with their project selection was high, 4.0 to 4.2 out of 5, but the students on the international projects were even more pleased with their choice, 4.5 to 5.0. Table 2 presents the results of the second survey. Questions 1 through 5 focused on what motivates students in their selection of projects. Consistently and overwhelmingly, the most important aspect to students is the subdiscipline(s) of civil engineering that the project emphasizes. One concern of the faculty was that an international project would be more work for the student team compared with domestic projects. The responses to Questions 6 and 7 show that on average, all students feel they work slightly harder on their project compared to the other groups. Therefore, there is probably no difference in time spent by teams on an international project compared with teams on a domestic project.

Table 1. Results of surveys conducted during week 7 of the capstone design course during the 2005-2006 and 2006-2007 academic years.

<i>Question</i> : I am ... pleased with the project to which I was assigned.		1: abs. not	2: not	3: somewhat	4: very	5: extremely	Average
Members of International Proj Team	2005	0	0	0	2	2	4.5
	2006	0	0	0	0	5	5.0
Members of All Other Teams	2005	0	0	7	13	7	4.0
	2006	0	0	8	22	15	4.2

Table 2. Results of surveys conducted during week 14 of the capstone design course during the 2005-2006 and 2006-2007 academic years.

Questions	Year	1: Not a factor	2: Small factor	3: Some factor	4: Important factor	5: Most important factor	Average
1. Indicate how much the international aspect of a potential senior design project would affect your choice of a senior design project	2005	4	9	9	8	0	2.7
	2006	13	9	15	10	0	2.5
2. Indicate how much the humanitarian/charity aspect of a potential senior design project would affect your choice of a senior design project	2005	5	2	10	11	2	3.1
	2006	6	3	16	19	3	3.2
3. Indicate how much the potential benefit of the project to the client would affect your choice of a senior design project	2005*	-	-	-	-	-	-
	2006	2	3	25	11	6	3.3
4. Indicate how much the civil engineering specialties aspect of a potential senior design project would affect your choice of a senior design	2005	0	0	4	6	20	4.5
	2006	1	1	3	19	23	4.3
		1: Abs. not	2: Prob. not	3: Possibly	4: Probably	5: Absolutely	Average
5. Rate your desire to work on an international senior design project if one was available in your preferred area of civil engineering	2005	0	6	14	7	3	3.2
	2006	0	9	19	10	9	3.4
		1: Much less	2: Less	3: About same	4: More	5: Much more	Average
6. Indicate how much work your project requires compared to the international project [domestic project team members]	2005	0	2	16	7	1	3.3
	2006	0	1	31	8	2	3.3
7. Indicate how much work your project requires compared to the other projects [international team members]	2005	0	0	3	1	0	3.3
	2006	0	0	3	1	1	3.6

\* Question not asked in 2005 survey.

When seniors in week 14 of the 2006-2007 academic year were asked to complete the statement “My biggest concern about working on a senior design project for an international client is...”, five students indicated “communication” and four indicated “obtaining data”. When asked to complete the statement “The biggest advantage about working on a senior design project for an international client is...”, the responses focused on broadening their experiences.

## **Ghana Trip**

In the summer of 2007, the student team commissioned to design the agricultural training facility in Ghana had the invaluable experience of visiting Ghana. This trip came about as a result of the Institute’s as well as the CE department’s desire to provide some international design experience to our students.

As part of the senior design requirements, the student team presented their final design report to the District Chief Executive of the town, the local engineer, and most importantly, the local community. Furthermore, the student team explored the feasibility of collaborating with students from Kwame Nkrumah University of Science and Technology on future senior design projects. Finally, to expand their cultural awareness, the students toured some of educational and historic treasures of Ghana.

## **Assessment Activities**

A summative assessment was planned for the 2006-2007 academic year to examine the impact of actually spending time in Ghana as part of a senior design project on students both academically and personally. Three assessment components were implemented for the current assessment including: 1) a pre-trip survey; 2) a focus group following the trip; and 3) daily journals kept by students during the trip. The assessment tools were chosen based not only on the small sample size ( $N = 5$ ), but also based on the type of feedback the department wanted. It was decided that focusing on qualitative feedback would be more beneficial this year over quantitative.

Seven main components were focused on for exploration during this assessment:

1. Expectations for the trip.
2. Motivation for the trip.
3. Preconceptions of Ghana.
4. Benefits of the trip.
5. Enjoyment of the trip.
6. Suggestions for change.
7. Student viewpoint of importance.

Information related to each of these areas is explored in this section.

## **Expectations**

Students were asked what they thought would be the most enjoyable and challenging aspects of their experience in order to gauge their expectations. Students predicted the most enjoyable



aspects of the trip would be learning about the culture of Ghana and meeting new people. The responses for the most challenging aspect were more varied than the responses for the enjoyable aspects. The predicted challenges include familiarizing themselves with the customs, becoming comfortable in a new environment, communicating with others about the project, deciding where in the project to focus their data collection effort, lack of Internet access, and lack of US daily living necessities.

Following the experience, students expected to know more about the language, culture, and people of Ghana. They also expected to learn more about the construction and engineering practices in Ghana.

### **Motivation**

Student motivation for going to Ghana included meeting the Ghanaians who would benefit from the proposed design and experiencing another culture. All of the students' parents were excited about the opportunity for their children to travel to Ghana. In fact, one student's family decided to go with him.

### **Preconceptions**

To identify the preconceptions students held about Ghana prior to their trip, they were asked how much they knew about Ghana and what came to their mind if someone told them they were going to Ghana. One student involved with the project has been to Ghana previously as his parents are Ghanaians. Therefore, he reported knowing quite a bit about the country compared to the other students. The remaining students reported limited prior knowledge including that it is a democratic country, was previously a British colony, a little geography, and the statistics of the agriculture.

Students thought of mission trips and humanitarian work first if they heard of someone going to Ghana. They also thought about the African continent, memories of senior design project meetings, and speculation concerning the specifics of the country.

### **Benefits**

During the focus group held following the students' return to the US, they were asked a series of questions to assess the benefits they received from the trip. The first question directly asked students in what ways they found the trip beneficial. Students reported both personal and academic benefits to the trip.

Personal benefits included seeing how differently people outside the US live, seeing the people affected by the project, learning about a new country,

*“It really helped me in thinking about who we serve as engineers. Seeing the people that are affected by my work gives me a stronger conviction to make the design perfect.”*

*“It showed me yet again that America is very blessed to have the luxuries that we can afford. The trip also showed me that people can be happy in every setting.”*

Academic benefits included establishing a relationship with the client. Students also benefited by learning about engineering practices in a different culture including construction methods, capabilities of a building in a different geographic area, building practices, and project management.

Students’ communication skills were enhanced as a result of the trip. They quickly became aware of the challenges of having a conversation in another country including feeling lost when Ghanaians used their native language and the loss of meaning in phrases once translated. Students also reported an enhancement of listening skills as well. Finally, students learned to tailor their presentation to meet the interest and needs of their audience.

*“Minutes before giving our presentation, we decided to cut out many of the technical aspects because the people of Obodan were not concerned about wind loads on the buildings...they were concerned about why and how this project would benefit their village. It was a big learning step in my development and something that I will use in the future in every project that I am involved.”*

Students also reported benefiting through learning about a different culture. They were surprised at how friendly and “laid back” Ghanaians were.

*“It was an opportunity to learn about a different culture that could not have been seen in any classroom, no matter how good the teacher is.”*

Recognition of the global impact of the project was another benefit students received as a result of the project. The center the students designed is to be used as an agricultural training center where people from other African countries will learn sustainable agricultural techniques to put to use in their own countries. Not only will the center benefit the local Obodan community, but has the potential to reach much of Africa.

*“Basically, this development, when brought to fruition, will take a 3<sup>rd</sup> world village and allow for the personal and professional development of its people.”*

A final benefit students reported concerned their understanding of designing for an overseas project. Students felt they are now more prepared for challenges and have a better understanding of necessary site-specific information needed for a project. They would like to visit a site before starting the main design in the future. Other areas of increased understanding include taking into account language and communication barriers, location, cost, and culture. Students also learned the need for being able to adapt quickly and efficiently as well as the need for a product that can

be used and is practical. One student summarized their increased understanding in this area by saying:

*“This project taught me that America builds like America and the rest of the world builds like the rest of the world. Designing for another country means that you have to think like that country and forget most things American.”*

## **Enjoyment**

Students reported their favorite aspects of the trip to be the relaxed pace and meeting the people. Their least favorite aspects of the trip included the humidity, lack of hot water, getting ill from the food, and realizing how many people live in poverty.

When asked what part of their final design product they were most proud of students could not pick just one aspect. Overall they were proud of the entire project. Specifically, they were proud of their design team’s recommendation for the order of construction because they gave the client “a practical way to phase in the compound, serving him beyond engineering design.”

## **Suggestions**

Unanimously the students would recommend an international design experience to other students. They felt it was a good way to make a difference as an engineer. Students reported facing different challenges than other design teams because of the international aspect and found the experience rewarding.

*“The only regret I have about this international project is that everyone in my class did not have the opportunity to take part in it with us.”*

Changes students would make to the experience include spending more than 5 days in Ghana, doing some of the construction work on the project (such as laying masonry block), learning about construction practices from a local engineer, and including more time to see the country and enjoy the culture.

## **Student Journals**

The students’ daily journals provide compelling insights into the student experience that would be diluted by an attempt to summarize them. Therefore, some highlights are presented here to provide an example of the type of content included in them.

### ***First Day***

This was the day that the students arrived in Ghana. . The students visited the District Chief Executive’s office where they will present their project. Later in the day they took a tour of the Nsawam town.

*“Today we flew into Accra for our first day in Ghana. It was an eye opening experience.”*

- Student A

*“This is the first time in my life that I have traveled overseas, let alone to Africa.”*

- Student B

*“One thing I didn’t expect is that we couldn’t find a waste basket anywhere in the hotel. All drinks are served out of bottles, which are recycled. There were no napkins, but we washed our hands before and after meals with water and a rag. Any food or items purchased were not packaged in any cardboard or plastic. There is almost no waste produced here.”*

- Student C

*“Before our meeting with the District Chief Executive (like a mayor), Akunzule took us to a botanical garden just behind the District Executive’s office. We each picked out two trees to plant on site which cost 5,000 cedis (about \$0.60) each. The total cost of everyone’s trees was about 90,000 cedis, so we gave the seller 100,000 cedis to include a tip, which she could not believe. We later learned that our \$1.10 tip was a day’s wage for the majority of the people. After that we all decided to tip more.”*

- Student C

## **Second Day**

The student team presented their final report to the District Chief Executive, District Engineer and the local community. During the presentation to the local community the students were able to see the impact of their project on the people’s lives. After the presentation the students visited the project site.

*“We gave the presentation in a small information center surrounded by many people from the village.... It was an overwhelming experience as the Queen Mother said grace and introduced us to all of the elders and important people in the village. It was important for us to see the impact our project might make on these people’s lives.”*

- Student A

*“It was at this moment that I was extremely proud to be on this project [to] help make the first step in building the village up from poverty.”*

- Student A

*“Today was one of the most eye-opening days of my life. The second part of our day was highlighted by our presentation to the people of Obodan. The Chief and sub-chief as well as the Head Mother were in attendance. I would guess that over 75 people were in attendance, including what Akunzule called ‘all the important people of Obodan.’ The meeting will undoubtedly be one of the most memorable moments of my life.”*

- Student B

*“I definitely wasn’t expecting to give our presentation through a translator, but it added another dimension to our project.”*

- Student C

### **Third Day**

This was the last day of the visit. The students toured a typical rainforest and a slave castle in Cape Coast; a town located in the southern portion of Ghana and west of the capital Accra.

*“It was in the scheme of things that the five of us were put on this project, that we were given the opportunity to visit this beautiful country, and that we saw what needed to be done to change the lives for the better of others who have less than we have.”*

- Student A

*“...This experience was one of the best of my life and that international projects are worth more than any dollar amount you could put on them. I would hope that every Rose student would be able to take an international trip and have the same kind of experiences that our senior design team had.”*

- Student B

*“We’ll be the first department at Rose to have that international connection. I hope I can come back to Rose in 10 years and hear about a project in West Africa involving students from both colleges.”*

- Student C

*“...We had a genuine interest in learning about the people, land, history, social issues, etc in the interest of giving whatever aid we could. That was the nature of our project.”*

- Student C

## **Important Considerations for Further Improvement**

Based on our second experience with international design projects, a number of key observations were made by the authors that will require consideration:

- There is the need to improve the medium for communication. For the next international design project the following communication channels will be explored; videoconference, teleconference via a phone line and web conference.
- To reduce the burden of gathering codes and making new arrangements for in-country soil testing, we recommend creating a long-term relationship with an organization in the region. Currently, the RHIT CE department has established a Memorandum of Understanding (MOU) with KNUST to achieve this objective.

Plans are far advanced to undertake a second project from Ghana for 2008-2009 academic year. The project will involve the design of a Cancer Research Institute. The mission of the Institute will be to reduce death and suffering from cancer in disadvantaged people in Ghana. Hopefully, through this project RHIT students will have the opportunity to collaborate with students from KNUST.

## **Future Assessment Goals**

From the students response obtained from the survey, focus group and daily journals, it appears that the short term benefits are immediate and profound. Our next goal is to assess the long-term benefits. Questionnaires will be sent to all students who have been involved with international design projects. The goal is to contact these students a couple of years after graduation to assess the impact of international design experience on their professional career and growth.

## **Conclusions**

In order to provide students with some international experience with regards to the global working environment and how to deal with the different cultural and educational environments, the OSUDEC project brought together student teams from the CE Department and EWB-RHIT, a professor, a client, and a local engineer from the project-source country. Some lessons learned from this experience are:

- The project provided the students the opportunity to consider economic, social and societal impact, application of appropriate technology, and the limitations of the project-source country while applying engineering skills.
- The students learned creative problem solving and cross-cultural communication.
- Collaboration between the student team, EWB-RHIT, a local engineer, and KNUST was very successful. EWB-USA is involved in a lot of projects all around the world and can be used as an avenue to obtain necessary information.

Overall, international design projects provide students with valuable experience in communication, design, and organizational skills. Additionally, such projects expose some of the challenges that can be encountered in dealing with an international client in a different cultural and educational setting. However, the humanitarian aspects of these projects cannot be over-emphasized. It is possible that this project provided a life-changing experience for one or more of these students; our long-term study should be able to assess this.

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