

Overcoming Challenges Associated with the Joint Project Model

John Aidoo¹, Shannon Sipes¹, Jim Hanson¹, and Kevin Sutterer¹
¹*Rose-Hulman Institute of Technology*

In 2006, the Department of Civil Engineering at Rose Hulman Institute of Technology (RHIT) initiated international collaboration with Kwame Nkrumah University of Science & Technology (KNUST), Ghana.

In the first form of this collaboration, each institution pursued its own design itinerary but both partner institutions used the same problem and design objectives. The disadvantage with such a model is that the course instructors in both institutions provided the necessary information for the successful completion of the project. Therefore, the project happened orthogonally and feedback received from the students indicated a lack of cultural experience between the students at both institutions. Based on this feedback, the next model pursued consisted of a parallel design project in which the student teams from both institutions worked independently on the same project but they were encouraged to share and discuss data and ideas to solving the problem. Finally, a “Joint Project Model” was implemented. For this project model, Rose-Hulman students were paired with KNUST students to design a project in Ghana as one cohesive team.

This paper discusses some of the challenges associated with the “Joint Project Model” and also offers potential solutions to these challenges.

Keywords: international project, collaboration, joint project model.

Corresponding Author: John Aidoo, aidoo@rose-hulman.edu

Introduction

Most industries are becoming more globalized resulting in an increase in engineers working with international clients as well as integrating their technical expertise with global experiences. However, undergraduate engineering students rarely get the invaluable experience of working on international projects even though, the Accreditation Board for Engineering and Technology (ABET) requires all ABET-accredited programs to demonstrate that students from such programs have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. Thus it is evident that future engineers should possess a better understanding of the ever-changing global economy, awareness of cultural diversity and possess the skills or experiences to work in multi-national teams (Esparragoza and Devon¹).

Beginning in 2005, the Civil Engineering (CE) department at RHIT began incorporating at least one international design project in its 25 year old, year-long, client based capstone design course. One of the main objectives for providing this international experience is to prepare our engineering students for the global

working environment. Additionally, the benefits of exposing engineering students to international projects are well documented: report on the engineer 2020 by the National Academy of Engineering² and Thomas Friedman’s book the “The World is Flat”³.

To better prepare engineering students in the US for the global challenges, most colleges have established some form of collaboration with overseas academic institutions. Examples of such collaborations have been published by Anwar et al.⁴ and Parkinson et al.⁵.

The initial model for our international projects was the “Stay at Home” model, where our students work on the project while at their home institution. Based on the challenges associated with this model (Hanson et al.⁶), changes were made to the format for subsequent international projects undertaken by the RHIT CE department. One of the main revisions is to partner with overseas academic institution in the country where the project is undertaken.

The goals of this particular partnership are to make it feasible to obtain site-specific soil data; a crucial component to a useful design by the student team and create an avenue to expose our students to a different cultural environment.

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

International collaboration between RHIT and KNUST was initiated in 2006. As noted previously, site-specific soil data is crucial to the successful completion of international projects especially in situations where the student team may not be able to visit the project source country. Since the first author is a native of Ghana, the RHIT CE Department decided it would be easier to establish our first international collaboration with KNUST, in Ghana.

Evolution of the Project Model for the Collaboration

In the first form of the international collaboration with KNUST (2006-2007 academic year), each institution pursued its own design itinerary but both partner institutions used the same problem and design objectives. The disadvantage with such a model is that the course instructors in both institutions provided the necessary information for the successful completion of the project. Therefore, the project happened orthogonally and feedback received from the students indicated a lack of cultural experience between the students at both institutions.

Consequently, the next model selected for this collaboration consisted of a parallel design project in which the student teams from both institutions worked independently on the same project but they were encouraged to share and discuss data and ideas to solving the problem. Sharing of ideas was achieved via video conferencing, teleconferencing etc. This was the model used for 2009 and 2010 academic years.

Finally, to further foster collaboration between students from the two institutions a “Joint Project Model” was implemented in 2011 and 2012. In this model, RHIT students were paired with KNUST students to design a project in Ghana as one cohesive team. This model facilitated continuous dialogue between the students. The design team met typically once a week to assess the progress of work. As part of the requirements for this collaboration, the student team defended their final design in the presence of a panel of practicing engineers in Ghana. This was done via video-conferencing for the RHIT students.

Challenges faced with the Joint Project Model

Semester Mismatch

One of the biggest impediments that we have encountered with our collaboration with KNUST is the different academic timeline in both institutions: KNUST is on the semester system and Rose-Hulman on the quarter system. In KNUST the senior design project is done within the fall semester whereas at Rose-Hulman our senior design lasts the entire academic year.

Therefore, for the “Joint Project Model” to succeed, the CE department at Rose-Hulman had to make some changes to the format of the capstone design course. Specifically, students involved in the collaboration project with KNUST were assigned an additional course credit. With this change, the Rose students were able to work with the Ghanaian students to complete the project within the fall semester. Additionally, with this format the design team was required to meet the deadlines as set by the KNUST senior design course instructor. At the end of the fall semester, the student team defended their final design in the presence of a panel of practicing engineers in Ghana via video-conferencing. The students were graded based on their contribution to the report as well as their performance during the oral defense. For the Rose team, each student was assigned a faculty design mentor whose area of expertise is best suited for the individual student’s sub-discipline contribution to the team’s project. Consequently, the grades received by the student was based on their contribution in their selected sub discipline.

Since at Rose-Hulman our capstone design lasts through the academic year, the RHIT students that were part of the collaboration are assigned different aspects of the Ghana project to work on for the remainder of the academic year (i.e. winter and spring). Typically, these involve parts of the project that were not fully addressed during the fall semester, such as different design alternatives, or the use different construction material, etc. During this time, the RHIT students maintain contact (to a lesser degree) with their Ghanaian counterparts as well as the KNUST senior design course instructor. At the end of the spring quarter the Rose students send a copy of their report to the course instructor in Ghana for review and feedback.

Different time zones

Working in different time zones presented a challenge for students at both institutions. Based on the Eastern Time Zone, Ghana is approximately 4-5 hours ahead of United States. To accommodate the different schedules, our meeting times were scheduled as early as 7.00 am in the United States. This worked well for the Ghana students, because this was lunch time in Ghana. On the other hand at RHIT classes began at 8.05 am. This set-up resulted in at least an hour of meeting time for discussions and ideas about the project without affecting their class schedules. The students were also encouraged to communicate after class hours.

Cost of Collaboration

A relatively new challenge for both institutions is the cost involved in this type of project model. Most of the cost issues have been raised by the CE Department at KNUST. From the feedback received from the KNUST

senior design course instructor the following areas were identified:

- The cost involved in having regular project meetings via teleconference, video conference etc. Internet access is not easily accessible to the Ghana students.
- The cost involved in obtaining additional engineering data for the RHIT students in the winter and spring quarter part of the collaboration.
- The cost involved in using a video-conferencing facility for the oral defense at the end of the fall semester.
- The additional time required by the KNUST course instructor for reviewing reports from the Rose students during the winter and spring quarter collaboration.

Based on our past experiences, some of these issues are very typical of collaborations with institutions located developing countries. Although the costs may seem small they could represent a significant portion of the budget for some of these institutions. We plan to have a meeting with our counterparts at KNUST to discuss potential cost sharing ideas.

Travel

Another challenge for both institutions is the cost of travel to the project source country. Since 2006 when we first started this collaboration only one senior design team from Rose-Hulman has visited Ghana. This was in 2007 when five Rose-Hulman civil engineering students designed an agricultural training facility in Ghana. The team presented their final design report to both the local engineer as well as the local community; the primary beneficiaries of the project. Funding for this travel was provided entirely by the Institute. In a paper published by Aidoo et al.⁷, results obtained from alumni survey indicated that site visit is crucial to the proper completion of international projects. Therefore, to be able to incorporate a site visit in our international projects, the CE department at Rose-Hulman is exploring a couple of potential sources to raise funds for travel: proposal through the National Science Foundation (NSF), and the Office for International Programs and Global Studies at Rose-Hulman.

Ultimately, our goal is to fund student team travel at least once during the academic year.

Conclusion

Although the Joint Project Model provides a higher level of collaboration between the students from the two institutions there are some challenges that need to be addressed. Below is a summary of the observations made for this project model and our proposed solutions:

- Higher level of collaboration between the students. *The joint team should be selected based on the sub disciplines such that it will enhance higher level of collaboration amongst the students. For example, the student responsible for the geotechnical design should not be in the same institution as the student for the structural design. This will ensure that they communicate with each other to get their design completed.*
- Higher cost involved due to regular meeting schedules. *This should be included in the Memorandum of Understanding (MOU) between both institutions. Furthermore, external sources of funding should be identified prior to implementation of the project model.*
- Higher number of contact times for faculty involved. *The course instructors and students for both institutions should establish the number of planned meetings in advance.*

Notwithstanding these challenges and the cost involved, international design projects provide students with valuable experience in communication, design, and organizational skills for working in a culturally different environment. This experience prepares the students involved to succeed in the ever-changing global working environment. Both short term and long-term impacts have been discussed by Aidoo et al⁷.

Future Work

For next phase of this collaboration, KNUST students will be paired with Rose students to work on a project located in the United States. Additional iterations to explore include:

- Working across time zones and regional cultures within the US
- Exploring collaborations in other countries and continents

Additionally, for the next phase, we plan to assess the level and quality of cultural learning by both student groups.

References

1. Esparragoza, Ivan and Devon, Richard (2007). Forming Global Engineers: A Freshman Engineering Design Course with Multinational Design Project Involving Latin American

- Institutions. *Proceedings, 2007 ASEE Annual Conference and Exposition.*
2. National Academy of Engineering, Committee on the Engineer of 2020. (2005) *Educating the Engineer Of 2020*, the National Academies Press, Washington, D.C
 3. Friedman, Thomas L. (2005). *The World is Flat: A Brief History of the Twenty-first Century*, Farrar, Straus, and Giroux Publishers, New York, NY.
 4. Anwar, S., Favier, P., and Jouglet, D.,(2008). *Proceedings, 2008 ASEE Annual Conference and Exposition.*
 5. Parkinson, Alan, Jensen, Greg C., Zaugg, H., and Magleby, S.,(2010). *Proceedings, 2010 ASEE Annual Conference and Exposition.*
 6. Hanson, James H., Houghtalen, Robert J., Houghtalen, J., Johnson, Z., Lovell, M., and M. Van Houten (2006). "Our First Experience with International Senior Design Projects – Lessons Learned." *Proceedings, 2006 ASEE Annual Conference and Exposition: Advancing Scholarship in Engineering Education.* June 18-21 2006, Chicago, IL.
 7. Aidoo, J., Sexton, S., Hanson, James H., Houghtalen, Robert J., and Lovell, M., (2012). "International Design Project Experiences: Assessing the Longterm Impact on Students." Capstone Design Conference