AC 2010-706: EVALUATION OF INTERCULTURAL LEARNING IN AN EDUCATION ABROAD PROGRAM FOR STEM UNDERGRADUATES

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Evaluation of Intercultural Learning in an Education Abroad Program for STEM Undergraduates

Abstract

This mixed methods study characterizes the intercultural learning that occurred among participants in a project-based education abroad program in Thailand. In addition to their interdisciplinary project work, these STEM students (N=17) engaged in cultural learning activities during a semester-long preparation period and two-month sojourn. In addition, about half of the students completed their projects in mixed teams of Thai and US students. Pre- and post-administration of the Intercultural Development Inventory (IDI) was used as a quantitative indicator of intercultural development, while semi-structured interviews provided some depth and context to the quantitative data. The change in students' developmental IDI scores was marginally statistically significant, with those in the mixed teams showing greater positive change on average. Most students remained in ethnocentric stages of development, however. Still, all students regardless of their IDI results were able to describe meaningful cultural differences. Overall, this study reinforces both the challenges and opportunities of significant intercultural learning in engineering education abroad programs.

Introduction

Science, technology, engineering, and mathematics (STEM) undergraduates and faculty are responding to broader national trends of increasing participation in education abroad programs.[1-4] These programs have particular potential to develop students' intercultural communication skills and understanding of difference, which have been identified as increasingly important attributes of STEM graduates for professional practice and citizenship in the 21st century.[5-10] However, intercultural learning does not occur *de facto* when students travel abroad. The primary intended learning outcomes may be in other domains, and STEM faculty typically have little or no experience fostering intercultural development. This situation is problematic in that education abroad experts have long known that without guided processing of cross-cultural encounters and cultural differences, people can return from these experiences with stereotypes reinforced and more ethnocentric worldviews, or develop technical solutions that have unintended negative consequences on local culture.[10-11]

This paper describes an evaluation of intercultural learning within an experiential education abroad program at Worcester Polytechnic Institute (WPI). As part of WPI's project-based undergraduate curriculum, all students complete an interdisciplinary research project involving both social and technical dimensions. This Interactive Qualifying Project (IQP), conducted in small teams of students under faculty guidance, is intended to help students learn how the social and cultural contexts of a problem impact its solution. Other learning outcomes are related to information literacy, teamwork and professionalism, and written and oral communication.[12] Most IQPs involve addressing open-ended problems posed by community-based agencies and organizations. Through WPI's Global Perspective Program, over half of WPI students complete their IQP at one of 15 Project Centers in Africa, the Americas, Asia, Australia, and Europe.[13-18]

WPI's Bangkok Project Center has been in operation since 1989.[19] Each year, a cohort of about 24 students (typically juniors) and two faculty advisors spend two months in Thailand, working fulltime on projects for local non-profit, NGO, and governmental sponsors. The project topics typically involve issues related to sustainability, such as energy, environmental protection, public health, education, or community development. Students prepare for the project during the prior semester by studying Thai language and culture, and also by taking a course on research methods that guides them through the process of background research and development of a written proposal. In Thailand, the WPI students and faculty are based on the Bangkok campus of Chulalongkorn University, although some projects involve extended fieldwork in rural areas of Thailand.

During the months of January and February 2009, four of the six projects completed at the Bangkok Project Center involved mixed teams of WPI students and Thai students from Chulalongkorn University (CU). The CU students were enrolled in their fourth year of an International Program in Applied Chemistry, which has a requirement called the Science and Social Project modeled after WPI's IQP. There were two types of project teams:

> *Mixed teams* consisted of three or four WPI students and two Chulalongkorn students, and were advised by faculty from both institutions.
>
> *WPI-only teams* consisted of three or four WPI students advised by WPI faculty.

All of the projects were sponsored by Thai organizations, and all teams interacted on a daily basis with Thai people as part of their project work. All of the WPI students were housed in an international student residence hall on the Chulalongkorn campus and also had regular interactions with Thais in their daily lives outside of project work. The 2009 program was the first time that cross-national student teams were used, which provided additional motivation for the faculty advisors to emphasize cultural learning during both preparation and the sojourn in Thailand.

A Modest Curriculum for Cultural Learning

Pre-departure preparation has always been a core element of WPI's Bangkok Project Center. Students receive 28 hours of Thai language lessons from a native Thai instructor. To encourage students to give time and effort to language learning, this activity counts as 25% of their grade for the preparation experience. In these classes the instructor also touches upon elements of Thai culture such as "do's and don'ts" related to Buddhism, reverence of the Thai king and monarchy, respect for hierarchy and elders, and the value assigned to saving face and avoiding confrontation. In addition, two hours of orientation meetings include discussion of culture shock and cultural adjustment. Upon arrival in Thailand, many of these cultural issues are revisited in orientation meetings. Once projects are underway, students and faculty advisors discuss the cultural context of their work in an *ad hoc* manner.

For the 2009 Bangkok Project Center cohort, we augmented pre-departure and on-site activities in an attempt to foster cultural learning more systematically and deliberately. At this point we should make clear that we are speaking of *culture* as defined by those who study intercultural

communication and competence: "*the learned and shared patterns of beliefs, behaviors, and values of groups of interacting people.*"[20] So that students might develop more cultural self-awareness and be able to transfer their learning to cultures other than Thai, the new pre-departure and on-site learning activities focused especially on "culture-general" knowledge—e.g., common areas of cultural difference—and strategies that can be used when confronted with difference in any cross-cultural situation. We used *Maximizing Study Abroad: A Program Professionals' Guide to Strategies for Language and Culture Learning and Use* as the primary source of ideas for culture-general learning activities.[21] Students were also asked to purchase the student's version of the same guide.[22] The free-access *What's Up with Culture?* website includes similar material but does not include suggestions for facilitators.[23]

During the preparation period, students were assigned to read sections of *Maximizing Study Abroad* relevant to pre-departure and to read a selection of essays by William Klausner illustrating certain aspects of Thai culture.[24] They were then prompted to draft essays in which they chose two "core cultural value contrasts" from *Maximizing Study Abroad* for which they believed there would be noticeable differences between Thai cultural perspectives and their own. Examples of these value contrasts include individualism-collectivism, equality-hierarchy, meritocracy-ascription, and polychronic-monochronic views of time. The drafts were discussed with the students in a group setting, emphasizing ways in which appropriately cautious cultural generalizations can be made without stereotyping people from another culture. After this feedback session, students were asked to revise their essays for submission. They were given a grading rubric explaining the four criteria: critical thinking about culture; organization and coherence; writing mechanics; and effort to revise. The latter three criteria reflected the dual purpose of this assignment; we were also introducing students to written communication as a core learning outcome of the project experience. Each student's grade on this essay counted as 10% of his or her grade for the preparation experience.

Once in Thailand two additional activities were added beyond the usual orientation meetings. At the first meeting of the 21 WPI students combined with the 8 CU students, we used an icebreaker called "What's in a Name" suggested in intercultural training materials.[25] We also administered a learning preferences inventory to trigger discussion within teams about differences they might encounter working together.[26] After one week of project work, the advisors met with only the WPI students to discuss types and stages of cultural adjustment they were experiencing, using question prompts suggested in *Maximizing Study Abroad.* We also introduced the Describe-Interpret-Evaluate (D-I-E) process, which was perhaps the most substantive addition to the on-site cultural programming.

The Describe-Interpret-Evaluate (D-I-E) process model is intended to help people separate their subjective reactions to a cross-cultural encounter from the objective aspects, and also to consider how a situation can be open to multiple interpretations that depend on cultural perspectives. Intercultural communication experts recommend this disciplined sequence as a way to work through cultural frustrations and confusing incidents and to be more successful in interpreting behavior and events in unfamiliar cultures.[22,27] Students were asked to choose an encounter they experienced that included "below the surface" elements related to culture, and then analyze it using the D-I-E model. As with the previous assignment, the students drafted essays and shared them with the advisors, who provided individual feedback. Students then revised and submitted

their essays. The cultural learning revealed in this essay counted a small amount toward the project grade.

In the last week of the sojourn, the WPI students met again with advisors for a meeting focusing specifically on preparing for re-entry and the likelihood of reverse culture shock. Again, question prompts for discussion were taken from *Maximizing Study Abroad.*

The cultural learning activities just described are summarized in Table 1. All told, estimated student engagement in these activities is about 30 hours. These estimates do *not* include the time that students might have spent in informal discussions that took place related to their cross-cultural experience.

Table 1. Summary of Cultural Learning Curriculum

	Cultural Learning Activities	*Estimated Student Involvement*
Pre-Departure	Elements of Thai culture within the language course	3 hours of instruction and discussion
	Thai culture and culture-general readings, essay, and revision: core cultural values and contrasts, stereotypes vs. generalizations	7 hours of reading, 5 hours of writing, 1 hour of discussion
	Cultural elements of pre-departure orientation programs	1 hour of instruction and discussion
On Site	Cultural elements of on-site orientation programs	4 hours of discussion
	Intercultural icebreaking and team-building exercises	2 hours of participation and discussion
	Describe-Interpret-Evaluate essay and revision	5 hours of writing, 1 hour of discussion
	Re-entry meeting	1 hour of discussion

Evaluation Methods

The evaluation objective was to investigate the extent to which the particular learning environment of the 2009 Bangkok Project Center, described above, facilitated intercultural learning. We were also interested in students' perceptions of their sources of cultural learning. We used a single-group, pre-post, mixed methods study design.

Twenty-one WPI students participated in the Bangkok Project Center in 2009. All were juniors majoring in fields of engineering or science. Of the 21 students, 17 gave their informed consent to participate in this study, and a small monetary incentive was given. The demographics of students in the potential sample and study sample, along with their types of project teams, are summarized in Table 2. We cannot report the number of international students in the study group since gathering that information would have compromised the privacy of their decision whether or not to participate.

Table 2. Characteristics of Students in Potential Sample and Study Sample		
	Number in Potential Sample	**Number in Study Sample**
Sex		
Female	11	10
Male	10	7
Citizenship		
U.S.	18	N.A.
*International**	3	N.A.
Type of Project Team		
Mixed CU-WPI	14	10
WPI-only	7	7

* None of the WPI students participating in the Bangkok Project Center participants were of Asian descent.

Intercultural sensitivity, as measured by the Intercultural Development Inventory[28] (IDI), is the construct that was used as a quantitative indicator of intercultural development. This instrument measures orientation toward cultural difference, which is well-aligned with our educational and evaluation goals. In addition, it is one of the most robust, highly regarded instruments in the area of intercultural learning, used in multiple education abroad programs both for diagnostic and evaluation purposes.[29] A 50-item pencil-and-paper or online questionnaire, the IDI was developed using best practices for construction of cross-cultural instruments, and its reliability, content validity, and construct validity have been established. Unlike several other instruments in this area, the IDI shows no systematic effects by gender, race or nationality, age, or educational level. In addition, the instrument has been shown *not* to be subject to social desirability bias.[28,30]

The IDI is grounded in the Developmental Model of Intercultural Sensitivity, which posits that as peoples' experience of cultural difference becomes more complex, their potential competence in intercultural situations is enhanced. In the ethnocentric stages (Denial, Defense, Minimization), one's own cultural worldview tends to be latent but is the central reality in which other cultures are experienced. In the ethnorelative stages (Acceptance, Adaptation, Integration), one's own cultural worldview is understood and experienced as one among many that are possible and valid.[31] The IDI measures position along this spectrum, reporting an overall developmental score ranging from 55 to 145, along with scales and clusters specific to particular worldviews, as shown in Table 3.

The IDI was administered to study participants at the start of the preparation period (early September) and about a month after their return from Thailand (early April). The results of the pre-test were not shared with participants, but students had the option of requesting an explanation of their pre- and post-results after the conclusion of the study. Students were assigned an identification nmber so that their pre- and post-results could be linked while keeping their identity confidential. Pre- and post-IDI developmental scores were compared using a paired-samples t-test and its non-parametric equivalent. The same statistical tests were used to

Table 3. Scales Measured by the Intercultural Development Inventory (IDI)		
	Scale	**Explanation**
Ethnocentrism	Denial/Defense (DD)	Simplifies and/or polarizes cultural difference
	Denial Cluster	*Disinterest in cultural difference or avoidance of interaction with cultural difference*
	Defense Cluster	*Tendency to view the world in terms of "us and them," where "us" is superior*
	Defense-Reversal (R)	Reverses "us" and "them" polarization, where "them" is superior
	Minimization (M)	Highlights cultural commonality and universal values
	Similarity Cluster	*Tendency to assume that people from other cultures are basically "like us"*
	Universalism Cluster	*Tendency to apply one's own cultural values to other cultures*
	Acceptance/Adaptation (AA)	Can comprehend and accommodate complex cultural difference
	Acceptance Cluster	*Tendency to recognize patterns of cultural difference in one's own and other cultures*
	Adaptation Cluster	*Tendency to shift cognitive frame and behavioral codes according to cultural context*
Ethnorelativism	Encapsulated Marginality (EM)	Incorporates a multicultural identity with combined or confused cultural perspectives

analyze whether changes in IDI score were different between students in mixed CU-WPI teams compared to those in WPI-only teams.

Semi-structured interviews were used as a qualitative measure of intercultural learning to provide some depth, context, and meaning to the quantitative data. Interview questions addressed students' experience of cultural difference, their cultural self-awareness, and their sources of learning about culture. Six students were interviewed using a stratified random sampling method in order to have both genders and team types represented in similar proportions as the whole sample. The same identification numbers were used so that interview results could be linked with IDI results. The interviews were conducted by phone by an independent professional interviewer, and students' responses were recorded and transcribed. NVivo8 software was used to assist with coding of the data into themes. In line with the traditions of qualitative research methods, detailed quotations are included in this paper so that readers may judge the extent to which the experiences of students in this small study population may be relevant or generalized to the reader's own program context.

Results

Students as a group showed modest positive development in intercultural sensitivity as measured by the Intercultural Development Inventory (IDI). The median change in their overall developmental IDI scores was +5.7, which is marginally statistically significant according to the

Wilcoxon signed ranks test (p = .06). Gains in the Acceptance-Adaptation scale were significant (p<.001).

Most students remained in ethnocentric stages of development, however. Figure 1 shows the number of students in various stages of development, before and after the Bangkok Project Center experience. Note that 15 of the 17 study participants were in ethnocentric stages of development at the beginning of the preparation process: 11 in Defense-Reversal and 4 in Minimization. Examination of the Denial-Defense and Reversal scales shows that the group had already resolved issues of denial and defense before the preparation process began, but that they were "in transition" regarding the reversal orientation. Reversal is a particular form of Defense that tends to romanticize other cultures. This particular education abroad experience was successful in moving four students from Defense-Reversal into the Minimization orientation, but seven remained in the Defense-Reversal mindset. Of the four students who started the preparation process with a Minimization orientation, one advanced to Acceptance-Adaptation while the other three retained a predominantly Minimization mindset. One of the initial two students with an Acceptance-Adaptation orientation remained there, while one returned with a Minimization orientation.

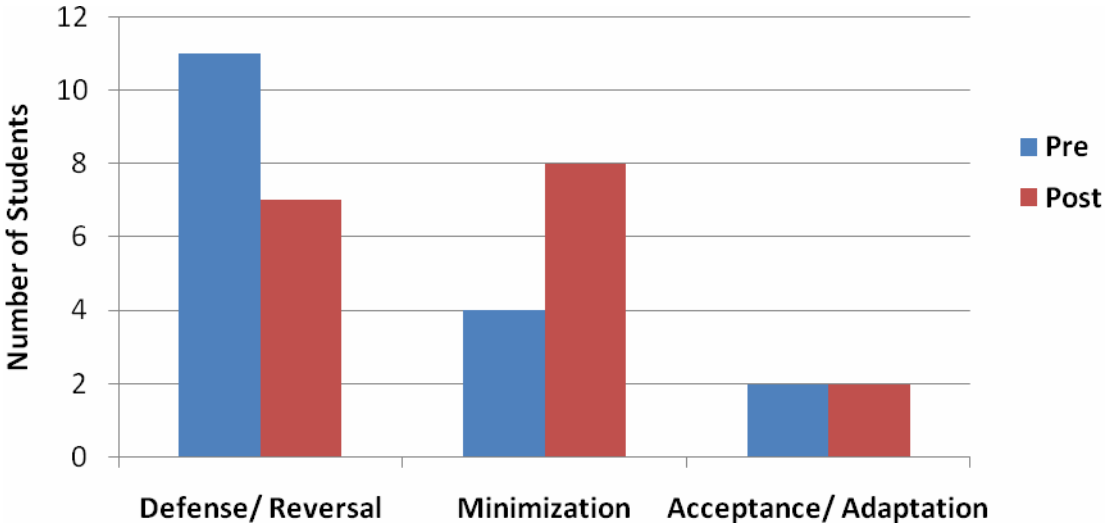

Figure 1. Number of students in various stages of development according to the Intercultural Development Inventory (IDI), before and after the Bangkok Project Center experience.

Figure 2 shows frequency distributions for the magnitude of change in overall IDI score, comparing students in the WPI-only teams with those in mixed CU-WPI teams. Students in the mixed teams showed greater positive change on average. This difference is marginally significant according to the independent samples t-test (p = .07). Investigating the particular scales more closely, students in the mixed project teams showed more progress resolving the Reversal orientation. This difference was statistically significant (p < .05).

Figure 2 also indicates that four students regressed in their intercultural development as measured by the IDI. Three of these students were from WPI-only teams. Examination of the

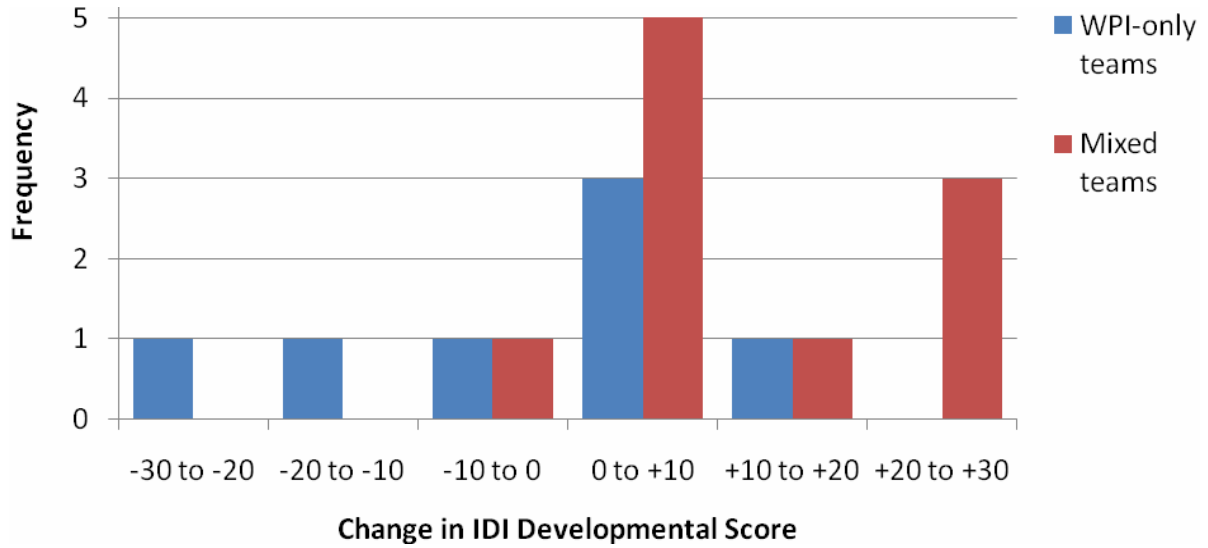

Figure 2. Number of students showing various magnitudes of change in their developmental IDI score (Post-Pre), for students in WPI-only teams and students in mixed teams.

underlying scales shows that upon return these students tended to agree with more items that indicated Reversal and Minimization mindsets than they had before the preparation and sojourn.

In interviews, all students regardless of their IDI results were able to describe meaningful cultural differences. Five students spoke about conflict avoidance, often in relation to their Thai team members or project work in general:

> *The management styles in Thailand are very different…and certainly the way the group ended up working was very different from how it would have worked in the US I think. So we learned that it's like most Asian cultures, very indirect….By that I mean if you have a problem with someone or you know a problem with their work they're very circumspect about, you know, telling them about it or criticizing especially. You know, direct criticism is a no no in the Thai culture. It was one of the things that we learned.*

> *We also did teamwork assessments every week….And it was hard for all of us to give negative feedback and we always tried to temper it with more positive feedback. But they* [Thai team members] *never gave any negative feedback. They just would not do it. Like we'd ask them for constructive criticism and sit there and wait for like 20 or 30 seconds while they both stared off into space until it finally got so awkward that we'd move on because we knew that they just weren't going to say anything….As Americans often times we see everyone as special and important and they sort of see the whole as important rather than – and they sort of just – they don't want to stand out from one another as much as I think we're encouraged to do as Americans. So I think they were hesitant to bring up any points of contention or conflict.*

I mean the whole thing of keeping face where they don't want to disappoint, which I found very true while over there. We ask them something or from them; they'll agree to it just to try and keep the conversation happy and don't want to disappoint….Keeping face as in not creating any conflicts so like they - I'm trying to think of an example…, like we'd want to set up a meeting. We'd be, like, can we meet tomorrow at this time? Instead of them inconveniencing us and saying that they can't meet, they'll say they can just to, I guess…and then last minute they'll say, oh, I can't make it. So it's like they want to keep the conversation positive; they don't want to - they don't want any conflicts, I guess, is a good way to put it. So that was a troubling thing because I, being from here, would expect if there's any problems that they'd be outwardly expressed as opposed to diverted.

Other cultural differences that students mentioned included attitudes about work and the importance of fun, respect for elders and the King, and less valuing of individual initiative and spontaneity.

The interview results provide an interesting point of comparison with IDI results. For example, one student who was interviewed had shown regression on the IDI—presumably a negative outcome—yet showed cultural insights and analysis in the interview that we would characterize as a positive learning outcome:

I wrote about euthanasia and how—in Buddhism euthanasia is extremely frowned upon and that's one of the reasons that they have these stray dogs on the streets which are a concrete example of the difference between the cultures. But under that is this underlying difference in the way people perceive the world. It's not just a matter of, you know, we have more stringent animal control.... In Buddhism suffering is seen as a necessary part of life and it's sort of the termination of life before its natural end is really something that's… it's not something you do in Buddhist culture is to terminate life…. It's just the idea that we have as Americans is usually if an animal is clearly in suffering and has no chance of getting better, to us it's fairly clear-cut that that's when you put them to sleep, you know? And in a Buddhist culture it's very different because they perceive suffering in a different way. And that's just to me, it's like a fundamental difference and it's not that Buddhist people are you know masochistic people who are looking for pain, but they perceive it in a different way…as necessary and not necessarily something to be terminated, you know something that's unavoidable and is an important part of life, whereas I think as Americans we think of it as something that's absolutely undesirable and should be done away with.

The students who were interviewed identified a variety of sources of cultural learning and reacted to the culture assignments in different ways. Two of the three interviewees who were in mixed project teams identified their Thai team members as their most important sources of learning:

I feel like it was a very useful and important part of the experience for me to be in a team with the Thai students. Though the main way I learned from them was just by talking with them about cultural differences and things that I noticed and asking, you know, where does this fit in in the Thai culture?

The girl in my group was about my age and she was from a very conservative family. But at the same time when we were together it didn't feel like she was at all. It felt really natural. But then when I saw her around Thai people and around her family or something like that I could tell that the way she behaved was very, very different from the way I behaved when I'm at home. So that helped me see a lot of the culture because I considered her like "a typical Thai girl"…I really liked the things I learned from her because she had so much respect for her professors and older people. And she would always serve everyone food before she served herself. And it's very – like small details that were very different from my culture.

Five of the six students who were interviewed described their Thai language teacher as an important source of learning about culture during the preparation period:

And also it was great when our Thai language and culture teacher would just tell us stories of Thailand, differences that she felt.

I also liked when we learned about the culture at the end of class she had a little session on the culture and how people behaved and how to act when you go to certain temples and how they eat and things like that. And that was very useful too and interesting.

Students had a range of reactions to the culture assignments and the use of *Maximizing Study Abroad.* Five of the six interviewees had positive things to say about the Describe-Interpret-Evaluate assignment. Following are examples of positive and negative feedback:

I think it got people talking about it within our group. You would hear other peoples' experiences and what had happened to them that they didn't really understand. So I think it was good to hear that a) it happened to other people, and b) how everyone can like interpret it and figure out what was really going on.

That was very good. I did mine on my scenario that I witnessed while I was in Thailand and it definitely - writing about it and thinking about it in the DIE way - process - definitely kind of gave me a new idea to think of other conflicts that I come upon when there's a little misunderstanding somewhere instead of immediately putting my opinion on it and just to try and look at it from their point of view and interpret it a little more before explaining it.

The reason it was so useful was that it would prompt dialogue between us and the Thai students about our topic.

I felt like writing – I felt like you were there for 9 weeks, you obviously became aware of the culture. Trying to pinpoint exact reasons for why it was different I found difficult and I also found it tricky that you were being – I felt that it was awkward for somebody to grade whether or not you understood the culture or not…I felt like people wanted to go out and talk to Thai people and hang out with the people, the Thai friends that they had met. And instead of being able to do that and further experience the culture you were stuck writing an essay about – and the other thing too was that the essay had to fall into

very specific things like you had to describe the situation, interpret it and then evaluate it. And I felt like trying to find a situation that fit well into that model was difficult because some of the stuff that I learned from didn't necessarily fit into that model well.

Students' reactions to the pre-departure assignment on core cultural values and contrasts were somewhat less positive:

I didn't get that much use out of it….Because it was mostly readings someone's opinion about Thai culture and then writing a paper on how I'll deal with them. And I thought it was important to learn – it was interesting to learn how Thai culture is different from American culture. But at the same time the assignment itself didn't give me much because they put a lot of emphasis on like don't stereotype, don't generalize, and don't say strong words. So I feel like most of the time I was just concerned with my wording and my language in order to please the advisors who were grading me rather than really reflecting on the assignment.

I don't really think I learned anything from it to be honest…. I mean I grew up with a lot of Asian friends so I already knew quite a bit about Asian culture so I don't think it really taught me anything new.

I think that was good in terms of preparing us for how things would be different… I mean they could just say, oh this is going to be different and things aren't going to be the same as home, but when you actually are critically thinking about it in an essay or in a discussion, I think it helps to get your mind –you can get ready for it; you're more prepared for the changes… One of the things that we did talk about was the time and commitments…. So I think when it did happen that we were "blown off" by the Thai students we were working with, we were kind of like OK, this is how they're used to doing things… So we were, I guess, a little more accepting of it.

While interviewees reported making use of *Maximizing Study Abroad* when they were required to, none reported turning to it at other times:

I brought it with me to Thailand and promptly left it on my desk for eight weeks. When I got to Thailand I realized that it was kind of one thing to read about it and another thing to experience it. And some of—you know we didn't utilize Maximizing Studying Abroad *to a great extent in [the preparation]. But we used it enough I think to get the general idea which was kind of keep an open mind. If I could say there was one lesson I took out of* Maximizing Study Abroad*, it was keep an open mind…. Just kind of be aware that there's going to be cultural differences, be aware that you – just be aware of yourself and also be aware of others who may have different opinions and be accepting.*

I did not make much more use than the assigned readings from it…. I was buried in other schoolwork and Thai language at the time before leaving and then I forgot it here when we went to Thailand....But, beforehand, I did read the sections on preparing to leave and helping like with the culture shock, just preparing for that, and it definitely was helpful and gave some ideas to know what to expect.

Discussion

This study attempted to characterize the intercultural learning that occurred in the context of a specific experiential education abroad program for a small number of STEM students (N=17). The group as a whole showed positive movement on the Intercultural Development Inventory (IDI). While the magnitude of change was small, it was similar to those of some other more traditional, language-intensive education abroad programs of similar and longer duration. [31,32] In interviews, even students with ethnocentric worldviews, according to the IDI, revealed many cultural insights and the ability to interpret some events and behaviors from alternative cultural perspectives. However, the single-group study design does not enable us to judge the incremental benefit of the program design and cultural learning curriculum compared to the smaller-scale curriculum we used in the past. In addition, the study evaluated the effects of the experience as a whole; we cannot credit the gains to the cultural learning curriculum.

In fact, both quantitative and qualitative data suggest that the Thai students may have been the most influential source of cultural learning and development of intercultural sensitivity, independent of the cultural learning curriculum. This finding, combined with students' positive comments about their Thai language instructor, reinforces the importance of interaction with "cultural informants" or "cultural insiders" in program design—something that has long been known and argued by education abroad experts. Still, it is possible that without some of the insights gained in the cultural learning curriculum, students would not have had the perspectives and tools to help them process confusing or frustrating incidents and encounters. Regardless, one outcome of this study is that we are seeking to extend and strengthen the 2009 experiment with mixed CU-WPI project teams.

While the study group as a whole showed positive movement on the IDI scale, there was quite a bit of variation, with large positive changes for some, negligible change for others, and negative change for some. Thus, the cultural teaching-learning activities put in place were not sufficient to eliminate regression for all students. Intercultural communication specialists typically recommend different teaching and training approaches for people in different stages of development.[34] For example, what is helpful to advance people in a Minimization orientation might be detrimental to those with a Defense-Reversal orientation. Providing learning activities tailored to each individual student's orientation might make regression less likely but poses an obvious teaching challenge.

In this study, students completed the IDI and were interviewed about a month after they returned to the U.S. from Thailand. Although it is possible that they gained more cultural insights after more passage of time, they might not engage in reflection without guidance. We have long recognized that the lack of a structured or facilitated post-sojourn reflection component, considered best practice in education abroad, is a gap in our overall program design. Moving forward we will be looking for ways to fill that gap within an already constrained senior-year curriculum.

Overall, this study reinforces both the challenges and opportunities of significant intercultural learning in engineering education abroad programs. While the results cannot be generalized, we hope to raise awareness within the engineering education community that international

experiences do not result, *de facto*, in intercultural development, and that explicit guidance and extensive interaction with people in the host culture may help produce modest gains.

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