Identifying, Creating, Developing and Framing a New Capstone Program in Panama

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Worcester Polytechnic Institute established global project centers over 35 years ago. Since then, WPI's global network has grown to more than 25 locations on five continents. Some 7,000 students have completed off-campus projects in that time. The majority of such centers focus on interdisciplinary work for junior-level students. More recently, opportunities for international capstone design experiences for senior-level students have been developed. In Panama, the objective was to collaborate with consulting, industry and government organizations to expose students to the challenges and opportunities of working in a Latin country undergoing extensive construction and development. In particular, it was desired to expose students to the Panama Canal Expansion project which was started in 2006 and is estimated to span eight years and cost over $5 billion. This massive civil and environmental engineering project to widen and deepen the canal channels is intended to increase the canal capacity and provide economic benefits to the country. Through development of the project center, it was found that in-country support is critical to ensuring good project pedagogy and arranging logistics for the students.

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Introduction

Worcester Polytechnic Institute (WPI) established global project centers over 35 years ago. Currently, WPI maintains a global network with more than 25 project centers in such diverse locations as Cape Town, South Africa; London, England; and Bangkok, Thailand. In the 2008-09 academic year, 469 students completed projects at off-campus locations. While the majority of these centers focus on interdisciplinary work for junior-level students, opportunities for international capstone design experiences for senior-level engineering students have also been developed. In Panama, the objective was to expose students to the challenges and opportunities of working in a Latin country undergoing extensive construction and development.

Project Initiation

Initiating project work in a particular country often originates from the collaborations that an individual faculty member has with an organization in that country. In the case of the Panama Project Center, the starting point was a visit by the WPI Vice President for Development and Alumni Relations to Panama in the fall of 2007. During this visit, the Vice President met with several Panamanian alumni as well as persons in national science organizations. The alumni were interested in advancing a conversation about projects in Panama, and the Vice President contacted me for information about proceeding with this conversation. A conference call was arranged in the winter of 2008, including myself, the Vice President, the Department Head of Civil and Environmental Engineering, and two alumni in Panama. During this call, we discussed the WPI Projects Program, areas of strength, project logistics, and potential needs and interests of Panama sponsors. A second trip to Panama was planned for the fall of 2008, which included the Vice President, the President of WPI, and myself.

Panama Planning Visit – 2008

The objective of my visit to Panama in the fall of 2008 was to confirm the feasibility of establishing a project center in Panama and to secure project sponsors. From an academic perspective, the projects needed to be relevant to civil and environmental engineering, include capstone design, and have an appropriate scope to be completed in 7 – 8 weeks. For the sponsors, the benefit of hosting a project team needed to be articulated.

Meetings were arranged by the WPI alumni with COPA airlines, SENACYT (Secretaría Nacional de Ciencia, Tecnología e Innovación; National Secretariat for Science, Technology and Innovation), the Chamber of Commerce, and Authoridad del Canal de Panamá (ACP; Panama Canal Authority). COPA airlines was open to a conversation about sponsoring a project team; however, their interests were in business management and revenue generation, which were more suited to management majors. Thus, this sponsorship was not

pursued further. From a logistical perspective, focusing projects in a particular major is important for planning purposes. Each global project center at WPI has a director – a faculty member who takes primary responsibility for developing projects, reviewing student applications, and selecting teams. By focusing on a particular major or two closely related majors, the director is able to establish long-term relationships with sponsoring organizations in a particular professional field and to start the process of project development well in advance of the students' travel dates. In addition, students in the same or closely related majors can work together as a team, rather than on individual projects.

SENACYT was open to working with WPI, though no specific project opportunities were identified at this meeting. The Chamber of Commerce had several WPI alumni as members, and discussions ensued regarding potential sponsors for construction projects, including a company owned by the family of one of the alumni. ACP provided a tour of the Miraflores Locks on the southern end of the Panama Canal and received information from WPI on sponsorship. Follow up conversations with several of these organizations were planned. Following this visit, an announcement was made to civil engineering and environmental engineering students at WPI that projects would be available on-site in Panama in the 2009-10 academic year. Four students were accepted for the project center (one later withdrew).

Panama Planning Visit – 2009

From the fall of 2008 through summer of 2009, potential sponsors were contacted via e-mail. However, no definitive agreements were reached. Therefore, a second visit to Panama was planned for August 2009. Meetings were arranged with SENACYT and ACP, and an informal discussion with alumni took place regarding other potential sponsors. The administration at SENACYT had changed in 2009, and thus discussions regarding sponsorship were started anew. SENACYT indicated a willingness to work with WPI and sponsor students (in particular on projects regarding environmental ecology and monitoring) in exchange for a benefit to their organization. It was suggested that workshops and seminars presented by WPI faculty at SENACYT could be useful. ACP also indicated a willingness to work with WPI students and expressed ideas for several potential projects. As only one project was needed for the one student group accepted to the project center, the association with ACP was pursued.

Following the visit, ACP provided brief descriptions of three potential projects. The students selected a project in October 2009, at which point they began preliminary research while at WPI.

Project Scope

The project goal was to develop a strategy to improve drinking water quality on Barro Colorado Island (BCI), located in Lake Gatun in the Panama Canal. BCI is the home of the Smithsonian Tropical Research Institute, which houses 200 to 400 researchers and receives about 4,000 visitors per year. Since the dredging activities for the canal expansion started, the turbidity and color levels in the BCI drinking water intake had been elevated. A pre-filter was installed at the water intake to mitigate the problems, but had not provided satisfactory results. As a result, water was being transported from the city of Gamboa to BCI at additional expense.

Several alternatives were proposed by ACP to improve drinking water quality, including moving the water intake, installing additional treatment processes, or continuing to import water from Gamboa. In order to evaluate these alternatives, the WPI students first collected data on the current BCI water treatment facility, including raw and treated water quality and usage data. Second, they obtained information on other treatment systems in Panama City and the regulatory requirements for drinking water quality. Third, they reviewed historical water quality data in Lake Gatun and other areas of the canal. Alternatives were evaluated based on water quality and quantity needs, longevity of each potential alternative, and cost.

Project Pedagogy

In coursework, students often are presented with projects that are reasonably well-defined, so as to fit in the confines of a classroom experience that also includes homework assignments and examinations. The goal of the projects at WPI is to work outside of this framework with real-world projects that are larger in scope and less well-defined. Panama provides the opportunity for students to become engaged in massive, multi-billion dollar projects and appreciate the enormity of such endeavors.

The first project in Panama was arranged with ACP for this reason. Key factors to a positive project experience – both for the students and the sponsor – include preparation, provision of liaisons, and access to resources. First, the students completed a project proposal during a preparation phase in the 7-week term prior to their departure for Panama. This preparation activity was the credit equivalent of one-half of a course. During this time, the students researched background information on the Panama Canal, the expansion project, and Barro Colorado Island. They also gained knowledge on water treatment alternatives that might be applicable to their project. Lastly, they contacted the sponsor during this time to report on their progress and ask some preliminary questions. This preparation phase is critical to the success of 7 – 8 week

projects, in which students need to begin data collection and analysis in the first weeks of the project period.

Once in Panama, the students met with their two project liaisons: a manager and an environmental specialist in the Department of Engineering at ACP. The students were able to work side-by-side with these professionals to not only make progress on their project, but also to gain valuable insights into the professional community at ACP.

Resources were needed in order for students to successfully complete their project. Within the first two weeks of the project, the liaisons had arranged a site visit to Barro Colorado Island and to several water treatment facilities, both on the island and in nearby areas. In addition, information on drinking water regulations in Panama was provided to the students, as well as environmental reports on water quality monitoring spanning ten years. Additional site visits were arranged after the students had analyzed their initial findings and identified data gaps. By the conclusion of the project, the students were able to quantitatively identify water quality problems on the island; research three potential solutions to the problem; develop costs estimates for each solution; and recommend an alternative to the ACP.

Project Logistics

In order for the students to work productively, all project sponsors are asked to provide work space for WPI projects. The students conducted their primary work at the ACP facilities, located in Panama City just north of the Miraflores Locks and in close proximity to the student housing (see below). The ACP facilities are located in a gated complex. The students were provided desk space in one of the ACP buildings that was not fully occupied during their time in Panama. While sponsors often provide computers, for this project the students brought their own laptops.

Logistics regarding project communication were not problematic. From October to April, there is no time difference between U.S. EST and Panama. Students and the advisor at WPI (myself) communicated via e-mail typically on a twice-weekly basis. A schedule was developed during the first week for completing project work and drafts of sections of the project report. WPI has course/project websites available for file transfer in addition to e-mail and video conferencing (e-mail was the primary mode of communication for this project). The only set-back in communication was with regard to internet access. The housing unit had wireless access which was operational upon arrival. However, the sponsoring organization required that the students and WPI sign contract forms and provide proof of insurance. IDs and internet access could not be obtained until this paperwork was completed. In future years, sponsors will be contacted well in advance of the students' arrival to process any paperwork ahead of time.

As part of the project, the students conducted several site visits – to BCI, to Lake Gatun, and to water treatment facilities. When ground transportation was required for the project, ACP provided transportation with one of their employees, or arranged for taxi service which is readily available and inexpensive. Ferry service to BCI was also available, arranged through ACP.

With regard to the project schedule, WPI operates on four 7-week terms per year, two in the fall and two in the spring. The students resided in Panama during the first 7-week spring term (arriving a few days before the term started and departing a few days after it ended to achieve a full 8 weeks in Panama). Students typically take three courses or course equivalents per term. As projects are worth the credit equivalent of three courses, the students were registered only for their project during the term and had no conflicts with other academic requirements.

Housing Logistics

Logistics regarding student living in Panama were arranged well in advance. First, housing was arranged based on the suggestions of the Panamanian alumni. Given the probability of ACP sponsoring the project, the alumni suggested housing at La Ciudad del Saber (City of Knowledge), a campus-like community of academic organizations, technology corporations and non-governmental organizations. The City of Knowledge has housing available for international students and researchers, and also has a market, restaurants, recreational facilities and more. I contacted the organization in the spring of 2009, visited the facilities in August 2009, and arranged the contract and payment via e-mail after that visit. It is important to note that the alumni were key players in determining the housing as I was not familiar enough with the options to make an educated choice. Their assistance with introductions was also critical in moving the process forward quickly given that most of the communications with the housing office were done from the U.S. Lastly, they provided an intermediary in any circumstances in which I was not able to reach the appropriate person, or required communication with a person who was not bilingual.

Risk management was coordinated with the Interdisciplinary and Global Studies Division at WPI, which has been coordinating global experiences for decades. As a new project center, a proposal for the center was developed that included information on housing, safety, emergency services and the like. Because of the extensive experience that WPI has with

global operations, risk management was not one of my primary tasks.

Language and Cultural Awareness

Students who apply to the Panama Project Center are not required to know Spanish, but are made aware that some understanding of the language may be useful in day-to-day activities. WPI does not have a general language requirement, and requiring Spanish fluency for this project center could result in a lack of student applications. All projects in Panama are conducted in English, and the majority of professionals are fluent in English. Outside of the working environment, knowledge of English is less pervasive, and students will encounter persons who speak only Spanish in stores, restaurants, museums, and taxis, for example. For the initial team of students in Panama, one was fluent in Spanish and two had some knowledge of the language from high school. My knowledge of Spanish is also from high school only. As all project meetings are conducted in English, there was not a language issue. The students did not take formal Spanish classes while on-site (because they were not affiliated with any college or university); rather, they learned in their day to day activities.

Prior to departing for Panama, I provided the students with a brief overview of Latin American culture based on my travels to Panama. For example, students are made aware that it is common for meetings to begin later than the stated time and that they should not consider this offensive. They are also made aware that Panamanians as a whole are very open and helpful, and that they should not hesitate to ask for assistance if needed. Lastly, they should expect that upper management at their sponsoring organization will be predominantly male.

After arriving in Panama, the students receive a guided tour of the city (with a professional tour company) so that they can become aware of the history of the country, areas of interest to visit, and areas that are not suitable for tourists to visit. The tour included historical areas such as Panama Viejo (Old Panama), the remains of the original city that was looted by pirates and burned down in 1671, and Casco Viejo, (the Old City), where the city was rebuilt in the late 1600's. Casco Viejo is home to the Presidential Palace, National Theater, hotels, homes, restaurants and shops, and is bordered by several neighborhoods that tourists should avoid. Also included in the tour were urban development areas (Costa del Este), Calzada de Amador (Amador Causeway, a tourist and recreation area built with material excavated from the canal), and artisan markets. A second planned activity revolved around the Panama Canal and included a visit to the Miraflores Locks to observe canal operations, as well as view the museum at the locks and the museum in Casco Viejo (exhibits exclusively in Spanish).

The students are introduced to taxi services, which were used for daily transportation to and from ACP. Taxis in Panama do not have meters or set fares. Fees are negotiated prior to departure, and both the driver and potential client can decline services if they do not agree on a fee. In addition, taxis drivers can be hired for round trip transportation including waiting time (for example, when going grocery shopping, as taxis were not commonly found in the shopping plaza closest to the student housing). In comparison to U.S. taxis, service in Panama is inexpensive. The bus system is not suitable for the students to use. While the official currency of Panama is the Balboa, the Balboa is no longer printed and the American dollar is used everywhere. Both American coins and Balboa coins are in use with equal value. Thus, there are no issues with monetary conversion.

Conclusions and Recommendations

Developing a new global project center requires significant time investment from one or more faculty members, and a network of interested individuals at the international location. A successful, international capstone experience requires:

- One or more dedicated faculty members who can travel to the project location for planning and to oversee project start-up and finalization;
- One or more in-country liaisons to provide contact with sponsoring organizations and assistance with logistics;
- Several faculty members who will serve as advisors to projects;
- A focus on projects in one major or two closely related majors (for development of long-term relationships with sponsors; planning of faculty advisors; advertising to students; and team development);
- Careful selection of student participants, as they are representatives of the university; and
- An understanding that while good planning is important, flexibility is also needed.

In the case of Panama, WPI alumni provided introductions and follow up assistance first with identifying project sponsors and later with logistical arrangements, allowing for an initial team of three students to work with the Panama Canal Authority on a drinking water quality project. The project topic was aligned with environmental engineering, and introduced students to the range of impacts that a massive project such as the canal expansion can have on the surrounding environment.