When Engineering Students Apply Theory to Practice Internationally

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Abstract

WPI has long embraced a project-based curriculum that now extends to sites throughout the world. Established programs in Europe, the Far East, Australia, Latin America and the Caribbean provide opportunities for undergraduates to complete degree-required projects with sponsoring organizations under the guidance of WPI faculty. This type of experience is unrivaled by traditional international study abroad and departs significantly from traditional internships. While working full-time, students successfully address real-world problems and are immersed in an unfamiliar culture. Each year, more than four hundred WPI undergraduates participate in this growing program. The unique opportunities inherent in the program are discussed in this paper. The students, who, each year, apply to the programs in record numbers, increasingly recognize those opportunities.

I. Introduction

For nearly thirty years, all WPI students have had to perform three academically substantive projects. One, the type discussed below, must be interdisciplinary and link technology or science with applications as well as the social implications of the application.   It carries the equivalent of a minimum three courses but more commonly counts for four—or even more—and can be accomplished through the global programs, which are competitive. As a result of a well-developed network of participating sponsors at each site, WPI students have had opportunities to perform valuable work that is integral to their sponsors' mission and that provides their sponsors with data and results that are of immediate use. Some sponsors propose a flow of projects that result in data and results that are cumulative over several years and, thus, have broad implications.

II. Global Sites

Formal project sites exist in many parts of the world including in the U.S. Sites are in San Juan, Puerto Rico; Copenhagen, Denmark; Melbourne, Australia; Zurich, Switzerland; London, England; San Jose, Costa Rica; Venice; Italy; Bangkok, Thailand; Hong Kong and even Washington, D.C. and Boston, Massachusetts. What characterizes a global site is that it is residential and off-campus; regular faculty accompany the students, often living in the same building or in very near-by housing; the students complete a preparation that includes both academic and cultural aspects; and on-site, they work on

sponsored projects full-time with active consultation from a technical advisor from the sponsoring organization. They meet with their faculty almost daily and the faculty and technical advisor maintain close communication by meeting with the students together.

Sponsors are government organizations, non-profits, multi-national and smaller private enterprises. They range from banana plantations, to museums, to pharmaceuticals, to national departments of natural resources and transportation, for example. Typically, the university sends fifteen to twenty-four students to each site. At the fifteen-student level, one faculty advisor accompanies the students. At the twenty-four-student level, two faculty advisors participate.

III. Projects Are Not Internships

WPI's projects are not internships. Students, working in interdisciplinary teams of three or four, know at least a term before they are on-site what project they will be doing. They undertake a rigorous preparation, discussed below, which also stresses learning about the host culture and which may include language training, such as is routine for the Latin American sites, Italy, Zurich, and Bangkok.

At the beginning of the preparation phase, students review the descriptions sent by their sponsors. During the preparation, they prepare a formal proposal for the work they will undertake, which includes a full literature review and a description of the relevant well-researched set of methodological tools that will be used. In addition, the student teams describe the steps they will take in applying the methodological tools.   On site, they focus solely on their own project, although they become familiar with the normal activities of their sponsors through daily interactions in the office. However, their focus is never drawn away from their project to tasks in the office.

At the end of the project, they defend their work in a formal oral presentation before their sponsors and other organization personnel, advisors, and invitees. At the same time, they present the sponsors and advisors a formal written final report, which is also archived in the library at WPI.

IV. Ensuring Quality.

Quality of the projects as well as the students' experience is never taken for granted. There are several levels of quality that are monitored constantly: at the site, with the sponsor, in the project, and during the preparation. Each site has a faculty site director who is responsible for developing relationships with sponsors and for developing academically worthwhile projects. The overall quality of the total experience is the responsibility of the director. At most sites, there also is a local coordinator who is the so-called "translator" of local culture to the WPI students and faculty. The faculty's responsibility is to ensure that the academic merit of the project is fully developed. During the preparation, faculty advisors have regular meetings with the students to augment the activities undertaken in the preparation course.

In internships, students respond solely to the sponsors' needs. In WPI projects, students must do that as well as develop the academic content. WPI stresses the academic content, which, on site, includes further development of the literature associated with the project and a full discussion of the societal implications. Sometimes, faculty will require substantially more than the sponsor requires, but the additional assignments are intended to strengthen the students' connection to the project and to increase their sense of responsibility. The reason for the project becomes ingrained and fully understood through these assignments.

V. How Valuable Is The Work?

Because this global studies program is set up to respond to sponsor's needs as the vehicle for educating WPI students, the value of the work must accrue, of course, to the sponsor, but the benefits to the students are immediate and profound. Because of the interdisciplinary nature of their work and of their teams, they are exposed to disciplines outside their own and to the value systems and approaches used by others to evaluate problems and solutions. Moreover, the topics in which they engage are often those to which they would never have exposure during the course of more usual education.

For instance, one team in Costa Rica, evaluated methods of tilapia fish farming for subsistence farmers in developing nations and prepared a manual of "best practices" in Spanish for Costa Rican farmers. Their report was also shared with Zibabwean entrepreneurs who wished to explore tilapia farming. Another team will, by the time of this conference, have completed an investigation of the potential for fish farming (multiple species) in Puerto Rico as a way to offer employment to displaced fishermen.

In Costa Rica, a team competed a needs assessment and then a feasibility study for the implementation of a Geographical Information System (GIS) for the national fire department of Costa Rica. Once having determined there was a need and that it was feasible, they developed a preliminary implementation plan and identified funding sources for the implementation. The Museo de los Niños, a science and children's museum, is now in possession of the plans for an interactive rain forest exhibit as a result of the efforts a WPI student team.

In Puerto Rico, several teams over several years have explored a variety of aspects of the impacts on Urban Sprawl. There reports are being used by environmental organizations to build information that will affect public policy decisions.

These sorts of projects are completed at our other sites as well. In London, for instance, one group developed a new type of wheel chair for the profoundly impaired by working with patients at the Royal Hospital for Neurodisabilities. Multiply the effects of fifty internationally accomplished projects each year at sites where the university maintains centers, and continuity and becomes more and more evident.

For the students, the value of their work persists. In some cases, students change majors as a result of their projects, prospective employers are often more interested in what effect doing the project had than they are in the students' grades. New friendships are forged among unlikely combinations. Students report that they had no idea they could respond to some of the challenges of their projects and of the sites. Alumni report that they learned how to problem solve and be adaptable while working on their projects. Others talk about the importance of the interdisciplinary approach and teamwork. Faculty are challenged to reach beyond the borders of their own disciplines to become versatile and able to advise students in whatever projects may be undertaken. They learn how to become better role models when they, too, are challenged to face their own intercultural discomfort. So the benefits of the projects are spread around and the educational benefits leveraged to all strata of the WPI system, making prospective employees more aware of their own capabilities. The translation of theory to practice internationally is a complex and gratifying process for the vast majority who undertake it and the effects last a lifetime.

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Susan Vernon-Gerstenfeld is Director of Academic Programs and Planning for Interdisciplinary and Global Studies at WPI. She directs WPI's Latin American project centers in Puerto Rico and Costa Rica and serves as faculty advisor to students at the global project centers. She earned her BA in Sociology and her MSW in Clinical Casework from Boston University and her Ph.D. in Social Planning from Boston College.