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## GLOBAL PROJECTS PREPARE WPI STUDENTS FOR THE 21<sup>ST</sup> CENTURY

**Abstract.** The WPI project based curriculum, which emphasizes discovery based learning are an alternative to the traditional information transfer process, has proved successful in delivering global engineering education. More than 25% of the learning process of the students is integrated into two formal projects, the Major Qualifying Project (MQP) which is designed as a capstone for professional technical competence and the Interactive Qualifying Project (IQP) which relates science and technology to societal concerns and student needs. Both the MQP and IQP may be completed on- or off-campus. Currently, over 50% of the graduating class will have completed one of the projects at an overseas location under WPI's Global Perspectives Program. Each year, more than twenty faculty members will be advising and sharing a learning experience with the students at international locations spanning six continents.

Living and working in an unfamiliar culture while pursuing real world problems of importance to local agencies or organizations provides a unique and stimulating learning environment. Students are fully immersed in the local culture and conduct their studies under the guidance of WPI faculty members. Traditionally, global projects have emphasized the inter-relationship of technology and society through the IQP. More recently, technical projects and research have been added through the MQP and graduate research efforts. The result of the student projects which are generally carried out by small teams, 3-5 students per team is typical, includes oral presentations and a final written report which is presented to a sponsoring agency as well as filed for future use at the WPI library.

This paper describes the WPI global program and is based on the experiences of the authors in advising project activities. It emphasizes the preparation of the WPI students for global projects, the infrastructure needed to support such activities, and the outcomes in terms of global aspects of some graduates' careers.

### 1. INTRODUCTION

Helping students to learn to learn for themselves so that they are better prepared for a professionally competitive environment has been the hallmark of the WPI programs since 1970. In teaching the students to learn for themselves project activities that rely on self-directed study have proved effective. These are called the Major Qualifying Project (MQP), the Interactive Qualifying Project (IQP), and Humanities Sufficiency. Furthermore, because the daily commerce of countries now takes place in a global context, the graduates of the technological universities, such as WPI, must be fully prepared to accept a new type of leadership role, one that integrates technological and humanistic-social know perspectives that can be applied in a variety of global situations.

WPI has been a pioneer in international projects by enabling students to travel to residential sites around the world where they work as junior professionals working on problems defined and sponsored by international corporations and local sponsors. This process provides a distinctive, perhaps unique, professional learning experience for the students. Typically, each student earns credit for the equivalent credit of three courses (nine semester credit hours). In addition, most students going overseas enroll in a pre-qualifying project (PQP) in which they study the country and its

culture, gain a rudimentary knowledge of the language of the country, and gather preliminary data for their project. The PQP is the equivalent of one course. The essence of the global perspective program is that of living and working on real-world problems while immersed in the local (unfamiliar) culture.

WPI's first global project center was opened in Washington, D. C. in 1974; its first overseas in London in 1987, and presently conducts programs at 20 overseas locations.

## 2. OBJECTIVE

This paper provides a synopsis of the global project program at WPI and the utilization of WPI's distinctive degree requirements, the IQP and MQP, in preparing engineering students for the world-wide practice of engineering in the 21st century. Project experiences of the authors in England, the Netherlands, and the United States will be used as examples. MQP, IQP; The interactive Qualifying Project, IQP, is usually completed in the junior year and requires students, usually teams of three to five members, to identify, investigate, and communicate effectively on a problem at the interface of science or technology and society. The Major Qualifying Project, MQP, is generally completed in the senior year and requires students to integrate and utilize their prior academic work to solve problems or perform tasks in their major field of study with in-depth understanding and confidence. Effective communication of the results through written reports and oral presentations is mandatory for both the MQP and IQP. Both projects require a minimum involvement of one-fourth of an academic year of full time study. For engineering students The MQP is often used to meet the "capstone design" requirement of their program. To date, about half of the IQP's are being completed by students in residence for eight weeks at overseas sites. The implementation of MQP activity at an overseas location has become more difficult but is increasing and is usually done in a semester abroad, 16 weeks, or partially at WPI.

## 3. DEVELOPMENT OF GLOBAL PROJECTS

In a rapidly increasing global context of business, industry, education and government, the graduates of WPI are being prepared to work and relate with people and cultures on a world-wide basis. At WPI the Global Perspectives Program which began more than a quarter of a century ago is designed to enable its undergraduate students and faculty to become personally involved with the cultures and customs of unfamiliar workplace environments. At present, 1999-2000, more than half of the junior class registered for projects abroad and were accompanied by about 20 different faculty members. To date, the IQP has been the principal mechanism for study abroad: a limited but growing number of students undertake MQP's both abroad and at residential domestic sites.

The IQP and MQP are required academic degree requirement for each student at WPI. The range of possible topics for projects is virtually unlimited as a project is a problem in need of a solution, of special interest and priority to a student or a

student team, requires professional competence to solve and there is seldom, if ever, a unique solution.

Both the IQP and MQP may originate with students, faculty, or with external agencies and must focus on solving actual problems associated with business, industry, government, social and educational organizations. The fundamental elements of any project whether on-campus or at a foreign location include a problem description, designation of the student team members and faculty advisor, and statements of the resources available and required. Financial sponsorship of projects whether locally or at one of the global project sites is strongly encouraged but must follow WPI's policies that ensure separation of work for hire from academic work. Sponsoring organizations must understand that the final report and recommendations are those of the students and not of the faculty as consultants.

Students usually get started on a project, MQP or IQP, by reviewing the Project Opportunities web page, meeting with faculty advisors, discussing recent projects or proposed projects with the Project Office Staff, and establishing a continuous dialog with students who are currently involved or have precursor projects. A college-wide Projects Planning Day takes place in April and a Global Projects Fair designed for students desiring to complete a project at an overseas location, is held in October.

A faculty advisor for an IQP may be from any disciplinary area, technical or non-technical at WPI. For the MQP the faculty advisor must be from the disciplinary area of the student. For students who carry out an off-campus project, domestic or overseas, a Preliminary Qualifying Project, PQP, is required prior to the off-campus term. Students report that they spend 45-60 hours per week on an off-campus project. Written and oral reports of a professional quality are required. When appropriate, video or audio tapes may be a portion of the report. The Writing Resources Center and the Instructional Media Center are available for the improvement of a student's oral and written communication skills. WPI places a high priority on excellence with regard to presentation, proposals, reports, and abstracts associated with projects.

The academic advisor assigns the grade of each student on a project and reports the grade to the Registrar through the use of the "Completion of Degree Requirement" form. The final report is distributed within a sponsoring organization by the advisor or project liaison individual. Project abstracts are published annually on the web site. Projects are catalogued for reference in the WPI Library, are retained for five years, and are available on request to interested individuals.

Legal agreements, insurance, and similar documents/activities for students and organizations are normally handled through the WPI Projects Office or the Interdisciplinary and Global Affairs Office for international projects. Typical examples are student housing, financial arrangement with sponsors, and the use of proprietary data.

#### 4. PRELIMINARY QUALIFYING PROJECT, PQP

The PQP may be directed by the WPI project advisor or by faculty with specialized expertise in the project or the project location. Included are such items as project proposal preparation, teamwork, subject area, background research with preliminary data collection, and individual and group meetings with persons who can brief the students on expected cultural changes, language, location, and monetary differences that are relevant to their projects. For students registering for an IQP at WPI emphasis is often placed on utilizing their prior studies in the humanities and social sciences. For students planning an overseas project the PQP is normally the equivalent of one course: for a domestic project one half of a course.

#### 5. TYPICAL PROJECTS WITH GLOBAL IMPLICATIONS

##### *5.1. London, England*

Challenge: The RAP Museum in Hendon needed to get repeat visitors by gaining the interest of younger, non-WWII population.

Solution: The student teams developed an oral presentation coupled with an involvement of the visitors in a theory of flight demonstration which could be used by the museum volunteer guides. The Museum followed up the success of this project by setting up a major portion of the Museum for "hands on" involvement by the visitors.

Sponsor: The RAP Museum at Hendon, England

##### *5.2. London, England*

Challenge: The workers, all visually impaired, at the London Association for Blind People needed to improve the efficiency and safety in manufacturing notebooks and similar non-metallic items used in banks. Low worker morale was a concurrent challenge.

Solution: The students prioritized a number of answers and then joined the workers, after agreeing to work blindfolded, to jointly develop answers to both the efficiency and morale problems.

##### *5.3. Delft, the Netherlands*

Challenge: Delft University of Technology students designed a support structure for a "Floating City for 10,000 People." The WPI students were to develop an operational "topside" to the structure.

Solution: The WPI team developed a model for the viable operation, physically and financially, of the City including the governance system, rental costs, utilities, and emergency services, for example. The study confirmed the excellence of the results of students of different backgrounds and languages who, through an integrated global program, established a model as students for later work as professionals.

#### *5.4. Stow, Massachusetts, USA*

**Challenge:** The Collings Foundation in their restoration of a WWII Grumman Avenger needed to develop a history of the particular airplane along with some physical help in the restoration project.

**Solution:** Student teams working at WPI and at Mayocraft where the Avenger was being restored evaluated and examined existing literature, conducted interviews with recognized experts in the history of the aircraft and aircraft restoration, worked with volunteers on the actual restoration of the airplane, and made recommendations for the identification and development of WWII technologies associated with the Avenger, and the results of these technologies on the outcome of WWII.

**Sponsor:** Mayocraft and the Collings Foundation

### 6. STUDENT OBSERVATIONS

Following the completion of a professional level project WPI students universally report that they now feel confident they can successfully compete in the international market place associated with their professional, technical fields. They have developed an ability to work in another culture as well as communicate and interact with persons whose native language is not English. The non-traditional element of the learning experience has developed in each student a degree of confidence and expertise well beyond the traditional classroom and textbook learning processes. Students state they are confident they can adjust, work and live successfully virtually anywhere in the world. It is especially important that living and working at a professional level in an unfamiliar cultural setting provides unsurpassed opportunity to gain a solid foundation in "global engineering."

Student evaluations of the faculty advisors and the programs are almost universally outstanding in their praise. Recruiters for the employment of college graduates are among the strongest supporters of the Global Perspectives program and the students who have been associated with it.

### 7. QUALITY ASSURANCE

Three basic words, people, programs, and facilities, are the key elements of success of domestic and global academic programs.

1. Students, faculty, and staff prepare themselves for a global project experience through the development of interpersonal skills, coupled with understanding and recognition of the people and the culture where they will be located. They establish communication with advisors, mentors, and other who may be related to their projects.
2. The fundamental program of preparation for overseas involvement in project work is the non-traditional WPI Plan. In addition there are many supporting programs such as campus seminars, language courses, discussions with natives of the country where the project will take place and contacts with international professional societies, for example.

3. Facilities associated with global projects are highly varied. Where possible, students live under circumstances similar to their counterparts in their new country. Arrangements for housing and living arrangements as well as an academic support area are completed prior to leaving WPI. All of the students must successfully present oral and written documentation of their project prior to returning to WPI.

## 8. FACULTY ADVISORS

The faculty advisor is the key individual at WPI's global project sites. A systematic evaluation of the faculty views of the personal and professional trade-off involved in advising at overseas locations is being conducted by the WPI Provost's office. The evaluation process involves several phases including discussions with faculty participants and identification of issues, determination of focus groups to conduct campus-wide surveys, and the analysis of results and policy implications. Some of the issues already under review include the rewards for faculty commitment as teachers to project advising, the rewards to faculty as professionals judged for merit raises, promotion, and tenure, the impacts on the research programs of the advisor, and the type of short- and long-term preparation of the faculty for global project work.

## 9. CONCLUSIONS

The students and faculty who have been involved with global projects universally state that the educational and cultural experiences have been personally and professionally rewarding to them and should be continued and expanded. In this regard, the Global Perspectives Program has been given increased emphasis and made a major thrust of WPI's current capital campaign. The excellence of the global projects has reinforced WPI's commitment to projects as a fundamental part of the teaching-learning process. Student have successfully utilized their required MQP and IQP as a mechanism for learning to learn for themselves in a professionally competitive atmosphere and in that way have distinctively prepared themselves for professional careers in the 21st century.

## 10. REFERENCES

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