

Chapter 4

The Interdisciplinary, Project–Based Infrastructure Degradation Curriculum at Worcester Polytechnic Institute

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ABSTRACT

In 2014, a new graduate-level course on infrastructure degradation was offered jointly by the departments of Mechanical Engineering and Civil and Environmental Engineering at Worcester Polytechnic Institute (WPI), USA. Over the course of the fourteen-week graduate term, seven professors from both departments offered lectures on their particular area of expertise. Together with conventional homework assignments, the course incorporated a multidisciplinary project aspect where students were divided into teams and assigned an infrastructure system. The students prepared detailed presentations on a specific aspect of the degradation methods affecting their infrastructure system. These presentations culminated in the first ever WPI Degradation Symposium, in which each student team presented a poster based on their research. This chapter outlined the motivation behind, experience with, and lessons learned from this course, which may serve as a model in corrosion education as such issues become more important with the continuing decay of the worldwide built environment.

DOI: 10.4018/978-1-4666-8183-5.ch004

INTRODUCTION

Worcester Polytechnic Institute (WPI) is nationally recognized as a unique educational environment (Tryggvason & Apelian, 2011). Undergraduates are required to complete major team projects during their third and fourth years, each of which are divided into four seven-week terms. Many undergraduate courses also contain a significant project component. Although there is no established framework for doing so, many graduate courses (which run in 14-week semesters) also follow the WPI philosophy and contain team project activities. In 2014, a new course investigating the degradation of infrastructure systems was offered at WPI and provides an excellent example of the WPI philosophy in action. It is both interdisciplinary (being taught jointly by the Departments of Mechanical and Civil and Environmental Engineering) and project-based, with students completing a team research project culminating in the first-ever WPI Degradation Symposium, a poster presentation session meant to resemble a conference. This course was developed and offered partially in response to a perceived lack of quality educational opportunities on the subject of corrosion and other infrastructure degradation mechanisms, thus providing an educational experience for WPI students that would both benefit them in their industrial careers and cannot be found elsewhere (The National Academies, 2009).

This chapter outlines the motivation, logistical structure, and experiences of this new course. A number of the benefits of interdisciplinary, project-based education will be identified and discussed, as well as the challenges encountered in developing this course. At the end of the chapter, potential solutions for overcoming these difficulties and suggestions for future areas of improvement will be detailed. Offering high-quality courses specifically geared towards corrosion, currently a rapidly-growing \$58 billion industry will become more and more important as infrastructure continues to age.

BACKGROUND

Since 1970 WPI has carried out undergraduate education through interdisciplinary team projects. Project-based education at WPI begins in the student's freshman year. An optional course entitled "The Great Problems Seminar" focuses on issues of global importance. The theme varies each year, with recent examples of "Heal the World", "Power the World", and "Feed the World". Students form interdisciplinary teams to investigate specific areas of these topics, culminating in a poster presentation day.

Junior and senior year projects are referred to as the Interactive Qualifying Project (IQP) and Major Qualifying Project (MQP), respectively. During each project, teams of up to four students are directly mentored by faculty advisors. Many teams are multidisciplinary, and many have multiple advisors from different disciplines. The projects are significant undertakings, the equivalent of three courses; students work roughly 20 hours per week for a total of 21 weeks. The students periodically deliver their findings through formal reports and oral presentations. In the words of a reviewer during an ABET accreditation visit: "Work produced by [undergraduate] students during their [MQP] is of postgraduate quality, and most of those reviewed could easily serve as master's theses in many institutions."

The IQP is a nine-credit-hour equivalent project involving applied research that connects science or technology with social issues and human needs. These projects are generally carried out in interdisciplinary teams, advised by one or more professors from various departments. Students submit written or oral reports to project stakeholders. WPI has articulated a number of learning objectives for the students: At the end of the IQP, students should be able to:

- Demonstrate an understanding of the project's technical, social and humanistic context;

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