Including Service Learning In The Environmental Engineering Research Project

David Pines

College of Engineering, Technology, and Architecture
University of Hartford

Abstract

Service learning provides a meaningful service to the community as well as a relevant learning experience for the student. The service done by the student is linked to course outcomes and enhances the learning experience that occurs in the classroom. Service learning was incorporated into the civil engineering curriculum at the University of Hartford in 1999 by adding a community sponsored environmental engineering research project. Semester long group projects on a relevant environmental topic typically include fieldwork, sample analysis, design and construction of laboratory bench scale tests, computer modeling, oral presentation, and written report. An important aspect of these studies is for the students to meet the sponsor so that they clearly understand how their results will benefit the community. This helps to reinforce the student's appreciation for the importance of a life-long commitment to civic responsibility. Assessment tools used in evaluating service learning have been student surveys, informal feedback from project sponsors, and acceptance of abstracts at professional conferences. Overall feedback from students has been very good or excellent and project sponsors have been very satisfied with the outcome of the projects. One student group received an award from the Town of Manchester, CT stating their appreciation for the students' work and several student groups have presented their results at professional conferences.

Introduction

The civil engineering curriculum at the University of Hartford includes a required 4-credit Water Quality Engineering course. Physical, chemical, and biological treatment of water and wastewater are the primary topics covered in this course. A Water Chemistry Laboratory taught by the Chemistry Department supports the Water Quality Engineering course. Students learn various analytical methods, which gives them a hands-on knowledge of how to characterize water samples. A required environmental research group project on a relevant water issue was added in 1999 to strengthen the Water Quality Engineering course and add a service learning component to the civil engineering curriculum. Two of the criteria for selecting projects are that

they provide a meaningful service to the community and are linked to the course outcomes. In addition, the projects should provide the students a broad research experience by including most of the following activities: fieldwork, sample analysis, bench-scale testing, and computer modeling. At the end of the semester, students make a formal presentation and submit a written report to their sponsors.

Benefits of Service Learning

There have been many papers written on the benefits of service learning. Specifically to the environmental field, the EPA Service Learning Document[1] gives the following benefits of service learning:

- Encourages students to learn and develop through active participation in thoughtfully organized service that is conducted in, and meets the needs of, a community
- Helps to foster civic responsibility
- Enhances the academic curriculum
- Enhances students' communication, team-building, and critical-thinking skills
- Provides structured time for students to reflect on the service experience

Based on these potential benefits, a service learning environmental research project was added to the civil engineering curriculum at the University of Hartford.

Selection and Instruction of Service Learning Projects

The Water Quality Engineering course is offered in the fall semester. Typical course enrollment is 10 to 18 students. Student project teams range from three to five students. Therefore, three or four projects need to be defined prior to the fall semester. Projects are requested from local towns and water utilities. These contacts are made through the University of Hartford Civil Engineering Design Center for Cities and Towns, Civil Engineering External Advisory Board, alumni, part-time graduate students, and previous project sponsors. Working together, the instructor and project sponsor define the goals and objectives of the project so that it enhances the learning experience in the classroom and meet the needs of the community. Furthermore, the projects must be focused enough so that students can complete the defined tasks in a 14-week semester.

The projects are introduced at the first laboratory meeting. A one-page summary of each project, which includes a list of the required tasks, is given to the students. The students break into groups and select the project that most interests them. Only one student team does each project and, if necessary, a random selection process is used in case more than one student group selects the same project.

The student's first requirement is to set up a meeting with their project sponsor and instructor. The meeting should be at the project site and be held within one week of the first laboratory meeting. Project sponsors are aware of this requirement and are expecting the students to contact them. The initial meeting is vital to the success of the project. It is during this meeting that the students should fully appreciate that this is a service learning research project and that their results will benefit the community. It is the responsibility of the instructor to have focused the project so that it also supports the course outcomes.

The students then propose a plan and schedule to complete the defined tasks. The plan is discussed with the instructor and project sponsor and modifications are made, if necessary. Student teams meet with the instructor on a weekly basis where they submit a progress report, review data, and discuss future activities. When necessary, the project sponsor is requested to come to the weekly meetings. At the end of the semester, students submit a professional report to the sponsor that states their experimental design, results, discussion, conclusions, and recommendations. The students also make a formal oral presentation of their results to the sponsors, interested community members, and to local environmental professionals.

Sample of Service-Learning Research Projects

Service learning research projects have ranged from water quality studies to optimization of water and wastewater treatment processes. A sample of the projects, their sponsors, relationship to course outcomes, and how the findings benefited the community are listed in Table 1. Two of the projects were extended to the following year because one-semester was not adequate for providing a full understanding of the issue. Several of the other projects would have also benefited by a follow-up study or a full-year water-sampling program. As can be seen in Table 1, the projects are linked to many of the course outcomes. In addition, the projects have provided valuable data and specific recommendations that have benefited the towns and water utilities in the Greater Hartford area.

Assessment of Service Learning

The tools used to assess the service learning research project were a student questionnaire given at the end of the semester, feedback from project sponsors, and acceptance of abstracts at professional conferences. The questionnaire was designed to determine if the students felt that the laboratory project had met the expected course outcomes. The students' responses reflect their opinion of whether the outcomes were achieved, but do not necessarily reflect whether they actually achieved the outcomes. Overall, one-third of the students thought it was an excellent learning experience and two-thirds of the students rated it as a good experience given the four choices of excellent, good, fair, and poor. Greater than 75% of the students felt that the research project approach was better or much better than the lab manual approach in learning about a current engineering problem, promoting team work, improving project management skills, and making an oral presentation. The one disadvantage of the research project format was that some students thought that they missed out on learning about a range of water quality topics covered in a more conventional laboratory setting.

Table 1. Sample of Service Learning Research Projects

Project	Sponsor	Benefit to Community	Support of Course Outcomes[§]
Impact of Closed Landfill on Groundwater and Surface Water Quality	Avon, CT	Determined impact of closed landfill on adjacent athletic fields and recommended alternatives for minimizing iron aesthetic problem	A,C, D, F, G, H
Filley Park Water Quality Study	Bloomfield, CT	Evaluated water quality of pond, performed bathymetric study to determine rate of sediment build-up, and measured water current patterns for evaluating methods to increase ice skating season	A, C, F, G, H
Backwash Filter Study	New Britain, CT Water Department	Investigated advantages/disadvantages of using anionic polymer coagulant in filter backwash system	A, B, D, F, G, H
Clearwell Hydraulic and Intrabasin Baffle Study (2 Semester Study)	Manchester, CT Water Department	Recommended alternatives for increasing plug flow characteristics of clearwell so that chlorine dosage could be reduced by performing full-scale tracer study, designing and constructing a physical model, and using a computational fluid dynamic model	A, B, D, F, G, H
Elizabeth Park Water Quality Study	Hartford, CT	Measured and evaluated water quality of pond and recommended treatment alternatives that fit into the natural setting of the pond	A, C, D, F, G, H
Unit Process Evaluation of the Canton Water Pollution Control Facility	Canton, CT	Collected and measured water samples before and after each unit operation, analyzed data to evaluate the performance of each unit operation, and made recommendations for improving effluent water quality and efficiency of treatment plant	A, B, C, D, F, G, H
Globe Hollow Water Quality Study (Year-Long Study)	Manchester, CT Water Department	Performed water quality and current drogue study, calibrated 2-D water quality model, and recommended water management strategies for minimizing the potential for taste & odor episodes	A, C, F, G, H

[§]The following are the course outcomes for the Water Quality Engineering course:

A. Understand the physical, chemical, and biological processes in water and wastewater treatment processes, and natural systems
B. Estimate the required size of water and wastewater systems and their components.
C. Understand the nature and significance of water pollutants and their sources.
D. Design systems and/or components of systems to remove specific water pollutants
E. Design systems to safely dispose of treatment system by-products.
F. Record, interpret, and use experimental and field data to provide meaningful information.
G. Make clear, concise, convincing, and accurate oral presentations.
H. Make clear, concise, convincing, and accurate written reports.

As a result, more demonstrations have been incorporated into the lecture portion. One shortcoming of the student survey was that the questions concentrated on course outcomes, but did not allow students to reflect on their service learning experience.

Anecdotal feedback from sponsors has been very positive. They are generally very appreciative of the data collected and recommendations made by the students. In most cases, the towns and water utilities did not have the resources to explore these issues in as much detail as was done by the students. In one case, the Manchester Water Department presented the student team with a Service Accreditation Award based on the students' findings.

The technical quality of the students' research was also assessed by the acceptance of abstracts at professional conferences. Because of financial constraints and the tight timeframe between the end of the project and graduation, the submission of abstracts is generally limited to regional conferences that do not require long review lead times. Even with these limitations, three project teams have presented their findings at a regional conference. Informal feedback from environmental professionals attending the conference has been very positive and contacts with potential sponsors for future projects have been established.

Conclusions

Adding a service learning environmental research project to the civil engineering curriculum has been very successful. Most projects have met the dual objective of being linked to course outcomes and providing a meaningful service to the community. One element that needs more attention is to provide structured time for the students to reflect on their service experience.

Acknowledgements

The author wishes to thank the involvement of all the project sponsors that make the student service learning research projects possible.

Bibliography

1. USEPA, Service-Learning: Education Beyond the Classroom, EPA Document EPA530-K-02-001, September 2002.

Biographies

DAVID PINES

David Pines is an Assistant Professor of Civil and Environmental Engineering at the University of Hartford. He completed his Ph.D. studies in the Department of Civil and Environmental Engineering at the University of Massachusetts, Amherst in 2000. He is actively involved with student projects sponsored by environmental engineering firms, municipalities, and water utilities.