

SERVICE LEARNING: A POSITIVE APPROACH TO TEACHING ENGINEERING ETHICS AND SOCIAL IMPACT OF TECHNOLOGY

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INTRODUCTION

Engineering Criteria (EC) 2000, the new accreditation criteria of the Accreditation Board for Engineering and Technology (ABET), requires engineering programs to demonstrate, under Criterion 3 Program Outcomes, that their graduates have “an understanding of professional and ethical responsibility” and “the broad education necessary to understand the impact of engineering solutions in a global societal context.” Most literature on engineering ethics and, to a lesser degree, on societal aspects of technology, focuses on the negative of wrongdoing, its prevention, and appropriate sanctions of misconduct. This paper proposes a more positive approach to teaching engineering ethics and social impact of technology via service-learning by offering justifications for the pedagogy based on engineering codes of ethics. This paper examines reflection issues in engineering, without which the full benefit of the service-learning pedagogy cannot be realized. The paper concludes by offering suggestions on reflection course materials for three types of service-learning projects found commonly in engineering.

Service-learning is “a form of experiential education in which students engage in activities that address human and community needs together with structured opportunities intentionally designed to promote student learning and development” [1]. These structured activities must provide opportunities for students to reflect on meaning and significance of the service-learning projects they have undertaken. It is also important that in doing so they take into consideration the perspectives of those for whom they have provided service.

While relatively new in engineering, service-learning is well established in the humanities and social science disciplines, and in disciplines where clinical experience forms part of student learning. Campus Compact, a national organization supported by university presidents who are committed to integrating community service into the undergraduate experience, found 11,000 courses with a service-learning component in its member institutions in a 1998 survey [2].

DISCUSSION

I. Justification for Service-Learning

It is not uncommon to find professionals who provide *pro bono* service, e.g., medical doctors and lawyers, to those who cannot afford the service or where there is no easy access to the service. Although the provisions are broadly stated, the National Society of Professional Engineers (NSPE) and American Society of Civil Engineers (ASCE) codes of ethics do justify community service as an important part of engineering ethics. For example, under Section III, Professional Obligations, No. 2, the NSPE code states “Engineers shall at all times strive to serve the public interest.” Subsection (a) reads: “Engineers shall seek opportunities to be of constructive service in civic affairs and work for the advancement of the safety, health and well-being of their community” [3]. Similarly, under Subsection (e) of the ASCE Fundamental Canons, No. 1, “Engineers should seek opportunities to be of constructive service in civic affairs and work for the advancement of the safety, health and well-being of their communities, and the protection of the environment through the practice of sustainable development” [4].

Because there is no qualifier that engineers are to seek opportunities to be of service to the community “in the performance of their professional duties,” it can be suggested that the obligations of engineers to the well-being of the public and their communities are not restricted to within their place of employment. Therefore, the NSPE and the ASCE provisions do provide a rationale for concluding that community service is an important feature of engineering ethics. Hence, service-learning can provide a more positive approach to engineering ethics by focusing learning on doing the work of an engineer responsibly and well, whether in the workplace or in community service [5].

II. Reflection in Service-Learning

Community-based design projects can be found in many engineering programs in the nation. These projects focus primarily on engineering design and only incidentally involve community service and therefore do not have a reflection component of service-learning. Even for those community-based design projects whose learning objectives match the objectives of service-learning, the student self-reflection component, without which the full benefits of service-learning are not realized, occurs more by happenstance than deliberately structured. The authors suggest that these courses can reap the benefits of service-learning by integrating a structured reflection component based on engineering ethics and social impacts of technology.

“Service-learning is based on the pedagogical principle that learning and development do not necessarily occur as a result of experience itself but as a result of a reflective component explicitly designed to foster learning and development. Reflection should include opportunities for participants to receive feedback from those persons being served, as well as from peers and program leaders” [1].

Moffat and Decker, in “Service-Learning Reflection for Engineering: A Faculty Guide” [6], state “engineering relies heavily upon linear, black-and-white thinking with little room for personal introspection and reflection.” Service learning “demands that students consider the gray areas which inevitably arise when dealing with social issues and incorporate them into problem-solving.” Therefore, “Successful reflection sessions in the classroom help students become familiar with different perspectives and prepare them to explore and discuss the societal impact of engineering as it relates to real-world problems.” The authors concluded that “Engineering faculty who implement service learning in their courses have the opportunity to inspire students to think in new ways which can tap their creativity and make them better engineers as well as better citizens” [6].

A structured reflection component, either in the form of classroom discussion or journal writing, can focus on a number of ethical challenges the students did not anticipate prior to undertaking their community-based design projects. For example, students can reflect on problems encountered in working in teams, and on deciding what to do when they see something of which they disapprove or when they have made a mistake that hasn't been noticed by others. Furthermore, because the service-learning experiences are closely related to student's preparation for their careers, the reflection component can focus on the directions they want their career to take and on the values and ethical ideals they hope to sustain in whatever pursuits they do eventually undertake[5].

III. Identify ways in which your service-learning/community-based design project would help in your own development

Three types of service-learning/community-based design projects are found commonly in engineering. They are partnered with K-12 schools, Habitat for Humanity, and grassroots environmental organizations. Some ideas for reflection exercises for these courses are:

- An “Introduction to Engineering” course in which the community partners are K-12 teachers or students -- Raymond B. Landis, in his book *Studying Engineering: A Road Map to a Rewarding Career* [7], identifies “Putting something back” as a part of student development to broaden and enhance the quality of a student's education. Landis cites “Serving as an ambassador” by returning to the student's high school or other high school to speak to teachers and students as an example of “Putting something back.”

A reflection exercise would consist of students writing short essays to respond to the following questions:

- 1) Does your service-learning/community-based design project meet Landis' definition of “Putting Something Back”? Why and how?
- 2) Identify ways in which your service-learning/community-based design project would help in your own development? In what ways would the project hinder your own development?

3) Assume you were a student ambassador visiting your alma mater. Knowing what you know now, what advice would you like to have heard from an engineering undergraduate when you were a middle-school student? When you were a high-school student?

- A service-learning/community-based design project in which the community partner is Habitat for Humanity -- There are a number of essays listed in The Ayn Rand Institute website that attack the ideals embodied in community service. One example is “Public Service and Private Misery” by David Harriman [8]. Mr. Harriman states: “Liberals and conservatives alike have embraced the view that individuals have a moral duty to serve society.” Harriman’s essay argues that “it is the opposing morality, that of ‘selfishness,’ that enables man to achieve his own happiness.”

Engineering faculty member could assign students to read Harriman’s article and/or other articles from the Ayn Rand Institute, and lead classroom discussion or assign students to write an essay to discuss the issues raised. The ABET definition of engineering states that the profession is “for the benefit of mankind,” so reflection could focus on the apparent conflict between Harriman’s thesis and responsibilities of engineers as outlined in the NSPE and ASCE codes of ethics.

- A course in which the community partner is a conservation/preservation/grassroots environmental group -- Moffat and Decker [6], offer the following reflection topics for either classroom discussion or essay writing:
 - 1) Is there a difference between the way engineers view environmental problems and the way the general public view the same problems? What are the differences, and why do these differences exist?
 - 2) How can engineers and citizens work together to solve environmental problems? Why should they?
 3. What non-technical information did you learn about the project from the people you worked with? Is this information relevant to your work? Why or why not?
 - 4) If you put this project on your resume, would you list it as community service? Does the engineering community value volunteer work? Why or why not?
 - 5) Do you have a stereotypical images of environmentalists before you begin the project? What are they? Are they confirmed or debunked by the project?
 - 6) Does your community partner or the general public have a stereotypical image of engineers? Are they true? If so, in what ways are the stereotypes an impediment to solving environmental problems?

CONCLUSION

The Service-Learning pedagogy provides a more positive approach to teaching engineering ethics and social impact of technology by focusing learning on doing the work of an engineer responsibly and well, whether in the workplace or in community service.

In the primer for service-learning in higher education, B. Jacoby states a goal for reflection is "to promote learning about the larger social issues behind the needs to which their service is responding. This learning includes a deeper understanding of the historical, sociological, cultural, economic, and political contexts of the needs or issues being addressed" [1]. While this goal of service-learning converges with EC 2000 Criterion 3 program outcome (h), "the broad education necessary to understand the impact of engineering solutions in a global societal context," it is doubtful that it can be achieved by a single course. Therefore, the solution may come in the form of service-learning-across-curriculum, in conjunction with design-across-curriculum, to prepare better engineers and better citizens.

REFERENCE

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