SERVICE LEARNING: BRIDGING THEORY WITH PRACTICE, KNOWLEDGE WITH ACTION, CAMPUS WITH COMMUNITY

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Abstract — *Service learning is a teaching and learning approach that is gaining popularity at universities across the United States. Students, as part of an academic course, participate in volunteer service activities that meet community needs and enrich their understanding of specific academic course content. In service learning, students are performing service while learning their courses by working in the community. In engineering, service learning has the potential to help students gain the skills necessary for lifelong learning and for practicing engineering in a manner cognizant of professional and civic responsibilities. By engaging in thoughtfully organized activities that address human and community needs together with structured opportunities intentionally designed to promote student learning and development, engineering students have the opportunity to interact with highly diverse populations and so can better develop their abilities to function on multidisciplinary teams and to communicate effectively.*

Index Terms ¾ Course Projects, Education Outcomes, Service Learning, University-Industry Partnership.

INTRODUCTION

A paradigm shift is taking place in undergraduate engineering education, with the inclusion in the curriculum of the objective of helping students develop what some have called "softer skills." These include team skills such as collaborative active learning; communication skills; leadership; an understanding and appreciation of the diversity of the students, faculty, and staff; an appreciation of different cultures and business practices; the understanding of global engineering practice, and understanding of the societal, economic, and environmental impacts of engineering decisions.

Various types of service learning programs can be defined based on their primary intended beneficiary and their overall balance between service and learning. *Volunteerism* is the engagement of students in activities where the primary emphasis is on the service being provided and the primary intended beneficiary is clearly the service recipient. *Community service* is the engagement of students in activities that primarily focus on the service being provided as well as the benefits the service activities have on the recipients. The students receive some benefits by learning more about how their service makes a difference in the lives of the service recipients. As with volunteer programs, community service programs imply altruism and charity. However, community service programs involve more structure and student commitment than do volunteer programs.

Internship programs engage students in service activities primarily for the purpose of providing students with hands-on experiences that enhance their learning or understanding of issues relevant to a particular area of study. Clearly, in internship programs, the students are the primary intended beneficiary and the focus of the service activity is on student learning.

Field Education programs provide students with co-curricular service opportunities that are related, but not fully integrated, with their formal academic studies. Students perform the service as part of a program that is designed primarily to enhance students' understanding of a field of study, while also providing substantial emphasis on the service being provided. While strong intentions to benefit the recipients of the service is evident, the focus of field education programs tend to be on maximizing the students' learning of a field of study.

Service learning programs are distinguished from other approaches to experiential education by their intention to equally benefit the provider and the recipient of the service as well as to ensure equal focus on both the service being provided and the learning that is occurring. To do this, service learning programs must have some academic context and be designed in such a way that ensures that both the service enhances the learning and the learning enhances the service. Unlike a field education program in which the service is performed in addition to a student's courses, a service-learning program integrates service into the course(s).

These forms of service programs were presented pictorially by Sigmon [1] where each service program lies on an experiential education continuum based on its primary intended beneficiary and its overall balance between service and learning, Figure 1.

What is Service Learning?

For over a quarter of a century, education researchers and practitioners have struggled to determine how to best characterize service learning. In 1979, Sigmon [2] defined

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service learning as an experiential education approach that is premised on "reciprocal learning." He suggested that because learning flows from service activities, both those who provide service and those who receive it "learn" from the experience. In Sigmon's view, service learning occurs only when both the providers and recipients of service benefit from the activities.

Recipient ← BENEFICIARY → Provider

Service ← FOCUS → Learning

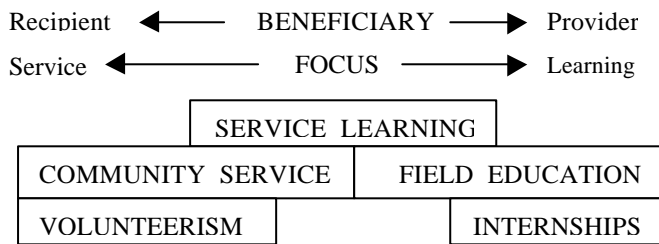| SERVICE LEARNING	
COMMUNITY SERVICE	FIELD EDUCATION
VOLUNTEERISM	INTERNSHIPS

FIGURE. 1
RELATIONSHIP BETWEEN VARIOUS SERVICE PROGRAMS.

The National Society for Experiential Education [3], which for years has focused on various types of experiential education programs, broadly defines service learning as "any carefully monitored service experience in which a student has intentional learning goals and reflects actively on what he or she is learning through experience."

The Corporation for National Service [4] provides a narrower definition that sees service learning as a "method under which students learn and develop through active participation in thoughtfully organized service experiences that meet actual community needs, that are integrated into the students' academic curriculum or provide structured time for reflection, and that enhances what is taught in school by extending student learning beyond the classroom and into the community…"

The Association for Service Learning in Education (ASLER) [5] characterizes service learning as a method of learning that enables school-based and community-based professionals "to employ a variety of effective teaching strategies that emphasize student-centered or youth-centered, interactive, experiential education… Service learning places curricular concepts in the context of real-life situations… Service learning connects young people to the community, placing them in challenging situations…"

One of the more frequently cited definitions of service learning was offered by Bringle and Hatcher [6]: "We view service learning as a credit-bearing educational experience in which students participate in an organized service activity that meets identified community needs and reflect on the service activity in such a way as to gain further understanding of the course content, a broader appreciation of the discipline, and an enhanced sense of civic responsibility. Unlike extracurricular voluntary service, service learning is a course-based service experience that produces the best outcomes when meaningful service

activities are related to course material through reflection activities such as: directed writings, small group discussions, and class presentations. Unlike practica and internships, the experiential activity in a service learning course is not necessarily skill-based within the context of professional education."

Therefore, one of the most significant ways in which service learning differs from many other community-related campus-based initiatives lies in its insistence that the needs to be met *must* be defined by the community, not the campus. In other words, service learning deliberately seeks to reverse the long-established academic practice of using the community for the academy's own ends. This, of course, does not mean the academy is expected simply to do the community's bidding. The watchword here is reciprocity: there must be an agreed upon balance of benefits and responsibilities on both sides.

Such a call for reciprocity has far more serious consequences than may at first be apparent. For one, it significantly qualifies the academy's traditional claim to preeminence by virtue of its expertise. In a service-learning concept, the concept of "expertise" encompasses more than theoretical understanding and technical skill; it also includes the in-depth knowledge that comes from having lived with a problem or set of circumstances over an extended period of time. Thus, the community lays claim to its own kind of expertise – an expertise that academy must acknowledge and respect.

Second, reciprocity implies that all processes and roles are functionally interchangeable. It is no more accurate to identify the academy as "serving" the community as "being served" than vise versa. If the community benefits and learns from the academy, it is no less true that the academy benefits and learns from the community. If the academy gives the community access to new technical and human resources, the community gives the academy access to new educational opportunities. It is commonplace among service-learning practitioners – students and faculty alike – to realize, once a project has been completed and evaluated, that those on campus have gotten back far more than they have given.

The difference between a traditional course and a service-learning course can be summarized as shown in Table I. In terms of learning pedagogy, a traditional course differs from a service-learning course as shown in Table II.

Service Learning Pedagogy

Principles of good practice in community service learning can be best summarized as published by Jeffrey Howard [7]:
- Academic credit is for learning, not for service.
- Do not compromise academic rigor.
- Set learning goals for students.
- Establish criteria for the selection of community service placements.

- Provide educationally sound mechanisms to harvest the community learning.
- Provide supports for students to learn how to harvest the community learning.
- Minimize the distinction between the students' community learning role and the classroom learning role.
- Re-think the faculty instruction role.
- Be prepared for uncertainty and variation in student learning outcomes.
- Maximize the community responsibility orientation of the course.

TABLE I
STRUCTURAL DIFFERENCES BETWEEN TRADITIONAL AND SERVICE
LEARNING COURSES

	Traditional Course	Service Learning Course
Place	Classroom	Classroom, Community
Teachers	Professor	Professor, Supervisor, Clients, Peers
Preparation	Readings, Previous courses	Expanded readings, Previous courses, Site visits, Personal characteristics
Learning	Writing exams, Cognitive Short term	Writing exams Cognitive & affective Short & long term
Evaluation	Professor	Professor, Supervisor, Self-assessment

TABLE II
LEARNING DIFFERENCES BETWEEN TRADITIONAL AND SERVICE LEARNING
COURSES

Traditional Course	Service Learning Course
Theoretical	Practical
Passive	Active
Sequential/Ordered	Perplexity/Random
Linear	Nonlinear
Structured & Compartmentalized	Expansive & Integrative
Convergent thinking	Divergent thinking
Deductive	Inductive
Learning is mainly assessed at end of course	Learning continues beyond the course

Effective Service Learning Practice

The main characteristics of an effective and sustained service learning program were best laid out by Jane Kendall [8] as a program which:
- Engages people in responsible and challenging actions for the common good.

- Provides structured opportunities for people to reflect critically on their service experience.
- Articulates clear service and learning goals for everyone involved.
- Allows for those with needs to define these needs.
- Clarifies the responsibilities of each person and organization involved.
- Matches service providers and service needs through a process that recognizes changing circumstances.
- Expects genuine, active, and sustained organizational commitment.
- Includes training, supervision, monitoring, support, recognition, and evaluation to meet service and learning goals.
- Insures that the time commitment for service and learning is flexible, appropriate, and in the best interest of all involved.
- Is committed to program participation by and with diverse populations.

Service Learning Site

The main requirement of a community-based service-learning site is that it must be doing work that is connected to the course in ways that will be obvious to students. In addition, activities at the site must give students opportunities to reflect on how course concepts relate to the activities. Whenever possible, students should have direct contact with client populations or constituency groups with which the organization regularly interacts in order to develop a clear connection to the main purposes of the organization.

When selecting a service-learning partner, it is imperative to discuss in advance the interests and expectations of the organization in the partnership. It is also helpful to discuss previous experiences of the organization with college students and institutions of higher education. Challenges and communication channels should also be discussed before hand.

Reflection in Service Learning

Reflection is that component of service learning that distinguishes it from traditional design projects. It is also that aspect of service learning that offers the greatest challenge to engineering faculty. Jacoby [9] defines the goal of student participation in reflection as "promoting 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." Through reflecting on their service experience, students will gain further understanding of the course content and discipline, gain further understanding of the service experience, develop self-assessment skills as a life-long learner, and learn to appreciate broad education

necessary to understand the impact of engineering solutions in a global and societal context.

For an effective service learning reflection, it has to be structured as ongoing aspect of the course and be included in the overall assessment of the course. Also, it is helpful if it is offered in multiple forms (journals, essays, research papers, logs, portfolios, case studies…etc) and be supported by class context.

For engineering faculty, however, reflection can present a challenge. There is no silence quite pregnant as the one when engineers, both faculty and students alike, are asked to talk about how they feel. This is not altogether unexpected. Engineers and physical scientists are trained to take the self out of the problem-solving process. Scientific analysis is the backbone of engineering, and this analysis must occur within a context of objectivity. Hence, this disciplinary culture, coupled with an overwhelming lack of reflective facilitation experience on the part of most engineering faculty, puts the reflection component of service learning at grave risk in the engineering classroom.

CASE STUDY: IMPLEMENTING SERVICE LEARNING IN INDUSTRIAL AND MANUFACTURING ENGINEERING PROGRAM

In the Spring semester of 2002 we decided to implement service learning in the Industrial and Manufacturing Engineering program at the University of Wisconsin-Milwaukee. The process of integrating service learning into an existing course started with the following list of guiding questions:
- What are the expected outcomes?
- Which course best serves the objective?
- Which type of service learning structure?
- What types of service projects?
- Which community partner?
- How will the learning be evaluated?
- How will the projects be implemented and monitored?
- How will the outcomes be measured?

The outcomes were identified in three categories: personal, social, and learning. Among the personal outcomes, service learning was expected to have a positive effect on student personal development such as sense of personal efficacy, personal identity, spiritual growth, and moral development. Also, it was expected to have a positive effect on interpersonal development and the ability of students to work well with others, and to improve their leadership and communication skills.

At the social level, service learning was expected to have a positive effect on reducing stereotypes, facilitating cultural and racial understanding, and creating a sense of social responsibility and citizenship skills. The learning outcomes were expected to improve students' ability to apply what they learn in the classroom into the "real world"

and to improve their complexity of understanding, problem analysis, critical thinking and cognitive development.

An introductory course to manufacturing engineering was selected due to its broad and practical content, which makes it easier for the students to relate to the outside world. Several types of service learning components were considered:
- Option within the course, where students have the option to become involved in service learning project. Portion of normal coursework will be replaced with service learning component.
- Required within the course, where all the students become involved in service as an integrated aspect of the course.
- Class service project, where the entire class is involved in one-time service project. Learning outcomes of one-time service learning projects are different than ongoing service activities.

The first model was selected since the experience was new to both faculty and students.

A local manufacturing company of plastics extrusion (Gossen Corporation) was selected to be a community partner due, mainly, to their previous interact with the faculty and students in the department, which facilitates many of the administrative issues. In addition the proximity of the company location to the campus was highly considered.

Gossen Corporation, a small size company with a little over 150 employees, relies mainly on low-wage labor to operate their production lines of Vinyl extrusion. The operators are responsible for tending the production machines and packing the products. Due to the high responsibility laid on the line operators, the job can become intimidating and many unskilled operators decide to quit their job and work a different job, maybe in a fast food chain restaurant, for an equivalent pay. The problem of quick turnover of employees causes harm to the local industry, company, and community. The need for effective training of the new employees was well agreed upon. However, the means and strategy was subject to lengthy discussions.

Our proposal was to allow our junior students to spend time with fresh employees and learn the job requirements, along with the new employees, citing the challenges and feedback of the process. An outside look on such issues has the advantage of being distant from everyday work routine and political shadows when evaluating internal operations. The project scope was suggested by the faculty and discussed with the involved people in the company.

Ten students were involved in the project, working in groups of two, with five new operators in the company. The students' assignment was to learn the process, along with the operators, and record a periodical evaluation of their own learning progress. The personal journals were then presented and discussed with the company personnel involved in the recruitment and training process.

Monitoring and Assessment

The students monitoring process involved both the faculty and company personnel. A monthly meeting at the company site was scheduled to discuss the progress of the project and the challenges faced by the students. The assessment procedure of the students' learning was composed of the following components:

- A weekly log of the students' activity with personal reflection on the project development and learning
- A biweekly informal class discussion (story telling)
- A formal presentation at the end of the course, and
- A formal report submitted at the end of the course

The outcomes of the project were measured by the following means:

- Evaluation forms filled by the participating students
- Feedback questionnaire filled by the involved company personnel, and
- Instructor evaluation of the students' learning compared to previous courses.

Project Outcomes

The outcomes of the project varied among the five groups. However, all groups demonstrated:

- A broader understanding of the day-to-day operations of the manufacturing organization
- A deeper understanding of manufacturing processes, especially the difference between theory and practice.
- Improved understanding of social, ethical, and professional practices in manufacturing
- Improved oral and written communication skills, and
- Improved sense of "life-long" learning, where the students realized at the end of the course that: given more time, more progress can be made.

On the company side, the project was successful in strengthening the ties between the industry partner (Gossen Corporation) and campus, in general, and the involved faculty, administrators, and students, in particular. In addition, students' comments and suggestions were considered by the company personnel and several actions were implemented during the project to accommodate these suggestions.

Although the project did not yield in a breakthrough in the participants' life, the enthusiasm and support of various parties involved in the project were a major achievement that will have a positive influence in future service learning projects.

Challenges

The idea of engineering students providing "professional services" through their service-learning projects raised several issues. These include: How professional a service do such projects provide? Are students even capable of rendering professional services? Could service learning displace the paid services of professional engineers? What about liability…etc? Clearly, some of these concerns could be more easily addressed than others. In addition, scheduling conflicts was always a challenge, because students and their community partners often followed conflicting schedules. It was also experienced that there are some students who did not believe in community service and might even challenge a service learning assignment.

CONCLUSIONS

Service learning application in manufacturing engineering demonstrated several improvements in the teaching and learning process at the same time. Essential requirements for the success of service learning are: the dedication and motivation of the faculty, students, and community partners; support of administration in both the academic institution and the participating organizations; thorough planning of the project by the faculty and site personnel; well-defined scope and outcomes of the project; well-defined continuous assessment procedure of the outcomes; and non the less, establishing strong communication channels between the involved partners.

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