Integrating Community Service in the Construction Technology Curriculum

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Abstract

The pedagogy of service learning has been documented since the mid-1970’s (Perry, 1970), but only in recent years have colleges and universities begun to integrate curricular-based service into higher education.

During the fall of 1996, the Department of Construction Technology, IUPUI; NBD Bank, Indianapolis; and the Concord Community Development Corporation (CCDC), teamed up for an innovative undertaking in community partnership. The pilot project involved the rehabilitation of an abandoned, three-room house located near the IUPUI campus. Students enrolled in a senior level design course elected to tackle this project in lieu of the traditional “Semester-End Design Project” required in the class.

This paper will describe some of the lessons learned from this pilot project and attempt to provide a blueprint for the integration of similar community projects into the engineering technology curriculum.

Introduction

Dr. Ernest Boyer, President of the Carnegie Foundation for Advancement of Teaching, describes the “New American College” as an institution that “celebrates teaching, supports research, and takes special pride in its capacity to develop a new model of higher education, one that would enrich the campus, renew communities, and give new dignity to the scholarship of service.”

Redeveloping inner city neighborhoods remains a national challenge. This issue is especially important for urban universities such as IUPUI. Ira Harkavay, director of the University of Pennsylvania’s Center for Community Partnerships, warns that “universities cannot afford to remain shores of affluence, self-importance, and horticultural beauty at the edge of island seas of squalor, violence, and despair.”

In a recent report entitled “Scholarship Reconsidered,” the author [Stanton, 1995] has proposed a new paradigm of scholarship, one that not only promotes the scholarship of discovering knowledge, but also celebrates the scholarship of integrating knowledge, of communicating knowledge, and of applying knowledge through service. Service, in this context, means far more
than simply doing good, although that is important. Rather it means that students and professors apply knowledge to real-life problems, use the experience to revise their theories, and become “reflective practitioners.” Service may be defined as a credit-bearing experience in which the students are involved in community service and reflect on the experience derived in such a way as to gain further understanding of the course content, a broader understanding of the discipline, and an enhanced sense of civic responsibility (Hatcher and Bringle, 1996).

Liberal art educators have been on the forefront of the movement to create active educational experiences for students, experiences which enable and require students to think critically on the world around them [Wagner, 1986]. The acceptance of the value of “service” in enabling students to link theory to practice and vice versa, has been slower in coming in engineering and technology disciplines, but the good news is that recently in cities such as Detroit, New York City, Baltimore, and Philadelphia, to name a few, engineering and technology disciplines have embarked on bold new initiatives to focus a rich array of academic resources on field projects directed towards renewing local communities.

**Senior Level Timber Design Course**

The three credit hour senior level design course, *CET 484: Wood and Timber Design*, is a part of the four course “Design Sequence” required of construction technology majors. The design sequence also includes: *CET 382: Steel Structures Design*, *CET 387: Reinforced Concrete Design*, and *CET 430: Foundation Systems*.

The primary focus of the course is to introduce students to:
- load calculations utilizing *building codes*;
- engineering properties of construction lumber;
- use of the *National Design Specification (NDS)* for wood construction; and
- fundamentals of design of members including beams, columns, diaphragms, connections, etc.

A secondary objective of the course is to serve as a “capstone design course”. In the past this objective was fulfilled through having students work in groups on a design project, one that was usually chosen from the text book. In addition to preparing and presenting the design calculations, the students were required to submit specifications, perform quantity takeoff and determine project cost. While a project like this has value in that the students learn to put to use the skills acquired in a variety of classes, there was always the question of “practicality” of the project. Students often questioned the “value” of such a project, complaining that “too much was required in too little a time”. A further analysis of the situation usually revealed that the students had “too little time” because they had not begun the project until the last three 3 weeks of the semester. One reason for that being the students perceived the project to be “text book material” and not something that had a “real world value”. The semester end course evaluations also reflected similar student sentiments.
Community Housing Project

It was felt that one way to overcome student apathy towards a “capstone project experience” would be through involving them in a community based project, which would require them to interact with various members of the community and thereby become “connected”. Experience with similar projects in the School of Education, IUPUI, had shown a dramatic growth in student interest and commitment.

During the fall of 1996, the Department of Construction Technology, IUPUI; approached the Concord Community Development Corporation (CCDC), to determine if they had house rehabilitation or construction projects that could gain from volunteer help to be provided by students in the construction technology department. Through initial meetings with the Executive Director of the CCDC some of the parameters for the partnership were established, namely:

- Formation of a Steering Committee,
- Defining the primary objective - “allow the students to apply their technical knowledge and skills”,
- Allow flexibility in selection of the project,
- Feedback mechanism - Monthly meetings to provide written project updates,
- Providing client (CCDC) with alternate designs and final decision authority,
- Project Deadlines - Final drawings and specifications to be furnished in four months, and
- Student involvement in all stages of the project - including the bidding process, selection of general contractor, and construction inspection.

During the first week of classes the students were escorted on a tour of the Concord neighborhood and shown the five properties that were scheduled for construction/ rehabilitation. The property on 1121 S. Senate Drive (Fig. 1) was chosen as the class project for the following reasons:

- the approximately seventy year old, three room, house was located on a quite tree lined street and had a good market potential once rehabilitated,
- the existing construction consisted of rough sawn lumber that appeared to be in excellent shape, and
- the property had to be enlarged into a three bedroom house to increase it’s resale value.

Once the property selection was finalized the students were divided into groups of five. The groups were assigned the following tasks:

- conduct property survey and furnish a Site Plan (Fig. 2),
- inspect the existing structure, obtain dimensions and furnish As Built Drawings, and
- Develop new Floor Plans.

Project Related Activities Accomplished In Class

Forensic Analysis Phase
One of the first tasks accomplished was the determination of structural sufficiency of the existing floor beams, roof rafters, and stud walls. Inspection revealed that the existing members were rough sawn and not of standard dressed dimensions. The origin of the lumber was questionable
as it did not have any grade stamp. Students were able to extract some samples to conduct
standardized testing in the laboratory. A forestry expert was also contacted to help determine the
species origin.

Most of the structural members appeared to be in very good shape. The studs were 2” x 3.75”,
the floor beams and roof rafters were 2” x 7.5” in dimension. It was also determined that the
wood was a mixture of walnut and oak. Calculations were performed in class which helped
determine that the existing members were more than adequate.

Alternate Design Evaluation Phase
Two alternate plans were presented to CCDC and NBD Bank, which agreed to finance the
construction through their Community Reinvestment Act (CRA) charter. One plan called for
extending the back of the house to accommodate the additional bedrooms, thereby maintaining
the “farm house” character. Another plan called for a two storied addition at the back of the
house while leaving the front of the house intact (Fig. 3). The second scheme would change the
front elevation of the house but by maintaining the current roof lines the changes would be kept
to a minimum. Although the later priced ten-percent higher than the first, the second alternate
was chosen by the CCDC for the following reasons:
- a better fit with the lot (30 ft x 120 ft) and the neighborhood,
- permitted room at the back of the house for a car port and a yard for children to play, and
- provided a better “flow” to the living space

Final Design Phase
Once the plans had been finalized all the groups began to work in earnest on the structural
design. Time was set aside in each class to discuss specific problems. Rather than using
hypothetical problems to illustrate concepts, specific aspects of the project were chosen for the
purpose. Some of the issues tackled in the class were:
- Should the new roof support consist of trusses or “stick construction”,
- Should the new floor beams and rafters be run in the same direction as existing
  members, thereby resulting in a common bearing wall, or in opposite directions,
- Will snow drifts from the adjoining property affect the loads on the structure, and
- How to tie the new structure with the existing structure without giving rise to
differential settlements.

The final design plans (Fig. 4) were submitted in November, 1996, to the steering committee.
They were approved unanimously. The specifications were submitted in the first week of
December, bids were entertained from three different contractors, and are currently under review.
Expected project completion date is June, 1997.

Demolition Day
The new plans called for gutting the existing bedroom on the first floor of the house and
converting the space into a bathroom and a stairway. Also, the plans called for removing plaster
from all the walls and replacing it with drywall. A “demolition day” was organized on
November 9, 1996, by the Society of Student Constructors in conjunction with other student
organizations in the School of Engineering and Technology. A local contractor donated a
dumpster for trash removal. Student and community volunteers helped perform the following tasks:
- “gut” the interior of the house to bare wood,
- trim overgrown trees and bushes, and
- yard cleanup.

Assessment of the Community Project Experience

Although many in the field of engineering education may advocate that providing “community service” lies outside the academic mission of their discipline, yet the objectives of “service learning programs” - programs that emphasize learning how to apply, integrate, and evaluate knowledge, are the very same ones championed by these educators in their individual disciplines.

To ensure that service promotes substantive learning it is important to require that students reflect on their experience so as to be able to connect it with the curriculum. In the present case this “connection” was fairly obvious to all involved. Nonetheless, the students were required to maintain a journal of their activities. The journal had two sections. On one side the students entered the various tasks undertaken as a group or on an individual basis. On the other side the students had to indicate how the activity related to the course content either in the CET 484: Timber Design class or that in another class. This was accomplished by sitting together as a group and analyzing the tasks.

As of the writing of this paper the feedback from the formal course evaluation is as yet unavailable. However from conversations held with the students the following seems to be true:
- students are motivated and take “ownership” of their community projects,
- students enjoy doing things that “give something back to the community”, and
- students are able to achieve the connection between “theory” and “practice”.

The community partners, namely the Concord Community Development Corporation (CCDC) and the NBD Bank, were overwhelmingly supportive of the effort and have expressed a strong desire to see the relationship continue in the future.

The School of Engineering and Technology has also benefited from this project through the publicity it has received in local newspaper and on television.

Principles of Good Practice for Combining Service and Learning

To successfully blend service and learning in a course involves a pedagogy with which most instructors (and most students) have little prior experience. Although literature is replete with discussions on community service learning, it is wanting in materials that provide models for, and address pedagogical issues relevant to, community service learning courses.

Based on the experience derived from this project and from consultations with others who have taken a leadership role in formulating the principles of “service learning” and have a great deal of
experience in this regard, the following list of principles may serve as a guideline for implementing an effective “service learning” program in the various disciplines:

1) Academic credit is for learning, not for service,
2) Do not compromise academic rigor,
3) Engage students in responsible and challenging ways,
4) Provide a structured opportunity for students to reflect critically on their experience,
5) Articulate clear service and learning goals for everyone involved,
6) Clarify the responsibility of each person and organization involved, and
7) Provide feedback and assessment mechanism to all involved.

**Conclusions**

Community service and academic excellence are not competitive demands to be balanced through discipline and personal sacrifice by students, but rather are interdependent dimensions of good intellectual work.

When effectively structured, facilitated, related to discipline based theories and knowledge, community based service learning experience ensures the development of graduates who will participate in society actively, ethically, and with an informed mind.

**References**


Fig. 1  Property on 1121 South Senate Street, Indianapolis, Indiana

Fig. 2  Existing Site Plan
Fig. 3 New Elevation - Scheme II

Fig. 4 New Floor Plan and Section
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Sanjiv B. Gokhale graduated with a B.S. in Civil Engineering from the Indian Institute of Technology, India, in 1981. He earned a M.S. in Structural Engineering from Vanderbilt University, Nashville, TN, in 1984, a M.Phil. degree in Applied Mathematics in 1990 and a doctorate in Engineering Mechanics in 1991 from Columbia University, New York City. He has six years of industrial experience in the areas of underground construction. He is a registered Professional Engineer in the State of New York. He is a certified OSHA inspector in the State of Indiana. Sanjiv B. Gokhale is currently serving as an Assistant Professor in the Department of Construction Technology at Purdue University School of Engineering & Technology, IUPUI. During Summer 1996, Sanjiv B. Gokhale collaborated with Prof. Stein, Ruhr University, Bochum, Germany, on research in the area of water tightness of buried conduits. He is the winner of Outstanding Teacher Award, 1993, William P. Jungcluas Award for Teaching, 1994, and Abraham M. Max Distinguished Professor Award in 1995 for his research on multi-media training simulators. He is a member of ASCE, NASTT, ACI, ASEE, AISC, PCI, and ICMA.

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