



Enhancing Student Learning and Engagement in Construction Course using Service Learning

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Introduction

Service learning is considered a valuable approach to apply concepts from the higher education classroom in real world settings and has become quite common in some disciplines. Engineering educators in the United States are making efforts to incorporate service learning activities and study their benefits for student learning and engagement. When classroom instruction is augmented with an out-of-class experience that provides a defining hands-on experience – for many perhaps their first – the classroom experience itself also takes on a new aura of reality and relativity. In contrast to traditional teaching methods, service learning provides students with an opportunity to interact with community members to construct knowledge and develop solutions to real world problems¹. Turning to the community as a source for real world projects as a context for such learning environments has been proven successful by many higher education institutions². Synergistically, the students emerging from this learning experience will be more confident and better prepared for follow-on courses in the curriculum.

The impact of such an approach as service learning on student education within the engineering discipline shows that students are learning and applying the content and processes they will need further in their future studies and profession^{2,3}. Through service learning, opportunities are created for students to monitor their learning and realize when to seek further information; vital to students in understanding complex subject matter and transfer learning to new settings⁴. Research has demonstrated that courses incorporating service learning components generally provide a deeper understanding of course material, a better understanding of the complex problems people face, and an ability to apply course material to new situations and real world problems. Service learning makes significant contributions to students' understanding of academic material, including a greater depth of understanding, increased analytical skills, and a greater ability to apply what is learned⁵.

For service learning to equally benefit the provider and the recipient of the service while ensuring equal focus on service and learning, it should have some academic context and be designed in a way that both the service enhances the learning and the learning enhances the service⁶. Likewise, students can be engaged in community service activities that primarily focus on the service being provided as well as the benefits the service activities have on the recipients⁶. During community service activities, students learn more about the cause and how to deal with the cause effectively, as they begin to engage in formal intellectual discourse around the various issues relevant to the cause⁶.

In an effort to effectively impact student learning and experiences in the engineering discipline, this research study was conducted to describe student perceptions and outcomes based on the Habitat for Humanity (HFH) projects as a service learning experience implemented in a 'Construction Materials' course at this University. The scope of the study where the HFH mission was tied to a specific course was apparently unique. This research study introduced students to construction materials and practices essentially in a methodology generally consistent

with a service learning approach with the students working in teams to execute real-world constructive endeavors involving planning and building a home. Specific research questions this research study attempted to address were:

- Did students perceive improved learning of course materials and greater understanding of the construction industry through the service learning project?
- To what extent do students value the service learning experience as an appropriate component of the course in terms of teamwork, interaction between and among students, faculty, and peers, challenges and benefits?

Research Setting and Methods

Students enrolled in an introductory ‘Construction Materials’ course in spring 2012 participated in service learning activities as part of coursework requirement. In groups created by the instructor of five to ten, students completed a service learning project at one of eight local HFH sites. Student teams were deployed off-campus to participate in HFH construction operations among several Habitat Affiliates in the region. The number of independent Habitat Affiliates built flexibility into the exercise by providing a number of opportunities to schedule different work projects. In assessing the impact of service leaning experiences, feedback was gathered from students concerning their perceptions of the effectiveness of the project and the Habitat experience in promoting the project objectives. Descriptive statistics were calculated to offer current and future evaluation of students' perception outside of the classroom as related to course material and learning gains.

Planning worksheet

Specifically in spring 2012, student groups were required to complete a planning worksheet and contact a participating HFH housing project to schedule their project. In completing the planning sheet, students were asked to individually choose their top three preferred housing construction tasks from a teacher-generated list based on tasks and skills of the construction field that are commonly part of HFH projects. These typical tasks commonly associated with the HFH projects are listed in Table 1 below. It was naturally expected that students would coordinate their HFH project site of participation based on their preferred construction tasks.

Table 1. List of Typical HFH Tasks

• Framing	• Flooring	• Siding
• Hanging dry wall	• Roofing	• Finishing work
• Foundation	• Insulation	

The instructors of the course observed and participated at all of the service projects, assessing student performance on assigned tasks, as well as demonstration of professional skills, such as level of teamwork and communication among their team members as well as with other people at the job site.

Self-Assessment and Reflection

Students completed a self-assessment at the end of the semester to allow some reflection on how the experience enhanced their interaction with the instructor and peers and their learning after the experience. Specifically, students completed self-assessment of their service learning experience (reflection) in the form both rubrics and open-ended reflection questions, as a component of the 'Construction Materials' course requirement. The self-assessment emphasized whether they perceived improved critical thinking and problem solving; increased their level of awareness of cultural differences and attitudes toward helping others; improved their communication skills; improved their sense of civic and social responsibility; enhanced their knowledge of course content; had a better understanding of how the field, profession or career could make a positive contribution; how the subject matter can be used in everyday life; perceived learning overall with the service experience; and the direct promotion of active learning through the hands-on format of service learning.

All items were on a Likert type scale, one being strongly agrees, five being strongly disagree. The reflection also consisted of four open-ended questions asking students to reflect further on their HFH experience as it relates to the 'Construction Materials' coursework, classroom experience, and overall value of the service learning project. Results were considered statistically significant if $p < .05$ for all analyses conducted.



Figure 1. HFH Participating Students Erecting Framing Wall

Analysis

The data analyses for this study involved mainly descriptive analyses, including frequencies and cross-tabulations. Chi-square tests of independence were computed in some of the analyses. All of the quantitative data analysis was done using SPSS. For the open-ended responses in the spring 2012 group, project investigators coded student responses for each question. Investigators

coded each question and compared codes to enhance trustworthiness of the results. Responses by each group to each questionnaire item were identified as those who agreed, strongly agreed, and those who responded neutral, disagreed or strongly disagreed.

Table 2. Student Perceptions of Satisfaction and Perceived Learning Gains from Service Learning Experience

Gains	Percent of Strongly Agree or Agree		
	Group A (assignment in one of top 3 choices)	Group B (assignment not in one of top 3 choices)	Chi-square
Critical thinking and problem solving skills	80.9	79.0	.256
Communication skills	75.7	69.3	.828
Better understanding of their field, profession or career contributes positively to public life	84.9	77.0	.740
Increased level of awareness of cultural difference and attitudes toward helping others	81.9	76.9	.712
Improved students' sense of civic and social responsibility and had gained skills to effectively participate in those activities	87.9	77.0	.645
Enhanced their knowledge of course content	84.9	61.6	.224
Learned how the subject matter of the class can be used in everyday life through working on Habitat for Humanity	84.9	76.9	.576
Learned more overall than if they had not participated in a service experience	81.8	92.4	.780
Hands-on format of Habitat for Humanity directly promoted active learning	91.8	100.0	.056

Student perceptions of service learning implementation in 'Construction Materials' show positive results in how the service learning experience contributes to learning gains. Overall, students in the spring 2012 implementation reported positive perceptions of the HFH experience for their learning. All students felt there were positive aspects of the service learning experience, such as its value and opportunity for teamwork, relationships, and understanding course topics

and construction field overall. Because students expressed their preferences prior to the service project, the authors were able to determine whether their assignment at the HFH site matched their interests. Students' satisfaction and perceived gains was high overall, as presented previously, and were high regardless of alignment of assignment with interests (see Table 2 above).

Further, satisfaction and perceived gains did not appear to be dependent on receiving an assignment aligned with their interests, based on chi-square analyses cross-tabulating group with the four agreement categories. Students were also asked to reflect on how they perceived the extent to which the HFH experience contributed to enhancing student teacher interaction, the ability to work with each other as a team and how well they felt they related to the professor and other students after the service learning experience. Student thoughts from their HFH experience included "better connection," "we're on the same level," "better and more confident communication," "respect of professor," and "teamwork." One student in particular noted this was the "first time (they) ever (saw) a professor as another human being, other than this (I) always felt inferior to them." Another student noted they felt they were "equals" with the professor. Within the same question, students were also asked to reflect on whether teamwork from the jobsite carried over to the classroom. Again, students responded positively that the "teamwork extended to classroom activities" and allowed for "enhanced learning of course materials, learning from a real life job situation."

Students were also asked the most important thing they learned from the service learning experience and the most challenging. Reflection responses showed that students learned of the "strengths and weaknesses of those they were working with," "cooperation," and "who they'd want to work with again." Other responses on important things learned, from the service experience included "skills," "different perspective and significance of chosen field of study," "applying knowledge from book to job," and "societal impact." The most difficult of the service experience for students was "hard work and needed effort," "pace of others," the "scheduling" and "coordinating among team members," "learning new things," and the "physical work" of the job, such as making "accurate measurements" and "putting up siding or rafters." One student noted the most difficult part of the service experience was "balancing school, work, and life." Teamwork was the most consistent theme across student responses on both the important and the most difficult aspect of the Habitat for Humanity experience.

The majority of students commented they had greater understanding of their intended field of study in construction based on working on the HFH project. Student responses include:

- "see what (their) job one day may be;"
- tasks "in the field taught a lot and made (them) more comfortable;"
- "allows students to see how important it is to become knowledgeable and capable people if they want to work in this industry;"
- work on true construction tasks such as laying out trusses for ceiling support, building a roof and shed, and framing;
- is "an essential tool to test the waters of the industry, a valuable aid to learning;"
- their field of study "truly helps individuals around the world."

The final question of spring 2012 student self-assessment asked students to reflect on whether they felt community service was a valuable and appropriate learning component of the course and why or why not. Most students agree HFH was a valuable and appropriate learning component and teaching method of the course. Below describes student responses according to reflection questions (see Table 3 below).

Table 3. Summary of Students Reflection Comments on HFH Experience (spring 2012)

Contribution of HFH on: (Common student responses from service learning reflection)		
Enhancing student teacher interaction; ability to work as a team	Relating better to professor and other students after service project	Carryover of teamwork from jobsite into the classroom
<ul style="list-style-type: none"> • better and more confident communication • teamwork 	<ul style="list-style-type: none"> • “better connection” • “we’re on the same level,” “respect of professor • “first time (they) ever (saw) a professor as another human being, other than this (I) always felt inferior to them.” • they felt they were “equals” with the professor 	<ul style="list-style-type: none"> • “teamwork extended to classroom activities” • allowed for “enhanced learning of course materials, learning from a real life job situation.”
Value of HFH Experience: (Common student responses from service learning reflection)		
Most important of HFH experience	Most challenging of HFH experience	
<ul style="list-style-type: none"> • “strengths and weaknesses of those they were working with,” • “cooperation,” • “who they’d want to work with again,” • “skills,” • “different perspective and significance of chosen field of study,” • “applying knowledge from book to job,” • “societal impact.” 	<ul style="list-style-type: none"> • “hard work and needed effort,” • “pace of others,” • “scheduling” • “coordinating among team members,” • “learning new things, ” • “physical work” of the job, • “accurate measurements” • “putting up siding or rafters.” • One student noted the most difficult part of the service experience was “balancing school, work, and life.” 	
Was HFH valuable and appropriate learning component of the course? (Common student responses from service learning reflection)		
Why	Why not	
<ul style="list-style-type: none"> • value they found in learning “hands-on” • “valuable skills” of the “profession and industry,” • the experience was “giving back to the community.” • “bridges the classroom with the experience,” • gained a “better understanding of course materials.” 	<ul style="list-style-type: none"> • Two of the 51 students who participated in the Habitat for Humanity experience felt that “community service was a valuable component but an actual construction site” would be more appropriate 	

Student Perceptions of Knowledge Gain and Value of Service Learning

The implementation of service learning in the ‘Construction Materials’ course show students perceive the experience as positively impacting their learning and awareness to the engineering field. Results of the study addressed much of the authors’ research questions. Overall results suggest the service learning component to be a valuable component of the course. The hands-on learning of HFH was found to bridge the class to the experience, with students feeling they gained a better understanding of the skills needed for the profession due to the service learning component of the course. Most students saw a connection to their future profession and the construction industry through the service learning experience.

The interpersonal skills of teamwork and communication in particular, necessary in the construction industry for the design, implementation, and completion of construction projects, were experienced most by students during the HFH project and found had carried over into the classroom. Students perceived greater learning of course material, better understanding of their intended field of study, and experienced the professional and interpersonal skills of teamwork and communication they would need in both the classroom and real life settings. Although results of the study were not found to completely support the hypothesis of greater satisfaction in students if experienced better planning with team members, student responses did suggest students had perceived great benefit and awareness of the planning stage of the service learning process. Significant differences were found on students’ perception of the direct promotion of active learning through the hands-on format of the HFH project.

Conclusions

The implementation of service learning in a Construction Materials course show students perceive the experience as positively impacting their learning and awareness to the engineering field. Results of the study supported much of the authors’ research hypotheses. Overall results of service learning within a Construction Materials course suggest the service learning component to be a valuable component of the course. The hands-on learning of HFH was found to bridge the class to the experience, with students feeling they gained a better understanding of the skills needed for the profession due to the service learning component of the course. Most students saw a connection to their future profession and the construction industry through the service learning experience.

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Significant differences were found on students' perception of the direct promotion of active learning through the hands-on format of the HFH project. These results suggest that regardless of students who participated in their preferred construction tasks at the HFH site and those who did not participate in their top choices of tasks, students perceived significant active learning from the hands-on format the course provided through the service learning experience. The authors conclude that students perceived greater learning through the format of active hands-on participation in spite of the task they're given when at the job site.

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