

Service Learning in Natural Resources Classes: Measuring the Impacts on University Students

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Abstract

The impacts of three service learning courses in the Department of Forestry and Natural Resources at Purdue University on student outcomes were evaluated using pre and post surveys. The three courses engaged a total of 69 unique students in projects intended to benefit the community, but according to survey responses there were differences in courses in terms of course enrollment motivations and desire to help the community after graduation. It was found that generally over the course of the semester, students developed a sense of connectedness and responsibility; a sense of the importance of helping others; and an interest in being personally involved in helping the community in the future. In courses where baseline measures were high, significant changes were not observed over the course of the semester. The survey questions used here were adapted from those typically used to measure the outcomes of courses focused on community development; this study illustrates that these survey questions can also work well for natural resource courses. Overall, the study confirms that service learning in natural resource courses can help produce civic-minded graduates, a goal of many universities and colleges.

Introduction

Service learning is a pedagogical technique in which students perform service for the community while simultaneously learning substantive course content (Furco, 1996; Bringle and Steinberg, 2010). One of the driving motivations for this approach is to produce civic-minded graduates (Bringle and Steinberg, 2010). This motivation is consistent with desired outcomes at many universities and colleges, including Purdue University's College of Agriculture.

As Furco (1996) illustrates, service learning can be contrasted from pure service due to the educational value of the community engagement. In a natural resource context, the continuum from service to learning can be illustrated the following way:

1. Service: Groups of students volunteer to pull invasive plants from a nature preserve.
2. Service learning: Groups of students earn class credit to design and implement a plan to remove invasive plants from a nature preserve based on learning about the characteristics of the plants.
3. Learning: Students earn class credit to identify different invasive plants and learn how to eradicate them.

Numerous scales have been developed to measure the impact of service learning courses on undergraduate and graduate students (Bringle et al., 2004). Traditionally these scales have been used in community development types of courses and not in courses that are focused on improving the natural environment. In fact, a review of the service learning literature found only one study of courses that have a natural resource focus (Tedesco and Salazar, 2006). We undertook this study primarily to see if natural resource focused service learning courses have a positive impact on students. A second objective was to see if scales developed for community development courses could be translated for natural resources courses.

We collectively taught three different courses in the spring of 2010 in the Department of Forestry and Natural Resources at Purdue University that each had a strong service learning component. We surveyed students from each class at the beginning and the end of the semester using questions adapted from several established service learning scales. We hypothesized that, overall,

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students would gain career benefits, a sense of the importance of helping others and an increased sense of responsibility to the community through their experiences in various types of service learning courses. We also hypothesized that the impact of the three courses would be different due to different features of the classes and the students.

Materials and Methods

There are several important factors that should be considered when assessing impacts of service learning such as the motivation behind enrolling in such courses (i.e., required vs. elective) and the course level (graduate vs. undergraduate). Herein, we address both factors among three courses that were recently offered in the Department of Forestry and Natural Resources at Purdue University.

FNR 408, "Natural Resources Planning," is a required course for four of five majors in the department (more information about this course can be found in Prokopy 2009). In this course, students spent the semester working in groups on a watershed management plan for a local watershed. Students presented their ideas to community members in a public poster session at the end of the semester and delivered a written plan. Stakeholders from the community came in to the class to present guest lectures and students were welcome to follow up with these individuals (or other relevant stakeholders) throughout the semester. Spring 2010 was the sixth time the course was taught in this format by the lead author of this paper. The second author was a teaching assistant for this class for five years. In Spring 2010, there were 52 students enrolled in the course; all of them were required to take it (however two students were absent on the first day of class and did not take the pre-survey).

FNR 498, "The Nature of Service Learning," was taught for the first time in the spring of 2011. In this course, taught by the third author, students learned how to design and deliver educational wildlife lessons to elementary students. This course consisted of three modules. The first module introduced undergraduates to successful strategies for the development of environmental education programs. The second module required undergraduates to work in groups and develop original environmental education programs that consist of classroom activities, as well as service learning experiences for elementary youth that benefit the environment and community. During the last module of the course, undergraduates presented their original educational materials to 3rd grade youth for an hour a week over an eight-week duration. Students were only admitted into this class with permission of the instructor and consequently the better-performing undergraduate students in the department took this class. In spring 2011, fifteen students took this class; none were required to take it (i.e., an elective course).

FNR 598, "Ecological Footprints," was also taught for the first time in the spring of 2011 by both the lead and

the fourth author. This course was cross-listed between the Department of Forestry and Natural Resources and the Agronomy Department. The course was listed as an upper level undergraduate / graduate course and had a mix of students enrolled from different departments on campus. In this class, the students wrote a grant proposal for a local watershed project for funding to develop an interactive website that community members could use to calculate and improve their ecological footprint (i.e. have a lower environmental impact). Students learned about the different dimensions of ecological footprints as well as how to write a grant proposal. Key stakeholders came to the class and gave presentations about their needs and resources but students did not have much other interaction with the stakeholders barring a presentation at the very end of the semester which was sparsely attended by stakeholders. Eleven students took the class in the spring of 2011; one student was required to take the course as a substitution for another class but the other students took it as an elective.

A survey instrument was developed based on existing scales from other studies that measured the effectiveness of service learning. This survey instrument was given to students on the first day of each class. There was some overlap between students in the courses; six students were enrolled in both FNR 408 and FNR 498 while one student was enrolled in both FNR 408 and FNR 598. Therefore, students enrolled in more than one of the classes completed the entire survey in the first class they attended. In the second class, they answered only questions specific to that course. A virtually identical survey was then distributed on the last day of each class.

To ensure consistency between courses, students in each were presented with the same PowerPoint lecture about service learning at the beginning of the semester after they took the baseline survey. Students also wrote at least three reflections about their experiences in each class (see Correia and Bleicher, 2008 and Hatcher et al., 2004 for more about the use of reflections in service learning classes). This study was approved by the Institutional Review Board at Purdue University (IRB# 0912008745).

The Survey Questions

Both the pre- and post-surveys were four page questionnaires that contained six sections. The first section asked students to define "service learning" in their own words. The second section asked about motivations for enrolling in the class. As all three classes intended to use intensive group work, the third section asked students about their prior experiences with group work. The fourth section asked a series of questions about perceptions of community involvement and was the longest section of the survey (with 25 questions). Section five asked about how students planned to be involved in community service in the future. Finally, section 6 had an open-ended prompt: "My future career is likely to involve..." There was one additional statement to respond to on

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the post survey in section 5: "I will use my experience in this class to help the community." The statistical analysis presented in this paper focuses on sections four and five of the survey; questions from section two are used to help understand the survey population.

Questions in sections four and five of the survey were based upon existing scales that have been developed to assess the effectiveness of service learning (see Bringle et al., 2004 for a comprehensive listing of such scales). Questions in the other sections of the survey were written by the authors. Traditionally scales in surveys consist of a variety of questions that measure one or more underlying constructs (often called subscales). These subscales are not presented to the survey-taker and the questions are usually distributed randomly throughout a question-block so the survey-taker does not know how their responses will be analyzed or grouped.

The majority of the questions for section 4 of the survey were taken from the Community Service Attitudes Scale (CSAS) developed by Shirella et al. (2000). This scale uses a seven point Likert scale for responses. Bringle et al. (2004) note that "the scale could be used as a moderator, mediating or outcome variable in service learning classes" making it very suitable for our purposes. In the case of the original CSAS scale, there are fifty-four questions and eight subscales (underlying constructs): normative helping attitudes, connectedness, costs, awareness, benefits, seriousness, career benefits and intentions.

To keep our survey a modest length, we used questions from only three of the subscales: normative helping, connectedness and career benefits. The original questions were written with a focus on community development courses and in two cases we needed to modify them to be relevant to natural resource courses. The questions for the Connectedness subscale and the Normative Helping subscale are presented in Tables 1 and 2, respectively. The questions we used for the career benefits subscale are presented in Table 3. The original career benefits subscale used in CSAS only included two questions. For our purposes, we added a question from the benefits subscale and three additional questions. These additional questions were modified from the Community Service Self-Efficacy Scale (CSSES) presented in Reeb et al. (1998). Overall the new career benefits subscale focuses on perceptions of community involvement related to skills or learning that an individual takes away from service to the community. The questions in the CSAS commence with a scenario which also has a community development focus, which we also modified (see Figure 1 for the text and modifications from the original CSAS).

Section 5 of the survey was focused on plans for future community involvement. One of the questions in section 5 of the survey came from the Civic Attitudes and Skills Questionnaire (CASQ) (Moely et al., 2002a, b). The other questions were written by the research team. These questions are presented in Table 4.

Data Analysis Procedures

The three subscales measured in section 4 of the survey (connectedness, normative helping, career benefits) and the future community involvement scale measured in section 5 are each intended to explore a unique dimension, or attitudinal construct, related to overall civic attitudes, skills, or views of community service. This was confirmed by conducting a factor

Table 1. Perceptions of Community Involvement – Connectedness Subscale

<p>CSAS Sub-Scale Analysis Factor Analysis: Percent variance explained by Factor 1 (pre-test) = 65.0% Cronbach's Alpha (pre-test) = .921; Cronbach's Alpha (post-test) = .932</p> <ol style="list-style-type: none"> 1) I am responsible for doing something about improving the community. (.783) 2) It's my responsibility to take some real measures to help others in need. (.869) 3) It is important to me to have a sense of contribution and helpfulness through participating in community service. (.840) 4) It is important to me to have a sense of contribution and helpfulness through participating in community service. (.852) 5) It is important to me to gain an increased sense of responsibility from participating in community service. (.830) 6) I feel an obligation to contribute to the community. (.808) 7) The environment deserves my help. [original question "Other people deserve my help."] (.644) 8) It is critical that citizens become involved in helping their communities. (.806) <p>Measured using a 7 point response scale from strongly disagree (-3) to strongly agree (+3). (Unrotated factor loadings in parentheses).</p>

Table 2. Perceptions of Community Involvement – Normative Helping

<p>CSAS Sub-Scale Analysis Factor Analysis: Percent variance explained by Factor 1 (pre-test) = 57.4% Cronbach's Alpha (pre-test) = .919; Cronbach's Alpha (post-test) = .916</p> <ol style="list-style-type: none"> 1) It is important to help people in general. (.727) 2) Improving communities is important to maintaining a quality society. (.762) 3) I can make a difference in the community. (.786) 4) Our community needs good volunteers. (.748) 5) All communities need good volunteers. (.760) 6) Volunteer work at community agencies helps solve natural resource issues [originally social problems]. (.639) 7) Volunteers in community agencies make a difference, if only a small difference. (.747) 8) College student volunteers can help improve the local community. (.841) 9) Volunteering in community projects can greatly enhance the community's resources. (.716) 10) Contributing my skills will make the community a better place. (.771) 11) My contribution to the community will make a real difference. (.818) <p>Measured using a 7 point response scale from strongly disagree (-3) to strongly agree (+3). (Unrotated factor loadings in parentheses).</p>
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Table 3. Perceptions of Community Involvement – Career Benefits

<p>Factor Analysis: Percent variance explained by Factor 1 (pre-test) = 60.7% Cronbach's Alpha (pre-test) = .869; Cronbach's Alpha (post-test) = .827</p> <ol style="list-style-type: none"> 1) I would be developing new skills. (.768) [CSAS benefits subscale] 2) I would make valuable contacts for my professional career. (.744) [CSAS career benefits subscale] 3) I would gain valuable experience for my resume. (.755) [CSAS career benefits subscale] 4) I would be able to make a difference in my community. (.797) [CSSES scale] 5) I would be able to interact with relevant professionals in meaningful and effective ways. (.777) [CSSES scale] 6) I would be able to apply knowledge in ways that solve "real-life" problems. (.828) [CSSES scale] <p>Measured using a 7 point response scale from extremely unlikely (-3) to extremely likely (+3). (Unrotated factor loadings in parentheses).</p>

Table 4. Future Involvement Questions (Survey Section 5).

<p>Factor Analysis: Percent variance explained by Factor 1 (pre-test) = 62.5% Cronbach's Alpha (pre-test) = .840; Cronbach's Alpha (post-test) = .870</p> <ol style="list-style-type: none"> 1) After graduation, I will look for ways that my educational background can help the community. (.837) 2) My career goals are to help communities improve natural resource issues. (.810) 3) After graduation, I will use my skills to help community projects. (.903) 4) I feel that I am currently prepared to help my community. (.626) 5) After graduation, I plan to become involved in programs to help clean up the environment. (.750) [from CASQ scale with words "after graduation" added] <p>Measured using a 7 point response scale from strongly disagree (-3) to strongly agree (+3). (Unrotated factor loadings in parentheses).</p>

Figure 1: Introduction to questions contained in Section 4 of survey

This scenario is modified from the original CSAS scenario to better reflect the content of our courses. Our modifications are noted in italics. Note that the final paragraphs appear before the appropriate set of questions.

We are trying to understand your willingness to donate your time regularly to a community service project. *For the purposes of the following questions community service is defined as a project related to natural resources in which you would volunteer at least twice a month for couple of hours and use your skills and knowledge.* In other words, this is more than just volunteering time *pulling up invasives or counting birds once.* These types of community service projects require a long-term commitment (i.e., at least one semester) and offer you the opportunity to share your skills, as well as develop new ones. Examples include *being a Hoosier RiverWatch volunteer, working in a school, development a natural resource management plan for a community, and writing a grant proposal.*

Please answer the following questions about your feelings regarding community service projects using the definition provided previously. Some of the questions might appear similar, but each one measures a unique set of information. If some of the questions do not apply to you, please skip those questions.

Now, pretend you are going to volunteer for a community service project sometime in the next year. Use the following scale to rate how likely you feel *each of the possible outcomes associated with volunteering* are to occur. [before extremely unlikely to extremely likely scale]

Again, pretend you are going to volunteer for community service, described earlier, sometime in the next year. *How strongly do you agree or disagree with each of the following statements about community involvement?* [before strongly disagree to strongly agree scale]

analysis for each of the subscales, which showed the presence of a single underlying latent construct for each subscale based on an examination of the scree plots and percent variance explained by the primary factor (for an overview of factor analysis see DeVellis, 2003). The factor loadings for individual items associated with each scale are provided in Tables 1-4. In addition, reliability analysis was conducted and an acceptable Cronbach's alpha score was obtained for each subscale – a score of above 0.70 indicating that each scale is a reliable measure of the latent construct (DeVellis, 2003).

A paired sample t-test was then used to determine if there was a significant difference in the mean score of students' responses to these four scales between the pre- and post-test. The results for each of the paired measures, see Figures 3 through 6, show whether a significant difference in the mean scores for each of the scales exists. These figures also illustrate differences across the courses for the pre-test measures for the scales. An effect size was calculated for each significant difference using the formula $d=t/\sqrt{n}$ in order to show the relative strength of the associated change in mean scores between each of the course groups.

Results

Before looking at the service learning specific scales, it is helpful to understand more about the students who

Figure 2. Answers to questions "I enrolled in this class because. . ."; scored on a five point likert scale from strongly disagree (1) to strongly agree (5)

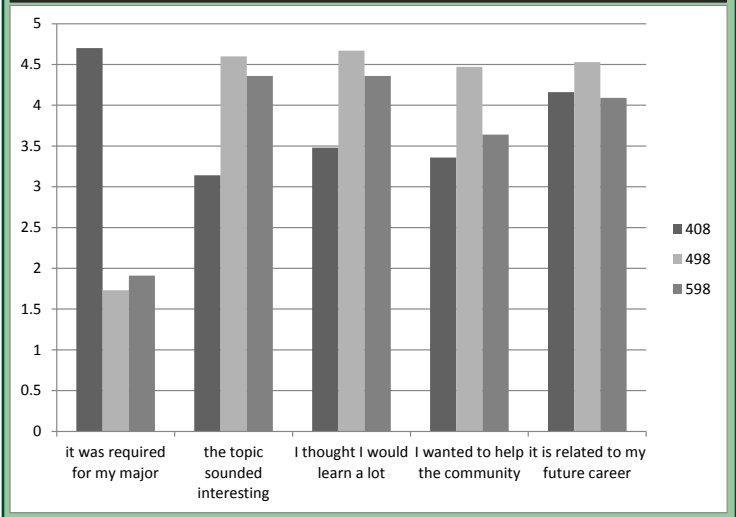


Figure 3. Questions about career aspirations from pre-tests; scored on a seven point likert scale from strongly disagree (1) to strongly agree (7)

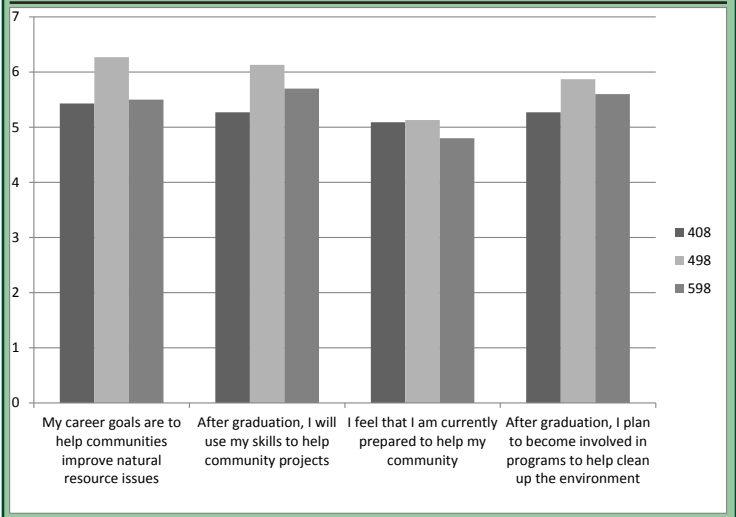


Figure 4. Mean Difference: Connectedness Scale

Pre-test		CSAS: Connectedness			
Strongly Agree	7	5.56	5.45	5.98	5.42
	A	4	4	4	5
Strongly Disagree	1	0	0	0	0
	L	8	8	8	8

Post-test	Change in Mean	Sig.	(d)
All Courses	+ 0.31	***	.419
408	+ 0.33	**	.436
498	+ 0.04	n.a.	
598	+ 0.66	**	1.26

Sig. & (d) based on paired sample t-test

*=.05, **=.01, ***=.001 probability level

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Figure 5. Mean Difference: Normative Helping Scale

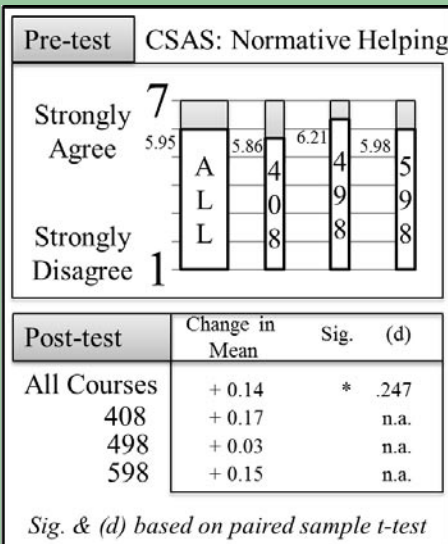


Figure 6. Mean Difference: Career Benefit Scale

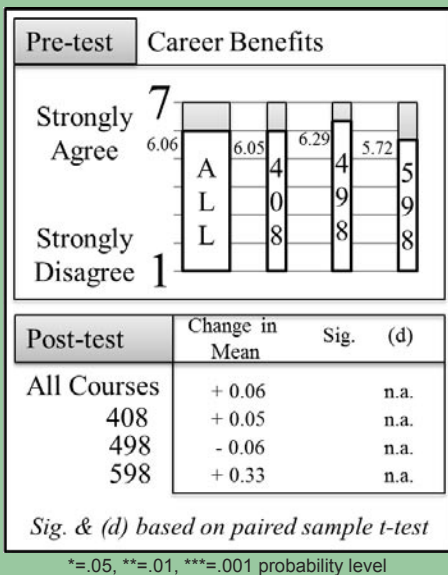
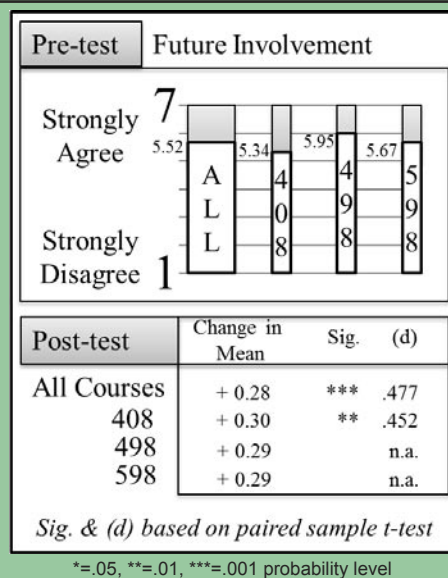


Figure 7. Mean Difference: Future Involvement Scale



enrolled in these courses. As can be seen in Figure 2, enrollment motivations varied across the classes. This is not an unexpected finding due to the varying voluntary nature of these classes. Students in FNR 498, “The Nature of Service Learning”, were the most likely to enroll out of a desire to help the community. There was high level of agreement across all the courses in terms of relation of the course to their future careers. Students were most likely to take FNR 408, “Natural Resources Planning”, because it was required and to simultaneously think that it was the least interesting sounding class and the class where they would learn the least.

At the beginning of the semester, students enrolled in FNR 498 “The Nature of Service Learning” were the most likely to have career aspirations related to helping communities and natural resource efforts. Students in FNR 598 “Ecological Footprints” were the least likely to consider themselves prepared to help the community. As a mixed graduate/undergraduate class, this possibly reflects the increasing recognition people have as they age about what they do NOT know. Results from some of the questions from section 5 of the survey are presented in Figure 3.

Figure 4 shows that for the combined data set and for 2 of the 3 individual courses, students had a significantly increased sense of responsibility and connectedness to the natural environment at the end of the semester. For FNR 498, there was an increase over time but it was not statistically significant. Note, however, that students in this course started at a much higher level of connectedness than in the other courses and had less room for improvement.

Results for the normative helping scale increased for all groups and increased significantly for the merged sample and FNR 408 showing that perceptions about the importance of helping the community changed over time (see Figure 5). Students in FNR 408 had the lowest scores for normative helping in the baseline survey and subsequently had the most room for improvement.

Interestingly, results for the personal benefits scale only changed significantly for FNR 598 (and showed a negative but insignificant change for FNR 498) (see Figure 6). This scale held together well according to Cronbach’s alpha but is a newly constructed scale developed by the authors of this paper and has not been tested in other course settings (unlike the other scales). However according to the results of this study only students in the joint undergraduate/graduate student class significantly changed their opinions about whether they thought that they would personally benefit from future community service work. Students in this course had the lowest scores on the pre-test and so had the most room for improvement.

Finally, Figure 7 shows the results from the future involvement scale. Across all courses and for FNR 408 and FNR 498, students were significantly more likely to think they would work to help the community in the future. This is likely insignificant for FNR 598 only due to a small sample size as the change in the mean is quite

high. This illustrates that these courses had an impact on students' willingness to be "good citizens" in the future.

Discussion and Conclusions

The overwhelming message from this study is that these courses each helped to improve students' experiences and civic mindedness. Despite the fact that motivations for taking each of these classes differed quite a bit, these classes all performed well in terms of the measured outcomes. Also, as hypothesized, there were some differences between the three classes due to different starting levels of the students. Where students already had high values in terms of connectedness and normative helping, statistically significant differences were not observed.

The "career benefits" subscale showed the least change and suggests that these less altruistic concerns were not influenced by participation in these courses with the exception of FNR 598 which had a low baseline score for this subscale.

While originally developed for courses that address social/human issues, the Community Services Attitudes Scale (CSAS) was adapted here to address natural resource focused classes. However, with students who already have a high sense of the importance of community engagement, the subscales do not necessarily work to measure change as it is hard to measure change when baseline attitudes score highly. Therefore it is not possible to know if change even occurred.

Educators interested in producing graduates who will feel a sense of responsibility towards the community and will be willing to use their skills to help improve natural resources should consider service learning as a pedagogical tool to help accomplish these goals. As noted in Tedesco and Salazar's (2006) assessment of their service learning experience in Indianapolis, students realize they can make a positive difference in the community through a service learning course. Educators interested in evaluating the impact of their service learning courses can use the scales presented in this paper unless they think their students will have high scores at the beginning of the semester.

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