

Preparing Students for a Diverse Future: Using Service-Learning for Career Training in Soil Science Community Outreach

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Abstract

We investigated the development of agriculture students' professional skills through a community-engagement project in which students taught seven weeks of sustainable soil management lessons to diverse populations in under-served communities. Our objectives were to (1) determine the skill sets desired by employers for community-based agricultural and food system work (2) evaluate the effectiveness of course activities to develop and improve these skill sets and prepare students for employment post-graduation and (3) compare results of an online survey evaluation of student skill development to narrative data provided by the student interviews and field observations of students teaching in the community. An analysis of student survey and interview data shows that when compared to a non-service-learning control group, service-learning students rate themselves as significantly more confident in career-relevant skills following the seven-week community engagement project. Field observation and student interview data indicated that by serving as community educators, students developed knowledge of agriculture, comfort working with diversity, leadership skills, and increased ability to teach agriculture-related content to the public. Preliminary findings suggest that service-learning projects incorporated into agriculture curricula provide students with experience that better-prepares students for the competitive job market.

Introduction

Colleges of agriculture with service-learning courses set in urban community gardens can provide students

with opportunities to witness firsthand the complexities and challenges of agriculture, communicate the role of soil in sustaining a growing global population, and develop career-relevant skills by working with the public (Parr and Trexler, 2011; Malone et al., 2014).

Globally, urban gardens are instrumental in growing and distributing food to food insecure populations, while increasing food production capacity (Milligan et al., 2004; Zezza and Tasciotti, 2010). In 2010, 14.5% of U.S. households had limited or uncertain access to adequate food for all household members to sustain active, healthy living (Gundersen, 2008; Nord et al., 2004; Coleman-Jensen et al., 2011). Food insecurity disproportionately affects minority populations with 25.7% of African-American households and 26.9% of Hispanic households reporting a lack of consistent access to food, compared to 10.7% of white households (Wang and Chen, 2011; Nord et al., 2009). Urban community garden development is one strategy used by non-government organizations (NGOs) to combat food insecurity, promote active lifestyles and empower communities (Teig et al., 2009). These gardens are also ideal settings for exposing agriculture students to the real-world challenge of feeding those populations most in need.

The number of employers interested in hiring students with a global outlook and international multicultural competency has grown exponentially within the last two decades (Navarro and Edwards, 2008). Required content taught in traditional agriculture lecture courses leaves instructors little time for practical experience

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beyond the classroom, resulting in students that lack skills desired by prospective employers. In one study, 87% of surveyed employers desired to see internship experience beyond the classroom in addition to coursework, due to its usefulness for developing skills that complement technical abilities (Briggeman and Norwood, 2011). In fact, multicultural sensitivity, problem-solving, ability to work and manage a groups of people, organizational communication, analytical, problem-solving and field-related technical skills are seen by many employers as critical attributes for job applicants (Hansen and Hansen, 2007). Service-learning projects in curricula can give the students the practical “hands-on” experience desired by their future employers. Consequently, agroecology, organic farming and sustainable agriculture courses that address social justice and environmental issues related to food production systems are becoming more prevalent on university campuses (Grossman et al., 2010; Grabau, 2008; Sriskandarajah et al., 2005; Bhasvar, 2002). Whole curricula have even been designed that focus on immersing students in real life agronomic phenomena to help them direct their own learning and decide relevant theory to learn (Lieblein et al., 2004; Grossman et al., 2012).

This research assesses a service-learning component of a soil science course at North Carolina State University entitled *Service-Learning in Urban Agriculture Systems* to determine its usefulness in developing employment skills. North Carolina State University is a land grant institution of over 34,000 students located in the urban state capital of Raleigh, North Carolina. This course partnered with the Inter-Faith Food Shuttle (IFFS) a non-government organization (NGO), whose mission is to alleviate hunger by developing systems to recover, prepare and distribute wholesome, perishable food for North Carolina’s poor, hungry, undernourished and homeless (“About IFFS”, 2011). Community gardens started by IFFS in 2009 are one of IFFS’ efforts to combat food insecurity by providing increased access to healthy local foods.

The assessed course represents a new form of education that seeks to expose students to aspects of sustainability and agriculture in the US via outreach projects designed to prepare them for future work in food systems (Nielwolny et al., 2012). Through student evaluation of a service-learning experience, this project evaluated how pre-service training improved student perceived preparation to enter the urban agriculture and community food security workforce following graduation. The three primary objectives of this project were to

(1) determine the skill sets desired by employers for community-based agricultural and food system work (2) evaluate the effectiveness of course activities to develop and improve these skill sets and prepare students for employment post-graduation and (3) compare results of an online survey evaluation of self-reported student skill development to narrative data provided by the students via pre and post service interviews and field observations of students teaching in the community.

Materials and Methods

Employer survey. We contacted sixty-four employers in the field of community agricultural outreach, food security and urban agriculture to determine desired skill sets for prospective employees. Of the sixty-four, twenty responded to our survey. Sample included ten NGOs, five universities and five private companies. Employers were contacted directly via email or phone and asked the following two open-ended questions:

1. Could you provide a list of qualifications that you would like to see in a person applying to work at (name of employer)?
2. Are there any specific skills that are required for working at your organization?

Staff members answered via email or directed us to a current job opening notice on their website to provide rich examples.

Service-Learning Course Design. Beginning in 2009, the Department of Soil Science at North Carolina State University offered *Service-Learning in Urban Agriculture Systems* (SSC 428), an advanced, two-credit course for undergraduate and graduate students designed to complement an upper level lecture-based ecological soil management course. Enrolled students used disciplinary knowledge to design teaching tools and accompanying lessons to educate youth on topics of sustainable soil management, agriculture and horticulture, with an emphasis on their relevance to human health and nutrition. Eleven students were then assigned a community in which they delivered their lessons to urban youth at IFFS’ gardens. Student-community contact occurred once each week for 3 hours over a 7-week period, providing each NC State student with over 20 hours of direct community contact and teaching experience. Although SSC 428 has been in existence since 2009, evaluation of professional skills began in 2010 (Y1) and continued through 2011 (Y2).

Students in SSC 428 were assigned to work at one of three sites: a high school horticulture class, a community garden in a subsidized housing neighborhood, or a

community garden in a manufactured-home community (Table 1). All three sites have been identified by IFFS as food insecure and are communities in which IFFS provides programming designed to improve community health and nutrition, and improve control over food choices.

Table 1. The demographics of assigned service-learning communities.

Year	Community	Program	Age	Ethnicity
Y1, Y2	High school for behaviorally challenged students	Horticulture class	Middle school - high school	Primarily African - American
Y1	Housing authority community	After-school mentoring program for low - income youth	Elementary - middle school	African - American
Y2	Manufactured home community	Community garden-based after school program	Middle school	Hispanic and African - America

Student Professional Skill Development. We used a mixed methods approach comprised of the following three specific methods: (1) quantitative survey data collection pre- and post-service-learning experience (SLE) (2) qualitative individual pre- and post-SLE student interviews, and (3) qualitative field observations recorded during students' community teaching. Field observations were conducted by a third-party individual not associated with course instruction. Quantitative data was used to validate themes that emerged from student interviews and field observations while qualitative data provided insights into survey scores.

The extensive online survey tool was delivered to students pre- and post- SLE. All surveys were conducted with SLE students (treatment group) as well as with non-service-learning students (control group) in an undergraduate soil science course (SSC 200), a course that included soil science content emphasizing the fundamentals of soil origin, composition, classification and chemical and biological properties (SSC 200). While the survey collected a broad range of data regarding achievement of learning objectives for students, for this study data from only 15 questions on student learning gains and demographics was used. The questions were followed by a five-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (5). In Y1 we were able to access demographic data on SLE students but not control students, therefore in Y2 additional questions regarding student demographics were added to yield a wider range of information about the student population such as grade level, GPA, major, gender and age. The North Carolina State University Institutional Review Board approved the study protocol and participants provided written informed consent prior to participation in survey. Only scores from students that completed both pre- and post- surveys were used in the final data analysis. In Y1 and Y2 a total of 11 students in the SLE class took both the pre- and post-SLE surveys. Response scores to each question from pre- and post-SLE surveys were statistically examined for differences using a matched-pairs *t*-test (JMP Pro 9.2). Using mean survey scores as an indicator of student confidence, we also conducted an independent samples *t*-test (JMP Pro 9.2) of Y1 service-learning experience (SLE) students (n=5) and Y2 SLE students (n=6) within each timepoint. The control student number in Y1 was n=7 and Y2 was n=11.

Field observation notes were taken during student teaching events in the community. Notations were made when students employed a professional skill or strategy in their service experience and were

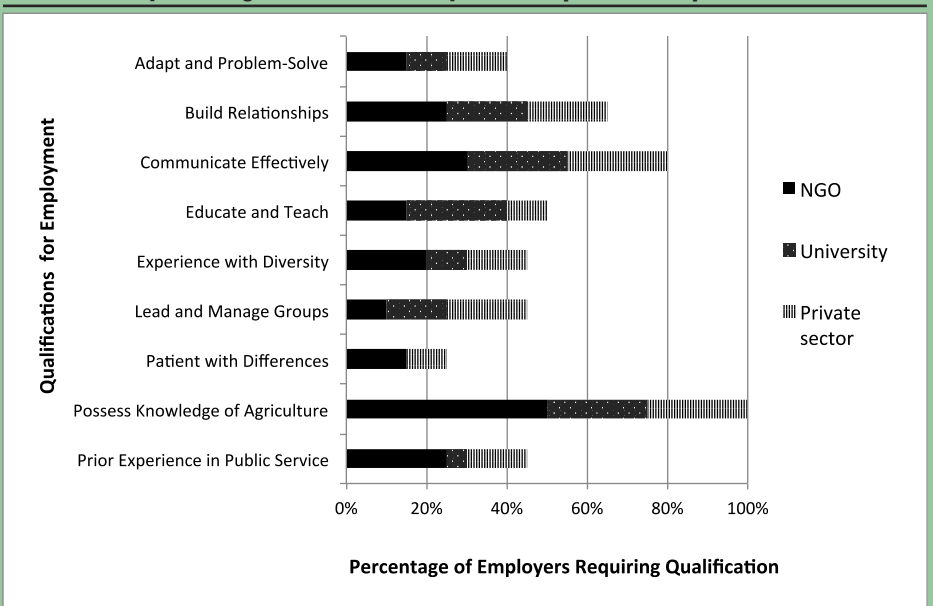
then compared to survey and student interview findings (Miles and Huberman, 1984).

Through interviews comprising of open-ended questions (Creswell and Plano Clark, 2007) SLE students assessed their experience and described both learning gains and project challenges. Students in the control group were not interviewed. Interviews consisting of 20 IRB-approved questions were conducted prior to and following the completion of their SLE. Student interview responses were audio-recorded, transcribed, and all data assigned anonymous numbers to ensure student privacy. Many questions were open-ended and therefore permitted students to communicate answers that include thoughts and reflections beyond the scope of the question. Pre-SLE interviews focused on the student's background, experience and confidence in skills relevant to the project. Post-SLE interview questions were similar to pre-SLE, but emphasized student perception of skill development and encouraged students to reflect on their service-learning experience by providing rich examples. A systematic coding framework was used to quantify changes student confidence in the following qualifications: Adaptability, Agriculture (content knowledge), Collaboration, Diversity, Leadership, and Teaching skill development (Strauss, 1987; La Rossa, 2005). Differences in mean values between pre-SLE and post-SLE responses were tested using a matched pairs *t*-test (JMP Pro 9.2). Research-relevant quotes were highlighted, categorized and used to explain survey and quantitative interview findings. Interviews were not conducted with control students.

Results and Discussion

Survey of Employers. Qualifications yielded from surveys with employers (n=20) were summarized in nine qualification categories (Figure 1). These categories

Fig. 1. Employer survey (n=20) of ten NGO's, five Universities, and five private sector agribusinesses yielded nine qualifications for required or desired for available positions. Each colored bar represents a different type of employer and the percentage of the whole sample that required each qualification.



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included the ability to: Adapt and Problem-solve; Build Relationships; Communicate Effectively; Educate and Teach; Lead and Manage Groups; be Patient with Differences; Possess Knowledge of Agriculture (including horticulture, food production, soil management, gardening, and farming skills); have Prior Experience in Public Service; and Experience with Diversity.

The 20 responding employers offered positions in different areas of agriculture yet desired skill sets were shown to be surprisingly similar. The NGOs offered jobs as farm community garden managers, fruit or vegetable specialists, community organizers in food security, and directors of youth programs. The abilities to “adapt” and “be flexible” were requirements for work at many of the NGO’s, as were skills and experience working with ethnically and culturally diverse populations. All university positions were associated with the Cooperative Extension Service interpreting, applying and disseminating relevant research findings in soil science, horticulture and agronomy to local producers. These employers primarily sought individuals with educator experience and strong communication skills for working with diverse populations. Positions in the private sector included consultants, sales experts, team managers, and scientists. Many private companies also emphasized diversity and leadership skills as well as community service experience (Figure 1). In addition to a strong understanding of all technical information, large agribusinesses like Syngenta and ConAgra, sought employees capable of collaboration and communication with culturally and professionally diverse groups. All twenty employers required applicants to possess skills necessary to not only work in agriculture, but also thrive in an ever-changing culturally, academically, and professionally diverse work environment.

Effective communication, leadership, teaching, and the ability to work with diverse populations were required qualifications at more than 50% of the organizations, universities and companies surveyed (Figure 1). It was evident that employers value prior experience working in an outreach or public educational capacity, suggesting

that without basic teaching, leadership, and diversity skills a student may be at a disadvantage competing for a number of these positions. Much evidence exists to support that experiential learning projects taking place beyond the classroom improve student mastery of skills in social work, medicine, and public health (Kaf and Strong, 2011; Sadana and Petrakova, 2007; Nandan and Scott, 2011). As students of a similarly technical and applied discipline, agriculture majors planning to conduct community work may also benefit from such experiences to train them for leadership positions where they can confidently demonstrate agriculture concepts to diverse audiences of people.

Survey Data. Analysis of student survey results from the Y2 (n=6) SLE group revealed service-learning students rating themselves as having increases ($P \leq 0.05$) in their ability to design and teach hands-on science lessons for diverse audiences (Table 2). No student gains were reported in response to one survey question: “I am able to prepare a lesson” in either year of the study (Y1 $P = 0.375$; Y2 $P = 0.075$). However, responses to four other survey questions that specifically queried student ability to prepare lessons “for the public”, “on soil science”, that are “hands-on”, and “for diverse audiences” did show confidence gains for Y2 SLE students (Table 2), suggesting that this group developed confidence in their abilities to perform their duties as instructors in a diverse community. Service-learning has been shown to increase students’ perceived competence as instructors by improving teaching skills and instructional strategies (Kahan, 1998; Watson et al., 2002; Freeman and Swick, 2001; Verducci and Pope, 2001; Lake and Jones, 2008).

We did not see significant increases in Y1 (n=5) treatment student survey scores between pre- and post-SLE assessment, although Y1 pre-SLE survey scores trended towards being higher than or equivalent to post- (Table 2). An independent samples *t*-test of mean survey scores for Y1 and Y2 treatment students showed that Y1 students rated themselves higher in pre-SLE survey scores than their Y2 counterparts, but had significantly

Table 2. Comparison of pre-and post-course mean survey scores for service-learning experience (SLE) and control students in year 1 (Y1) and year 2 (Y2)

Survey Question	SLE Y1 n=4		Control Y1 n=7		SLE Y2 n=6		Control Y2 n=11	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
I am able to identify resources I need to be able to teach a hands-on science lesson to the public.	4.60	4.20	3.00	3.10	3.17	4.67*	3.73	3.73
I am able to confidently develop a science lesson for diverse audiences from social, economic, or cultural groups different from myself.	4.60	3.80	2.87	2.30	3.33	4.33*	3.27	3.55
I am able to confidently teach a science lesson for diverse audiences from social, economic, or cultural groups different from myself.	4.20	3.80	2.87	2.29	3.17	4.33*	3.36	3.73
I am able to work effectively with diverse populations (i.e. income, race, ethnicity, class, education or ability different from myself).	4.20	4.20	4.27	3.90	4.00	4.50*	3.91	3.91
I am able to prepare a lesson.	4.20	3.60	3.20	2.70	4.00	4.00	3.45	4.00
I am able to teach a lesson to the public.	4.20	3.60	3.20	2.70	3.67	4.50*	3.36	3.82
I am comfortable communicating soil science concepts to the public.	3.60	3.60	3.27	2.70*	2.50	4.00*	3.82	4.09
I am comfortable teaching diverse audiences.	4.20	4.20	3.27	2.30	3.50	4.17*	3.64	3.82

¹ Significant at $P \leq 0.05$ using matched pairs *t*-test.

lower post-SLE survey scores (Figure 2). Community-projects immerse students in “real-life” situations that may be ‘messy’ and may place them in situations that are uncomfortable. The Y1 data suggests that this particular group of students’ confidence in their own abilities and skills may have been inflated at the outset, and dropped once they were required to utilize these skills in their SLE. This finding is not uncommon, as student self-efficacy has been demonstrated to decline following community work if students initially believed themselves to be better prepared than they actually were (Guthman, 2008, Lichtenstein et al., 2011). Year 1 students from the introductory soil science (control) course, report being less confident in their ability to communicate soil science concepts to the public at the conclusion of their course than at the beginning (Table 2). Such a result may be attributed to students reevaluating their ability to teach soil science after learning more about the complexity of the topic, or to specific classroom experiences. Aside from this there was no significant change in the pre-and post-survey scores for Year 1 and Year 2 control group students (Table 2). Future qualitative data collection, such as student interviews, would help tease apart drivers for the decline in confidence within the control group. The introductory soil science course was fundamentally distinct from the SLE group course in that it was not designed to provide students with opportunities to exercise and or develop confidence in skills necessary for community outreach and extension-based agriculture work, thus such results were somewhat expected.

The most obvious difference between control and SLE student demographics was age, where our SLE group was slightly older (mean age 24 yrs) than the control group (mean age = 20) (Table 3). Further, the average reported GPA of the SLE group was 3.9 whereas the control group was 3.1 (Table 3), suggesting that students opting to participate in the service-learning class, at least in the years the study took place, were of above average academic achievement. There exists the possibility of bias created by survey respondents vs. non-respondents in the control group. A response bias can occur when the population being studied differs systematically from those invited to participate in the survey, but typically a study such as this, in which the response rate is very low, includes minimal or undetectable bias (Menachemi, 2011). However, due to this possible bias and the small sample sizes we are cautious about making generalizations beyond the scope of this data. Here we instead highlight trends worthy of future investigation looking for correlations between quantitative and qualitative findings.

Field Observation Data. Field observation data (Table 4) support survey and interview results demonstrating improved ability and confidence in adaptability (problem-solving), diversity, leadership,

and teaching skills. Over the course of their seven weeks in the community, students learned to modify their lesson designs and teaching approaches to make inclusive exercises that engaged the diverse groups of people they were teaching. Their time in the community shifted from being primarily lecture to collaborative learning experiences where students demonstrated the importance of sustainable use of soil resources and horticultural concepts through hands-on demonstrations and activities, and tied these concepts to community members’ quality of life. Consequently, at the end of the experience SLE students appeared to have increased their ability to lead their assigned community groups through discussions and activities that connect soil science and horticultural practices to issues of nutrition, food access and availability.

Student Interview Data. An increase ($P \leq 0.05$) in the mean number of times students in both years cited confidence in professional skills during interviews suggests that the SLE facilitated career-relevant gains for students (Figure 3). Gain in adaptability skills (ability to adapt, be flexible, resourceful and problem-solve) was one of the areas in which we saw the greatest increase in confidence from pre- to post-SLE ($P = 0.01$) (Figure 3). A community-based service-learning project sometimes involves working with community members with inconsistent interest levels in subject matter. The

Figure 2. Independent samples t-tests of year 1 service-learning experience (SLE) students’ (n=5) average survey scores and year 2 SLE students’ (n=6) scores within time points, $P \leq 0.05$.

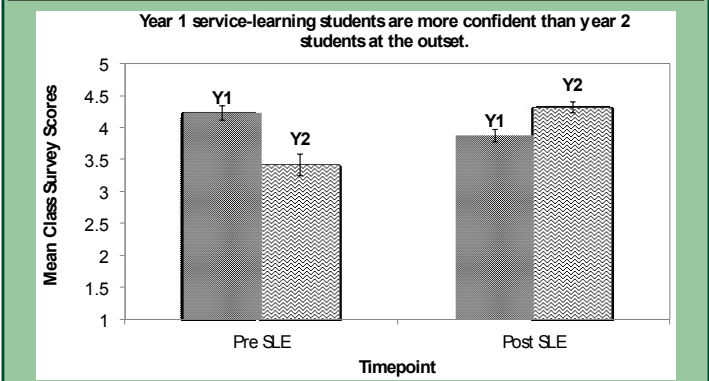


Table 3. The demographic parameters of year 1 and year 2 service-learning experience (SLE) students and year 2 control.

	SLE Y1	SLE Y2	Control Y2
Number of Student Respondents	5	6	11
Sex	1 female 4 male	4 female 2 male	8 female 3 male
Mean Age	21	24	20
Mean GPA	3.6	3.9	3.1
Grade Level	3 graduate students, 2 juniors	3 graduate students, 3 sophomores	3 sophomores, 6 juniors, 2 seniors
Ethnicity	5 white	3 white, 2 Hispanic, 1 Native American	9 white, 1 Asian, 1 mixed ethnicities
Disciplines Represented	Crop Science, Agricultural Education, Horticultural Science	Biology, Crop Science, Industrial Engineering, Food Systems	Agricultural Education, Natural Resources, Environmental Science, Horticulture Science, Biological Engineering, Plant and Soil Science

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Table 4. Field observations made during student teaching days show improved teaching and leadership skills over the course of project.

	Y1		Y2	
	Group 1	Group 2	Group 1	Group 2
Preliminary	Students had difficulty managing and organizing group (leadership skills). Lesson did not engage community members (teaching skills)	Students teaching style was primarily "lecture" in style did not engage community members (teaching/diversity skills). Students used advanced science vocabulary but didn't explain the meaning of the words.	Students immediately organized group of community members and asked questions to get to know their audience (leadership/diversity skills).	Students started with a structured lesson plan, but were forced to adapt their design dues to small attendance and challenging behaviors (community members yelling, leaving, cursing) (adaptability, teaching skills).
Intermediary	Students adapted lessons to be shorter and more relevant/engaging (teaching/diversity skills), sometimes on the spot (adaptability/problem solving skills)	Students began to simplify and explain concepts to help community members understand soil concepts and improved abilities to work with and lead the diverse group (diversity, leadership skills).	Students were challenged with climate (rain and wind) and disruptive people at soccer field (next door) and had adapt (adaptability skills) their lessons to maintain community member engagement.	Students began to ask community members about their interests and values in order to build relationships(diversity). They used group management techniques to work through attention and behavioral challenges (leadership, teaching skills).
Final	Students still encountered group management and organization challenges, but displayed improved (leadership) skills and had lessons and activities that engaged for their diverse community.	Students delivered lessons relevant and engaging to community members and included students in the learning process (teaching skills).	Students displayed confidence in their ability to teach concepts and work with their community (agricultural, diversity skills).	Students delivered lessons that related soil science and agriculture to their assigned community members' values and interests. Lessons were both informative and engaging (leadership, diversity, teaching skills).

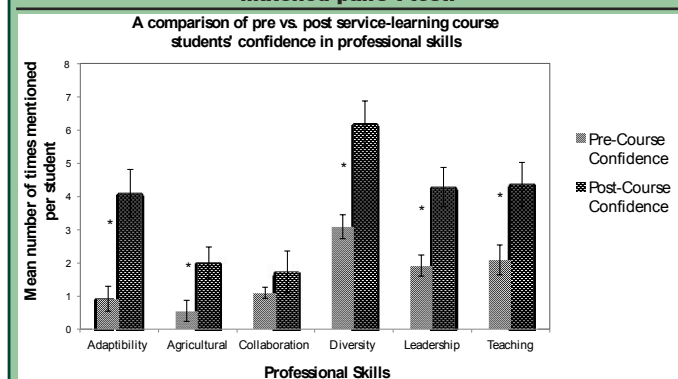
gardens where our students taught were located in three demanding locations (Table 1): a school for behaviorally challenged students, a subsidized housing community, and a manufactured home community. Student teaching was often limited by factors such as a distracting environment, climate (most sites did not have an indoor classroom option), lack of community member attendance, and other disruptions that required them to adapt their lesson plan for the day to ensure community member engagement and attention. In post SLE interviews students described the importance of adaptability and problem-solving skills, for example:

Student E: "I think you really learn a lot about adapting and problem-solving and thinking on your feet when you teach."

Student G: "We HAD to problem-solve..... I guess it [the SLE] helped me to work well under pressure, come up with solutions when you don't have a lot of time."

Student B: "We had a lesson plan for every day and we had a presentation for every day and many times....every time... [laughs] that changed on the spot."

Figure 3. Pre- and post-course coded interview data for all service-learning students (n=11). *Significant at $P \leq 0.05$ using matched pairs t-test.



Multi-disciplinary approaches are often used to teach students to adapt and problem-solve in real life situations. Christy and Lima (2007) describe several service-learning projects where engineering students meet a local community need by designing much needed facilities (for example a wastewater plant) and simultaneously learn to troubleshoot and adapt their plans in the context of the real world. Manufacturing scenarios in which students must adapt for success, as they would at a job, are challenging to accomplish in a typical lecture. This SLE provided students with ample opportunity to develop this career-relevant skill (Figure 1).

An important finding of this study is that after teaching agricultural science in these low-income and predominantly minority communities, SLE students rate themselves as more confident (Figure 3) in their ability to lead (Leadership Skills; $P = 0.01$) and to work with and teach (Teaching Skills; $P = 0.04$) diverse populations (Diversity Skills; $P = 0.01$). Cultural competence, the awareness and knowledge of how integrated patterns of human behavior, including language, thoughts, communications, actions, beliefs, values, customs and institutions of racial, ethnic and social groups affect one's group identity (Cross et al., 1989), may be argued to be a critical skill for individuals working with any public audience, as well as one that is desired by the employers surveyed in this study (Figure 1). The incidence of food insecurity has been shown to be high in minority neighborhoods where education and resources are often lacking (Wilson et al., 2006; Keppert et al., 2007). Increased perceptions of competency to interact with diverse populations, as well as greater cultural competence and increased leadership skills, are well-documented outcomes of student participation in multi-cultural service-learning projects and community work (Carter and Spotsanski, 1989; Mefford, et al.,

1999; Ladson-Billings, 1994; Flannery and Ward, 1999; Domangue and Carson, 2008; Meaney et al., 2008). Students participating in our study documented their increased comfort through quotes and examples, such as the following:

Student G: [in the future] “...I’ll try and avoid making stereotypes and just ask people about themselves...I definitely learned things about how to keep groups focused and excited.”

Student K: “I think I’ll just try and get to know [the community members], instead of assuming I know about their life.”

Student L: “I feel like a leader, being able to group-up the kids, like break up a classroom into smaller groups, take charge and being able to teach a group of people.”

Teaching and collaboration were two areas in which increases in student confidence were expected. Service-learning students spent seven weeks teaching soil science to their assigned community in groups of two to four students. We found that SLE students mentioned confidence in their teaching skills in post SLE interviews twice as often when compared to pre-SLE interview data. Due to the high level of collaboration needed to carry out successful lessons, we expected increases in student confidence in their ability to collaborate with others, either in their group or in their community. Although students occasionally mentioned examples of collaboration skills in relation to their development as leaders within their groups, interview data did not support a significant increase in student ability to collaborate with others (Figure 3 and Table 2).

The weekly practice of developing and teaching a lesson plan appeared to be a driver in advancing student learning for a variety of reasons. Three students provided examples showing that while they previously had little teaching experience they now felt competent enough to design lesson plans and teach soil and agricultural science to a variety of audiences. One student in agriculture education was surprised by his reaction to community based-teaching, stating, “Let’s start with my major being ag education. This was kind of a big wake-up call...it was good to get that teaching experience.”

During interviews students explained that the pressure to teach the information to others required them to have a deeper understanding of the content and simultaneously improve their public-speaking skills. They describe their SLE as helpful for increasing ($P = 0.01$) their knowledge of horticulture, food production, soil management, gardening and farming (Agriculture Skills), and particularly their knowledge of soil science because the project required them to utilize and teach knowledge either gained through previous lecture material, or through self-education via books or other resources.

Student A: “I feel like...um we had moved beyond these basic soils science concepts in [previous lecture course], but going back to those was healthy, very healthy, for my understanding.”

Student L: “Academically I learned that even though I feel like I have a pretty good mastery of certain concepts, I really don’t. Because when you get in a classroom you start getting all these questions!”

Student B: “Example of something I learned? The refinement of my skills with soil science....there were a few things I was trying to get across and relate them to soil science and I realized that I was really not too comfortable with teaching that material, so I went back and looked at that...so in an academic sense, I got a lot more comfortable with teaching materials that I’ve spent so much time learning, but never teaching.”

These findings are supported in the literature where service-learning participation has been shown to positively impact student academic goals (Serow et al., 1996; Barber and Barrisoni, 1993; Eyler and Giles, 1999; Zlotkowski, 1998) by enhancing student achievement of core educational outcomes (Markus et al., 1993; Osborne et al., 1998). Consequently, student teachers such as those in this study tend to internalize the knowledge when they use it to solve “real world” problems (Phelps and Kotlik, 2008).

In their core courses, agriculture students are often provided with evidence suggesting the importance of concepts such as soil health, biodiversity, and the impact of current agronomic practices on the environment. This SLE required that they enter a community with a great degree of urbanization and various injustices, and many students expected to be well received when trying to demonstrate the benefit of sustainable urban production of food. But instead, as described in Guthman (2008), students were sometimes met with community member indifference, reluctant participation, as well as much larger problems than they had anticipated. Faced with these challenges, students sometimes questioned the purpose of their activities. We observed that through their various experiences, students discovered that working in the community modified their perceptions about how one successfully effects positive change with regards to food production and access. In particular, following their service-learning experiences students realized that, as paraphrased from quote by Student C any inroads to agricultural education for the general public may take more than basic knowledge of agricultural production in order to create lasting changes. To this end, students emphasized the importance of change occurring via the building of solid relationships with the community, with this being the key any educational progress. Mentioned 21 times during interviews, the act of “building relationships” is described as an effective way to develop food leaders within the community.

Student J: “...you get to know the community, you understand how they communicate and build a relationship with them, you’re understanding their reality and their comfort zone...listening is a really important skill, learning to actively listen to the community.”

Students explained during interviews that benefits of the SLE extended beyond just skill development. The experience provided them an opportunity to work

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outside of the university and offered perspective to concepts learned in university classrooms. One student described her experience as providing her with concrete examples of things she is learning in lectures across many courses.

Student J: *"In class we talk a lot about childhood obesity or food systems research, and how some elementary and middle school students consume up to 80% of their calories at school...like the kids [in the community] would talk about eating breakfast, lunch and snacks at school and you're like 'Holy crap! Kids really do this!'"*

Through the SLE, Student J was able to personally witness a food security related phenomenon that the student had learned about in lecture. These types of experiences help students better understand various food security-related factors that ultimately contribute to obesity and other health problems. Another student mentioned that he was "shocked" when community members refused to eat carrots harvested from the garden because at one point in the carrots' lifecycle they "had dirt on them." Witnessing this community member's disconnect from the origin of their food made him realize that his service-learning group was there to perhaps do more than teach soil science, and that their work may indeed change preconceptions about food production. The student explains, *"They had never seen dirt on their food before. You wash it off, you eat it, it's fine. You tell them, 'The food is really good and it's healthy and it's what you need to be eating and all of your food had dirt on it at one point anyway,' but they had never seen that, so it was a really difficult mentality to work with."* Both Student J and C illustrate that community-based learning projects offer university student's exposure to real-life complexities and challenges of our modern food system. Our data shows that students leave the project not only more confident in professional skills and agriculture, but also having gained experience and perspective that increases their potential as future food system leaders.

Summary

Our survey of employers in the field of agricultural outreach and education found that organizations are interested in hiring graduates who are proficient in skills beyond knowledge of agriculture. Despite the small sample size, this study demonstrated how the integration of service-learning opportunities into agriculture curricula better-prepares students for the competitive job market. Student in this service-learning course credit the experience for providing helpful preparation for their careers, but more importantly for giving them insight into the issues surrounding food security and the role relationships play in education and social change. Such approaches to agricultural education can serve to both build strong relationships with the general public, and develop leaders who are able to communicate their scientific knowledge effectively.

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