Growing Together with the Community through Service Learning

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Abstract

This work in progress (WIP) study provides the students with mindset of an engineer, serving the community. The Accreditation Board of Engineering and Technology (ABET), American Society of Civil Engineers (ASCE), Institute of Electrical and Electronics Engineers (IEEE) and other engineering associations set the expectation of an engineer. Two of the eleven ABET Student Outcomes[5] highlight on ethical responsibility of an engineer, and understanding the impact of engineering solutions in a global and societal context. ASCE also highlights on the well-being of our communities and consistently improving the quality of life of the general public[4]. IEEE emphasizes on engineers' responsibility in making decisions consistent with the safety, health, and welfare of the public[6]. To meet the needs of the society and to train the engineering students with the importance of 'serving the community' we created a course called Service Learning. The students are expected to understand the importance of 'serving the community' and gain the perspective of improving the quality of life of the general public with their skill sets. The long term outcomes of the course are: 1) to be able to communicate and work with the general public as the ultimate recipients of our engineering goods; 2) to be able to transfer the knowledge to younger generations and to continue to produce professional engineers. Our curriculum includes the service learning requirement as a course for all of our engineering majors. This has been a successful class to provide the students with the mindset of an engineer, serving the community. The course also helped our college to be involved with local county affairs and helped surrounding elementary schools to high schools with many Science, Technology, Engineering and Math (STEM) activities.

How is the course organized?
The purpose of the course is to take engineering out into the community through service. A few examples from many activities that are important to the community include: 1) design a booth for engineering firms for the Science, Technology, Engineering, Partnership event in our city, 2) judge local science fairs, 3) work on a Habitat for Humanity to revitalize the houses for families, 4) assist local high school engineering clubs, 5) address the local community issues like transportation, energy usage, after school activities for youth, and etc. The activities are intended to stimulate ideas of engineering designs.

The course outcomes for the students are to: See the opportunities for engineers to serve in their communities, see which types of service opportunities they resonate with the most, see how to connect with the surrounding community, and be able to reflect on their experiences and see the value of service. The course meets the ABET Criterion 5 by broadening of the role engineering can make in the world and seeing engineering as service, by planting a seed for seeing opportunities for lifelong learning and engaging the community.

There are three major assignments to meet the course requirement. The first assignment is to read first two chapters of 'Service Learning: Engineering In Your Community'[1] by Marybeth Lima,

PhD and William C. Oakes, PhD, PE. The first two chapters lay out the detailed linkage between engineering and service learning. After the reading assignment the students are required to submit their writing assignment which consists of four different parts: executive summary of the reading, reflection on the reading, two to three questions from the reading and an application. The major portion of the course requirement is meeting the service hours. The students are required to serve 30 hours. The requirement can be stretched over three semesters to complete. The service opportunities can come through different channels and funneled down to the course instructors. The opportunities are then posted on the course website using a shared document. The posting of the opportunity includes the job description, date/time, location, contact information and a link a sign-up sheet. The sign-up is also shared with the community we are serving. The students are required to fill out a service log sheet with a signature of a supervisor at the event. Last assignment is a reflection paper after completing the 30 hours of service to share what they learned and gained from the opportunities.

How is the learning assessed?
The instructors collected more than ~150 reflection papers from the students that were enrolled in the course in the academic year of 2014-2015. Only the recent data are analyzed for the paper to be consistent with the time window of service opportunities we had for the recent academic year.

How is the community evaluated?
A survey was created and was sent to our constituents we served in the academic year of 2014-2015. The questions we addressed in the survey are as follows:
- How was the quality of service delivered from our student volunteers?
- How was their attitude towards your event/service opportunity?
- Rate the following statement based on your experience with our service: The college of engineering student volunteer(s) performance was (were) excellent. From 1 to 5, where 5 is the best experience, please rate your overall experience.
- Additional Comments and areas of improvement.

Opportunity Highlight I
One of the many opportunities we had for the service learning course is through Nao robot outreach team. Nao robot has capabilities of talking, walking, dancing, and etc., which attracts people at the community outreach events. For engineering students, it is a great way to do STEM outreach by giving presentations and demonstrations using an interactive humanoid robot through community events and school visits.

A simple drag-and-drop graphical programming interface called Choregraphe that came with the Nao robot made it possible for students without much programming experience to put together simple demonstrations. Over the years, different components like music, dance moves, impersonation, simple dialogues, storytelling, interactive games, etc. have been added to a collection of demonstrations which engaged the audients especially the school-aged-children.

In the fall semesters of recent years, the Nao outreaches were integrated with the freshmen team design projects conducted in another course: EGR101 Introduction to Engineering with Christian Worldview. In EGR101, students formed teams and worked on various engineering projects. In the beginning of October, about a month into their freshman year, these engineering students were already able to present their Nao robot projects to the public at events such as the Science and Technology Education Partnership (STEP) conference, and Long Night of Arts and Innovation of Riverside. Thousands of people showed up at these events and our engineering students had the opportunity to share their passion in engineering, encouraged the children to work hard on their math and science, and made them aware that STEM field career can be fun using the example of designing robots and programming them. More importantly, the Nao demonstrations were developed with their own teamwork. This experience gave the students strong sense of achievement. In their reflection papers for Service Learning, many students expressed the feeling of being proud of themselves because they can impact the society and inspire younger generation using robots.

Students who actively participated Nao outreach obtained grant-sponsored research opportunities as well. Started in 2013, the university has been offering internal grants called MicroGrants to sponsor around ten research projects proposed by faculty members each year. Two of the projects funded by MicroGrant utilized the Nao robot. One was "the Development of the Framework for a Robotic Tour Guide using a Nao T14 Humanoid Robot", the second one was "Using a Humanoid Robot (Nao) for Social Training and Language Development with Preschool-Aged Children with Autism". Both projects offered paid research assistantship to engineering students who gained Nao programming experiences through outreach activities. The student who worked on the tour guide project presented his research at the Southern California Conference of Undergraduate Research.

Opportunity Highlight II
MATHCOUNTS is an annual math competition for middle school students. It is a math enrichment program with different levels of difficulty as the students' progress through a series of math competitions at four different levels: school, chapter, state, and national. The participating students at different levels all receive valuable training in logic thinking and problem solving skills. Many of them continue math related activities and competition at high school and choose a career in STEM when selecting a college major. Most of them cited years later the positive impact of the program in their life.

Our College of Engineering has been hosting the Inland MATHCOUNTS chapter competition since 2009. Each year, as part of their engineering service activity, over 50 of our engineering students spend between 4 to 8 hours on a Saturday helping registration, proctoring contest, and grading contest papers for over 150 local middle school students. Our engineering students, most of them freshmen, were very excited to work with the younger students from the local community. The process began with signing up for the service a month earlier. On the competition day, the MATHCOUNTS organizer provided a brief training for each of the tasks. Our engineering students got to play "professors" for one day in front of those middle school

students. For the registration task, our engineering students got to interact with both students and school teachers for verifying participants and hand out lunch tickets (free lunch provided by the College of Engineering). For the proctor task, engineering students ran the actual competition process per competition rules and got the firsthand experience on maintaining exam integrity as a "professor". For the grading task, the engineering students got to experience what a typical professor involved in the grading process. After this experience, many of the participating engineering students reflected that they now had better understanding on the daily routine a professor going through in a typical semester.

The College of Engineering collaborated with California Society of Professional Engineers in this math competition to promote STEM education among local middle school students. Since 2009, the program has been steadily growing with the number of participating schools increasing from 9 schools in 2009 to 25 schools in 2015. Many early participants are now entering college pursuing STEM related majors of study. Some of them even came back and served as coach for the schools they previously attended.
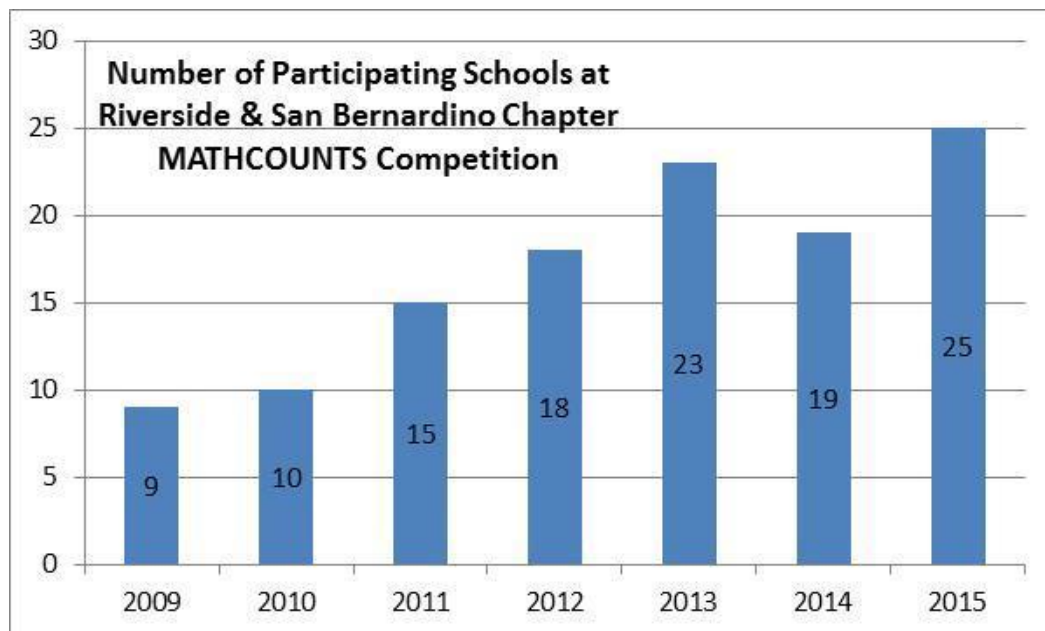
As part of the requirement of this engineering service course, each student wrote a reflection paper after completing their required service hours. Many of them wrote about their MATHCOUNTS experiences with positive feedback with the following two notable points:

(1) Majority of the students stated that the engineering service experiences, including MATHCOUNTS, enhanced their view of the importance of community service as part of their future engineering career;
(2) Many students also stated that the engineering service activities, including MATHCOUNTS, also improved their communication skills and their ability to work with the general public, and therefore, will help their engineering career in the future.

The engineering students' service involvement won praises from community, including California Society of Professional Engineers Education Foundation (CSPEEF), the organizer of annual California MATHCOUNTS competition. With consistent contribution of our engineering students, the Riverside/San Bernardino MATHCOUNTS Chapter competition was well organized each year and was praised as one of the best run chapter competition in the state of California, per CSPEEF Board Director.

From our College of Engineering perspective, the long term goal of organizing this competition is to further promote and improve local K-12 STEM education so that more students will choose engineering as their future careers and for those who choose engineering as their career will be better prepared.

The Impact
We had 204 students enrolled for the course in 2014-2015 academic year needing to complete 30 hours of service hours, total of 6120 hours. In one year, we have reached out to 49 organizations.

Elementary:	4
Middle School:	3
High School:	7
Career fairs:	2
K-12 events:	9
Community events and activites:	13
Tech fairs:	3
Reasearch and Grant Activities:	1
Student Chapters/Clubs:	5
Other:	2
	49

Few of our large events were the Maker Faire, Long Night of Arts and Innovation, and Science, Technology and Engineering Partnership (STEM) which we had more than 60 students volunteer throughout the event.

Assessment of Student Learning
We evaluated 30 reflections out of 156 reflections we received. The students enrolled in spring of 2015 are still working on their 30 service hours and the reflection paper is not due until April of 2016. Only 30 of the reflections were submitted electronically which were evaluated as a first batch and the information are included in the table below. We set the generalized comment categories and counted their responses totaling at 111. The top count comment was 'Great overall experience', and the two negative responses were 'Disliked not having in-depth knowledge of what we were doing' (at 1 count) and 'Feeling the hours are compulsory, detracts from the possibility' at 1 count.

The students' responses include the comments in the areas of our addressed course outcomes:
1) To be able to communicate and work with the general public as the ultimate recipients of our engineering goods – The students gained multiple opportunities to talk to different groups of people and 'enjoyed' talking to them.
2) To be able to transfer the knowledge to younger generations and to continue to produce professional engineers. – The students gained multiple opportunities to transfer their knowledge to younger kids through NAO robot display, career fairs, robotics clubs, in-class room presentation, and science fairs.

Count	Comment (Generalized):
20	Great overall experience
12	I got to help the community
12	Got to work for God/do God's will
11	Meet many new people
10	Work with kids
9	Gave me joy/excitement/passion for engineering
7	Fun working with others
5	I gained experience talking with people
5	Fun work to do
4	Working together with friends/other students
4	Represent/promote CBU engineering
3	display engineering-related projects
2	Feeling of accomplishment/satisfaction
2	Taught me leadership skills
1	Able to overcome difficulties
1	Disliked not having in-depth knowledge of what we were doing
1	Learned time management skills
1	See what goes on behind the scenes
1	I feel that the hours being compulsory really detracts from the possibility

Community's Evaluation on our Service Learning
We sent out a survey to our community to evaluate our volunteers. We received 17 responses and the results are shown in the table with each survey questions and the open-end comments are shown below.

1. How was the quality of service delivered from our student volunteers?		
Answer Options	Response Percent	Response Count
Excellent	70.0%	14
Good	30.0%	6
So-so	0.0%	0

Needs improvement	0.0%	0
Not good at all	0.0%	0
answered question		**20**
skipped question		**0**

2. How was their attitude towards your event/service opportunity?

Answer Options	Response Percent	Response Count
Positive and willing to serve	95.0%	19
Okay, they were learning	0.0%	0
So-so. They only served to meet the course requirement	5.0%	1
Negative, not ready to serve others	0.0%	0
answered question		**20**
skipped question		**0**

3. Please rate the following statement based on your experience with our service: The engineering student volunteer(s) performance was(were) excellent

Answer Options	Response Percent	Response Count
Strongly agree	52.6%	10
Agree	42.1%	8
Some what agree	5.3%	1
Disagree	0.0%	0
Strongly disagree	0.0%	0
answered question		**19**
skipped question		**1**

4. From 1 to 5, where 5 is the best experience, please rate your overall experience.

Answer Options	Response Percent	Response Count	
5	68.4%	13	
4	31.6%	6	
3	0.0%	0	
2	0.0%	0	
1	0.0%	0	
	answered question		**19**
	skipped question		**1**

The 13 out 20 responders provided comments below:

- We would love to partner with the Engineering students again. Our scholars learned so much and had a great time speaking with and working with the engineering students.
- The volunteers were friendly and knowledgeable, really enjoyed working with them.
- They arrived in good time, had an interesting display, they were prepared to explain what they had to show. Thank you so much for contributing to our event in this way.
- I am pleased that the college has this program. The students and the instructors have been a pleasure to work with. Thank you!
- The engineering students that have volunteered to help with parking at the Riverside Airshow have been punctual, reliable and showed excellent people skills. They focus on the task at hand and need minimum supervision.
- They were terrific! Engineering should host a summer day camp.
- They were incredible and volunteered all day, in the heat.
- The student was professional and excellent in explaining NAO to the special education preschoolers.
- Our teachers are already inquiring if we can schedule the presenters for this semester too. To be honest this group is tied 3 ways for favorite & best presentation.
- They were great!
- All the students were very professional and caring.

- I am glad to bring students to external venue in this case C4TK@LA hackathon. I got positive feedback from the event organizer that it would have been not possible without our students help.
- I wish other college do the same thing to encourage student services

The 7 out of 20 responders answered the last question of areas of improvement and all 7 responses were 'none' for the areas of improvement.

Continuous Improvement of the course
We plan to include more detailed surveys next academic year. To evaluate the student learning and assess the outcomes accurately, we will be implementing a 'Pre-Service Learning' survey and 'Post-Service Learning' survey. The difference in their perspectives before and after can be

used as a direct measurement to evaluate the course outcomes. Few other surveys can be given at the end of their college career and three to six years after the graduation. We also like to increase the constituent survey response rate by giving the community survey immediately after the service event. Lastly, we plan to include more details on their reflection requirement to highlight what they learned by posing few questions to reflect on.

Bibliography

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[5]   ABET, "Criteria for Accrediting Engineering Programs', student outcomes (a)-(k), page 3. Engineering Accreditation Commission.

[6]   IEEE, "IEEE Code of Ethics", http://www.ieee.org/about/corporate/governance/p7-8.html