A Qualitative Investigation of a First-Year Engineering Service-Learning Program

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Abstract

Service learning is a pedagogy that integrates community service into the academic experience. Studies have shown that service learning can positively impact student learning, provides a rich environment for students to learn the professional skills that are often difficult to teach in traditional classes, can increase retention in participants, and can broaden the view of engineering among the participants. Service-learning can greatly enhance the services of local community service organizations that lack the technical staffs and/or resources to take full advantage of current technology. The potential benefits of service learning have motivated the Department of Engineering Education at Purdue to begin implementing service learning into the first-year engineering courses. 143 students participated in a service-learning experience at Purdue University in the Fall semester of 2003. Student and community partner evaluations have shown initial success

A detailed qualitative investigation has been conducted to fully understand the impact of the experience on the student participants. Specifically, one hour interviews were conducted with 20 first-year students, 10 male, 10 female and five underrepresented students. This paper will report on the findings from the study using narrative vignettes.

Introduction

According to ABET's EC 2000 accreditation guidelines set in 2000 [1, 2] students must not only meet with competence the basic "traditional" engineering knowledge of mathematics, science, and engineering and experience in engineering problem solving and system design, but now are also mandated to be able to function on multidisciplinary teams, to communicate effectively, and to understand a wide range of issues in engineering. These issues include: professional and ethical responsibility, the impact of engineering solutions in a global and societal context, and knowledge of contemporary issues. Service-learning has the potential to meet these objectives and have been shown to be successful in programs such as the EPICS program [3].

"Service learning which has been described as experimental learning through the integration of traditional classroom teaching with structured community service" [4], is pedagogically consistent with the literature on recruitment and retention of women in science and engineering with its social context; emphasis on general educational goals including communication; employment of cooperative and interdisciplinary approaches; and problems with a "holistic, global scope" [5,6,7] and containing many attributes or factors that are relevant for

attracting and retaining minorities [8,9] and retention of engineering students in general [10]. The ability of service-learning to achieve a successful integration of all of these aspects has made service-learning the most obvious choice for its ability to enhance learning and simultaneously meet ABET standards.

While service-learning has been well established in many disciplines in higher education and many people in these disciplines have reported the impacts and the experiences of service-learning on students [11 -16], engineering has been much slower to adopt the pedagogy [17]. There are examples of service-learning that have been effectively integrated and used in engineering contexts [18]. Examples include first-year introductory courses [17, 19], capstone senior design courses [20], multidisciplinary approaches [21,22] and integration of co-curricular activities [23].

There have been, however, few studies that have looked at the experiences and impacts of service-learning on engineering students. In order to provide a voice and to create a model of experiences and impacts of service-learning on the first-year engineering student; this study reports the findings of a qualitative investigation of the students involved in the first-year service-learning engineering program..

First-Year Engineering Service-Learning Program

Service-learning has shown benefits which include enhance retention for students participating during their first year. The EPICS Program is a very successful engineering-based service-learning program at Purdue University, but it is not possible to engage a large percentage of the first-year students in EPICS. First-Year students do participate in EPICS, but first-year students are the lowest number of participants. The complex nature of the EPICS projects requires senior level participation and with over 1600 new first-year students in engineering coming into the Department of Engineering Education, it is unlikely that a large percentage of these students could be engaged in the EPICS program in their first year. Service-learning was integrated into a special section of the first engineering course for students choosing to participate in the Engineering Learning Communities (ELC). In the ELC, groups of first-year engineering students attend two or three core courses in the fall semester together.

Participating students had the option to live in the same residence halls to facilitate the community environment. All students took the first engineering course, Engineering Problem Solving and Computer Tools, where a half semester service-learning project was assigned. They also took a seminar class and either chemistry of communications. These other courses provided opportunities to address the broader issues of the service-learning and opportunities for reflection of their learning and experiences. The service-learning projects provided curricular links between each of the linked courses [24].

In the Fall semester of 2003, 143 students participated in the ELC with 218 participating in 2004. This study focuses on the 2003 cohort. Each section of the seminar class was assigned responsibility for all of the approximately 1650 first-year engineering students. All engineering students are required to complete a common first year core of classes.

The classes were divided by divisions of the introductory seminar. Each division had a different community partner. Since each seminar division was also in the same engineering lab,

we used the teams assigned from the engineering course. Each team of 3 or 4 students was assigned a different project for each community partner. Some times the projects overlapped and sometimes they were independent projects. Table 1 lists the community partners for the 2003 year. A more complete description of the projects has been documented [24].

Table 1: Service-Learning Project for Fall 2003

Organization	Tasks
Community and Family Resource Center/ Head Start	Tutor head start students and report on how technology can be used to enhance the classrooms
Greater Lafayette Recreational Soccer Alliance	Research and recommend improved data management tools for the league
Caregiver Companion	Created and installed a website for the organization
Purdue's Boiler Volunteer Network	Researched and identified ways to improve data management of volunteers
Freshman Engineering	Designed and implemented outreach curriculum for middle school children
Trinity Mission	Developed training materials for fixing computers and appliances for thrift store sales.
Hanna Community Center	Tutored after school children and reported on ways to improve facilities through technology
Imagination Station Children's Museum	Designed curriculum modules for science outreach programs
Imagination Station Children's Museum	Created displays for highlighting the technology used in the building's operation
Habitat for Humanity	Surveyed community and developed standards for assessing sub-standard housing
Science Bound	Developed and implemented a project design for Science Bound students and performed a feasibility student on future collaborations with Science Bound

Methodology

Qualitative inquiry is an excellent approach to gain valuable information about people's experiences, perceptions, opinions, feelings, and knowledge [25]. The focus of this study is to gain a better understanding of the impact that service-learning has on the first-year engineer experience.

Participants

This study was conducted at Purdue University. There were 143 first-year engineering students who were involved in the ELC with a required service-learning component. Out of these 143 students, 20 student interviews were conducted. Participants were selected to insure representation of each type of service-learning project, gender and ethic populations and team

performance level. The population consisted of 10 females and 10 males with five of these students being from an underrepresented population. Each type of the service-learning projects that could be done was represented by at least one of these 20 students. The participants came from 3 performance groups that were characterized by their community partner. Out of these 20 students there were 8 low performing, 4 medium performing, and 8 high performing students. Stability in the data was reached with the length of the interview time, an average of 50 minutes, and number of participants interviewed [26].

Procedure

Each of the 143 students were solicited via email individually second semester after their service-learning projects in the first semester were completed. Phone calls to 10 women and 10 men were made out of those students who responded followed by email confirmation of the time and date to meet for the interview. Interviews were held in a room of a building that was not an Engineering building at Purdue University to help secure the privacy of the participants. At that time students were further informed in more detail on the purpose of this study. Informed consent was well discussed and students were told of the opportunity to be able to review their transcripts at a later time if they so chose. Students were asked if they wanted to choose a pseudonym for themselves and if they chose not to, were told that they would be assigned a pseudonym to maintain their anonymity. These pseudonyms are used in this study.

Data Source

To obtain data for this study a set of interview questions were generated. These questions were aimed at asking the same questions to all those who were interviewed but yet general enough to let the interviewer address and readdress topics as he or she thought were pertinent to the study. These audio-taped semi-structured individual interviews were collected in the spring of 2004. Individual interviews ranged from 35-70 minutes and the general goal was to get students to tell what kind of impacts and experiences they had during and as a result of service-learning. To accomplish this task in this interview The participants were roughly asked these 21 questions:

1) Have you participated in any other service-learning, community service, or volunteer programs before entering college?
2) What impact did the learning community have on your first-year experience?
3) What impact did the service-learning experience have on your first-year experience?
4) Do you see your service-learning experience as "engineering" why?
5) What was you definition of engineering before you started this program?
6) After being involved in this experience have your thought on what an engineer is and what an engineer can do changed or stayed the same?
7) After this experience do you feel like an engineer? Why? If not what will it take for you to feel like an engineer?
8) Lets focus on learning communities. What was your most positive experience that you got out of being involved in the learning community? Negative?
9) What about the most positive experience with service learning, negative experience?
10) Has being in this learning community affected your grades, how and why?
11) Do you feel like you were in a community, why or why not?
12) Is being involved in a community important to you, explain?

13) Why did you choose to be in a learning community?
14) Was the learning community what you expected, why?
15) Did you like the service-learning project that you had, why?
16) Would you be involved in this program again, why?
17) Would you recommend this program to your friends, why those people?
18) Compare and contrast your own development at the beginning of the school year to now, what has changed, is it positive or negative, why?
19) Should this program be mandatory?
20) What would you change about this program?
21) Is there anything else about this program that you think is or is not necessary about this program?

After reading these interview questions one may notice that questions concerning the learning community were added. This is important to note because we wanted to distinguish between what impact the learning community had versus the impact that the service-learning had on the students. In doing so, we not only obtained a voice of the student on their experiences and impacts of service-learning but also a voice of the student on their experiences and impacts of being in a learning community. We will only report on the experiences and impacts of service-learning in this study.

Data Collection and Analysis

The data came from the verbatim transcription of these interviews. Interviews were checked with the audiotape to make sure that verbatim transcription was accurate. About 13 hours of audiotape resulted in about 400 pages of transcripts. Data was then uploaded into a computer software program called Atlasti [27] to aid in the organization and analyses of the data.

Once data was uploaded and sorted, the data was then mined for emerging themes. Initially these themes followed closely and were grouped with the specific interview questions that were asked. Once the interview questions and answers to those interview questions were grouped together broad generalizations were made. These generalizations were then checked for how consistently they represented the data. These generalizations were revised over and over again until they were thought to be accurate representations of the data. These generalizations became the assertions.

After these assertions were generated they were individually checked and refined by the other two authors of this study by reading the data that supported each assertion. This data was already assigned pseudonyms and any possible identifying comments of the student participants so that only I maintained the student participants' identity. Next, the three authors of this study meet together to decide on the appropriate assertions. No assertions were kept until we came to a unanimous decision concerning each assertion. These six assertions were generated and were thought to be the most accurate representations of the data:

Assertion 1 (A1): Many students entering service-learning experience did not know what engineers do and those that did had a very naive view of engineering.

Assertion 2 (A2): Students thought that the service-learning experience helped them understand what engineers do and that they had a more accurate view of what engineers really do.
Assertion 3 (A3): Many students at the end of the service-learning experience had a broader view of engineering.
Assertion 4 (A4): Most students who were in this service-learning program had participated in other volunteer programs.
Assertion 5 (A5): Students learned how to work in a communal environment.
Assertion 6 (A6): Students learned how to manage their time.

Results

A1. Many s*tudents entering service-learning experience did not know what engineers do and those that did had a very naïve view of engineering*.

Many of the first-year students who come to Purdue University want to join the College of Engineering. These students come from many different high schools in the United States as well as different races and socioeconomic backgrounds. These first-year students also come from many different countries taught in many different types of educational settings. To be accepted in the College of Engineering, first-year engineering students must carry a substantial course load. First-year engineering students at Purdue tend to claim that they have no life other than studying while other students in other majors seem to have plenty.

It was assumed that students who were willing to live this life and wanted to be an engineer had a well developed understanding or definition of engineering. When the students of this study were asked to reflect back and discuss these definitions we found that most students simply did not know what an engineer does. This is interesting because these students have stated that they wanted to be an engineer. For example, Anthony was asked what is your definition of an engineer; Anthony replied, "***I don't know if I really have a definition***." Many students just don't know. For many students we heard comments that were very similar to comments made by Rachel, who said "***I didn't have a clue when I came***" here about engineering.

There were also those who had a very narrow view of engineering which they obtained from workshops or high school classes where they had to build things. Like Domink, who said, "***Before I got here we built cars and robots, so I thought that was engineering***". There were those like James who said when they thought of engineering "***they think of someone working on a computer or some rocket ship or something***", or Kim who "***thought it was working with tools or machines***". .

There were also many students who seemingly had a better understanding. However, even when most of these students tried to describe what an engineer does most of these students still had a naïve view of engineering and freely admitted that they really didn't know what engineers do. Lance described it as, "***Designing something or helping with the efficiency of something. Getting planning done***" and then paused and said, "***I don't know. Just making things work better***".

Many students like LaShawna said that engineering is "***Math and science and applying it to whatever you're doing***". While others had a similar understanding of what engineering was it was also evident by their quotes and by the look on their faces that like Lance, there was some considerable confusion trying to answer this question. For example Patricia, when asked to define engineering, in a confused look and an unsettled voice gave this response,

I don't know. It's science and math and all that but not so much on the extreme analytical side. Kind of on the 'how am I going to get this to work with this chemistry'. Not necessarily 'if I have this many atoms what am I going to get when I put them all together', but working together to achieve something that is more theory but you can see. I don't know.

Another participant, Dawn, when asked a similar question answered in a similar confused look,

That's hard. I'm not quite sure. Dealing with math and science more than anything. I wouldn't consider English to have anything to do with engineering but that's because I don't like English that much.

Even those whose parent or parents were engineers still showed many characteristics that were consistent with the other students in this study. This can be best illustrated by what Nina said when asked a similar question,

I didn't really know what engineering was. The high school counselor would say 'Oh, you're smart you should go into engineering". That's what happened. I knew engineers did a lot of different things. My dad was in chemical engineering; he was a lot better at chemistry than I am. He loved it and he used to tell me about engineering when I was little and all the different areas I could go into so I had heard about it from my Dad. When I went into it I looked into environmental engineering the most. I knew there'd be a lot of math & science and had the stereotype that it's a bunch of nerdy guys but that's what I was thinking when I came into it. It was right in a lot ways, but there's a lot of people who aren't nerdy – I was surprised. I didn't really have a clear-cut idea but I knew it was broad and you could do a lot.

Most of the students in this study all shared one common characteristic; they did not know what engineers did and had relatively little knowledge or views of engineering.

A2. Students thought that the service-learning experience helped them understand what engineers do and that they had a more accurate view of what engineers really do.

While the students reported having little or naïve views of engineering when they started their first semester, most reported that the service-learning experience helped them develop a better understanding of engineering and they felt like they had indeed had and "engineering" experience. For example, when Jeremy, was asked about his service-learning experience he said that "***It helped from an engineering aspect and what it feels like to be an engineer***". This statement was found to be similar in what other students though about their serving-learning experience. All of the students thought that the service-learning experience was an engineering experience because they saw it as something that an engineer would have to do in real life. This experience became a real-life experience, applicable to the student because they thought that engineers either had to work with people and/ or become problem solvers. Paul thought that this

was engineering because he had to work with people. When Paul was asked if he thought of his service-learning project as engineering he said,

Not so much with the technical skills but people skills, yeah. We were exposed to all kinds of people we probably wouldn't have talked to otherwise. Gaining experience that way helps you in future jobs.

Nate whose service-learning project involved to painting parts of a children's museum, resonated a similar explanation when asked if the service-learning project was engineering, "***Painting? No. Teamwork, defiantly. You're going to work in teams a lot in the business world. A lot of coordination and meeting deadlines***". Many students like Patricia, Rachel, and Dominik, with very naïve views of engineering, when asked the same question responded in a similar fashion, Patricia said;

Not so much the work, but we didn't know enough to actually do engineering the first semester. The aspect of engineering about working together and swapping ideas and how to go about doing stuff was. Not technical engineering, tho'.

Rachel said;

Interacting with people, definitely. In engineering you have to work with people at lots of different levels and I guess you could say the customer, being able to work with the administration above you. That's engineering in any discipline.

and Dominik said;

I felt I was doing engineering work, I didn't feel that it was what I wanted to do but I did think it was engineering and I wanted something engineering-related. It was a good break from Matlab. Meeting people and one on one communication was good. We actually got to talk to BVN and see what they wanted. We made a program initially that wasn't at all what they wanted and we had to go back and change it. It seemed real-life.

Students saw this service-learning experience as being more consistent with aspects of engineering because they all had to work with people. Other students also thought that this experience was "***real life***" because their service-learning project not only afforded them the ability to work with people but also because they got to become problem solvers. When Nina, the engineer's daughter, was asked if she thought the project was an example of a real-life application to engineering she stated,

I think that's why they had us do it. Most likely an engineer isn't going to go to a place like that and tell people how they need to spend their money but on a larger scale with a company maybe. It gave us an idea of what we'd do as engineers and also a lot of people think engineers do math problems. It helped me to see in a way I hadn't that thru this job you can help the community. Social workers, teachers, etc. we think of helping the community but not usually engineers. It helped me see we can do that.

When she was asked was that important for you? she responded,

Yeah. I think it helped. We discussed it in our LC class. One of the things we always learned was how to deal with people; not the math problems necessarily. We did that and could have done that without going and working with these people. We learned how to deal with people and that was important. I wouldn't have gotten, if I wasn't in this service learning. The people who weren't in the LC weren't working with people; they were solving problems on the computer. We solved problems, too, but also how to work with people.

In addition when John was asked about the most positive aspect of the LC he talked specifically about the service-learning experience.

The project work with 106. The service learning section was a great experience. I talked with some of the people who did the regular 106 curriculum. My specific project was with (a museum) designing education curriculum. It brought challenges and a whole different aspect to it that I don't think I would've found with the 106 project. For example, we had to try and figure out what they were looking for – education curriculum wasn't something we had any experience with and we came into 106 thinking "okay, they'll have us make an airplane or design something very engineering-specific". Build a building – something you'd normally think of, but education curriculum caught us off-guard and we had to do a lot of research and have a lot of interaction with the people at (museum) and try to get their input and see what exactly they needed us to do.

When John was asked about whether he thought this project was engineering he said,

Yeah. I do. It isn't what you think of as a classic example like I was saying before; it's really not involving a lot of technology that engineers usually use but I think it certainly has a problem solving aspect. We were given a pretty open-ended problem: we need after-school curriculum for 2 weeks. We had to go from there; okay, what do they need to include, what are the resources with the class-size, age group, what does the teacher have available. All those factors had to be taken into consideration. I think that level of problem solving was what made it an engineering problem.

Both Nina and John, along with the other students thought that there service-learning experience was applicable to engineering. Aside whether the students at first claimed they knew what engineers did or did not do. Service-learning seemed to be a vehicle in which students begin to shape their ideas of what engineers do which is a more accurate view of engineering. In the next assertion we show this shaping in the first-year engineering students who participated in this study.

A3. Many students at the end of the service-learning experience had a broader view of engineering.

After their service-learning experience, every student in the study viewed engineering as much more than they thought when they started the semester. Students said that service-learning helped them to develop there views of engineering. James, who originally had thought that engineering was "***working on a computer or rocket ship***" said, after the service-learning project, that, "***It showed me that there's more and opened the possibilities to what I can do***". Dominik

who at first thought that engineering was "***building cars and robots***" and "***at first***" said that "***I did not***" think this service-learning project was engineering "***but later***" said "***I did***", changed his views of what an engineer did. "***Engineering is not so much designing things as impacting the community***". Rachel who said, "***I didn't have a clue when I came***" Now has developed a more workable definition of what engineers do,

I guess it would be interacting with other people on different levels with problems. Whether it be using other people as your resources or a computer to solve problems.

Jeremy said "***at first I didn't***" think the project was engineering but later "***he did***" had a new way of viewing engineering,

It's like engineers have to be customer-eccentric so that's what I learned mostly. You have to be what other people want; it's not like you have the right answer and know what you're doing. You have to consider others; not just rely on yourself.

Even Patricia who once again said, "***I didn't know a whole lot when I got here***" about engineering, "***I just knew it was something I wanted to try because I like figuring out how things work.***" said this about her new found definition of what it means to be an engineer,

I didn't realize everything involved. A lot of team work, individual work and then coming together to see what you get. I didn't know what to expect so it's changed.

In addition, even Nina, the engineers' daughter, who seemed to have a slightly better idea of what engineers do than all of the other participants in this study. Felt better about her decision to join engineering after the service-learning project because it allowed her to help people.

I feel better about my choice to go into engineering. I think because I always went to Catholic schools and had that service incorporated into our classes. I think this is why I'm enjoying it here. They always encouraged helping other people and social justice. Most people don't think of engineering when they hear those words but it made me feel better about my choice. You can have a good stable job but help people at the same time.

The service-learning experiences that all of these students had, undoubtedly have impacted these students lives to shape their views of engineering.

A4. Most students who were in this service-learning program had participated in other volunteer programs.

It is interesting to note that the majority of the students who participated in this study had participated in other volunteer programs during their middle and/ or high school years. For many of these students their participation in these programs was extensive, extending well over 200 community service hours before coming to Purdue University. Out of these 20 students only one student said he did not do any volunteer work before coming to Purdue University. Participants in this study seemed to volunteer more toward one or the other specific types of task. This gravitation towards specific volunteer activities seemed to be dependent on the gender that each student selected for themselves.

Men were more likely to volunteer for activities that helped the community in general. For example Lance said,

I've painted houses around town every April or so. We had to have service hours for our high school and grade school. I had to do 20 hours every year since I've been in school. Another participant, Patrick, noted that, "***In high school" and "in elementary I did community service in my neighborhood***". While this was the general consensus for the men in this study, some did volunteer for activities that involved direct contact with people, physically having to touch people. John was one of these men,

I was in the Honors Society and did a few different things. Making blankets for charity was one. A few other things. I taught piano for a few kids in the community. James was another who said "***In eleventh grade I helped with the special Olympics and in 8th grade I tutored a 3rd grader in math***".

However, even these activities were not as people oriented when compared to what activities the women in this study choose for volunteering. Women were more likely to volunteer for activities that involved being in direct contact with people. Women mainly volunteered at hospitals like Natasha, "***Yeah***" I did service work, "***Thru the Honor Society at school and then I volunteered at a hospital***"; nursing homes like LaShawna, "***I volunteered in nursing homes and tutored people learning English. I volunteered at the library also***"; or help disabled children like Jennifer who said,

I volunteered in HS for SCEC (Student Council for Exceptional Children) and I was president for 2 years. We participated in activities with students that had disabilities. That was for 3 years and then I got involved at a state level, too, traveling to other high school's in Ohio where I'd talk about our club and how they could start their own.

Whether women or men the data indicate that there seems to be an unspoken prerequisite for the type of student in this study who is more likely to participate in a service-learning program. In addition this data seems to give us insight into the types of service-learning projects that might be more attractive to men and also more attractive to women.

A5. Students learned how to work in a communal environment. and A6. *Students learned how to manage their time.*

While much of the data described has shown how service-learning can fulfill ABET criteria. These two assertions with the data that follows can be correlated with the current reforms of the engineering educational models. Models directed by the "Engineering Criteria 2000" to give the engineering skills that engineering students will need when they enter the workplace and or to help give them a full spectrum of professional, or "soft" skills that will stimulate current industrial practices (Hughes 2001). In the workplace students have to be able to function in a timely manner and not only function in multidisciplinary teams on many levels but also communicate effectively and function in a more global and societal context (ABET, 2002). Students who participated in this service-learning program learned and made their understanding

of these concepts explicit. Consistent with these concepts, students like John, Natasha, and Rachel learned these types of lessons. John said,

One of the people we dealt with was pretty unreliable about getting (things) in. It was a frustration, but I think it something that was good to realize, that universally you just can't tell somebody you need something by this time – even if you give them plenty of notice. It still might not get done. You have to check up on it. Scary but not a bad thing to know.

Natasha said service-learning allowed here to "***know how to interact with adults in the future who have more authority than you do***". When Natasha was asked if she had dealt with people like this before she said,

Not really. Not an organization or anything. The way you act with them isn't the same as how you'd act with your friends. How professional you are with them is good experience for when you get a job.

When Rachel was asked what was the most positive thing about service-learning she said service-learning,

Definitely taught me a lot about interacting with kids and people that are co-workers that you don't necessarily know already. The supervisor even. You can't just go in the day before without an appointment. I learned about the business part of scheduling. Interacting with people who are already established in a particular place and you're the new person that comes along.

In addition when Rachel was asked was there any other skills that she had to developed she said, "***People depended on each other***" in the service-learning project "***to do different things and I had to find time to do***" different tasks. Many other students said that they learned similar lessons of how to manage their time from their service-learning experience. When Nate was asked what impact do you feel service-learning had, he remarked that service-learning, "***Definitely teaches time management***". Patricia also exemplified how she learned time management. Patricia said this,

The kids were complaining about it just being free labor for (the museum) but they didn't really play a part in the scheduling of getting everyone there at the same time and managing the group.

When asked how this affected her she responded,

I think I've learned to work harder and spend time doing stuff. I've learned time management. I have all kinds of list and my planner is planned to the hour! If I don't do that it won't get done.

Lastly, while students talked about their service-learning experience and how they learned time management and also to work in a communal environment. LaShawna sums up all of these experiences quite nicely. The impact of these experiences and what was learned as a result of these impacts were revealed by talking about what she viewed as the most positive things about her "***real people, real world***" service-learning experience. She explains,

Learning how to ride the bus was a good experience for all of us. None of had experience with public transportation before. (a pause) and I think dealing with real people because so far we've been with our parents or teacher or group and in (our) hometown where we know everyone. Now, we're actually with people we don't know and have to try and be friends.

When LaShawna was then asked if she thought it was important to meet real people outside the university. She then smiled and said,

Yeah. Once you go out into the real world you have to interact with others and it's different than here. If we graduate and go out in the work field it'd be strange if we didn't have experience with meeting other people while we're here.

Like LaShawna, in many situations students saw service-learning important for the "real world", which seemed to be separate from their school experience? Service-learning seemed to bridge this gap simply by allowing the students in this study to believe that they were meeting "***real people***" and having "***real world***" lessons in or during their school experience. Something that might makes service-learning seem more appealing to students then traditional projects.

Conclusions

In 1993 ABET defined engineering as devising components, systems, and processes to meet needs [17, 28]. By 2002 ABET had made amendments to this definition regarding the education of the student of engineering [2]. ABET and now many others have not only an objective view but a more subjective view of engineering, involving values and moral judgments [17].

While the world is already and increasingly becoming more technologically complex there needs to someone who is aware of developing technology and the reality of what that technology means. Who else would be better than the engineer who is technologically literate to decide and help the public gauge what is good or bad technology. Obviously technology in and of itself is not bad or good it just is; but technology doesn't live in a box, it influences people and cultural activity. Someone has to take on the responsibility to ask what type/kind of activity we want generated in the future. These questions in this technological age are questions that must be answered and discussed by the engineer. Therefore it is important for engineers to develop what it means to be an engineer.

This qualitative investigation to evaluate the impact of the implementation of the first-large scale service-learning program at Purdue University has revealed several things about the participants. Before the service-learning experience it is interesting with how naïve and incomplete a view of engineering students had when they came into the engineering program. This has implications for outreach and recruitment programs in the engineering community. It is also interesting that most of the students did not associate engineering with work related to the community, even though most had had significant volunteer experience prior to coming to college. Recent studies have shown that nearly three quarters of students entering college have had volunteer experience prior to enrolling in college. Connecting interest in community issues

with engineering solutions has a potential in increasing interest in engineering, especially among underrepresented populations.

Service-learning has allowed our first-year engineering students not only to work in professional environments, work in teams, problem solve, develop a broader understanding of engineering, and impact the community but also see themselves as doing engineering. Where the students believe that they have had a "real life" experience unlike what students have said about their traditional engineering projects.

It was a good break from Matlab. Meeting people and one on one communication was good. We actually got to talk to BVN and see what they wanted. We made a program initially that wasn't at all what they wanted and we had to go back and change it. It seemed real-life. said Dominik. Service-learning has the potential to create a rich learning environment, even for first-year students.

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