Farm to Fork: How a Third Year Computer Science Class Took On the Issue of Food Insecurity

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Abstract
Sense of community has been largely taken out of the conventional education system, including higher education institutions. Community-engaged learning (CEL) challenges conventional teaching methods and encourages a reciprocal collaboration between higher education institutions and communities to create meaningful and positive change in communities. This process yields a wealth of benefits to students, such as improved comprehension of the subject matter and development of transferable skills. Although CEL is increasing in popularity, its presence is scarce in the field of Computer Science (CS). This article describes a project in an undergraduate Computer and Information Science class titled ‘Farm To Fork’ based on CEL principles and methods. This case demonstrates the benefits of applying CEL in a CS class for students. Results suggest students not only perform better academically, but develop skills they will utilize outside the classroom. Additionally, the Farm To Fork project increased students’ sense of community and their expectations of CS as a discipline. Most importantly, Farm To Fork demonstrates that CEL can be highly successful when applied in the discipline of CS.

Introduction
There has been increasing pressure on post-secondary education to help students develop transferable abilities and skills that can be applied to practical, real-life situations beyond the classroom. Universities are expected to produce productive, culturally sensitive, and responsible students capable of actively participating in a free and democratic society (Gruenewald 2003, 2008; Bell and Lai 2006; Melaville et al. 2006; McInerney et al. 2011). These increased expectations are applying pressure on the conventional education system – a system that has embraced the standardization of student experiences and decontextualized content and testing, while ignoring the concept of place, culture, and community in which the institution is embedded (Gruenewald 2003; Bell and Lai 2006; Graham 2007; Semken and Freeman 2008; Davidson et al. 2010). Several national surveys in the United States illustrate that both students and educators favour real-world learning and believe it improves engagement and results in school (Melaville et al. 2006). Community-engaged learning (CEL) is one way in which post-secondary education institutions have attempted to develop more active learning and more diverse skills amongst students. CEL refers to learning, teaching, and research practices that involve collaborations between higher education institutions and their communities as a way of creating social action and change (Strand 2000; Beckman and Hay 2003; Melaville et al. 2006; Roche 2008; LaMarre and Hunter 2012). In CEL, higher education institutions and community partners partake in a mutually beneficial exchange of knowledge and resources, and emphasize reciprocity (Melaville et al. 2006; Roche 2008).

Although there are increasing examples of CEL in university courses, these are scarcer in disciplines such as Computer Science (CS). Strand (2000) believes that knowledge in these disciplines is presented in an abstract, linear manner that is disconnected from human experience. Incorporating community knowledge and resources into such disciplines can often be
perceived as a threat to the objectivity and universality upon which the discipline often relies. There have been increasing efforts to include CEL in disciplines such as mathematics, physical sciences, and CS. For example, Semken and Freeman (2008) applied CEL to an undergraduate course in physical geography and Showalter (2013) studied place-based mathematics education (PBME) as a means of enhancing students’ learning of mathematics. These studies suggest CEL can be applied to science courses. Nevertheless, Showalter (2013) calls for examples that integrate culture and community with sciences so others can be inspired to contribute to the novel practice of CEL.

‘Farm To Fork’ is an example of an undergraduate level CS class at the University of Guelph that applied CEL to address the issue of food insecurity in its community. The third year undergraduate class, Systems Analysis and Design in Applications, developed Farm To Fork, which aims to increase the quality and quantity of fresh food donated to food banks and pantries by developing online tools that address the needs of emergency food service providers through real-time connections with donors. The system informs donors of the type and quantity of food and other resources local emergency food providers (EFPs) – such as food banks and food pantries – require. Farm To Fork provides an easy way for citizens to donate fresh and high quality produce that can help improve health and wellness of those facing food insecurity.

This article will illustrate the impacts of CEL on students in an undergraduate CS course. The aim of this article is to contribute to the ongoing dialogue about the benefits of CEL in higher education, using an example from a CS course. We will first examine CEL as a teaching model that improves the learning experiences of undergraduate university students. We will then describe the Farm To Fork project and illustrate how it enhanced the learning experiences of students in the Systems Analysis and Design in Applications class. Based on students’ responses, the impacts will be divided into four categories, including academic impacts, personal and skills development, increased sense of community, and increased expectations of CS as a discipline.

Community-Engaged Learning

The definition and applicability of community-engaged learning (CEL) as a teaching and learning method is greatly debated in literature. Some authors use the term community-engaged learning interchangeably with community-engaged research, community-based research, environmental education, service learning, and place based learning (Astrand 2000; LaMerre and Hunter 2012); while others attempt to differentiate them (Melaville et al. 2006; Hicks 2009). For the purpose of this article, CEL is a term that collectively refers to the various strategies listed above. More specifically, CEL refers to partnerships between higher education institutions and community partners that focus on a reciprocal process of creating meaningful solutions to issues identified by communities (Strand 2000; Beckman and Hay 2003; Melaville et al. 2006; Roche 2008; LaMarre and Hunter 2012). Strand (2000) differentiates CEL from traditional teaching by stating that CEL works with the community, rather than on the community and that it seeks to create meaningful and positive change in the community, which he claims is lacking in conventional teaching.

A wealth of literature supports the notion that CEL yields multiple benefits to students. Students not only acquire knowledge about the subject matter, but apply that knowledge to real-life issues. Students are provided with opportunities of applying novel skills in novel settings with a variety of experts (Melaville et al. 2006; Gruenewald 2009). By applying their knowledge to real-life issues, students develop a personal connection to the content, improving their ability to retain information, becoming increasingly engaged in the content, and seek further
opportunities to apply their knowledge (Ball and Lai 2006; Edelglass 2009; Davidson et al. 2010). Despite the strong support for CEL, making connections between classroom and community-engaged learning has proven a challenge in the post-secondary context.

CEL gives students the opportunity to build connections to their communities and develop knowledge and skills necessary for active citizenship. CEL encourages students to reflect on wider social issues including the environment and health in their communities (Gruenewald 2003; Edelglass 2009; Davidson et al. 2010). It challenges students to examine the limitations and strength in their communities, as well as themselves, and find innovative solutions. Students are expected to understand the complexity of those issues and take into consideration issues of power and equality when formulating potential solutions (Ball and Lai 2006; Davidson et al. 2010). In a CEL model, students become agents of their own learning. Rather than being consumers of knowledge, they become co-creators (Azano 2011). Knowledge production is a collaborative process between educators, students, and community partners. Students’ knowledge and perceptions are often challenged in this way, creating curiosity that initiates meaningful education (Beckman and Hay 2003). In addition to reading, writing, and listening, students in CEL are encouraged to use their own methods, skills, and designs to approaching various types of information (Hicks 2009; Davidson et al. 2010). Access to community partners also develops resources and networks. Students can find mentors in their communities and can explore opportunities for internships, or gain insight into specific career paths. CEL helps students better prepare for the workforce by helping them gain new transferable skills such as critical thinking, problem-solving, teamwork, responsibility, appreciation for deadlines, and seeing connections between inputs and outputs (Ball and Lai 2006; Melaviller et al. 2006; Gruenewald 2009).

Students engaged in CEL recognize a sense of purpose and accountability. They are not only partaking in class activities and writing reports for the professor, but often feel accountable to the community partners as they feel their participation has a purpose and meaning that is greater than demonstrating their comprehension of course materials (Strand 2000; Melaville et al. 2006). Students have the chance to realize that when applying the information found in their text to daily practices and issues, the process is often non-linear, unpredictable, and uncontrollable (Strand 2000). It provides students the opportunity to learn from their professor, but from other sources of knowledge, such as community members and their fellow students.

The Farm To Fork Project

Systems Analysis and Design in Applications, a mandatory third-year course in the School of CS at the University of Guelph, tasks students to work on a single, semester long (12 week) project. The educational goals of the semester long project include developing and prioritizing a list of project requirements, establishing meaningful timelines, and communicating within and between coding teams. The students are required to develop a concept and produce a working prototype as the final output. In the past, the project focused on developing a computer game. In this case, the professor acts as the real-world client, answering questions regarding the goals and outcomes of the game. By introducing CEL to the course, the students now worked for a real client and worked on a project that addressed the needs of the community. It is important to note that the CEL project did not change the educational goals of the course.

The introduction of CEL required substantial research prior to the students starting the project. In this case, the work was facilitated by brokers at the Institute for Community Engaged Scholarship (ICES)/Research Shop at the University of Guelph (see http://theresearchshop.ca/);
an institute that fosters collaborative community-university partnerships, and strengthens faculty and student engagement with the broader community in which they live. The existing relationships developed between the Research Shop and local food security groups (the Guelph-Wellington Food Round Table and two of its working groups; the Food Access Working Group, and the Food Distribution Working Group) provided students a secure and trusted environment in which to develop the Farm To Fork project, and a set of needs, priorities, and capacities as identified by the community partners. Further, students were provided several Research Shop reports identifying challenges and opportunities related to food security work in the Guelph-Wellington region (see for example, Institute for Community Engaged Scholarship/The Research Shop 2011 and Institute for Community Engaged Scholarship/The Research Shop 2012). The pre-existing relationships between the Research Shop and the community, the research conducted by the Research Shop prior to the Farm To Fork project, and the availability of the ICES brokers to facilitate communication with community partners throughout the semester, were essential to the introduction and success of CEL in the classroom.

Motivation for the Farm To Fork Project

Every day, millions of people are impacted by food insecurity. Food security refers to “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (FAO 1996). Globally, there are approximately 1 billion people who face food insecurity daily (FAO 2012). Contrary to the beliefs of many, food insecurity is not limited to developing countries and is increasing throughout the developed world, including Canada and the United States (Lang and Heasman 2005; Rosin, Stock and Campbell 2012). Approximately one in ten Canadians are considered food insecure (Health Canada 2010), and about 850,000 Canadians visit emergency food providers (EFPs) every month (Food Banks Canada 2012).

Since the 1980s, EFPs have played a considerable role in addressing food insecurity throughout the developed world (Friel and Conlon 2004). Nevertheless, criticisms towards the current EFPs have been increasing. The focus on non-perishable food items is being recognized as an approach that provides poor quality food with minimal nutritional value. Most non-perishable food items are high in sugar, salt, and saturated fats, are highly processed, and lack essential nutrients, minerals, and vitamins (Friel and Conlon 2004; Rosin, Stock and Campbell 2012). This increases health risks and puts further stress on those facing food insecurity. Food security is thereby not only measured by the quantity of food, but by the quality of food as well. Friel and Conlon (2004) suggest that the dietary behaviour between people facing food poverty and who are food secure are one of the underlying contributing factors of social inequality. EFPs are in urgent need of fresh vegetables, fruits and food that is nutritionally complete.

Overview of the Farm To Fork Project

The Farm To Fork project has been designed to bring fresh, healthy, and nutritious food to those in need. Specifically, students developed an online tool that allows EFPs to send donors electronic reminders of the type and quantity of food required. This occurs after the donors have created an account and identified the day of the week when they are most likely to go grocery shopping. The donor is allowed to pledge particular food items and the system is automatically updated to ensure the EFPs’ needs are met. The system has been designed to increase the quantity and quality of food donated, as well as to keep the issue of food insecurity at the front of
donors’ minds throughout the year, not just during annual food drives. It is hoped that the Farm To Fork project will also ensure higher level of donations throughout the year.

While the students have finished their course requirements, many continue to work on the Farm To Fork project with community partners. This includes the development of mobile applications that use location-based technologies to remind donors when they enter a grocery store/market of EFP needs. Additionally, due to interest from across Canada, the United States, and Europe, expansion of Farm To Fork to other regions is under exploration.

Impact of Farm To Fork on Students

To gain a better understanding of students’ experiences during Farm To Fork, several students were asked to reflect on their time with the project. Students were provided with a series of open-ended survey questions focused on the impact of the project on their education, community life, and career choices, as well as any challenges faced during their time with the project. When asked to reflect on their time in the class, students reported mainly on their hands-on community engagement and interactions with other students surrounding the Farm to Fork project. For some students, lessons reflect specific scenarios while for others the lessons are broad and have transformed various aspects of their lives. These students partook in various activities of Farm to Fork including development of the interface, prototyping and communication with community partners. Excerpts from the surveys are presented here and are embedded in relevant literature that supports the benefits of CEL on students in higher education. Responses varied, but most replies can be grouped into the following impacts: academic impacts, personal and skills development, increased sense of community, and increased expectations of CS as a discipline. These categories are described in greater detail below.

Increased Sense of Community

The Farm To Fork project helped students form a better sense of community. The project introduced students to community members they would otherwise not have met. As one student stated, “I consider it to be an experience that students should have a chance to do because it gives them a different perspective on their work and a chance to interact with people outside of the university.” Students became more conscious of the issues their community is facing and recognized the depth and complexity of food insecurity. Students were introduced to multiple, diverse approaches to dealing with food insecurity. For students who were already involved with the community, Farm To Fork helped them learn the subject matter more effectively as they felt more accountable to the community. As one student claims, “The information felt relatable and we had a good excuse to learn it. Not because it would be on the final exam, but because if we did it right, it would help the project.”

Studies show that providing students with opportunities to connect with their communities will increase students’ commitment to their school, communities, and civic responsibility (Melaville et al. 2006; Davidson et al. 2010). As mentioned before, CEL is an effective method of creating more active and engaged citizens. Farm To Fork supports the CEL literature, as students did recognize the challenges their communities face and realizing the importance in helping address those challenges.

Academic Impacts

One of the most noticeable outcomes of CEL for students was academic impact. Students recognized that they were able to retain information much better as they were excited and
engaged in the project. Students were greatly surprised by their commitment to attending lectures. The students were impressed that attendance in class remained high throughout the duration of the course. Enthusiasm and feelings of ownership towards the project encouraged high classroom attendance. Over the course of the semester, the average daily attendance exceeded 96%. Several students referred to a specific incident when the course professor was late to class. Rather than leaving, the students organized themselves and discussed course materials related to the Farm To Fork project. As one student describes,

“That was the first time I have even seen a full lecture every class. In fact, the students kept track of one another - if a member of your team didn’t show up, then they were not participating in a discussion that would affect Farm To Fork. My favourite moment was when our professor was late to class - so we had the lecture without him. All of the students stayed for the ninety-minute lecture and we reviewed the requirements for the project and chose which ones were more important. When [the professor] arrived an hour in, he was stunned. We were in a heated discussion about the material so he sat in a chair and enjoyed his coffee, speaking up when we had questions.”

For many, demonstrating their ability to organize themselves and facilitate a productive discussion on their own was a highlight of the course. Numerous studies illustrate that CEL increases enthusiasm and engagement of students in learning course content and improves academic achievement (Melaville et al. 2006; Showalter 2013). Improved attendance and reduced drop-out rates have also been demonstrated as academic outcomes of CEL, especially amongst high-risk students (Melaville et al. 2006).

**Personal and Skill Development**

Utilizing CEL in this class allowed students to develop skills that expand beyond the classroom. In addition to learning the course content in a more effective and engaging manner, students learned skills they can utilize outside the classroom, including the workforce. Some of the skills learned include teamwork, interpersonal skills, communication skills, team management, writing, and presentation skills. CEL gives students more independence, freedom, and responsibilities (Hicks 2009). As a result students gain confidence, competence, autonomy, and feel empowered when partaking in CEL related projects.

Students were clear that skills learned via the Farm To Fork project will be beneficial when they seek to enter the workforce. They believe the experiences they gained during the project provided them with advantages over students who have not been exposed to CEL related projects. They feel better equipped to deal with teams, clients, and stakeholders of various backgrounds. The Farm To Fork project also broadened students’ perceptions about their career choices and the types of organizations they wish to work for. One student believes the Farm To Fork project gave him “a new outlook of what I can do with my degree after I am done school. I will be able to help the people in my community with the skills I have learned.”

For some students, too much independence and freedom translated to lack of structure and support in the classroom. As one student states, “The support that we were given when it came to programming was somewhat limited but it forced us to think on our feet to get things done, and to use existing libraries instead of writing all of our own from scratch.” However, students supported one another and used their own skills and creativity to gain the structure and support they were seeking.
**Increased Expectations of Computer Science**

A surprising impact of the Farm To Fork project was the increased expectation from students on courses in CS. It appears students starting the class had very bland perceptions of what would be taught and achieved. As one student stated, “I would have never considered community-engaged scholarship for a project, not because I wasn’t interested, but because I thought that only professionals could do it, or that it’s not what people in computer science do. Aren’t we supposed to do our assignments then graduate and work for Google?” After the program, students recognized that education in their discipline is capable of more than simply delivering information. CS education can deliver learning in a way that is stimulating, engaging, and provides students with a wide variety of opportunities, skills, and resources. This is nicely summarized by a student below, who claimed,

“I was unaware that a program such as computer science has the ability to make a huge difference in our community. It also reinforced the idea that not all programmers have to be pushing code out the door for the latest software patch. That you can actually make programs for free for the community that will better a large number of people’s lives indirectly.”

Farm To Fork not only improved students’ experiences inside the class, but also taught students about CS as a discipline. Students’ increased expectations suggests that students will continue to be actors of change not only in their communities, but within their disciplines, encouraging others to question the outputs and processes of teaching students in higher education.

**Conclusion**

This article demonstrates the significant impacts CEL can have on students in higher education. It also provides a much needed example of how CEL can be incorporated into a CS course and provides support that CEL can be a very useful way to teach courses in all disciplines including CS. The content of the discipline was not compromised when applying the Farm To Fork project to the course in question. This article points to the notion that CEL can be valuable in bringing forward questions of epistemology surrounding the practice of teaching in the discipline of CS. CEL is more than collaboration between higher education and community; it questions how knowledge is produced, and how students gain skills and training in higher education. The Farm To Fork project demonstrates that students can greatly benefit from CEL. Not only did the Farm To Fork project enhance the learning experiences of students, it taught them a wealth of skills that they can transfer to their chosen career paths. Students felt a greater connection to their communities and deeper understanding of the issues their communities face. CEL, as illustrated by the Farm To Fork project, can help create successful, long-term sustainable solutions to social issues like food insecurity. An impact that has received little attention in CEL literature is the increased expectations students formed of their schooling and education. This suggests that students are becoming active members of social change in their communities outside school, but also actors of change within academia. Students can be active in demonstrating that higher education institutions play a role in creating communities and active citizens.

The Farm To Fork project described in this article has continued to grow outside of the original CS classroom. Students continued to work on the project outside of the classroom setting, successfully launching the website (www.farm-to-fork.ca) in October 2013. The website is actively used by donors who can sign up for a real-time list of needs, and by multiple
emergency food providers (EFPs) in the Guelph-Wellington area. The students are currently working to expand to other regions, as the project founders have received numerous requests from EFPs across the country and around the world requesting similar websites in their geographical areas. This again confirms that via CEL, students can partake in projects that address relevant and sometimes urgent issues in their community. Students are also working to develop mobile applications for Farm To Fork that will make use of location based technologies – bringing EFP needs directly to the mobile devices of donors the minute they enter a grocery store or market.
Bibliography


