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Assessing the Impact of Community-Based Experiential Learning: The Case of Biology 1000 Students

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Teaching and learning of many undergraduate science courses often remains confined within the boundaries of classrooms rendering learning of these subjects irrelevant and detached from students' lived experiences. Community-based experiential learning (CBEL) is one way to address this issue. This paper reports the development and implementation of a CBEL activity and its impact on students' learning of Biology in a large university within Western Canada. Data corpus for the study included written pre- and post-CBEL student reflections, which were analyzed qualitatively. The results suggest that CBEL experience significantly enhanced the quality of students' learning across academic, civic, and personal domains. Emerged themes inform that the students considered their CBEL experience as valuable and empowering as it created opportunities for them to contribute to their own and peers' learning, as well as to the local community's and entire ecosystem's ecological wellbeing. They acknowledged that the CBEL experience enhanced their academic understandings and technical skills, which they can utilize in many other contexts. Outcomes of this study will inform revisions of the Biology 1000 curriculum in new iterations of the course. The study will also interest science educators who strive to promote students' learning in wider Canadian and other international contexts.

Research suggests that regardless of how constructive classroom learning experiences are, students often do not view science as having personal relevance to them (Wyss & Tai, 2012). Community-engaged experiences are reported to enhance students' academic understandings by engaging them in authentic learning activities, which help them connect and utilize course content to address identified needs of the local and wider communities (Furco, 2001; Howard, 1998). Community-based experiential learning (CBEL) is one such community-engaged pedagogical approach that serves as a contextualized community-based learning platform which could positively stimulate students' interest in the particular subject and/or discipline, as well as influence their future career aspirations (Abraham, 2002; Astin, Volgelgesang, Bceda, & Yee, 2000; Gray, Ondaatje, Fricker, & Geschwind, 2000; Prentice, & Garcia, 2000). However, there are very few studies that inform the impact of community-engaged experiences on students' learning of science (Wyss & Tai, 2012).

Moreover, despite the increasing acceptance of community-engaged learning at the higher education level, often CBEL integration in academia involves inherent challenges of providing appropriate professional support to faculty members in designing, implementing, and assessing the impact of such projects on their students' learning (Blanchard et al., 2009; Jameson, Jaeger, Clayton, & Bringle, 2012; O'Meara & Rice, 2005). CBEL activities are based on underlying values of community-engaged scholarship which emphasizes integrating university-community expertise, sharing responsibility and credits among all stakeholders, and ensuring mutual benefits and growth (Gass, 2008; Jameson et al., 2012; Mills, 2012).

In this paper, we share an example of a successful CBEL project in an undergraduate biology course at a large research university in Western Canada, which was developed and implemented as a three-way partnership among the university's Center for Community Engaged Learning (CCEL), the Biology Program, and the community partner. We present an assessment of the CBEL activity's impact on student learning and discuss the utilization of CBEL experience as one way to connect theoretical concepts of biology with the students' lived experiences and explore its impact on students' academic and civic learning, as well as their personal growth. All names used, including the names of the community partners, organizations, and institutions, are pseudonyms. We understand that generally in qualitative studies, the participants are also given pseudonyms but, in this study, we have assigned numbers to participating students. We feel that once you assign a name, even if it is a pseudonym, it automatically triggers some assumptions about the participant. These assumptions may include gender, ethnicity, native vs. English as an Additional Language Learner and many more. Assigning pseudonyms to students may also influence reader's perceptions of the response and/or give a slightly different "flavor" to the response. Thus, we are not comfortable in assigning pseudonyms to students as this can then portray the participants in a way which may not necessarily reflect their subjective reality and the true nature of the Biology class which they are representative of.

Context and Community-Based Approach

Biology 1000 is a large multi-section introductory course offered to first-year undergraduate science students. The course does not have a laboratory component and serves over 1,800 undergraduates every

year. One-third of the course curriculum is dedicated to fundamental ideas and concepts in ecology, which have traditionally been taught through lectures, discussions, and other in-class activities, as well as some readings and homework assignments. While classroom learning can serve as an excellent foundation, often the absence of appropriate authentic experience that connects this learning with students' lives poses a significant challenge in making this learning meaningful and germane.

Moreover, the student population at our institution is largely composed of students who grew up in an urban environment, and they often do not have much experience interacting with the local ecosystems. From the instructor's perspective, employing an outdoor CBEL activity to teach one of the ecology units has the potential of helping students see and experience how seemingly abstract concepts apply to the real world, thus making learning more meaningful and authentic. In addition, such an activity allows students to experience and interact with a local ecosystem, partly compensating for the lack of a laboratory component in the course. The Biology 1000 learning objectives that instructors aimed to address (in part) with the CBEL activity are as follows:

1. Evaluate how biotic and abiotic factors (and human activities) enable or prevent the establishment of a population in a given location, and explain how these factors control population growth over time.
2. Predict how changes in abiotic or biotic factors, or the occurrence of disturbances in a community, will affect the survivorship and reproductive potential of individuals, based on their life histories, and thus affect the structure of the community, in the short and in the long term.
3. Appreciate the diversity of living organisms, observe and notice changes and patterns in the environment, and become familiar with some local species of plants and animals.

CBEL has been widely recognized in academia as a powerful pedagogy that could promote students' learning at any level of education (Baldwin, Buchanan, & Rudisill, 2007). However, for CBEL experiences to be effective, it is essential that they meaningfully connect with the subject matter and serve as potential platforms for achieving curricular goals and intended student learning outcomes (Astin et al., 2000; Wyss & Tai, 2012). Recognizing that the successful implementation of any CBEL experience requires an equitable, collaborative partnership among academics and community partners, Harkavy (2004) emphasized the importance of developing mutual trust and respect among the key stakeholders involving academics, community partners, and students. The success of such projects relies on commitment at both university and community levels.

Therefore, to ensure sustainable vitality of CBEL experiences, it is essential that such programs are carefully designed to minimize the asymmetrical power dynamics between the academic knowledge and community knowledge. Inviting community as a collaborative co-constructor in the process of knowledge creation, CBEL utilizes a strength-focused approach which encourages students to work *with* the community rather than *on* or *about* the community (Mathie & Cunningham, 2003). Hence, a successful CBEL experience is rewarding for all people involved because it establishes meaningful connections between subject matter's theoretical concepts and targets global problems by acknowledging their occurrences at the local levels. As per Harkavy (2004) in such experiences:

> Relationships of trust, so essential for effective partnerships and effective learning, are also built through day-to-day work on problems and issues of mutual concern . . . the local community is a real-world site in which community members and academics can pragmatically determine whether the work is making a real difference and whether both the neighborhood [the community] and the institution are better as a result of common efforts. (p. 16)

Moreover, the outdoor aspect of CBEL activities could be tied with the principles of place-based education. Place-based education recognizes that "places are what people make of them—that people are place makers and that places are a primary artifact of human culture" (Gruenewald, 2003, p. 627). That is, our cultural experience is "placed" in the "geography" of our everyday lives, and in the "ecology" of the diverse relationships that take place within and between places (Gruenewald, 2008a, p. 37). Rather than teaching merely for standardized testing and competing for "rituals of alignment" that focus on filling the "achievement gaps," place-based education demands a more active role of educational institutions that could promote valuing and knowing how to live locally with a recognition of place within which one lives (Gruenewald in Green, 2005). Thus, based on the place-based critical pedagogies, the CBEL activities could lead to providing opportunities for students to participate meaningfully in the processes of place making and prepare them as active and engaged citizens who are willing to contribute towards creating democratic, socially just communal places in their own societies (Gruenewald, 2008b).

However, as Ash and Clayton (2009) mentioned, while applied learning pedagogies like CBEL that involve experiential strategies outside the classroom have great potential for significant student learning,

they also involve inherent challenges of facilitating and assessing that learning as well as achievement of individualized learning outcomes often in non-traditional ways. In such situations, critical reflections focused on well-articulated learning outcomes could serve as key strategy to help generate, deepen, and document students' learning.

Development of the CBEL Project

The project was developed as a three-way partnership among the Biology Program, the community organization (City Parks), and the university's CCEL. The CCEL's roles included identifying a suitable community partner, initiating the relationship between the community partner and the Biology Program, educating the Biology 1000 course instructors on community-engaged approach and CBEL pedagogy, supporting with the design and implementation of all aspects of the project and ensuring that the principles of effective CBEL pedagogy were in place. CCEL staff were also instrumental in sharing strategies to avoid possible sources of tension between instructors, students, and the community partner, which can include students' lack of training and skill, differences between the university's (or the students') and the community partner's priorities, or constraints due to students' academic schedules and availability (Mills, 2012).

The CCEL's Educational Developer identified the local organization City Parks as a suitable community partner. City Parks was initially deemed an excellent fit for the project because of the alignment between some of its priorities and the pedagogical goals of the Biology 1000 course, as well as because of its experience working with large community groups. For instance, City Parks' mandates include both regional park and natural resources management, as well as public education and engagement; the partnership would allow City Parks to educate and engage several hundreds of young people.

Teaching students and having them actively engage with local ecosystems are also goals of the Biology 1000 course/instructors. City Parks also has ample experience with implementing educational community-based activities, including projects where members of the public participate in the management or restoration of local ecosystems. This aspect was crucial, as it meant that the organization had the resources to effectively manage a large student group such as a Biology 1000 class. Importantly, City Parks's portfolio includes several ecosystem restoration projects that do not require any specialized skill and would benefit from the help of large groups of participants. Thus, City Parks was identified as a suitable community partner who could provide ideal opportunities for novice Biology 1000 students to actively contribute to the organization's goals and simultaneously learn targeted aspects of the Biology course through this engagement.

Alignments between the community partner's and the university/course's priorities would also minimize the potential for tensions between the two parties while maximizing reciprocal benefits. In order to also avoid potential issues with time commitment and scheduling, the experiential component of the project (hereafter "CBEL activity") was planned to take place over four hours on a Saturday, and transportation to and from City Park was provided. Students were informed of this at the time of course registration, which allowed them to make any necessary arrangements well ahead of time. The half-day length for the CBEL activity was chosen after careful consideration of the students' level of experience with this pedagogy (they are often novices), their demanding academic and extra-curricular schedules (we did not want the CBEL activity to turn into a "burden"), and the amount of resources that City Parks would have to devote to the activity knowing that 600 to 1,000 students would participate each semester.

The course instructors, the community partner, and the CCEL Educational Developer collaboratively designed an instructional unit that would 1) address some of the learning objectives set out by the Biology 1000 curriculum, 2) have students actively participate in a community project that City Parks deems important, and 3) enrich the students' experience by providing an opportunity for them to develop some practical skills, interact with ecosystem restoration professionals, and spend some time immersed in a local forest ecosystem.

The four-hour CBEL activity component for this unit, which fulfilled the three above requirements, consisted of participating in the strategic removal of English Ivy, an invasive species, from one of the forests managed by City Parks. During the course design, the lectures and readings related to certain biological and ecological concepts were integrated in a manner that could help prepare students for the CBEL activity. These involved discussion and readings related to the characteristics of plants that make them reproductively successful, potential consequences of differential reproductive features, and survival of various organisms including invasive species, as well as the introduction of City Park and the problem that it was facing with the invasive species in question and the role that the students would play in solving it. Students also completed an assignment that covered some relevant biology content and a short reflection . This reflection (hereafter referred as "pre-CBEL assignment") consisted of eight short, open-ended questions, three of which were about students' expectations regarding various aspects of the CBEL experience and five

focused on the biology and ecology of the English ivy within the park ecosystem.

This pre-CBEL assignment was given closer to the CBEL activity so that students could be "primed" for the community engagement and field experience. The pre-CBEL assignment had two goals: to prepare students for the CBEL activity by encouraging them to start thinking about what they might expect through this community engagement, and to help students see some connections between the invasive species removal activity and relevant concepts discussed in class. Moreover, the pre-CBEL assignment served an important purpose in the context of the present study, as it allowed us to document students' expectations about the CBEL activity and provided us with a point of comparison to evaluate how students' understanding might change as a result of the CBEL experience. This assignment also informed the instructor's pedagogical practices as students' expectations of CBEL activity informed how the instructor shared further information about the CBEL activity and also its planning and execution.

The actual execution of CBEL activity involved four student groups of fifty to sixty students going to the City Parks over the course of two weekends. The activity was organized in four half-day sessions (either a morning or an afternoon per group) to accommodate for the students' midterm exams as per the university-wide timetable, and the community partners' schedule and feasibility to support and guide the learning of a large number of students. After participating in the invasive species removal CBEL activity at City Parks, the students completed a second assignment (hereafter "post-CBEL assignment") with the purpose of demonstrating, and reflecting on, their learning. This post-CBEL assignment was more comprehensive than the pre-CBEL assignment and included three sections.

The first section addressed students' familiarity with some of the organisms encountered at City Park and had them provide pictures of particular plant species that they took during the CBEL activity. The second section consisted of six questions (five of which were the same as the ones used on the pre-CBEL assignment) on the biology/ecology of English ivy. This section is where students could demonstrate their newly developed, or refined, understanding of community and ecosystem ecology. Finally, the third section of the post-CBEL assignment aimed at providing students with an opportunity to reflect on their learning experience beyond the biology content. This section comprised five open-ended questions inviting students to reflect on several aspects of their community-based learning of biology, on their impressions regarding the work that they accomplished, and on proposals for other possible community-based activities that would benefit the park's ecosystem and future Biology 1000 students.

From a pedagogical point of view, the objective of the post-CBEL assignment was to engage students in the next step of the experiential learning cycle (Kolb & Kolb, 2009) by encouraging them to actively reflect on their CBEL experience. In terms of the present study, the purpose of the five biology/ecology questions in common between the pre- and post-CBEL assignment was to document changes (or lack thereof) in students' views and understanding of the biology of English ivy and its interactions with the park ecosystem, while students' answers to the third section of the post-CBEL assignment ("reflection questions") allowed us to gain insight into how they experienced the CBEL activity and what skills they felt they developed through this community engagement.

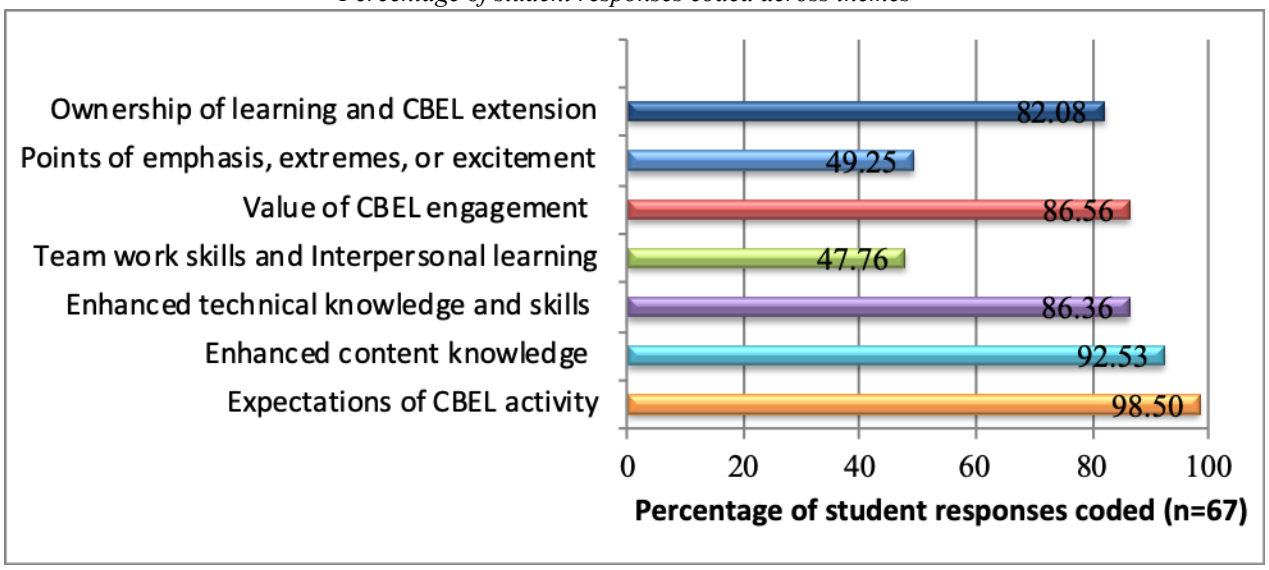
Purpose of the Study

The integration of a CBEL activity into the Biology 1000 was very resource-intensive, especially in the initial stages, and all of the instructors involved were new to CBEL pedagogy. We set out to document the impacts of this activity on the participating students specifically as a means to: a) justify the necessary resource investment and b) improve its quality and effectiveness in future iterations. This paper reports the findings of an analysis of pre- and post-CBEL assessments submitted in one section of Biology 1000 that took place in 2014-2015. The overarching guiding questions for the study were twofold: 1) How does students' understanding of the "Biological content" change as a result of the CBEL experience? 2) What additional skills and/or insights did students develop/strengthen from the CBEL experience?

Methods

To assess the impact of the CBEL activity on Biology 1000 students' learning, we gathered the written pre- and post-CBEL assignments from students in one of five course sections that participated in the CBEL project in 2014 – 2015. This section was comprised of total 221 students of which 145 (66%) self-identified as females and the remaining 76 (34%) self-identified as males. Based on their year of study, 203 of these students were in their first year, 11 (5%) in the second year and remaining 7 students (3%) were in the third year of study in the Bachelor of Science program. No other demographic details regarding students' age, gender, race, culture, sexual identity, socio-economic class, country of origin, citizenship or any other identification category were collected. Out of the total 221 students, only 203 students completed both pre- and post-CBEL assignments. All these assignments were anonymized by an independent individual, who was not involved with the course and the research processes in any way, and were then shared electronically with the university's CCEL office.

Figure 1
Percentage of student responses coded across themes



A team comprising four people—two CBEL experts, one graduate research assistant (one co-author) who had expertise in CBEL assessment and evaluation, and the Biology 1000 course instructor (the other co-author)—were involved in data analysis. An open-coding technique was employed to formulate the emerging themes and triangulate the data. All students' responses in the sample were coded across themes that emerged from the data which were analyzed qualitatively with the data analysis software NVivo. We acknowledge that this is primarily a qualitative study, however, to make these qualitative findings "appealing" to the members of the institution's Zoology and Botany departments (where most people are familiar and comfortable with quantitative representation of data) we "quantified" the responses by keeping track of the number of student responses coded across each theme and respective subthemes. In this study we report the "quantified" results based on the qualitative analysis of the first 67 randomized student responses. We consider these first 67 randomized student responses as representative of entire data corpus as subsequent analysis of remaining student responses did not yield any new themes.

Results

Our results indicate that by creating opportunities for students to relate their theoretical knowledge gained in the classroom with practical, hands-on learning in a real-world, outdoor, community setting, this CBEL experience served as a contextualized approach of making learning relevant and meaningful for Biology 1000 students. The main themes that emerged from the data show that almost all students gained a more nuanced or completely new understanding of ecological concepts. In addition, most students identified this CBEL experience as empowering, and they identified it as a valuable experience for themselves, for the community, country, and entire ecosystem. Many acknowledged that this experience has helped them in developing broader technical skills, which they can utilize in many other life contexts. Overall findings of the analysis of student responses coded across the key themes emerged are presented in Figure 1.

The following section includes details of each of the key themes as well as direct student quotes for each theme along with some pictures of Biology 1000 students engaged in CBEL activity:

Emerged Themes

Theme 1: Expectations of the CBEL activity. Prior to the experience 66 out of 67 (98.5%) students in our sample shared positive expectations of the upcoming CBEL experience. Recognizing that such experiences require hard work and could be challenging, most students enthusiastically identified their upcoming CBEL experience as a "fun, rewarding, interesting… educational, learning opportunity" which creates spaces for interactive team work as evident in the following student's quote: "I expect my field experience to be fun, rewarding, interesting, muddy, challenging, and a great opportunity to learn more about ecology." (Student 01_pre-CBEL Response). Similarly, another student expected the CBEL activity

Figure 2
CBEL Expectations: Twenty-one most common words

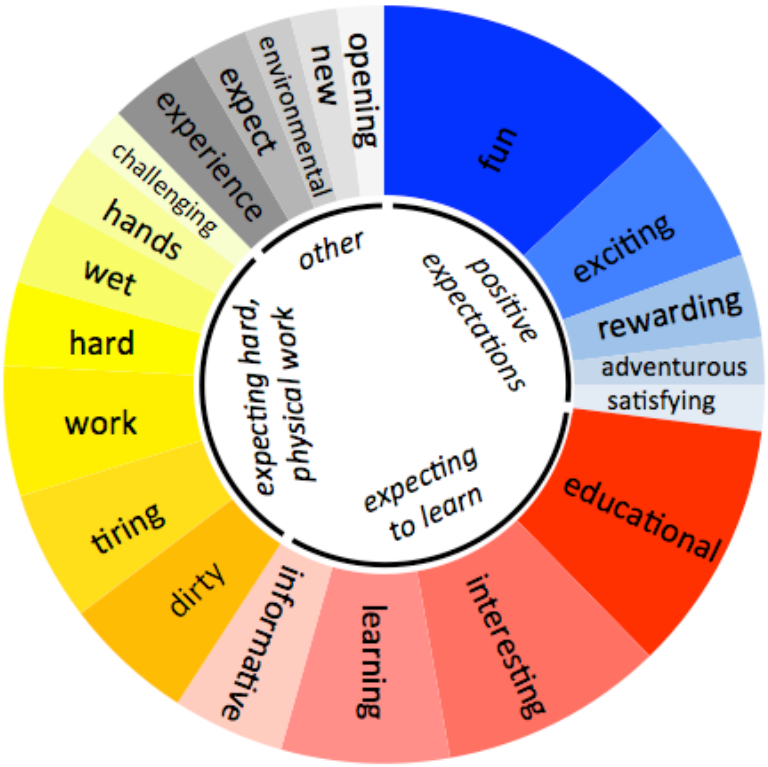
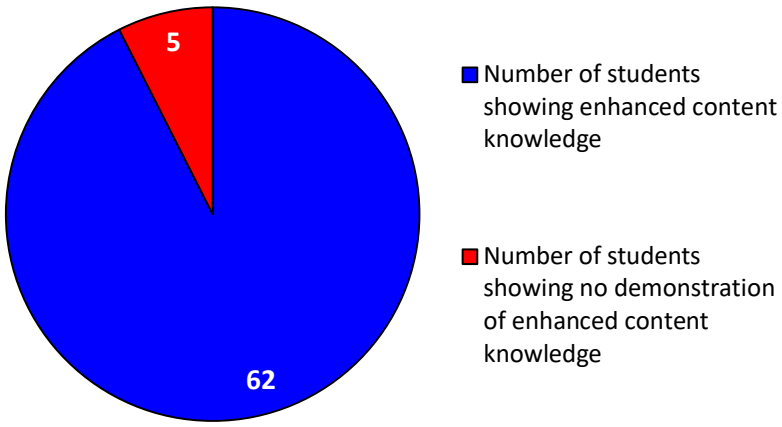


Figure 3
Overview of Enhanced Biology Content Knowledge



as an "Educational, interesting, labor, interactive, teamwork… (Student 09_pre-CBEL Response).

The twenty-one most common words that the students used to share their expectations of CBEL activity are shown in Figure 2, with the relative area assigned to each word representing the word's frequency. These most common words served as an informative framework for the instructor and gave the instructor an idea about whether most students were looking forward to going to the field or dreading it, whether they expected the CBEL activity to be very serious and rigorous or challenging-but-fun, and so on. These words also helped the instructor in making pedagogical decisions about the way the instructor talked about the CBEL activity in class.

Thus, through the students' expectations of CBEL activity, the instructor learned that students were going into the experience with a very positive mindset, expecting to have a "fun" experience, which they considered as "educational" and "interesting." The student responses expressing their expectations of CBEL activity as "work," "tiring," "hard," "challenging," "wet," and "dirty" helped the instructor in understanding that many students also had a very realistic view of what to expect of the CBEL activity: restoring an ecosystem is not just fun and excitement, it is also hard work in (sometimes) non-optimal conditions. Although these answers seem to show that students mostly expected the experience to be valuable for themselves (in terms of experiencing something positive, learning something and so on), the fact that students showed an overall positive expectation may speak to the idea that even an activity as simple as invasive species removal can be well-received by university students: students do not seem to feel like they are beyond this experience, or this is a too simplistic activity.

Theme 2: Enhanced content knowledge. The comparison of the 67 students' pre-CBEL responses to their post-CBEL responses revealed a positive impact of the CBEL activity. The experience of removing English ivy from City Park was clearly identified as a worthwhile component of Biology 1000 as after this activity, 62 out of 67 (92.53 %) students demonstrated enhanced content knowledge as indicated in Figure 3:

The majority of students (nearly 93%) gained a more nuanced or a completely new understanding of ecological concepts involved in the Biology 1000 course. Although there were some overlaps, we distinguished students' enhanced content knowledge as either more nuanced or completely new understandings. This distinction between more nuanced or completely new understandings was based on the shift in student's understandings as reflected in the comparison of their pre-and post-CBEL assignments. The more nuanced understandings involved a mention of certain biological concepts in the pre-CBEL assignment and a more comprehensive elaborated understanding of the same/similar concepts in the post-CBEL assignment of the particular student. Whereas when students post-CBEL assignments reflected a description or introduction of a new concept that was not mentioned in their pre-CBEL response to the same question, their responses were coded under the subtheme indicating completely new understandings.

Out of the 93% students who demonstrated enhanced content knowledge, 73% students exhibited a more nuanced understandings about a specific plant, English ivy, and its reproductive success, as well as physical features that make it a successful invasive species at the City Park. The following students' pre- and post-CBEL responses to the question, "What characteristics do you expect English Ivy to have that make it reproductively successful at City Park?", exemplify this shift in students' understanding. For instance, in their pre-CBEL response to this question, one of the students noted: "The [English ivy's] ability to reproduce in mass amounts as well as overtake the resources and nutrients from other plants" (Student 76_pre-CBEL response). In the post-CBEL response of the same student, we could see the shift in understanding from a generalized to a more specific content knowledge, as evident in the following quote:

> This plant is so reproductively successful at [City Park] because it has the ability to produce lots of offspring and it has physical characteristics that help it when it is in competition with other plants. For example, it has broad leaves, which absorb sunlight and cover other plants that grow on the ground leaving them to die without sunlight. (Student 76 post-CBEL response)

Thus, in the pre-CBEL response, this student has listed generic factors and characteristics about the English ivy that one could expect any reproductively successful plant to have (high reproductive abilities and being an effective competitor). Any plant that reproduces successfully and is a strong competitor will do very well in the particular ecosystem (City Park), and in this case, the student does not have a sense of whether any one of the two factors may be more relevant. Instead, the student thinks that both factors must be important. The student response does not include any details about what characteristics of the English ivy allegedly make it successful at reproduction (there is no information on how the plant might achieve this success); and there are no details about what makes this plant an effective competitor (no information on what these "resources" and "nutrients" might be).

In post-CBEL response there is only a gradual shift in student's understandings. Although, the student does show a bit more specificity referring to the plant's ability to "produce lots of offspring," there is only a small change in the way the student talks about reproductive success. The post-CBEL response includes details on what makes the plant a strong competitor as the student points out that it is the physical characteristics of the English ivy that give it its competitive edge and provides a specific example describing how a given physical characteristic of the ivy affects the ability of other plants to access a crucial resource. Thus, the student response indicates more nuanced or deeper understandings of the same aspects that were mentioned in the pre-CBEL response but does not reflect any new understandings.

In addition to developing the above evident more nuanced understandings, in many cases students' enhanced content knowledge was demonstrated in form of a completely new understanding which was present only in the post-CBEL responses and, therefore, most likely gained through the participation in the CBEL activity. This completely new understanding was evident in 74.6% of students' responses where they shared their new understandings of the specific invasive plant under study, as well as its impact on native plant species and their ecosystem, as reflected in following student's response: "[Reproductive success of English ivy is due to] The lack of natural predators which allow it to reproduce unchecked" (Student 03 pre-CBEL response).

Thus, in this case, the student in pre-CBEL response mentioned the "lack of natural predators" as the only reason for English ivy's reproductory success. However, in the post-CBEL response, the student also talked about the botanical features and growth habit of the English ivy, as well as its ecological interactions with other surrounding plants. As evident in the following response, the student indicated new understandings that were gained by engaging in the CBEL activity:

> English Ivy lacks natural predators at [City Park], which allow it to reproduce unchecked and completely outcompete the native species which do have predators. The ivy also crowd out other low vegetation by covering the forest floor and preventing sunlight from reaching the ground. They also climb up trees and shrubs and restrict the amount of sunlight that reaches the leaves of the native species. The added weight of the ivy can also make it difficult for the tree or the shrub to grow properly. English Ivy grows across the forest floor and up the trunks of trees. (Student 03 post-CBEL response)

Theme 3: Enhanced technical knowledge and skills. In their post-CBEL reflections, the majority of students (86.36%) indicated enhanced technical knowledge and skills which involved observational techniques and also the mechanical skills that they could use beyond the Biology 1000 course as evident in the student's response: "I practiced my vine/weed-pulling skills, which was challenging physical work. I also developed observation skills by noting the different plant species around me in the area we were working in…" (Student 38 post-CBEL response)

In addition to learning specific desired skills of observations that one may consider essential with regards to developing scientific aptitude, the students' responses also indicated their learning of step-wise strategic planning which is in alignment with the scientific methods. The student responses indicated that engaging in this CBEL activity made them cognizant that for successful eradication of invasive plant species, its correct identification, as well as strategic planning while removing the invasive species in a particular area/ecosystem, are crucial:

> The most challenging aspect of removing the ivy is finding its roots in order to remove the plant completely from the ground. The task of finding the roots involves tracing the vine through low lying foliage, which could pose a danger to your eyes, and the vine is often entangled with other vines. Ivy that grows on trees grows incredibly thick and requires heavy duty tools in order to remove them. However, there is no need to look for the ivy's roots. You need only to separate the ivy from its roots. (Student 03 post-CBEL response)

Many of these students acknowledged that the development of these technical skills will also help them in other life contexts such as gardening, while strategic planning could be applied to managing time and deadlines. These perceptions are exemplified by the following student response:

> I had never thought to go about an invasive species removal so strategically, pulling the Ivy out along the edges first and working your way in. It makes so much sense, considering how much Ivy there was at the park, since it'll keep the English Ivy from growing further out into the park. I thought that was an interesting tactic to learn about and participate in. I also think that concept is relevant in many ways to life in general, starting at the more threatening spots and then moving to the other parts of the patch that pose less of a threat. You could even relate that tactic to schoolwork and deadlines, completing what's due first and then working your way to whatever comes next. (Student 24 post-CBEL response)

Theme 4: Team work skills and interpersonal skills. While developing team work skills was not

specifically included as an intended learning outcome of this CBEL activity, it was interesting to note that 47.76% students acknowledged that by engaging in this CBEL activity they have learned how to work as a team and have also developed their interpersonal skills as represented in following students' responses: "Teamwork was one skill especially we practiced a lot in the park. I worked in a small group of three, and we found it much easier to remove the Ivy if we all focused on the same piece and gave each other feedback and help" (Student 05 post-CBEL response).

Thus, the students emphasized focused and collaborative teamwork where they were able to support each other in completing the assigned task through constructive feedback:

> Through the working experience in the Park, I learned and develop teamwork skills. My group and I found out that it was more efficient if one person held the bag, while two other people pulled the Ivies and the remaining person collected the Ivies from those two people who are in charge of pulling. In order to perform a successful flow of removing English Ivy, communications between members are extremely important. (Student 56_post-CBEL response)

In the above example, again the importance of open communication and shared team-work, where each member has a particular role to play, are emphasized as keys for "successful" and timely completion of task of removing the invasive species.

Theme 5: Value of CBEL engagement. Many students acknowledged that this CBEL activity motivated them to learn more about ecology and continue community engagement as it provided them with an outdoor learning opportunity that was physically satisfying, mentally strengthening and morally rewarding. In their post-CBEL responses, 86.6% students characterized this CBEL activity as a collaborative outdoor experience which is valuable not only for themselves, but also for the park, community, and the country, as well as for the entire global ecosystem, as evident in the following response:

> I genuinely believe that this project was most beneficial to the forest. Without this trip, I would not have realized the extent of damage invasive species inflict on our environment, it was truly an eye opener. As well, it made me more aware of all the people who are so involved and dedicated to making their community a better place, motivating me to learn more about ecology. (Student 14 post-CBEL response)

Sharing that this was their first experience of engaging and contributing at a community level, many expressed a sense of pride, as well as a desire to continue such engagements through volunteering and to learn more about ecological concepts. The following student responses reflect appreciation of the CBEL activity:

- "Personally, I feel proud and accomplished from working in [City Park]. In the duration of several hours, I had the taste of being an ecologist and also an ecosystem savior. Knowing that the environment has become healthier and sustainable from my help made me realize my capability and importance as a Canadian citizen: (Student 56 post-CBEL response).
- "Since I have never contributed to any work on the environment of a park, working at [City Park], removing invasive species, and allowing other native species to thrive, made me feel a sense of pride. Being able to say I tangibly contributed on an ecosystem!" (Student 55 post-CBEL response).
- "I very much enjoyed the trip to [City Park]. I appreciated being able to spend time outside with my peers and being able to help restore a weakened ecosystem at the same time. It did not feel like work at all, and my friend and I have decided that we want to volunteer doing similar work at [another] Park throughout the year" (Student 66 post-CBEL response).

Theme 6: Points of emphasis, extremes, or excitement. Indicating their involvement in the CBEL activity was an exciting one, almost half of the students (49.25%) utilized exclamation points, italics, and/or strong metaphors to show their enthusiasm for what they have learned through this CBEL experience. Some examples of varied sources of excitement during the CBEL engagement are evident in the following students' responses. One noted, "One of my most favorite parts, however, was seeing the salamander! I have only ever seen such species in places like the zoo or aquarium, so seeing such a cool animal in action in nature was really amazing!" (Student 01 post-CBEL response). Similarly, the students used exclamation marks to indicate their satisfaction and accomplishment: "I feel very satisfied about the work we accomplished at the park. With a lot of hard work, we managed to liberate two grown trees!" (Student 14 post-CBEL response). They felt proud of the contributions that they made in the community by "restoring the natural state," as evident in following quote: "The work I accomplished at [City Park] made me feel very proud that I was able to make (though small!) a contribution to restoring the natural state! (Student 01 post-CBEL response)

Theme 7 Ownership of Learning and Extension of CBEL experience. This CBEL experience motivated students to take ownership of creating their

own learning experiences. In their post-CBEL responses, more than 82% students provided recommendations that could help in making such experiences more worthwhile as well as suggested CBEL activities for future iterations of the Biology 1000 course. The student responses indicated their awareness of effect of pollution on the environment as evident in following student response:

> I find littering to be equally as damaging to an environment, where garbage such as aluminum cans can lead to paint spills in surrounding streams that could cause harm to organisms that live in the ecosystem. Something students could do is to pick up garbage around the park. (Student 13 post-CBEL response)

Thus, the student responses indicated their awareness of the "place" and the needs of the local community members, as well as the potential role that the Biology 1000 students could play in improving the natural environment and the community's engagement with it:

> Planting native species in order to make them more populous. This would benefit the plants and all of its consumers. Another activity students could do is create trails that run through the park so that users won't step on the many small shrubs and vegetation that lie on the forest soil (Student 21 post-CBEL response).

Discussion

The present findings of Biology 1000 students' involvement in a CBEL activity at City Park reverberates with the CBEL literature, as this experience not only resulted in enhanced content knowledge among most students, but also promoted development of additional technical skills, team work, and increased sense of social responsibility towards their own learning and contribution to the park, society, and ecosystem, the "place" with which they engaged.

Many students acknowledged that this CBEL experience motivated them to learn more about ecology and continue participating in CBEL activities as this experience provided them with an outdoor learning opportunity that was physically satisfying, mentally stimulating, and morally rewarding. The above findings are consistent with the literature on community-based experiential learning which suggests that CBEL experiences are an essential part of inquiry and can serve as a catalyst for enhancing students' learning and sense of social responsibility and civic engagement (Baldwin et al., 2007; Berman & Allen, 2012; Butin, 2007; Fusco, 2001; Harrison, Clayton, & Tilley-Lubbs, 2014; Myers-Lipton, 1998).

According to Dewey (1998), community-based learning experiences present students with experiences of inquiry which lead to dissonance and thus require students to take on complex roles often in unfamiliar and challenging situations. By critically reflecting on these experiences, students test and refine the knowledge and skills gained, utilize these to pose and examine new questions, and learn about themselves as learners.

The analysis of CBEL activity's impact on students' learning during their involvement in a Biology 1000 course resonates with the literature which posits that community engaged experiences have multiple positive impacts on students' learning regardless of the ways in which they are assessed (Eyler, 2000; Gemmel & Clayton, 2009; Kassabgy & El-Din, 2013; Warren, 2012). Similar to Bringle and Hatcher (1995) and Furco (2001)'s studies, the Biology 1000 students demonstrated enhanced academic learning when they engaged in CBEL activity. This experience allowed them to broaden their understandings of various ecological concepts which they learned theoretically in the Biology 1000 classroom, as well as to connect the theory with the practice by utilizing the course content learned in the classroom to engage in the hands-on tasks in a collaborative communal manner.

As indicated in the students' responses, the positive impact of the CBEL activity extended beyond the academic learning and induced deepened understandings of civic, social, moral responsibilities among Biology 1000 students, as also reported by Billig, Jesse, & Grimley (2008) and Wyss and Tai (2012). The students developed a sense of connection with the "place" as they were introduced to the ecosystem of the park, as well as to its uses by the public in recent history. However, considering the one-time, half-day aspect of the activity, we feel that in this CBEL activity, the "place" was present more in terms of the ecosystem (students were right there, in the ecosystem and its context) than in terms of community. The other aspect of "place" was that they worked on "helping" the ecosystem right in the ecosystem, alongside the professionals from City Parks, and thus were "immersed" in the community's ecological/ habitat restoration processes.

Thus, in alignment with the principles of CBEL and placed-based pedagogies, the students worked "with" the community "for" the sake of the community. Many of them expressed their desire to continue engaging in CBEL activities through varied volunteering opportunities, which indicated their perceived benefits of CBEL for self, local community, and wider global citizenry—as also mentioned by Soria &Thomas-Card (2014)—and willingness to "give back" to the community (Gray et al., 2000).

Limitations

Our goal here was to document the short-term impacts of the activity on the Biology 1000 students for resource justification and quality improvement purposes, so this study has several limitations. We acknowledge that due to the highly contextualized nature of this study, the findings cannot be generalized universally. Long-term follow-up with the students, as well as the instructors and community partners, may help in a more thorough investigation of the impact of CBEL activity on students' learning (Gelmon, 2000).

The utilization of students' reflections submitted in the form of pre-and post-CBEL responses also limits our ability to distinguish what the students actually feel and think from what they are able to express in their written responses, which were desired in English. This limitation could be addressed through a more rigorous data collection approach such as the one suggested by Polin and Keene (2010) where they used an ethnographic approach to collect additional forms of data. For assessing the changes in students' knowledge, skills, beliefs, and attitude regarding community involvement rather than relying solely on individual written responses, multiple sources of data could be used, *e,g*., focus group interviews, as well as exit interviews (taken by community partners with the help of interpreters if needed). The reflections collected as pre- and post-CBEL reflections could be replaced with Ash, Clayton, and Atkinson's (2005) series of reflection drafts to help gain insights regarding changes in students learning over the course of the term.

Conclusion

This study presents an independent assessment of the impact of CBEL activity on students' learning in an undergraduate science course in a large university. Even though the course instructor was actively involved in designing and implementing the CBEL activity and the preliminary coding for qualitative analysis, the overall analysis of students' responses was done independently by the university's Center of Community Engaged Learning's research professionals who were not involved in the teaching of the course and/or engaged with the students. Hence, as mentioned by Cooks, Scharrer, and Paredes' (2004), the results and insights generated from this study may have been different if the course instructor assessed students' responses.

Based on the above findings, this CBEL experience was deemed to be a worthwhile component of Biology 1000 and informed the future iterations of the course, as well as the teaching practices and curricular design in the course. At the time of writing, four more iterations of the CBEL activity have taken place, an indication that the course instructors and Biology Program, as well as the CCEL and the community partner, found the collaboration to be fruitful. Furthermore, the data collected as part of this study contributed to securing departmental support in the form of an experienced, dedicated Graduate Teaching Assistant position to coordinate the CBEL activities: to enhance, adapt, and mark the pre- and post-assignments; and to assist with the refinement of in-class activities that connect to the CBEL experience. While the specific activities vary slightly from year to year, and the level of involvement differs among course sections, the use of CBEL to teach a part of the ecology unit, as well as the collaboration with City Parks, have now become regular aspects of Biology 1000.

The insights generated from this study may help inform integration of CBEL components in diverse disciplines in wider Canadian and international contexts that value community as a source of knowledge, serving as an example for other higher education institutes that wish to promote students' academic, civic, and personal growth and strengthen university-community partnerships. Future studies may be conducted to investigate the impact of CBEL activities on faculty members' teaching practices and course design, as well as on community partners' involvement in supporting and assessing students' learning, and the organizational role and values of universities as done in other contexts (for example, Jameson et al., 2012; Kimball, & Thomas, 2012; Shapiro, 2012).

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