PROJECT REPORT

Exploring Interdisciplinary Co-Curriculum Service-Learning Through a Student-Formed Consulting Community

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Abstract

A campus-wide student-formed consulting community provides an interdisciplinary co-curriculum service-learning opportunity that connects students from various disciplines across a Midwest university to work on sustainability challenges in the local community. Projects include using waste glass in construction materials, cutting carbon footprint by a lighting retrofit, using a rain garden for stormwater runoff, and beneficial use of dredged materials. The real-world impact truly engages and excites students; taking action and serving the local community gives them a strong sense of connection to that community. Students also gain in their professional skills development, particularly in the areas of taking initiative, collaborating in a teamwork environment, problem solving, and communication/presentation skills. Faculty mentors consider this not only as a great experiential learning and civic engagement opportunity, but also an opportunity to collaborate with faculty in other disciplines, and some have extended service-learning projects to interdisciplinary research and grant opportunities. Challenges and lessons learned are also discussed.

Introduction

Service-learning is one high-impact educational practice (Kuh, 2010) that engages the student, university, and community in learning through authentic situated experiences, where individuals learn through participation and engagement (Fenwick, 2003). Steiner and Watson (2006) critically examined the implementation of service-learning in business education, highlighting a disconnect between the intended civic and ethical objectives of service-learning and its actual application in business curricula. It was found that nearly half of the courses treated service-learning projects as standard assignments, with only 18% explicitly emphasizing civic responsibility and community involvement in their objectives. Steiner and Watson (2006) reported that for service-learning to fulfill its potential in fostering civic engagement and ethical awareness, educators must clearly articulate and promote course objectives that integrate these values.

Service-learning is usually offered in the context of a single course, because "academic work traditionally segments knowledge into specific disciplines. . ." (Culhane et al., 2018). While the benefits of an interdisciplinary education that shapes well-rounded individuals who can think critically and solve complex, multidisciplinary problems are being recognized by many institutions of higher education (Lindvig et al., 2019; Culhane et al., 2018; Godemann, 2006; Zeppos, 2018), examples of interdisciplinary service-learning in the literature are typically between two disciplines or in a capstone course taught by instructors from two disciplines (Hill & Yazici, 2013; Marx et al., 2021; Culhane et al., 2018), with fewer involving more than two disciplines (Brassler ,2018; Marshall, 2013). In a study conducted by Zlotkowski (1998), a collection of case studies from diverse disciplines showcasing successful models of service-learning were summarized. This study provided replicable examples and inspiration for structuring a program with strong interdisciplinary emphasis.

Service-learning opportunities can also be implemented in co-curricular settings where community engagement is not bound to a particular course. Participation in these activities is not credit driven, as students voluntarily participate in a community engagement that is not integrated into their regular course of study (Judge et al., 2011). Co-curricular types of service-learning provide meaningful experiential learning experiences with widely reported positive learning outcomes, including a student's growth in academics, social maturity, critical thinking, communication, collaboration, and leadership skills (Saddiky, 2020; Bakar & Esa, 2017; Keen & Hall, 2009). While the values and benefits of applying an interdisciplinary approach to co-curricular service-learning are recognized (Bloomquist et al., 2022), such programs reported in the literature are scarce. Notably, an innovative interdisciplinary service-learning program that compliments the curriculum has been reported by University of North Carolina School of Medicine at Chapel Hill. In this program students who majored in seven healthcare disciplines—medicine, nursing, occupational therapy, pharmacy, physical therapy, public health, and social work—volunteered to provide monthly home visits to isolated, elderly individuals in the community with complex medical and social issues (McWilliams et al., 2008).

This article describes our exploration of an interdisciplinary co-curricular service-learning program in which no academic credits of any kind are earned. This program aims to enhance civic engagement and help students develop professionally though a student-formed consulting community. Faculty and staff from across the university have encountered many service-learning opportunities that require interdisciplinary collaboration, yet there is no mechanism within the university to implement them. In the meantime, it may be difficult for students to find a high-quality internship, often because of a lack of prior professional experience. This program presents an opportunity to address both issues. In this article, we describe the logistics of the program and present a few examples of community sustainability projects completed, feedback from students and clients, challenges and lessons learned. In conclusion, we discuss what we plan to do going forward.

This student-formed consulting community, the Innovative Consulting Community (ICC), is made up of Illinois State University (ISU) students and mentors and provides solutions to local for-profit and not-for-profit sectors. The ICC provides a mechanism to connect students across campus, from various disciplines, to work on real-world clients' problems, while giving students the

opportunity to further develop a creative mindset and to propose solutions to complex problems using innovative strategies. The program is university wide, drawing students and faculty mentors from across disciplines to serve real-world clients from the surrounding community. Students from all majors and any grade level are welcome to participate. The program's interdisciplinary nature successfully draws together students and faculty mentors from over 30 academic majors across the ISU campus, including the disciplines of business, music, theatre, dance, interior design, nursing, political science, public relations, psychology, foreign language, English, sociology, computer science, biology, geology, environmental science, agriculture, and education, to consider projects such as employee retention, providing fresh produce to students, sustainability practices, and marketing to millennials in the local community.

In the spring and early summer, projects are identified, scoped, and posted on the ICC website. The ICC website layout and content were tested with university alumni, who provided valuable feedback before the site went live. Projects are identified mainly by alumni, faculty, networking on LinkedIn, various university weekly email updates, social media of alumni and faculty, and word of mouth. After projects are identified, mentors with relevant backgrounds are identified and asked to participate.

At the beginning of the fall semester, students are introduced to projects through the ICC website. Each project has a detailed description. Marketing of the ICC website is mainly done through advertisements in the university's student newspaper, invited talks during the student association meetings, educating career and academic advisors who have close contact with students about the benefits of the ICC, and personal emails from the ICC faculty coordinator to students whose majors or fields of study are aligned with projects. Typically, there are four to six students working on a project and three or four mentors from relevant disciplines who provide technical guidance to these students. Student teams select a project manager, then function as a consulting team to achieve the project goals. In the fall semester, students complete a series of online learning modules available through the university's learning management system (LMS) to help prepare them for the consulting experience. These online learning modules offer fundamental training in leadership, project management, design thinking, and how to work as a team and be effective as a team. Students complete the modules on their own time, without receiving course credit, and are graded on a pass or fail scale. Following successful completion of the modules, students spend months researching and fine-tuning recommendations for the organizations. Faculty mentors serve as student team guides rather than supervisors and are expected to meet with student teams once every two weeks in the spring semester. The faculty mentors help the student teams follow a design-thinking model: define and understand the problem; develop an array of solutions by engaging with users/clients to fix the problem; and finally, pick the best of those solutions through testing, analysis, and experimentation.

At the end of the spring semester, students present their findings/solutions to the clients with an oral presentation and a final technical report. The time commitment in the fall semester is approximately 15 hours (total, not per week) and the spring semester time commitment is approximately five hours per week until mid-April.

ICC Sustainability Projects

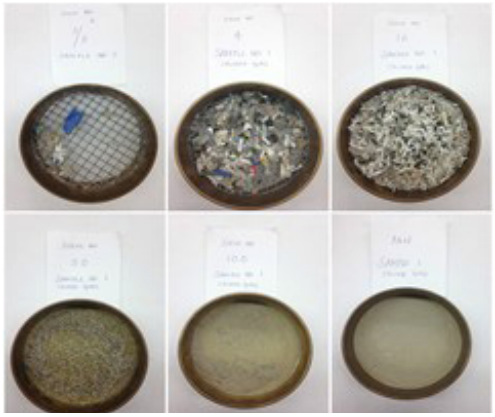
In this article, we present a few ICC projects that focus on environmental sustainability, such as beneficial use of waste glass, cutting carbon footprint through lighting retrofit, and other sustainability practices in the local community. Universities play a unique role in addressing climate change and creating a sustainable society, by demonstrating best practices, researching solutions to real-world problems, educating future communities and leaders, and promoting sustainability (Barth et al., 2014; Evans et al., 2015; Ralph & Stubbs, 2014). Specifically, students working on the projects presented in this paper majored in environmental health and sustainability; construction management; geography, geology, and the environment; conservation biology; agriculture; and business.

Waste glass to construction material

This project involves working with a local single-stream recycling company. Their recycling process produces a broken glass material that is difficult to recycle because of mixed color, contamination, and small size (Figure 1). The company is losing money from glass recycling and

FIGURE 1. (a) Stockpile of Waste Glass at Local Recycling Facility
(b) Sieved Portions of Cleaned Crushed Waste Glass Obtained from Local Recycling Facility

1a



1b

FIGURE 2. Students making and testing flowable fills samples with cleaned and grounded waste glass powder (a) application of flowable fill in the field; (b) cleaned and grounded waste glass powder coarse (left) and fine (right); (c) flow test; (d) making flowable fill specimen for strength test; (e) dried flowable fill specimen for strength test; (f) strength test

2a

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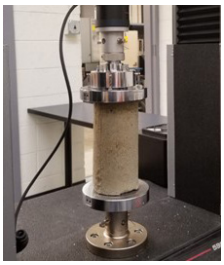


2f

will stop the glass recycle program unless they can find a market for the waste glass.

Our students proposed that broken glass be used in construction material, specifically in Controlled Low Strength Material (CLSM), also known as flowable fill, which is widely used for non-structural purposes such as backfill or road bases (Figure 2a). Recycled Glass Powder (RGP) is well known as an effective pozzolan in concrete and in many applications is equal or superior to conventional Portland cement or its alternative such as fly ash, if milled to <50 μm (Dyer & Dhir, 2001; Shi et al., 2005). Using waste glass powder as a partial replacement for cement is a sustainable practice, as it cuts carbon and toxic pollution associated with manufacturing cement (Islam et al., 2017; Jani & Hogland, 2014). The cement industry is the third largest source of industrial pollution, emitting more than 500,000 tons of sulfur dioxide, nitrogen oxide, and carbon monoxide per year (USEPA, 2024a).

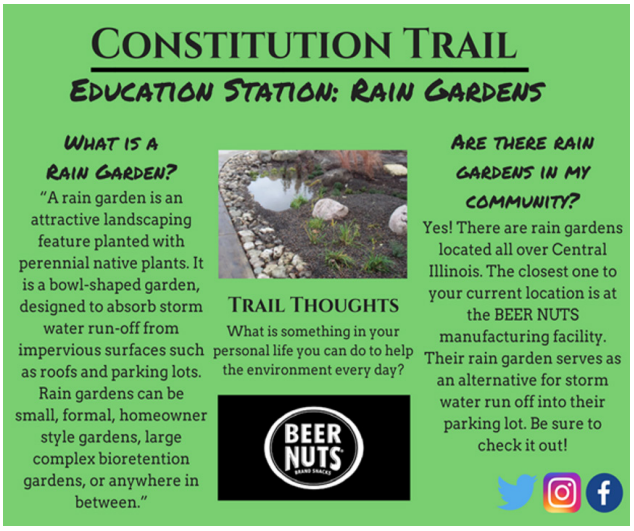
Students worked with local concrete companies to make flowable fill concrete using waste glass and test its properties (Figure 2b–2f). Students also worked with the local public works department to determine the annual demand for this type of concrete and proposed this to the recycling facility.

Lighting retrofit to cut carbon footprint

This project serves our local snack brand, BEER NUTS®. They are hoping to cut their carbon footprint, eliminate mercury exposure, reduce cost, and improve the productivity of their employees through a retrofit of their lighting system. Currently the company is using florescent lights, which contain mercury. Lighting is one of the largest uses of electricity in the facility, contributing to the plant's carbon footprint as well as its operating costs. To reduce both costs and greenhouse gas emissions, the company retrofitted the plant several years ago with more efficient fluorescent lighting. However, recent improvements in LED (light-emitting diode) lighting offer an option even more efficient than fluorescent lighting (USEPA, 2017). In addition, because fluorescent lights contain mercury, they must be recycled at a significant cost, and the presence of mercury-containing equipment in a food production facility is always a concern. Therefore, replacing fluorescent lights with LED lights could have a number of benefits for the company and the environment (Hoang et al., 2020; Shahzad et al., 2015; Souza et al., 2019). After a detailed tour (Figure 3) and energy audit of the facility, students conducted a thorough analysis of the bulb options, replacement costs, maintenance, recycling regulations, and incentives offered

FIGURE 3. Students and CEO of Beer Nuts (first from the left) after touring the facility.

FIGURE 4. Educational Sign Outside Rain Garden



by local energy suppliers. Then, the team came up with three retrofit scenarios for the facility. For each scenario and each sub-option, students calculated and presented energy savings, greenhouse gas emission reductions, cost savings, and other financial metrics. The team provided their recommendation for the best option, and the company has implemented the team's recommendation.

Rain garden for storm water management

BEER NUTS® is also looking for a way to minimize storm water runoff from their property and the associated storm water fee. In addition, precipitation surge in parking lots that freeze during the winter has been a terrible fall hazard for their employees and customers. Our students proposed using a rain garden to address this problem. A rain garden is an attractive landscaping feature planted with perennial native plants to slow runoff, encourage infiltration into the soil, reduce flooding, and reduce storm water fees (Asleson et al., 2009; Ishimatsu et al., 2017; Sharma & Malaviya, 2021). Based on the roof and parking lot area and local weather conditions, several local landscaping companies were contacted and asked to design and estimate the cost of a rain garden, and one is recommended by the team. Since the BEER NUTS® facility is very close to the Constitution Trail in town, students proposed placing an educational sign at the section of the Constitution Trail close to the facility. The sign (Figure 4) will educate the public about the environmental benefit of a rain garden and the importance of storm water management.

Beneficial use of dredged materials

A student team worked with U.S. Army Corps of Engineers (USACE) on this project. As a result of USACE's continuous clearing of waterways for improved aquatic navigation, a surplus of more than 2,000,000 cubic yards of dredged material requires sustainable repurposing. After analyzing reports provided by USACE and related literature search, the student team proposed that engineered soil be created by mixing the dredged material with various amounts of agricultural by-product, municipal tree waste, manure, and backwater sediment, depending on the final beneficial use of the engineered soil. The team also identified five potential applications/markets where the engineered soil could replace current materials in construction, habitat building such as artificial and oyster reef creation/restoration, landfill covering and lining, soil remediation such as increasing moisture content, and soil for university farms (Schelinski et al, 2020; USEPA, 2024b). The student team conducted surveys across the five potential markets. Survey questions included feasibility considerations in terms of desired material composition, locations of the application sites, and costs associated with use and transportation of the dredged material. Finally, the team provided their marketability plan to USACE based on the results drawn from the survey results.

Feedback of participating students and clients

Since ICC is co-curricular, participating students do not complete a standard college course evaluation; instead, students are encouraged to share their reflections on the experience through a campus news platform. Student

TABLE 1. Themes from Students' Feedback

Themes	Example quotations that fit each theme
Civic engagement	"I chose this as a good way to get involved and make a positive impact on the community while learning as well." "I am more aware of community needs and felt that I could contribute and make a difference." "I am so excited to lead a project that gives back to and improves the community." "I was able to learn so much about my local community, our conservation efforts in play right now and what we could be working toward regarding conservation efforts in the future."
Real-world impact engages and excites students	"I think my favorite part of working on this has been knowing that the work myself and my teammates are doing is going to bring a real and tangible impact in the real world and someone's life. The knowledge that I played a part in helping someone has really made this all worthwhile." "Working with a real group has made everything feel much more substantial and impactful. I won't remember all the simulations I did in my classes, but I will remember the clients and the firms that we've worked with for this project." "Real-world clients equal real-world impact. The opportunity to help an organization attempting to create a valuable product for people in need is rewarding. Working in the real world is different because there isn't a blueprint or rubric to pull from. We have been given an issue and are trying to figure it out as best we can." "In the classroom, our ideas don't often move beyond the hypothetical. It was exciting to work on this project because we had the opportunity to propose solutions that will become a reality in the coming months."
Professional skills development (taking initiative, problem solving, teamwork, communication, presentation)	"It opens up a lot of doors and you have to teach yourself a lot." "Our mentors were definitely there for help, but it was mostly our group that set up all of the meetings and held ourselves to the deadlines." "You learn a lot of skills that you can apply to your career; definitely problem-solving and conflict management were two of the biggest things." "The project taught me how to collaborate with people from different backgrounds, how to organize better, and how to effectively communicate with my teammates." "Knowing this is a new class implemented in ISU, I find it to be one of the best I've ever taken. It truly dives in depth into problems and challenges you will come across in your life and will have to solve." "The final presentation was the most rewarding part of this experience. I look forward to seeing the launch of the merchandise line. It's fulfilling to see a project through from start to finish."

reflections from this news platform as well as mentors' observations during project meetings and final presentations are summarized in Table 1, with three themes identified. Because they take action and serve the local community, students feel strongly connected to it . The real-world impact truly engages and excites students; students feel that it is rewarding to make a difference and help people in the wider community. Finally, students feel they have made significant progress towards professional skills development, particularly in the areas of taking initiative, collaborating in a teamwork environment, problem solving, and developing communication/presentation skills.

Clients are generally pleased with their experience. Clients' feedback was drawn from observations at regular project team meetings, comments during final oral presentation and communication following submission of the final project report. Feedback from clients is summarized in Table 2 with three themes identified. Clients not only appreciate the information and new ideas student teams provided, but also concepts that were easy to act on. A few have already been implemented. Clients are also impressed with the professionalism student teams have demonstrated including taking initiative, problem solving and critical thinking skills, and good teamwork, as well as communication and presentation skills.

TABLE 2. Themes from Students' Feedback

Themes	Example quotations that fit each theme
Real-world solutions implemented	"Not only did we get the information we requested, they also provided us with many additional alternatives that we did not consider and one we ended up choosing." "They approached the task methodologically by first understanding the challenge, doing in-depth research and providing viable real-world solutions that can be implemented by my organization." "The students not only provided our department with new and exciting ideas, but also delivered concepts that were easy to act on, two of which have already been implemented this season."
Professionalism (taking initiative, communication, presentation, critical thinking, teamwork, problem solving)	"Regardless of the distance, they managed meetings and kept ongoing communications with my team and myself." "We met biweekly with the students, who had great questions. We were able to give them some direction, but they were creative in finding solutions and taking initiative to research the topic." "They were problem solvers. They asked for some information but were able to dig into it to find meaning and relevance. They looked at the problem from many different perspectives and provided suggestions from those perspectives. They also did not just provide one solution because of the complexity of the topic they worked on throughout the semester." "The presentation itself was professional, and I was impressed with the delivery of their material." "I'd be interested in participating more with ICC and doing more of these projects and getting more of our business units involved to get that exposure to thinking differently and to thinking longer term."
Assistance in decision-making	" The LED project was extremely helpful in our decision making, The team gave us the facts to clearly direct decision-making." "Depending on the information delivered and the conclusions drawn, that could help us make or break certain decisions that we may be indifferent about."

Discussion and Going Forward

A campus-wide student-formed consulting community provides an excellent interdisciplinary co-curriculum service-learning opportunity to connect students from different disciplines across campus to work on real-world problems and challenges in the local community while developing competencies and skills transferable to the workplace. Students feel strongly connected to the local community because of the actions they have taken to serve it. The real-world impact truly engages and excites students; students feel that it is rewarding to make a difference and help people in the wider community. Students also gain in their professional skills development, particularly in the areas of taking initiative, collaborating in a teamwork environment, problem solving, and communication/presentation skills.

These findings are consistent with outcomes of co-curricular service-learning reported in the literature (Hamid et al., 2024; Cruz et al., 2024; Baker & Esa, 2017; Mann & Casebeer, 2016). Marzouk (2008) presents several such programs at Virginia Tech and highlights the gain in students' civic engagement and leadership. John et al. (2019) show statistically significant positive influence in students' commitment to democratic values. Professional skill development is another prominent learning outcome that is well documented (Saddiky, 2020; Keen & Hall, 2009). Improved career opportunities and job interview skills are also reported (Cruz et al., 2024; the Ohio State University, 2020).

Civic engagement is defined as "working to make a difference in the civic life of our communities and developing the combination of knowledge, skills, values, and motivation to make that difference" (Ehrlich, 2000). At our university, civic engagement involves developing the combination of knowledge, skills, values, and motivation to make a difference in the civic life of our communities and promoting the quality of life in a community through both political and non-political processes. We believe that student-formed consulting communities follow this definition of civic engagement, and we should celebrate them.

There are various challenges encountered and lessons learned in this program. Financial support of a dedicated ICC faculty coordinator who is responsible for running the program is a necessity. In our case, a small endowment allows for one course release time each semester for the coordinator and nine months of support for a graduate assistant each academic year. Continuation of such financial support is essential for the viability of the program. Financial support of co-curricular service learning is a challenge that is often encountered (Moore & Gayle, 2010).

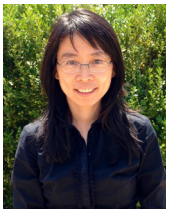
A substantial time commitment is another big challenge for co-curricular programs (Olewnik et al., 2023). In our case, we found that it is imperative to inform students early on of the time commitment so that they can plan their course loads or other responsibilities carefully for the following spring term when project workloads get intense. The issue of students dropping out of a project team a month or two into the semester has been addressed successfully after the time commitment has been explained and emphasized early on. However, for students who work 15 or more hours in addition to their classes, this program is not feasible. Providing this program with an alternative option as an independent study course could be a possible solution. Other ways to make this program more inclusive are resource intensive and will need university support.

The initial meeting between the student team and faculty mentors is also important. In that meeting, students can learn in more detail about the scope and the specific objectives of the project and what is expected of them, and then decide if this is the project for them.

Mentors are not compensated in this program. Faculty mentors view this not only as a great experiential learning and civic engagement opportunity, but also as an opportunity to collaborate with faculty from other disciplines and extend some of these projects to interdisciplinary research and grant opportunities.

Going forward, students will have the option of participating in this program for academic credit as an independent course. This will accommodate students who have to work significant number of hours on top of classes. We also plan to conduct a systemic assessment of this program including both quantitative and qualitative components. Feedback from the assessment will provide additional guidance on how the program could be improved. Since STEM majors are involved in this interdisciplinary program, feedback on the impact of this program on students' commitment to continuing in STEM careers will be included.

About the Authors



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