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INTERACTIVE POSTER: DESIGN FOR COMMUNITY: PERSPECTIVES FROM PROFESSORS, STUDENTS AND COMMUNITY PARTNERS

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ABSTRACT

Santa Clara University has a commitment to educating competent, conscious, and compassionate students. Engineering education has a need for more real world, hands-on, and team-based problem solving. Our project aims to showcase a collaboration between an engineering course (Community-Based Design) and SCU's Food Justice Outreach Program, Bronco Urban Gardens, which has successfully incorporated student learning and social justice through project-based learning. Overall we will discuss three different perspectives of those involved with this collaboration, specifically detailing participation goals, success definitions, and challenges from each point of view. Some specific student-produced design solutions will be given as examples of this effort.

1 INTRODUCTION

Higher education in engineering has a need for more hands-on, team-based problem-solving with real customers and design practice. Santa Clara University, as a Jesuit University, has an overarching commitment to educating competent, conscious and compassionate students. The partnership between Community-Based Design (ENGR 110) and Santa Clara University's Food Justice Outreach Program, Bronco Urban Gardens (BUG), is a reflection of the University's mission and a response to this need.

Our proposal aims to showcase problem-based learning for social justice, using three different perspectives to explore the collaboration between Bronco Urban Gardens and Community-Based Design. The perspectives include the Bronco Urban Gardens coordinator, the course instructor, and students previously enrolled in the course. Each collaborator will share

their experiences and identify a framework for how problem-based learning in higher education can be achieved in a community setting. Each framework will detail participation goals, give results, and review challenges that emerged from this partnership, along with how these challenges might be addressed.

2 BACKGROUND PERSPECTIVES AND PARTICIPATION OBJECTIVES

Bronco Urban Gardens

Solidarity is central to the mission of Bronco Urban Gardens, and it frames the projects and programs designed for student engagement. Often referred to as BUG, Bronco Urban Gardens is the food justice outreach program of Santa Clara University. Based out of The Forge Teaching and Organic Garden, Bronco Urban Gardens works within marginalized neighborhoods and communities, supporting garden projects and spaces that create hands-on learning experiences for students of all ages and backgrounds, including SCU undergraduates. BUG provides technical support and garden-enhanced education that serves to increase ecological literacy, unpack issues around food-access, and raise nutritional awareness.

Bronco Urban Gardens has three hubs that include a partnership with a local shelter and two school gardens in the San José Unified School District. ENGR 110 student projects have been incorporated into the Washington Elementary and Gardner Academy school gardens, which are located at the base of downtown San José. As Title I schools, Washington Elementary and Gardner Academy receive additional federal funding to help serve their student populations who face significant challenges related to systemic poverty in their neighborhoods. Their students often enter the school day hungry, tired and not fluent in the language spoken around them. 94% of Washington and 76% of Gardner's students are on the free and reduced lunch program. 70% of Washington students are English Learners, while 60% of Gardner students are English Learners.¹ These statistics share a certain stark reality; however, the resilient nature of each school community as lead to unique approaches to the challenges they face. For example, at Washington Elementary a formation of mothers has created a volunteerism program- Madre-a-Madre.² In addition to a seasoned teachers, Washington also has a robust support staff and a range of

¹ Data from the EdData Educational Data Partnership website, accessed 12/10/2017

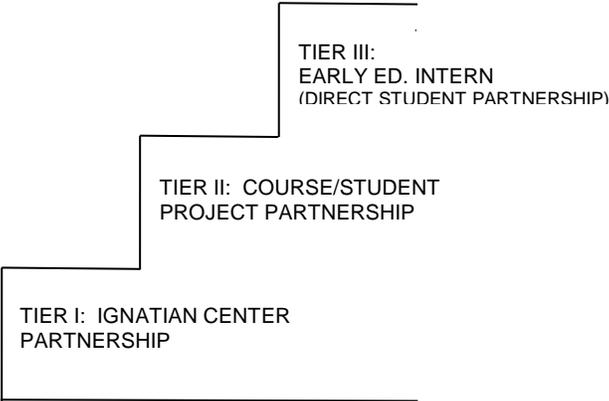
<http://www.ed-data.org/district/Santa-Clara/San-Jose-Unified>

² More information about Madre-a-Madre can be read at UEP post by Benjamin D. Baldwin 11/27/2015, <http://sites.tufts.edu/uepblog/2015/11/27/giving-what-you-have-community-development-in-the-washington-neighborhood-san-jose-california/>

enrichment programs orchestrated by their principal, Stephanie Farias. On the Gardner campus, principal Daisy Rosas has begun the work of connecting community partners that range from Second Harvest Food Bank to Estrella Family Services. Her consistent leadership has increased collaboration, serving to create a more cohesive network of support. Both school communities embrace working with Santa Clara University, showing a willingness to collaborate with BUG and ENGR 110.

BUG core objectives focus on learning from the resilience so well exhibited by these vibrant communities and achieved through the meaningful connection between undergraduates and community members. It is through this connection that undergraduates learn with and from community members. The BUG undergraduate engagement is best understood through a 3-tiered partnership model, beginning with our Ignatian Center partnership, as shown in Figure 1. This partnership places approximately 15 undergraduates each quarter in BUG hubs through the Arrupe Weekly Engagement. The second tier of engagement is supported by partnerships directly with a specific undergraduate course or student project, and the number of students involved vary each quarter. The Early Education Internship is the final tier of engagement, where a student partners directly with BUG. This is a relatively new BUG program, which provides garden time for TK students at Washington Elementary.

Figure 1: BUG partnership model illustrating stages of engagement



The ENGR 110 partnership falls within the second tier of engagement, and the partnership supports the school gardens of the Washington Elementary and Gardner Academy. BUG works directly with students in this class on specific projects, providing a community

context for the objectives set by the professor. For the context of ENGR 110, community is defined as individuals potentially using the educational builds designed for the school gardens. This encompasses the K-5 classrooms, extended day programs, as well as BUG garden-education programs. It is worth noting, especially with respect to the Gardner Academy, the homes surrounding the school gardens should also be considered as part of the community. The student work in ENGR 110 serve to increase the use of the garden as well as enhance the overall look of the space, serving to deter vandalism and dumping in this part of the neighborhood.

3 COMMUNITY-BASED DESIGN

ENGR 110 is a 10 week project-based course, where student teams are partnered with a local community business or organization and complete a design project from problem identification through final prototype. The purpose of the course focuses on “hands-on” experience in project management, building cross-disciplinary team skills, communication, and prototyping. ENGR 110 also fulfills SCU’s Civic Engagement core requirement. As a Civic Engagement course, the primary learning objectives include ‘critically evaluating the role of public organizations’ and ‘analyze and evaluate civic issues by engaging in active and collaborative learning’. Thus, social justice is a theme throughout the course and it is embedded in of many course activities.

Some examples of course activities include an initial design project where students build a card tower in-class. Some project constraints exist for the card tower, but an unspoken objective is for students to ask the customer for more input through the design phase. Students quickly realize that not requesting or clarifying the customer’s input will lead to a less successful project. Another course activity is where student teams interview their community partner on-site at the project location. This activity is meant to illuminate project parameters defined by the actual space and aid in determining critical customers for their project. This activity, along with reflective assessments geared towards understanding the social and civic realities by the targeted community, help the student design towards the community needs. By the end of the term, students will have designed and built a project conforming to project specifications determined through this partner/student collaboration, which is managed by the course instructor. ENGR 110 student learning objectives are fulfilled when students are more aware of their target community and its particular wants and needs, are able to develop a design which meets these needs, are

successful in communicating their designs, and are able to satisfy the community partner with their project results.

The BUG outreach program is one community partner that provides a community context for student projects. Projects are aimed to fulfill a want or need that the community has; for the BUG hub schools, projects completed are often aimed for K-5 children and can be used as part of curriculum for the teachers to enrich learning. Due to the nature of the BUG hub schools and their location, there are often other community issues which must be considering including vandalism and theft of any project installations. The ENGR 110 community partner serves as the ‘client’ or liaison for the community. In this case, the BUG coordinator serves the Washington and Gardner Elementary schools and communities and helps student teams understand the wants and needs of the community.

4 STUDENTS

Students participating in this course are diverse in age, major, and experience. In a typical class, approximately half to three-quarters of the students are engineers and the remaining students are from the College of Arts and Sciences or the Business School. Students are a majority juniors and seniors, but they will usually span from first-years to super-seniors. Students are placed on teams with 2-5 team members, which are vertically integrated and disciplinarily mixed to ensure diversity of experience and perspective for every team.

It is also worth noting a few student demographics about the undergraduate student at SCU. Overall, the student population at SCU is around 51% white, 18% hispanic, and 19% asian.³ About 62% of undergraduates are from California. While 77% of students receive some kind of financial aid, the median family income of a student is \$193,100.⁴ This is worth noting, because a majority of our students will not have first-hand experience with a community such as the BUG hub school sites. Thus, students must work to empathize with community surrounding the school gardens, to ensure that their project designs will effectively meet community needs.

Students take ENGR 110 for a variety of reasons. Some students are simply hoping to fulfill their Civic Engagement core requirement, but many students are looking for actual projects

³ Data from the SCU Class Profile website, Accessed 12/15/17. URL: <https://www.scu.edu/admission/undergraduate/choosing-scu/class-profile/>

⁴ Information from the NY Times website, accessed 12/15/17. URL: <https://www.nytimes.com/interactive/projects/college-mobility/santa-clara-university>

to build and impact a local community. A few self-identified student goals for enrolling in the course include “improve my engineering skills and use my creativity in a way to benefit society”, “create a working, functioning product or prototype for a community that has an actual positive impact on the residents and their daily life”, and “gain some engineering experience, learn about the engineering design process, and work as a team”.

5 COLLABORATION AND PROJECT RESULTS

Through an ongoing collaboration between Community-Based Design (ENGR 110) and BUG, several student projects have added educational dimensions to the school gardens and created a positive visual impact to the spaces. In a two year period, over the course of three quarters, student teams were able to ideate, design, and build 3 different projects for the elementary schools including a Mobile Cold Frame (Figure 2), a Weather Station (Figure 3), and also a Root Viewer and Scale (Figure 4).

Figure 2: Mobile Cold Frame installed at Washington Elementary (Spring 2016)



Figure 3: Weather Station installed at Gardner Elementary (Fall 2017)



Figure 4: Root Viewer and Scale installed at Gardner Elementary (Fall 2015)



Each student team had to factor in environmental constraints, both physical and contextual in nature. The threat of theft and vandalism was a significant concern at Gardner Academy, making it necessary for installations to be permanent as well as developmentally appropriate. Physical space in the Washington school garden is limited, due to its location in the central courtyard of the school. This required the students to create a mobile design that could be tucked away, when garden programs were not in session. While each ENGR 110 project helps to

build out the existing space, supporting multiple learning purposes in each school garden, the builds should be seen as byproducts of community engagement.

Students and community stakeholders need to mutually benefit from the relationship formed through engagement. The benefit on the part of the students, from the perspective of BUG, is the opportunity to engage in the school garden, explore a range of content their projects might support, and witness the joy and resilience of the community through interaction. The relationship with community members is shaped by how ENGR 110 students actively listen, ask probing questions and show a willingness to engage. One excerpt from a recent ENGR 110 student states:

“Getting the chance to actually go into the school and interact with the students was a very helpful experience, I loved seeing how curious they were with the environment and how hands on they liked to be. This suggested to us that our design should be something very tangible, where the students could feel the instruments and wouldn't have to worry about breaking it. Similarly, seeing how distracted they were when it came to following instructions inspired me to use bright and bold colors that would draw their attention. Getting to know the students also completely changed our perspective on sizing of the weather station, as they turned out to be significantly smaller than we had imagined them to be. Finally, a lot of our design was influenced by you, both by your enthusiasm for the garden, and by your suggestions on what would best suit the academic curriculum of the students.” (Marina Predovic, ENGR 110 Student)

Marina explains how a meaningful connection offers undergraduates the space to practice and apply what they are learning in the classroom back on campus; moreover, how partnerships can support the creation of engaging educational spaces that offer inclusive learning opportunities for all participants.

In ENGR 110, these projects have been successful from both the course instructor and student perspectives. From the course instructor perspective, it is always rewarding to see how students progress through the quarter, build their team dynamics, manage projects, develop communication skills, and ultimately design a team project that has a direct impact on a local community. This project-based course allows students to learn more effectively as they directly experience community partner interactions, visit school communities, and build a physical project. The experience of taking a project from initial ideation all the way through project installment is extremely rewarding for the students, and they often find the ‘engineering’ or technical aspects the least challenging. Another huge aspect to the experience offered to students is in having community partners who allow creative freedom for the student teams. When a partner can allow a design to grow organically as student ideas mature, students feel much more

engaged in the design process and invested in the final design. Additionally, the rewards from community impact are more personally felt. A student said it best:

“Lisa was a huge assistance for us towards our project mainly because she set very few requirements and allowed us to be creative. She trusted our adjustment and allowed us to be innovative in our approach.”
(Catherine van Blommestein, ENGR 110 student)

Directly from the ENGR 110 student perspective, students have been very proud of their project accomplishments and their community impact. Some quotes from a self-reflection assignment for each project that revolve around connection with their partner and target community are provided below in Table 1. In addition to these student quotes which highlight the project-community impact, the students also reflected on other course learning objectives attained. Objectives specifically mentioned included the importance of teamwork, especially for multiple perspectives gained, the value of communication, both between team members and between the partner and team, as well as their improved ability to manage their project both in understanding and communicating user needs and organizing their time management. One student quote resonates this point:

“I never thought that a small 2 unit class... would turn into a project to improve the quality of life for people.” *(Francesco Petrini, ENGR 110 student)*

Table 1: Student reflection on BUG project development

Project	ENGR 110 Student Reflective Quotes
Mobile Cold Frame	<ul style="list-style-type: none"> ● <i>“The BUG program helps educate kids about gardening and helps them get off their phones and disconnect from technology for a little while, providing more balance in their life. It also provides them with a safe haven from their troubled neighborhoods and a way for parents of the kids to connect, as many of them are volunteers in the garden.”</i> <i>(Ben Brown)</i> ● <i>“Personally, it was great to know that I was making a difference in the lives of elementary kids, as well as creating a means of education for them and the process has been a really rewarding experience.”</i> <i>(Ben Brown)</i> ● <i>“My group and I are providing far more than gardening equipment to our community partner—we’re providing a tool for community engagement”</i> <i>(Francesco Petrini)</i>
Weather Station	<ul style="list-style-type: none"> ● <i>“[This course] made [our team] appreciate being able to create something that our community would really appreciate.”</i> <i>(Marina Predovic)</i> ● <i>“I realized how important understanding your environment, your partner, and your customer are in making a project that would be able to stick around for awhile.”</i> <i>(Christi McKnight)</i> ● <i>“My project gave me a sense of purpose, a target that I could map out and construct, that I knew would positively impact the students.”</i> <i>(Marina Predovic)</i> ● <i>“The BUG organization works with SCU to help out many schools around the area create a garden setting for students to learn in. It is through this organization that we were able to help out the Gardner Academy and the kids to attend. I believe that</i>

	<i>it is through this organization that we are going to be able to impact these kids in a positive way.” (Christi McKnight)</i>
Root Viewer and Scale	<ul style="list-style-type: none"> • <i>“Both we here at SCU and all of the people we worked with on the community partner’s end have the final goal of providing the children of Gardner Academy education and opportunities that will allow them to grow into productive members of society.” (Paula Back)</i> • <i>“The community consists primarily of low-income families in the San Jose area, and we hope to improve their civic lives by improving the BUG garden and civic values it promotes. ... I hope they enjoy the new scale and root viewer in their garden. I hope this project will inspire children to be more interested in STEM areas and environmental awareness.” (Gregory Fay)</i> • <i>“The soil board and scale will give the kids better knowledge of how nature works first hand and develop an appreciation for the environment.” (Astha Singh)</i>

6 CHALLENGES

While the collaborations between community partner and ENGR 110 have largely been successful and rewarding, there also exist many challenges to these partnerships. The first challenge, from the BUG perspective, lies in time constraints proposed by a quarterly academic calendar. As the faculty member works to secure projects, keep students on schedule, and meet course objectives, it is challenging to maintain communications with the community partner. The schedule of highly collaborative projects can leave little time for the course instructor and community partner to reflect on questions that emerge from the collaboration. After several student projects, questions have begun to form on the part of BUG. These questions include how projects are budgeted, what support expectations are required of the community partner (beyond attending presentations), are there guiding questions/prompts to ask the student teams during meetings? Upon reflection the question of how being defined exclusively as a client with a ‘problem’ has also emerged. As a client, with a problem to solve, the community members expertise might be overlooked. While this might be understood as a subtle articulation difference, when it comes to roles, it may be worth considering how defining the community partners’ role could enhance the productivity of both the university and community stakeholders and collaborate more effectively.

The course instructor in ENGR 110 has challenges including juggling 4-5 project teams each academic quarter, each with a different community partner. Finding community partners with community needs that can be explored by a physical design project in just 10 weeks by a student team often requires extreme organization and communication. Additionally, project-based

courses require a lot of time and resources that typical lecture-based courses might not. For example, every class meeting each team gives an informal project status to the professor. At these meetings, the professor helps guide design, gives feedback, and provides resources for project materials for projects to progress. In addition, many ‘soft skills’ are taught as part of the course such as project management, which the students often have no experience with and thus takes time to implement meaningfully as part of student projects. Furthermore, each community partner is unique and has differing ideas on how to approach project design, student teams, communication, etc. As mentioned previously, BUG has been a great community partner allowing student ideas to evolve within project constraints. Other partners have had much more specific ideas about what they ‘want built’ and student teams have had frustrating experiences trying to manage partner expectations with their own team desires. Through all these challenges, the BUG partnership has been very successful, yielding highly impactful student learning experiences and successful projects implemented at their target school communities.

Student challenges often revolve around time management and project communications. For example, students often struggle to find common time outside of class to meet as a team or interact with their community partner. A common frustration from the partner perspective is that students don’t update them regularly, leaving them in the dark with design decisions. Students can then feel disheartened by project results when their design doesn’t meet some community needs or expectations and the customer isn’t fully satisfied with the end result. Managing these interactions is partially the job of the professor, but also is a great learning experience for the students. Additionally, students also struggle with communicating design specifications and progress throughout a 10 week quarter. While design communication is extremely important, students often find it difficult to put into words their design work and progress. The communication format for their design work is an electronic portfolio. Students must weekly update an individual project log of their personal activities towards the project, and also update a team project section detailing any meetings or activities held outside of class. One student remarked:

“I know the [electronic] design notebooks are important, but they can be such a chore!” (David Kim, ENGR 110)

A final student challenge to note is the ability to manage a project. Because students have very little experience in bringing a project idea through to build and installation, student projects

often come up against unexpected time delays and challenges. These delays are commonly due to material availability, weather, unexpected installation requirements (e.g. when design doesn't meet reality). Overall, this project-based learning experience profoundly impacts student learning, as witnessed by a final student quote:

"I wish everyone had to take this class prior to taking Senior Design [Capstone Experience]. This class is so helpful in learning how to manage a project! I learned more from this experience than I did from my other [engineering] courses about design." (Bernardo Quevedo, ENGR 110)

7 CONCLUSION

The ongoing collaboration between Community-Based Design (ENGR 110) and BUG has been successful from each perspective, delivering student projects which have added educational dimensions to the school gardens and created a positive visual impact to the spaces. Both students and community stakeholders are mutually benefiting from the relationship formed through engagement, clearly indicating how partnerships can support the creation of projects which offer inclusive learning opportunities for all participants. While challenges exist, the class will continue to evolve and hopefully the partnerships will continue to be meaningful to all involved.