Immersive Community Engagement Experience

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Abstract

As the number of community engagement efforts increase, it is important to understand the impact of these experiences to inform best practices and to ensure that the efforts are positively benefitting all of the stakeholders. Although our program, EPICS, is well-established and has intentionally focused on long-term partnerships, research suggests that immersive experiences can help develop more comprehensive ways of understanding of the community partners. This past summer, our service-learning design program offered a local immersive design experience to a group of 13 students from a variety of majors in a camp for children with disabilities. This paper describes the immersive experience and examines its impact on student learning through analyses of the student reflections and course evaluations. In addition, it describes how these findings can inform this program specifically, as well as other courses and programs using a service-learning pedagogy, especially those that engage in design.

Introduction

The past several years have seen a dramatic increase in community engagement activities in engineering education, as evidenced by the record breaking creation of the Community Engagement Division of ASEE. However, as the number of community engagement efforts increase, it is important to understand the impact of community engagement experiences to inform best practices and to ensure that the efforts are positively benefitting all of the stakeholders. Although our program, EPICS, is a well-established program that engages multidisciplinary teams of students throughout their curriculum in community-based design projects[1], we continue to offer new opportunities and take a research-informed approach to evaluating these new opportunities.

Our community engagement program has intentionally focused on long-term partnerships and local community partners because of the learning benefits afforded through the ability to engage with community partners more regularly. Previous studies have indicated that understanding the nature of those interactions between students and their community partners and other stakeholders is important. For example, research suggests that critical experiences (where design assumptions are confronted) and immersive experiences are needed to develop more comprehensive ways of understanding design[2]. These kinds of experiences include international trips to experience the culture of a partner community.

This past summer EPICS offered an immersive design experience to a group of 13 students (12 undergraduate, 1 graduate) from a variety of majors. The design team's goal was to make a camp more accessible to children with physical disabilities through the design of an accessible tree house and the adaptation of a sailboat to allow control of the steering through a switch (e.g., puff and sip or joystick). The students completed one week on campus, then traveled to the camp for children with disabilities for a week. During this week, the students ate meals and attended various activities with the campers and met with various stakeholders. They also involved the campers in the design of the tree house. After spending a week at camp, the students returned to campus to continue work on the designs. Throughout this course, the students completed daily

reflections, as well as a final reflection, on their experiences, describing what they learned, how they learned it, and the impact of that learning.

This paper describes this immersive experience and examines the impact that this experience had on student learning through analyses of the student reflections and course evaluations. In addition, it will suggest how these findings can inform this community engagement program's development and assessment specifically, as well as courses and programs that use service-learning pedagogy, especially those engaged in design.

Background

Previous studies have indicated that understanding the nature of the interactions between students and their community partners and other stakeholders is important, especially as related to design. Zoltowski, Oakes, and Cardella's (2012) phenomenographic study explored students' experience (and understanding) of human-centered design and identified seven qualitatively different ways in which the students experienced human-centered design within the context of "designing for others". These different ways of understanding are referred to as categories of description. Each category reflects a qualitatively different way of understanding or experiencing human-centered design.

The seven categories of description resulting from the study formed an outcome space that was two-dimensional with distinct, but not independent, axes: "Understanding of the Users" and "Design Process and Integration". The axes depict complex constructs and have scales that were derived from the categories themselves and are ordinal in nature. Five of the categories were nested hierarchically. From less comprehensive to more comprehensive, those categories included: Human-centered design as "User as Information Source Input to Linear Process", "Keep Users' Needs in Mind", "Design in Context", "Commitment" and "Empathic Design". Two categories represented ways of experiencing human-centered design that were distinct: design was not human-centered, but "Technology-Centered" and human-centered design was not design, but "Service".

Furthermore, the study suggested that critical experiences (where design assumptions are confronted) and immersive experiences are needed to develop more comprehensive ways of understanding stakeholders with whom we partner, especially as related to design. These kinds of interactions are also recommended by the international design firm IDEO who present a research method of "in-context immersion", where designers should "[meet] people where they live, work, and socialize… Try to do what your constituents do and talk to them about their experience of life in the moment"[3]. IDEO lists several tips about the benefits of an immersive experience: 1) "what people say (and think) they do and what they actually do are not always the same thing" 2) "putting yourself in someone's shoes enables you to get beyond what people say to what they think and feel" and 3) "deep immersion shows commitment and staying power". We use the phenomenographic study, as well as recommended practices of IDEO, as a framework to explore the experiences of the students as described in their final reflections and course evaluations.

Course Description

EPICS is a service-learning design course in which teams of students from across campus work together on long-term projects that benefit the local or global community. Project work centers around the engineering, technology, and computing needs of a community partner, but interdisciplinary team interaction is an integral element for project success. Students may participate in EPICS multiple semesters and participation for multiple consecutive semesters on a project team is encouraged. Teams are composed of first year students through seniors from any discipline, as well as graduate students in a few select disciplines such as audiology or industrial design.

Most EPICS projects last at least one-year, although partnership with the community organization continues for several years. Projects are intended to solve real problems, are defined in partnership with their community partners, and span the complete design process cycle [problem identification - specification development - conceptual design - detailed design - production - service/maintenance – retirement].

Although the traditional offering of the EPICS courses provides many opportunities for the students to interact with the community partner, it does not typically allow for an immersive experience. However, the Summer 2013 EPICS offering was a special 3-week, 3-credit hour version of the course in which the EPICS program partnered with a camp for children with disabilities located within the state that facilitated an immersive experience for the students. Enrollment was open to all students on campus; however, we did require potential students to provide a short explanation of why they would like to participate and accepted only those students who mentioned the campers in their responses. The size of the Summer course was comparable to typical sections of EPICS. The Summer 2013 course schedule was as follows:

Week 1 On campus	Class met M - F from 1:30—4:30 pm for introduction to design and to learn design skills such as prototyping and conducting observations. Activities included: Wallet Design Exercise[4], background and prior art research, observation exercise[5], ideation exercise using design heuristic cards[6], specific skill development session (to learn how to program an Arduino microprocessor, Google SketchUp, or how to use wood/machine tools)
Week 2 At camp	While at camp, the class ate several meals and participated in various activities (e.g., art, swimming, boating, horseback riding) with the campers to learn about their needs first-hand and to design and prototype solutions to meet those needs. The students conducted a tree house design activity with campers to elicit their ideas, needs and hopes for the tree house. They also met with other stakeholders, such as the camp directors, the activities director, and organization involved in fundraising for the project, and a architect involved in the project. The project teams created prototypes and presented to the campers and other stakeholders to get their feedback during the week. The student completed peer evaluations of teammates and received feedback from advisors on their teamwork, leadership, communication, and design skills and strategies.
Week 3 On campus	Class met M - F from 1:30—4:30 pm to finalize designs and documentation. Students completed leadership readings. The teams participated in an external design review and completed end-of-course reflections and evaluations.

The students and instructional staff were assigned to a specific cabin for the week in order to develop a better relationship with the campers. The camp is accustomed to having various volunteers, so participation of the EPICS students and staff was not uncommon. The EPICS students and staff quickly learned and participated in the many camp rituals such as having to roll on the ground when being "moosed" by a camper, banging on the table during the meal clean up, and emergency dance sessions.

Wallet Design and Observation Exercises

Students participated in two exercises in the first week of class that they referenced specifically in their final reflections. The first was the Wallet Design Exercise[4] which is a fast-paced design activity developed by the d.school at Stanford whereby participants design the ideal wallet for a partner through the prototyping stage. The activity allows participants to experience a significant portion of the design cycle in a short amount of time. In our class, the students completed this activity on the first day of class to introduce them to key elements of the design process, as well as the broad ideas of human-centered design. In addition, it served as an ice-breaker as students got to know their design partners better as a result of designing for them.

The second activity was an observation exercise in which the students observed their teammate use a wheelchair to get from one classroom to another classroom in a nearby building in the 10 minutes usually allowed for class changes. This activity leveraged a framework from the d.school with which to record the observations[5]:

Concrete Observation	Move to understanding	Step out on a limb of interpretation
WHAT (what is the person doing?)	HOW (how are they doing it?)	WHY (why are they doing it this way?)

Role of the Researchers

The first author functioned as the instructor of the course, while the second author participated as a teaching assistant of the course. Course evaluations and reflections were developed by all three of the authors.

Course Evaluations

The EPICS program collects course evaluations from the students every semester to better understand the impact of the course. The means of the 5-point Likert self-report responses to several items related to the course objectives are given below for the Summer course, and as a comparison, to the data from the Fall 2013 semester. The average responses for a typical semester are already very high, with all items averaging in the agree to strongly agree range, and the summer means were even higher.

Please rate the following:	Summer 13 Mean	Fall13 Mean
This course helped me apply knowledge from previous coursework in my discipline to design problems.	4.6	4.0
This course helped me develop my ability to identify and acquire new knowledge as part of the problem solving /design process.	4.9	4.2
This course enhanced my understanding of design.	4.8	4.3
This course enhanced my ability to function on a multidisciplinary team.	4.3	4.3
This course enhanced my appreciation for the contributions from individuals from multiple disciplines.	4.4	4.2
This course enhanced my ability to communicate effectively with audiences with widely varying backgrounds.	4.7	4.2
This course enhanced my understanding of the role of the customer in product design.	4.9	4.3
This course enhanced my awareness of professional ethics and responsibility.	4.5	4.2
This course enhanced my appreciation for the role that my discipline can play in the social contexts.	4.5	4.2
This course helped me develop my awareness of community needs.	4.6	4.2

Similarly, for the course evaluation questions that were focused on aspects of the course related to service-learning, the regular semester responses average very high, and the immersive Summer experience responses were higher than the regular course averages.

Please rate the following:	Summer 13 Mean	Fall13 Mean
Working with a real customer (partner) helped me learn design.	4.9	4.2
Having a real project helped me to learn design.	5.0	4.4
I was more motivated to complete work on my project because it is serving a need in the community.	4.8	4.1
My participation in EPICS has made me more likely to pursue community service opportunities in the future.	4.5	3.9
My participation in EPICS helped me see how my discipline can be used to help the community.	4.5	4.2
The immersion week at [camp] enhanced my understanding of the design process.	4.9	NA

In addition, the students were asked to identify the three most important things that they learned in the course. A table of the responses is given below.

Topics	Frequency
Human-centered design and design	10
Understanding and including stakeholders	8
Teamwork	6

Documentation/communication	4
Leadership	3
Appreciation of community organizations and learning that he/she could make a difference	2
Developing empathy	2
Universal design	2

These responses are similar to the responses that are given by the students in the EPICS program during the regular offering, where teamwork, design, and communication are typically given as the top three[1]. However, the summer session responses reflect a greater emphasis on *understanding* and *involving* the stakeholders in the design, and include responses such as universal design and empathy that do not typically occur during the regular semester.

Reflection

In addition to the course evaluations, the students completed a final reflection[7] due on the final day of class that identified more specific details about aspects of their learning. Instructions were as follows:

> For **two** of the four areas below, critically reflect about what you have learned in that area this semester. **Each** reflection should address the following questions and contain at least 300 words.
>
> Guided questions for the reflection:
>
> - What did I learn?
> - How did I learn it?
> - Why does this learning matter?
> - What will/could I or others do in light of this learning?
>
> Four areas (Choose two):
>
> a. Personal and Professional Development: What did you learn about who you are (your strengths, weaknesses, assumptions, skills, convictions, etc.) and who you want to become, personally or professionally?
> b. Social Impact: What did you learn about the broader impacts of your work and how you and others can affect change locally and/or globally? What did you learn about the community, the needs, and/or the quality of the service provided?
> c. Academic Enhancement: What did you learn related to your discipline and how was that enhanced by the service-learning context? What did you learn about Human-Centered Design?
> d. Ethics: What you have learned about professional ethics, the ethical issues you encountered in your team and your project, and how decisions regarding ethical issues are made individually and as a team?

Analysis of the Final Reflections

In the final reflection, the students identified that they learned similar things as identified in the course evaluations, but provided more details about many of them. Many students identified

personal strengths and weaknesses as a result of the experience. For example, one student indicated that she was quick to judge and place limitations on others, especially those with disabilities prior to the experience, but as a result of spending time with the campers, she learned to have more empathy and recognize the abilities, not just the limitations.

> *I learned several things about myself throughout the course of this project. A lot of this came during the second week when we were at [camp]. When I first interacted with the children, I felt awkward and I quickly made judgments about their capabilities in my head. As time went on however, I really got to know them and felt more comfortable around them and I realized that many of them were able to do a lot more than I had initially given them credit for. This revealed a weakness in me: that I am quick to judge and place limitations on others, especially those with disabilities. I was so grateful for this experience to really open up my eyes and allow me to have more empathy for them. I hope to continue this trend of empathy with whoever I may come in contact with in the future.*

The students also reflected on how they learned the importance of human-centered approach to design, and the importance of involving stakeholders throughout the process:

> *However, a huge difference with EPICS was the emphasis to have an iterative process with the stakeholders included throughout. This really expanded my knowledge and was so much more effective with the design process! It helped to get constant feedback from them and to interact with them and better understand their needs (even if those needs are not spoken). This allows the design to better fit the needs of the stakeholders.*

Another student who thought they understood the need, but then was confronted with their assumptions, and learned as a result, said the following:

> *Before we visit [sic] the camp, we thought we had considered and met a lot of needs already based on the problem that had been presented to us. However, after we spent a week at [camp] it made me more passionate about the design.*

Many of the students embraced the camp's philosophy of "engagement, empower, and empathy" and commitment to universal design, and indicated that they wanted to include aspects of these in their future professional work. For example, one student indicated:

> *Spending a week at [camp] and working with these children was inspiring and life-changing. Being able to watch these children challenge themselves in new ways and allowing themselves to simply be "normal" was a huge motivation for me. I entered into this project in a slightly detached state so I could remain objective in my analysis and design processes. However, spending time at [camp], I found that there was no way for me to remain objective or detached. I was highly motivated to see this project succeed. I was able to witness the making of not just a summer camp, but a thriving community where disability did not matter. [Camp] is able to implement a practical social model that theorists can only talk about. As I continued on this project, I became increasingly convinced that that [sic] the way [camp] views disability is the way the entire world should view disability. Based on my experience at [camp], I plan to strive toward*

integrating a universal design component into every software engineering project that I work on. They have inspired me to push these ideals into every proposal I will make.

The students also identified that they learned teamwork and leadership skills, and how they could specifically improve their ability to lead and/or work in a team environment.

…I realized that I tend to just do tasks on my own (I wasn't seeking much input from the advisors). And I can quickly lose vision and do the bare minimum, which is very ineffective leadership. So I learned to communicate better, plan ahead, put in the work that's needed, hold on to a great vision for the project, and communicate this vision and plan with the team.

However, I need to do a better job with communicating as a leader. Although I always know exactly what I'm doing and why, other people aren't in my head and don't know these things, so I need to do a better job of communicating the reasons behind my methods so that people don't doubt me wondering what I'm doing. Similarly, I need to keep people more involved and be less controlling.

They also indicated that they learned that they had a voice (that they could contribute), the benefits of a multidisciplinary team, and the value and importance of documentation.

As I personally developed during the three weeks of being on the [team], it became evident that I had changed. Prior to being on the team, I was unsure of how to make a difference in my local community. Now that the three weeks of class are complete, and the course has come to an end, I can now reassess who I am and how I grew. I learned that I have a voice that can be heard, especially when it comes to sharing ideas with a group.

I learned that a team of people with multiple disciplinary backgrounds can be extremely useful in a project such as this because every member sees the project from a different angle and thus the team as a while sees the project more completely than a team in which every member has a similar background ever could.

I especially never liked to take notes on anything that I did when it came to projects and design work. Yet after this EPICS design project, I can see how documentation can really help, particularly for future groups working on the project. There were things that I even forgot after a couple of days that I wanted to reference later but couldn't because I would forget to note them while the thought was still fresh.

In addition, they indicated that some design activities that we completed on campus prior to our going to camp such as the Wallet and Observation Exercises facilitated their learning and awareness of certain issues at the camp.

The wallet design exercise at the beginning of class really helped to show me how important an accurate problem definition was. Once we interviewed our stakeholder/customer, some people realized that the problem was not centered around a new wallet, but it was based on the need for a compact way to carry essential items (such as credit cards, money, keys, chapstick, etc).

The power of observation and immersion cannot be underestimated. This was learned by the wheelchair observation activity the first week of class. By observing [teammate] getting from [building] to [building], I saw how although the buildings on campus met ADA standard, it was extremely inconvenient. Just getting to a building next door took over the allotted 10 minutes of passing time.

Throughout all of the responses, the students indicated that the immersive week and the ability to interact with campers (attending meals and daily activities) contributed significantly to their learning. Two examples of this are:

Lastly, interacting with the campers face to face helped me to realize that you really need to get to know the needs of the people for whom you design on a personal level before you can get the right idea for how you can satisfy those needs, and I never would have been able to understand this problem's context fully unless we had all gone down to the camp.

I learned many of these things by being completely immersed in the camp for a week. By spending time directly with the campers and the staff, it made me more aware of their needs. For example, by spending meal time with the campers, I was able to better understand some of the physical capabilities of the campers. Some had little to no fine motor skills. Some had disabilities that I expected to limit the way they used eating utensils, but had adapted to feed themselves.

Conclusions

Although the traditional offering of the EPICS courses provides many opportunities for the students to interact with the community partner, it does not typically allow for an immersive experience. Analysis of course evaluations and student reflection data shows that an immersive experience provides unique opportunities for gaining empathy for their partners in community engagement projects. Other research examining changes in the students' understanding of human-centered design also demonstrated statistically significant improvement from the course[8]. Our findings suggest that even short immersive experiences can have a large impact on students' understanding of their users, especially when using a human-centered design approach as part of the curriculum. It also has the potential to change their lives. This motivates us to try to incorporate more opportunities to spend time with the project partners, and that even a relatively short time can be very beneficial. This work also suggests that it is important to take a data-informed approach as we engage in service-learning and other community engagement activities. This paper addressed the benefits to the students, but we see the need to include additional assessments and measures of the impact on the community in our future work.

A limitation of the 3-week course is that the students were able to complete preliminary prototypes of the projects but were not able to complete a final, deliverable version of the projects during the summer session. However, these projects have been continued by project teams with new members during this academic year. The tree house build has been delayed because of funding issues, so the team is currently focused on designing accessible trails to the tree house and zip line sites. The sailboat team expects to deliver a functional prototype to the camp at the beginning of the summer to be tested and used by the campers during the summer.

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