COMMUNITY FINDING AS LEARNING: IMPACTS OF A NOVEL MODEL FOR COMMUNITY ENGAGED, PROJECT BASED LEARNING IN ENGINEERING

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Abstract –

This paper explores the impact of a specific implementation of community engaged engineering design pedagogy. By asking students about their experience in choosing, engaging with, and researching a community to develop an understanding of and clearly articulating a design problem in a Requests for Proposals, we seek to understand how student initiated community engaged learning (CEL) can contribute to learning about design.

Results of the survey show that students did pick up skills and experiences that reflected course and activity learning objectives. Students engaged and relied on – sometimes to their detriment – personal contact and communication with stakeholder communities for information. They expressed an awareness of the importance of personal investment in the community, even if that investment was limited in their own projects. Not unexpectedly, students also reported a preference for and greater perceived learning in a more conventional design education experience. However, the act of community finding and engagement did impact their understanding of engineering design, particularly around often neglected aspects, and helped them to see design more holistically.

Keywords: Design, problem based learning, community engagement, engaged learning

1. INTRODUCTION

Community Engaged Learning (CEL) promotes learning through collaborative projects that meet both curricular learning goals and community needs. By encouraging engagement with community partners as stakeholders and active reflection on the process, CEL provides a much needed opportunity to develop both technical and non-technical graduate attributes defined by the CEAB and ABET [1-2]. In fact, many of the central tenets of CEL have been part of engineering pedagogy for years now, even if the terminology is not readily applied.

Traditional client-based design projects could be considered a form of CEL, even if the client is an industry, rather than a community, partner. Global or humanitarian engineering co-curricular projects and activities – such as those sponsored by groups like *Engineers without Borders* – provide other examples of CEL implementation, with a focus on social responsibility and slightly more indirect relationship to the communities in question. Prior work has rightly argued that CEL pedagogy is, however, still establishing itself in engineering education, and should be informed by an acknowledgement of the multiple ways it operates within engineering curricula [3], involving different modes of instruction, types of engagement, and relationships between communities, students, and instructors.

Different implementations of CEL in engineering education offer ways to deepen our understanding of how – and how well – CEL pedagogy works to meet both course learning objectives and graduate attributes. One of the unique ways in which Praxis II, a first year engineering design course at the University of Toronto, enacts CEL is to make students responsible for finding the community partner and working with them to define their needs. In a typical client-based design course, students are assigned clients or community partners with a predefined design problem. In Praxis II, however, students engage with the community to define a design problem over the first six weeks of the course, during which they write Requests for Proposals (RFPs): these activities are scaffolded by lectures and activities outlining key principles and processes in community engagement and engineering design problem definition, including requirements setting and RFP writing. This set of student produced RFPs are assessed over reading week, and the best/most appropriate 7-8 are assigned to student groups. The second half of the course, then, functions as a more conventional CEL project based or design course, in which students develop solutions to the assigned challenges within the specified communities. Students then present their solutions at an end of term Showcase where community partners are invited to attend.

Praxis II thus presents us with a unique framework to examine the learning that takes place through these two approaches to project generation and community engagement in CEL – one that is student initiated, and another that is externally imposed. In our study, we seek to:

(1) Identify how students experience these two different approaches, and how learning outcomes may differ

(2) Assess the efficacy of existing scaffolding and identify ideas for better supporting student-led community engagement efforts

The results of this study should help inform the use of CEL in engineering education pedagogy going forward, particularly regarding the value of student initiated community connections.

2. COMMUNITY ENGAGED LEARNING SUPPORT IN PRAXIS

The first half of Praxis II is designed to prepare students for the community engagement required in order to identify, learn about, and define a design problem to help a local community in the Greater Toronto Area. Both lectures and studios are directed at establishing and promoting principles and practices for effective community engagement. Our student survey directly engages with some of this supporting framework.

In one lecture, for example, students are provided with a conceptual model for student-community engagement that explores the role that specific cultural and individual beliefs and values may play in shaping that interaction. This model serves to outline the ways in which cultural assumptions may impact perspectives on design problems, particularly in communities remote from the designer's experience. The lecture then shows how these biases have negatively impacted design projects, for example with attempts to provide groundwater access in Africa [4]. The models and cases outlined in this lecture are intended to help inform students' attempts to engage communities authentically, responsibly, and ethically.

In their weekly design studios, student groups are run through activities that also help prepare them to engage and understand a community, and then to define an engineering design problem in an RFP. In the first studio, for example, students – both individually and in groups – must define their own design values as a way of determining who, how, and what they would like to engage with in their student initiated project. As this is also likely their first opportunity to define their own design problem, we hope to use what they care about as a means to motivate their own personal engagement with their potential community and their project. A second scaffolding activity linked to community finding asks students to reverse engineer criteria for a 'good' community to engage with for Praxis II. Identifying

practical characteristics, such as geographical distance, accessibility of information/ representatives, and safety, alongside more ideological ones, such as shared values or personal investment, student groups come out of this activity with a better understanding of what a 'community' is in this context, a way to assess their initial ideas, and ultimately, a way to choose between communities to engage with.

Studios also focused on developing specific practical skills required to properly interact with, engage, and understand a community and its design challenges. Students, for example, were given the opportunity to conduct mock cold calls and discuss proper email etiquette, particularly around providing appropriate context for their requests. Observation, research, and note taking skills key for information gathering was practiced in studios as well. Students watched videos on the daily lives of a community, then were asked to take notes as well as prepare a research strategy for that engaging with the community. These notes formed a starting point for group discussions of observation versus interpretation, how different perspectives might be generated from the same events (depending on different values), and how to approach information gathering in their interactions with outside communities. These activities provide examples of how scaffolding for community engagement and understanding is developed in Praxis II.

3. METHODOLOGY

Data was gathered through a survey sent to students after their final Design Showcase. The survey used both Likert scale and free form responses to questions posed. Students were told that the survey was part of pedagogical research being performed in order to understand the nature of the learning that took place in the first stage of the course: they were also told that the participation was voluntary and that non-participation would have no impact on their grade. We received 30 responses out of 230 students, approximately a 14% submission rate.

The survey began with the following prompt to provide context and rationale for the survey:

Praxis II is an example of Community Engaged Learning, "an educational experience that allows students to (a) participate in an organized service activity that meets identified community needs and (b) reflect on the service activity in such a way as to gain further understanding of the course content, a broader appreciation of the discipline, and an enhanced sense of civic responsibility." (Bringle & Hatcher, 2009, p.38). In the first stage of Praxis, we take an unconventional approach in building community partnerships by asking you to find your own. In this survey, we'd like to ask you a few questions about your experiences in community / opportunity finding to understand the nature of your learning.

There were three main question areas, after an initial question about prior CEL experience used to gauge student familiarity with this mode of learning. First, the survey asked about their experience in finding a community, focusing on resources and strategies used, motivation for choosing the community, and challenges faced. Second, we looked at the resources, strategies and techniques required to engage with and understand the communities they chose. Finally, we asked them about the first – community engagement – versus the second – design in response to an RFP – phases of course, including about their perceived learning and preferences.

A second component for the study has been planned but not yet been carried out in time for the submission of this paper. There, we expect to carry out a series of semi-structured interviews with students that allow us to examine more deeply the learning outcomes and experiences in the community finding and engagement component of the course.

4. RESULTS

4.1. Prior Experience with CEL

The prompt to the survey was intended to help define CEL, both as a concept and within the context of their Praxis experience. We asked students about their prior experience with CEL as a means of identifying student familiarity with this pedagogical model, which may help use determine how much and what type of initial scaffolding might be necessary.

Only 20% of Incoming First Year Students Identified as Having Experience In CEL

Figure 1: Prior experience with CEL

Only 20% of students reported having prior experience with CEL, suggesting that a deeper introduction to the pedagogy behind community engaged learning, including its motivation and learning objectives may be useful. Of the students who reported having done CEL before, most had done so as part of extra-curricular volunteer work that was self-guided, rather than as part of their high school curriculum. One student did comment, however, on a lack of familiarity with the vocabulary rather than the concept; although she had not participated in something explicitly identified as “Community Engaged Learning,” she had

done work for community groups as part of her high school curricular work in a leadership class.

4.2. Community Finding

We were first interested in the strategies and resources students used to identify their potential communities, in part to help focus and improve scaffolding for next year (Fig. 2).

Figure 2: Strategies/Resources used to Find Communities

All students who completed the survey used personal contacts/experience in finding a community to engage with. That result concurs with the push for personal engagement and interaction provided in lecture and studio. Unsurprisingly, many students also reported that personal experience/contacts were the most important resource (87%) and primary motivation (60%) for community finding. However, only 27% of students reported having used a neighborhood walk around – an activity modeled in a prior design course as a way of identifying design challenges – as a method they used to find a community. This suggests that further support for personal interaction and communication– beyond the activities described above – might be useful for students.

As an extension of the importance of personal interactions identified above, many students (6/30) – in the advice for future students section of the survey – commented on the importance of personal interest and engagement with the community in question:

Find something that you have been or are currently interested in. If I were to go back 3 months ago, I would've tried to engage with a rock climbing/bouldering community considering I'll be doing that this summer. Just find a place that you would genuinely go to during your spare time if Praxis II wasn't a thing.

Reach out to people/places that you think would be really cool to work with, even if you can't imagine getting a response and don't know what sort of opportunity that community might have.

You have interests of your own. Find a way to connect this project to those. Otherwise, you'll spend a lot of time working on something you're not interested in.

Unexpectedly, however, this enthusiasm for finding projects that meant something to the students did not necessarily translate into actual investment in their project. When asked “How personally invested were you in the community and project chosen for your RFP,” the responses were normally distributed, with the largest group being only moderately invested in their community (Fig. 3).

Figure 3: Personal Investment in Community

While students acknowledged the importance of personal interest, their ability to develop connections to a community they were actually invested in personally was limited. The gap between these responses deserves further exploration.

4.3. Community Engagement/Understanding

The second part of the survey focused on the resources and methods used in developing an understanding of the community and its design challenges. Students were asked first to identify which resources / methods they used (Fig. 4).

Figure 4: Methods/Resources Used

Unsurprisingly – and reflecting the results of the previous question – when asked to identify their most important resource, students overwhelmingly identified in person

contact (87%), with only a few choosing (13%) email/technology mediated communication. While the students’ focus on the community is to be lauded, the relative lack of engagement with other sources, particularly that of field research and scholarly articles that may help frame an understanding of the problem within the academic literature remains a concern. With the course’s emphasis on direct communication with stakeholders, it is likely that students place too much of responsibility on their community to provide information that is accepted uncritically. In fact, one student offered this piece of advice for students seeking to understand the perspective of their community:

While it's important to talk to the community, I had to fact check many of their claims, and found them to the contrasting to other sources. While the stakeholders do have an important perspective, it is only one perspective. And there may even be disagreement within a community, as we experienced!

This sort of ambiguity is not unexpected, but likely presents challenges to first year students’ ability to create a coherent picture of a community.

When asked about the relative difficulty of community finding versus community engagement, students reported developing an understanding of the community as significantly more difficult, as indicated in Figure 5.

Figure 5: Ratings of Difficulty of Community Finding (Top) versus Community Engaging (Bottom)

Perhaps reinforcing the above point, several of the difficulties students identified as significant were related to the primacy of personal contact as information: more than half of the of students reported both finding the time to meet with their community and interpreting/validating the information given by their stakeholders as accurate to be the most challenging part of the activity. Less than

40% of the students reported design activities such as identifying the systemic or underlying of the problem or developing requirement as the most difficult part of the activity.

4.4. Phase I versus Phase II

In the final section of the survey, we asked students about their perceptions of Phase I versus Phase II of the course. We assumed that Phase I, the community finding and engagement part of the course, would be farther outside of their expectations for engineering design and engineering education. Similarly, we expected that students would be more comfortable with Phase II, because it could be more easily understood as an engineering design activity. Their responses to questions about preference and learning shown in Figure 6 confirmed our hypotheses.

Figure 6: What Part of the Course Did You Prefer / What Part of the Course Did you Learn More In?

Several students referred to Phase II as constituting “actual engineering” versus “figuring things out about people and their problems,” despite acknowledging that “community engagement is a necessary part of doing design well.” Their comfort with the second phase was expressed as clarity in purpose and certainty in objectives: “I liked making things more than coming up with requirements. My goals felt better defined, and I knew more of what I was doing.” According to these students, the second phase of the course constituted more “learning by doing” – drawing, building, testing – rather than “trying to understand theoretically how good design works.” This perception of the theory/practice divide is an interesting one, since Phase I does require concrete activities as well, though those that are not readily perceived as engineering design. But this is how one student explained the perceived difference:

Writing the RFP and engaging with the community is for the most part a theoretical activity, and one can believe that everything is working well. While responding to the RFP (and during Beta, Showcase) is when we discovered actual issues (or changes that

needed to be made) with our design concepts, requirements, understanding of the opportunity, etc.

Similarly, another student articulated the following difference:

[Phase II] is when testing actually starts and you realize the importance of the objectives and metrics that are set. Before that you are just hoping that you cover everything but you have little to no prior experience in actually doing something technical or hands on.

It was not unexpected that students would prefer Phase II; however, that it was the immediate feedback of the design–build–test process of Phase II that leads to students’ perception of greater practicality and engineering–ness was a useful finding.

Yet despite their clear preferences for the more immediately practical portion of the course, students still showed an appreciation for having done the community engagement required in Phase I. One student argued that it helped them see engineering design as an iterative process that includes revising an understanding of the design problem and its requirements as you try to solve the problem:

The first version of requirements (i.e. RFP), is mostly useless/impractical to apply. It's a good starting point to get your head in the design space, but not too useful. It's just for getting to the next stage.

Another explained that Phase I helped them to see the steps behind the brainstorm, test, and build components that more typically defines engineering design.

Engineering Design requires a framework. During high school I assumed engineers just started building things (which does happen), but now I understand that RFPs, requirements, research and stakeholder engagement are actually important.

Despite their clear preferences, these reflections do indicate that the experience of Phase I does impact their understanding of Phase 2 and, more generally, engineering design itself.

5. CONCLUSION

Community engaged learning that is student initiated demands a different skillset and provides a different learning experience. Even those these results are preliminary, they show that asking students to define their own – and potentially their classmates’ – projects challenges students to communicate effectively with communities outside of the university in order to

conceptualize a problem, forcing them to step out of the role of designer and into those of their various stakeholders. More importantly, it seems to equip students with a deeper understanding of engineering design that acknowledges often neglected aspects of that process. It also seems to set up a deeper understanding of design challenges. Even if students are unlikely to be given the opportunity to develop their own design problem and community in the future, the process does help them to develop skills required in design thinking and practice.

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