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Partnerships Compass: Guiding Questions for Equitable and Impactful Engineering Community-Engaged Learning

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ABSTRACT

Campus-community partnerships are integral to community-engaged learning, service-learning and similar pedagogies that extend project-based learning beyond the classroom into "real world" communities. Community-engaged courses have increased in prevalence in engineering education. Evidence suggests that they are effective at connecting engineering theory to practice, engaging students motivated to "make an impact," and preparing students for global and multicultural collaboration. In community-engaged courses, campus partners (students, faculty, staff) and community partners (individuals or organizations from non-academic communities) collaborate on an engineering project that, if successful, benefits community members and contributes to student learning. However, partner relations are not always a primary focus, and partnerships can flounder and fail resulting in limited or imbalanced outcomes, dissatisfaction among partners, or even harm. Building upon documented principles for community engagement and frameworks such as critical service-learning, this paper directs attention to the relationships between campus and community partners as a crucial yet under-studied aspect of engineering community-engaged learning. We interviewed 22 campus and community partners involved in engineering projects spanning seven engineering colleges and five continents. The findings are presented in the form of a Partnerships Compass with guiding questions for nurturing partnerships that are both impactful (in achieving partners' collective goals) and equitable (in attenuating power imbalances, unequal risks of harm, and

outcome disparities between partners). Ultimately, the paper aims to provide a timely perspective and actionable tool for engineering instructors, students, and community partners who aim to jointly build enduringly equitable and impactful partnerships.

Key words: community-engaged learning, service-learning, partnerships

> *"You know how it is: If you want to make a difference in life, do it together…*
> *Very little is done alone." — Interviewee (Professor of Mechanical Engineering)*

INTRODUCTION

Engineering courses that engage students with community partners offer the potential for benefits for all involved, but also pose risks of harm. As an example, an engineering instructor and interview participant in this study described an encounter when a group of students traveled from the United States to South Africa to work with providers in a clinic:

> [The students] showed up […] and nobody at the clinic had been briefed on who the students were or what they were doing. But the students had assumed that the [community] partner who was taking them around had a connection to this clinic and had told [the clinic] what was going on, and that just hadn't happened. It was a huge communication gap. […] So [the students] were talking to the clinicians, and at some point, the manager of the clinic comes in and basically yells at them and says, "I'm sick of seeing young white researchers show up and just do research. It comes to nothing. You're wasting our time. Who do you think you are?" […] Then one of the students […] responded very poorly and yelled back at this manager: "We're here to help. […] It's rude that you're talking to us this way."

This excerpt illustrates several dangers in facilitating engagement between students and communities (i.e., a community of clinicians and community health workers). The student who "responded very poorly" appears to have made particular assumptions about their role (that they were there "to help" and actually could help, see: Schneider, Lucena, & Leyden, 2009), the clinicians (that they were in need of help, were aware of, and were interested in what the students were doing) and the value of the clinicians' time (that they did not have more important things to do than to talk with and educate white foreigners whom they may never see again). How might we—as engineering instructors, students, or community partners—avoid situations like this?

Many community-engaged engineering courses include preparatory work that supports students to examine, for example, histories of international aid and exploitation (e.g., Easterly, 2007; Moyo, 2010), critical perspectives on community engagement (e.g., Martin, 2016; Yep & Mitchell, 2017), and their own critical consciousness (e.g., Freire, 1968; Lorde, 1984). Such preparatory work could have helped this student at the clinic to foresee the possibility that a key stakeholder (the clinic manager) had not invited them to be there. They might have reflected on the potential power imbalances due to their race and position coming to South Africa from a U.S. university and taken extra care to ensure that they were not imposing themselves on the clinicians or others. Critical examinations of this nature appear rare in engineering, in part because engineers are rarely trained in it (e.g., O'Meara & Jaeger, 2019). How can we expect engineering faculty to help students to foresee, avoid, and unpack complex sociocultural situations if they themselves have not been trained in community engagement or facilitating critical dialogue? Engineering instructors may work with social science or humanities faculty (Gilbert et al., 2015; Harsh et al., 2017) or their Office of Public Service or Community Engagement. However, according to Eby (1998:6), "individual faculty often carry the additional workload and cost of incorporating community partners into courses" and may do so with little or no institutional support.

This paper aims to support engineering instructors (in addition to students and community partners) by examining the question: *What are the makings of equitable and impactful engineering campus-community partnerships?* By *impactful* we mean achieving the impact goals of all partners, and by *equitable* we mean monitoring and attenuating power imbalances, unequal risks of harm, and outcome disparities across partners. Building upon established principles of community-engaged learning in higher education (Avila-Linn, Rice, & Akin, 2015; Butin, 2010; Haas Center, 2002; Honnet & Poulsen, 1989; Leiderman, Furco, Zapf, & Goss, 2002; Tinkler, Tinkler, Hausman, & Tufo-Strouse, 2014) and acknowledging that community-engaged learning projects are multidimensional with important technical, economic, social, political, and cultural lenses, this paper highlights partnerships as a crucial yet understudied aspect of engineering community-engaged learning. We conducted interviews to collect narratives (like the one above) told by a relatively small but broad sample of 22 campus and community partners involved in engineering projects spanning seven engineering colleges and five continents. These were analyzed resulting in guiding questions organized into seven themes that form the Partnerships Compass, a navigational tool to help partners traverse the complexity of campus-community partnerships (see Figure 1). Instead of reading the findings sequentially, we encourage readers to first review Figure 1 and then navigate to the themes that appear most unaddressed in their partnerships or relevant to their needs.

Figure 1. The Partnerships Compass.

In developing the Compass, we were influenced by our positions as current and former students and instructors of engineering community-engaged courses at large, well-funded private and public U.S. universities. We have been educated in engineering and social sciences in the U.S. and have worked on or advised engineering projects with community partners in the U.S., Central and South America, East, West and Southern Africa, Southeast Asia, and India. We have developed this guide in the hope of improving partnerships between engineering students, instructors, and community partners at our own institutions and perhaps beyond.

BACKGROUND

We use "community-engaged learning" as an umbrella term encompassing service-learning (Furco, 2003) and other pedagogies that involve a partnership between a campus partner (a college or university student, faculty, or staff member) and community partner (an individual or organization working to create social benefit within a non-academic community). Community-engaged pedagogies have a rich history in higher education (Butin, 2010; Dolgon, Mitchell, & Eatman, 2017) and many community-engaged courses are now well-established in engineering (see, for example: Baillie, Feinblatt, Thamae, & Berrington, 2010; Coyle, Jamieson, & Oakes, 2005; Dzombak, Mouakkad, & Mehta, 2016; Pinnell & Eger, 2005). Such courses can improve student learning by integrating engineering theory and practice with context and meaning (Butin, 2010; Eyler & Giles, 1999) while actively engaging students (Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, & Wenderoth, 2014; Smith, Sheppard, Johnson, & Johnson, 2005). This can expose students to a broader view of who engineers can be and serve. Studies have found that this appeals to students motivated to "make an impact," supports women to persist in engineering, and better prepares students for a multicultural and globalized world (Bielefeldt, Paterson, & Swan, 2009; Duffy, Barry, Barrington, & Heredia, 2009; Huff, Zoltowski, Oakes, 2016; Immekus, Maller, Tracy, & Oakes, 2005; Litchfield, Javernick-Will, & Maul, 2016). Alarmingly, Cech (2014) found that many engineering students disengage from public welfare concerns over the course of their education. Community-engaged learning can re-engage students with a sense of purpose, ethics, and social and environmental responsibility (Colby & Sullivan, 2008; Lathem, Neumann, & Hayden, 2011; Immekus, et al., 2005).

There are, however, reasons to be wary of community-engaged engineering. Engineers can over-attend to the technical aspects of situations and, in the process, perpetuate economic or socio-political forces that maintain systems of inequity and oppression (Mitchell, 2008; Mitchell, Donahue, & Young-Law, 2012; Nieusma & Riley, 2010). As a result, there are very real possibilities for well-intentioned engineering students and instructors to not meet the goals of community partners and even do harm (for elaboration on harms, see: Donaldson, 2008; Starr, 2017; Illich, 1968). Eby (1998) advocates

for campus partners to contribute their "fair share" to partnerships, i.e., via in-kind services such as program evaluation or financial compensation for the time that community partners give to campus partners. Eby explains that involving students without proper context, preparation, and engagement strategies can lead to an oversimplified and individualistic grasp of social challenges and strategies for social change.

While engineering campus-community partnerships vary tremendously, one important dimension of this variation is the distinction between market-based and community-based approaches. Partnerships that pursue a market-based approach implement projects via a business venture and draw from the logics of capitalism, social entrepreneurship, impact investing, etc. to promote the exchange of value, recurring revenues and, typically, concentration of ownership. Partnerships that pursue a community-based approach, on the other hand, implement projects via a community initiative and draw from the logics of community organizing, cooperative resource management (e.g., Ostrom 1990), and non-Western traditions to promote solidarity, reciprocity and, typically, shared community ownership. These approaches are not mutually exclusive—for example, partners taking a community-based approach might pursue recurring revenues through a business venture. The choice of approach carries implications for what kinds of community partners will be involved and how campus and community partners will engage each other. Students working on a market-based engineering project to develop a new product might engage a community partner that acts as an "implementation partner" (e.g., a manufacturing firm). The interactions between students and an implementation partner might be quite transactional with clear terms and exchanges of value. This differs from a community-based approach where, for example, students design a solution for a single user or community organization that has no intention of commercializing the work. In these cases, interactions may be more relational — dictated not by terms and transactions but by actions and care that place people and relationships first.

Partnership orientations can be apparent in the labels that partners use. Campus partners may refer to a community partner as a "partner" (implying that students and community partners work together in solidarity toward a shared goal) or a "client" (implying that students are responsible for delivering value to their client) (Brubaker, Trego, Taha, & Sheppard, 2018). Some argue that a client orientation gives more power to community partners. Others argue that a partner orientation facilitates a "relationship between equals" (Mitchell, 2008) and encourages partners to "share generously [...] the full resources of their combined humanity" (Remen, 2000:198). The degree to which partners engage in transactional or relational ways may depend on structural elements like the type of course (elective, capstone), length of partnership (short-term, long-term), level of institutional support, and the positions, engagement, and commitment of partners (Gorski & Mehta, 2016).

Taken together, partnerships play a key role in engineering community-engaged courses, yet many partners have limited training in, and resources for, effectively engaging with each other especially across cultures, socioeconomic strata, and other potential power imbalances. Building upon existing resources, this paper offers guiding questions in the form of a Compass (a navigational tool) that we hope will further point the way toward more equitable and impactful campus-community partnerships. Guiding questions are identified for instructors, students, and community partners (as noted in each thematic box in Figure 1).

DEVELOPING THE COMPASS

To develop the Partnerships Compass we conducted 22 semi-structured qualitative interviews with seven instructors, seven students, and eight community partners (see Table 1).

Table 1. Summary of Interview Participants.

	Number
Total Participants	**22**
Women	11
Men	11
By Partner Type	
Community Partners	**8**
Representatives of U.S.-based nonprofits	1
Representatives of U.S.-based for-profit social ventures	1
Representatives of Non-U.S. non-governmental organizations	3
Representatives of Non-U.S. for-profit social ventures	3
Instructors	**7**
Tenured or tenure-track faculty	3
Teaching faculty, lecturers, or instructors	4
Students	**7**
Undergraduate students	3
Graduate students	4
U.S. Engineering Colleges Represented by Instructors & Students	**7**
Large public engineering colleges	2
Large private engineering colleges	1
Small public engineering colleges	1
Small private engineering colleges	3

We initially recruited participants through a literature review of engineering faculty who had written about their community-engaged courses, followed by referral sampling to community partners, students, and other instructors. We limited invitations to instructors with roughly 10+ years of experience with community-engaged courses. These instructors came from seven U.S. engineering colleges that spanned public and private, large (>5,000 students) and small (<5,000 students) engineering schools. Instructors described their community-engaged courses as electives or capstones for undergraduate and/or graduate students from one or more disciplines (i.e., primarily Civil or Mechanical Engineering sometimes paired with Architecture, Business, Medicine, or others). A majority of instructors held some connection to Mechanical Engineering. Community partners came from many backgrounds and were associated with different kinds of community organizations (e.g., for-profit, nonprofit, hybrid). Two were focused in the U.S. and six outside of the U.S. (Central America, East Africa, Southeast Asia), as shown in Table 1. While the interview sample is relatively broad, it is also relatively small and not intended to represent the full population of engineering community-engaged courses, associated partners, or cultural contexts across the globe.

All invited participants agreed to be interviewed for 30-60 minutes in English in person or virtually. We used a semi-structured interview protocol focused on narratives of critical incidents of engineering campus-community partnerships. Questions included: "Could you describe a community-engaged engineering project that you have been involved in that did well in meeting its goals?" and "Could you describe one that did less well?" Follow-up questions clarified the contextual factors perceived as tied to challenges and successes. On average, interviews lasted for 58 minutes and all but one (per participant request) were audio recorded and transcribed. Hand-written notes were taken during the unrecorded interview. A team of two authors collaboratively and iteratively built a codebook and coded all interviews. Thematic analysis was performed in two rounds, starting with a review of the content in each code followed by a reorganization into emergent themes. Guiding questions and recommendations, as presented below, were developed from each salient code that held multiple pieces of coded data (e.g., the data from the emergent code: *turnover* led to the guiding question: *Is the project resilient to personnel turnover?*).

THE PARTNERSHIPS COMPASS

In response to our organizing question (*what are the makings of equitable and impactful engineering campus-community partnerships?),* we identified seven emergent themes that appeared across partners involved in a wide range of engineering community-engaged courses. These are: (1) establishing and renewing partnerships; (2) vetting projects; (3) clarifying community partner

expectations; (4) clarifying student expectations; (5) understanding histories, power, and self; (6) facilitating communication and trust; and (7) concluding partnerships. Each theme is developed in turn below and summarized in Figure 1 as a collection of guiding questions for nurturing equitable and impactful partnerships*:* the Partnerships Compass. The Compass is limited in that it stems from a small sample of largely retrospective interviews. It is not intended to be static or exhaustive but, rather, a dynamic and evolving set of questions and recommendations that those involved in engineering community-engaged courses may use to guide their thinking, preparation, and partner engagements. Readers are encouraged to navigate the Compass by reviewing Figure 1 and skipping to the themes that appear most unaddressed in their partnerships or relevant to their needs.

THEME 1: ESTABLISHING AND RENEWING PARTNERSHIPS

Partnerships start through a formation process raising questions about how partners are chosen and who does the choosing. This section outlines five guiding questions for partners (students, instructors, and community partners) to consider when establishing or renewing a partnership.

How is success defined among partners, and who has defined it? Our interviewees described the importance of understanding how success is defined by each partner, who defines it, and how it will be evaluated. For example, an instructor explained that "I consider my first mandate to get a good education to the student, [...] but I recognize that if we don't launch some ventures and have some success [community-defined positive impacts], the students will question the value of the education." In contrast, a community partner emphasized a focus on community impact:

> Yes, I want [students] to have a good experience, but, more importantly, I need [students] to be doing something that's going to be meaningful. [...] Just making sure that whatever [students] developed wasn't just an exercise [...] but, rather, something that we could hand to someone or something that would be useful to someone [in the community].

Students expressed different degrees of prioritizing community impact versus their own learning goals. While this may not be an inherent tradeoff, there may be tensions when "co-developing a shared understanding of success," as one instructor described it. Such discussions may be structured by co-developing a "partnership charter" or letter of agreement between campus and community partners (for an example, see: Anderson, et al., 2014).

Recommendation: To mitigate possible tensions, hold upfront discussions and co-develop a partnership charter that clarifies each partner's goals, how collective success is defined and how it will be evaluated.

Have all potential partners engaged in a mutual vetting process? Partner vetting—an evaluation or courting process among potential partners—can mitigate the risk of a partnership forming with misaligned goals, values, capabilities, etc. After recounting a challenging experience, an interviewed student illustrated the importance of vetting:

> I don't know what the teaching team could have done [...] besides to not have worked with this [community partner] at all. [...] I feel like, honestly, if the [community partner] just really cared and was truly invested in what the solution was that we were working on, everything that we went through would have been avoided.

Interviewees cautioned against engaging in partnerships with uncommitted or ill-suited partners. While all partners may benefit from a vetting process, it is notable that in this sample, only campus partners spoke of vetting community partners (not the reverse), and community partners appeared to have fewer partnership options than campus partners. These observations illustrate power imbalances between campus and community partners. Campus partners described initiating projects, selecting which community partners they engaged, and entering spaces carrying a range of resources, including institutional legitimacy.

Recommendation: To mitigate possible power imbalances, acknowledge and communicate openly about the existence of such disparities—not to pretend to eliminate structural power differences but, rather, to create the conditions that enable both community and campus partners to *mutually* vet each other and make free and informed partnership choices.

Are project champions present among both campus and community partners? Interviewees emphasized the importance of identifying champions when establishing partnerships. Champions are highly engaged individuals committed to the long-term success of projects and may be community partners, students, or instructors, as an instructor illustrated:

> I've had a passion for this for decades. I have [community partner] connections [...] and a broad skillset. I work at a university that values social justice initiatives, and I've lived in this region [of the U.S., near my community partners] for almost four decades.

Champions can also be students, as an instructor described:

> [The student] had close conversations with the nurses [...] and women in the community. She never would have identified the need for this had she not had those close collaborations. And even after she graduated, she went back [...] to engage in the project.

Recommendation: To help projects and partnerships to thrive, invite and support project champions both on campus and in communities.

Are potential partners likely to share candid, direction-setting feedback with each other? Students and instructors described relying on community partners to provide connections, contextual understanding and cultural translation (especially when engaging with a community that was not their own). An instructor shared that, "[Community] partners are often your only true connection to ultimate beneficiaries, users and stakeholders." Recognizing this, campus partners expressed a desire for community partners who are willing to say, "I don't like an idea" and share other ideas about what is really needed. At the same time, community partners wished for campus partners who listen, trust and are mindful of the balance between closely involving them versus over-burdening them.

Recommendation: When forming or renewing a partnership, invite discussions that make clear that candid, direction-setting feedback is welcome and assess the likelihood of this occurring between potential partners.

Are there established checkpoints when all parties can suggest changes and decide whether to renew their participation in the partnership? Interviewees shared the importance of regular opportunities to debrief projects, discuss possible improvements and determine whether to renew a partnership. An instructor recounted how they hold such conversations with community partners:

> We reaffirm the partnership in-person. We reaffirm with [community partners] exactly how it benefits us. [We ask:] "What are the benefits to you? Is this working for you? Do we need to make any adjustments? [...] We think the project [...] works for both of us, but we understand that it's still asymmetric in a way. [...] We have the resources to come and go, and you don't. And [we want to] better make this work for you."

This instructor explicitly acknowledged structural power imbalances ("asymmetries") between partners as a means of facilitating a candid partnership renewal conversation. Other instructors described being less direct in their approach.

Recommendation: Create checkpoints—including a formal review at project completion—that acknowledge power imbalances and invite partners to check-in, suggest improvements and decide whether to renew the partnership.

THEME 2: VETTING PROJECTS

Projects matter because they are common foci of engineering campus-community partnerships and, in many cases, the primary vehicle for achieving desired impacts. A risk, however, is that projects may fail and leave campus or community partners dissatisfied or, worse, harmed. Interviewees agreed that, for a project to achieve its desired impacts, it must be well-prepared, designed, and executed, but they varied in their suggested criteria for determining suitable projects. Some partners targeted projects with specific technical (e.g., structures, power systems) or sectoral (e.g., agriculture, healthcare) criteria. Beyond such foci, projects appeared to vary along several general dimensions, as shown in Figure 2.

Some projects aimed to positively impact a small number of people (e.g., a specific person or community) while others aimed to impact many (e.g., a movement or market segment of millions). Instructors who supported projects with large impact ambitions discussed the need to allow projects to run for multiple years because students and community partners could not typically achieve such impact in a few semesters.

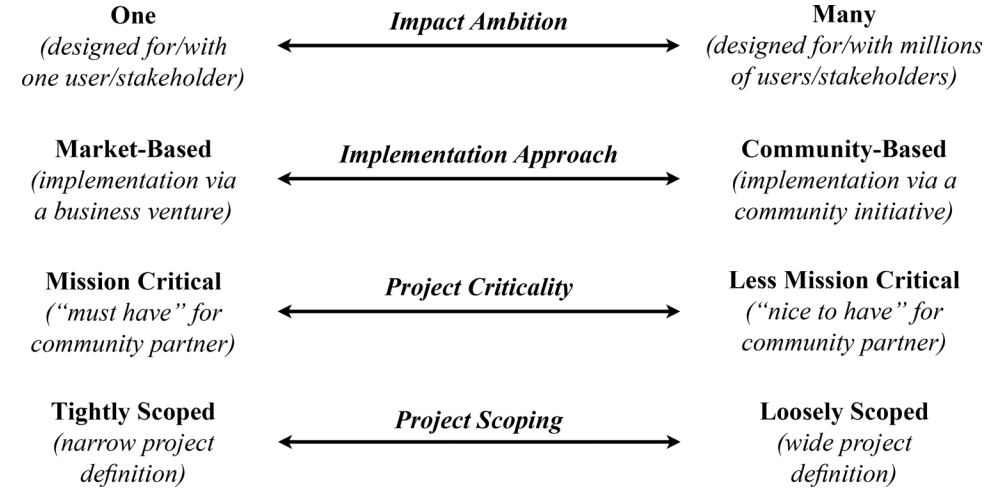

Figure 2. Emergent dimensions of engineering community-engaged projects.

As described in the Introduction, projects can take a community or market-based approach. Those taking a community-based approach implemented projects through some form of community-led initiative. These were organized through, for example, individual community leaders, informal community groups, or formal community-based organizations (nonprofits, NGOs, coops, for-profit mission-driven companies, etc.). Those taking a market-based approach implemented projects through some form of business venture and usually aimed to achieve widespread adoption of a product or service (alongside the associated financial, social, and environmental returns).

Projects may be "mission critical" (must-have) or less mission critical (nice-to-have) for community partners. If a project is mission critical, community partners explained that they were at risk of campus partners not delivering a crucial aspect of their work. This risk sometimes led to significant pressure on campus and community partners to ensure project success. In contrast, less mission critical projects were lower priority for community partners and at risk of partial implementation or minimal impacts.

Finally, project definitions may be loosely or tightly scoped. A loose project definition has the advantage of allowing students and community partners to engage in jointly developing the problem framing before developing solutions. Some interviewees advocated for loose project definitions to encourage higher quality problem framings and more nuanced and contextualized learning among students. Others advocated for tightly scoped projects because they facilitated quicker project progress and more immediate impacts among community members. Overall, understanding where a project falls on these four dimensions (among others) can help to resolve how a project may be best prepared and executed. The remainder of this section describes six guiding questions for partners to consider when vetting projects.

Is the project grounded in the experiences and constraints of people living the issues being addressed? Prior studies have shown that community-engaged engineering projects often fail because they are not well grounded in the lived experiences of stakeholders (e.g., Wood & Mattson, 2016). In alignment with classic service-learning and community organizing principles, partners suggested that projects be self-identified and self-determined largely by community partners. This is illustrated by an instructor's reflection on the genesis of their course projects:

> I feel like the projects [...] where a community was saying, "Look, we have this thing we'd like to work on," or somebody was saying, "I'd like to start a business like this," [...] those are the ones that seemed to have the most trust. It was just people's effort from the beginning and it turned into something, as opposed to: "We're coming here with something, and we're going to try to deploy it."

Recommendation: Engage in dialogue with partners to ensure that potential projects are firmly grounded in the needs, desires, assets, and constraints of community partners and stakeholders.

Is the project well-scoped? Projects vary in being more tightly or loosely scoped depending on the course. Instructors of courses with loosely scoped projects described supporting students to engage in the upfront work of problem-framing and contextualizing the challenge. Instructors of courses with tightly scoped projects described giving students pre-prepared problem framings, design requirements, and more. As an example, an instructor described a project with a relatively tight scoping that was well-suited for their course:

> The [community partner] had ramped up a manufacturing facility [...] so it was a perfect setup for engineers. [...] It was very technical-heavy [...] and actually didn't require as much insight into the user [...] so [the students] were able to do that well remotely.

Students described that projects are sometimes too nebulous or loosely defined which puts them at risk of floundering. A student described a classmate's project:

> One poor team was [given the challenge] of water and sanitation in refugee camps. I was like, "That's a big issue." And many refugee camps are very different. How are you supposed to solve that in [one term]? [...] You need a more specific problem.

Another student clarified that: "I find my own creativity able to shine when I feel like there's structure, like there's a confined space that we're working within." It may be tempting to offer projects that are unrefined early ideas, but, as a student noted, it can be obvious when a project has been "half-baked":

> I think, in some ways, [our community partner's] goal for us [...] was a little bit half-baked. I think there were much bigger challenges, and it was hard for us to just focus on [...] solving those problems when there are so many other unanswered questions. In the end, [...] I don't think [what] we designed for them has really gone anywhere.

Poorly scoped projects can lead students and community partners to lose motivation. To curb this issue, an instructor recommended:

> Get more certainty in the project. [...] Make it clearer what the project is about [...] because you want them to get traction sooner and get results sooner. [...] Results are motivating.

> If you spend a lot of time not knowing what to do or where to go, the project becomes demotivating. [...] The two interact... scoping interacts with motivation.

In order for students to deliver on an academic timescale and actually see results, the amount of uncertainty and work in a project must be manageable. Across the board, instructors discussed the importance of scoping projects such that students and community partners can get to results and actually see consequences of their work. But tightly defined projects can also pose risks. Community partners described a desire for flexible project definitions that can evolve with time:

> I appreciated [...] flexibility because we were able to change our path. [...I would like campus partners to] be aware that the more flexible we are, the more we can modify things as we go, the better it will be. And perhaps thinking through a system of how we can do that in a way that won't be extremely stressful, so we have a plan but allow flexibility.

Recommendation: Assess whether potential project definitions are well-scoped for the course and flexible enough to evolve as the community context changes.

Is there potential for interpersonal connection between students and community partners during project work? Campus and community partners may come from different cultures, speak different languages, and be geographically separated which can create barriers to interpersonal connection. An instructor described:

> The problem is that the community we are working with is so remote. [...] There's no way to get any kind of conversation going except through email, [...] and I think that's been really difficult for the students. I think that's a big part of why they've lost their motivation, because they don't have a personal connection.

Another instructor explained: "We do not do projects where intrinsic motivation is not clearly felt by the students. [...] If they cannot feel the motivation clearly, emotionally, directly enough, then that project is at risk of failing." Connecting with students is also important to community partners, as a community partner described: "I was very glad I did [the project] because I think it was really *really* neat to see so many students excited about it."

Recommendation: Assess whether potential projects afford regular opportunities for interpersonal connection between students and community partners.

Do partners collectively have the capability (knowledge, skills, relationships, etc.) to implement the project? Students may be new to real-world engineering projects; faculty may have limited experience and skills in community-engaged work; and community partners may have limited capability to fully implement a project. Interviewees recommended assessing the project-specific capabilities of all partners when vetting potential projects. Some described a difference between working with graduate versus undergraduate students, as a community partner shared: "It was more helpful to have graduate students, for example, than undergraduates, because I feel like the graduate students brought in [...] more specific skills." This should not preclude undergraduates from working on community-engaged engineering projects, but it does suggest that projects and skillsets should be matched realistically and intentionally. As with students, it is important to match potential projects to the capabilities of instructors and community partners. An instructor explained:

> [The community partner] actually being able to implement. That's where it gets dropped. [...] Some organizations [...] don't see their own limitations. They'll be like, "Yeah, that would be a really interesting [project] for us to work on. We're super-interested in you pursuing that." But [...] they've never done it before.

This is especially challenging with complex projects involving multiple campus or community partners. For example, multiple partners are often needed to accomplish the many product development and regulatory steps in designing and bringing a medical device to market.

Recommendation: Assess whether partners collectively have the capability (knowledge, skills, relationships, etc.) to implement potential projects.

Do partners collectively have the capacity (time and funding) to implement the project? Partners described being constrained by available time, timing (the cadence of work), and funding. As discussed above, academic timelines constrain projects, and students typically have many other things happening in their lives. An instructor observed that students, "have so many other things going on, just trying to figure out themselves, and their friends, and their other classes," explaining that such busyness and personal growth can contribute to breakdowns in student-community partner communications. Community partners also have time constraints, as an instructor shared: "Our partners have only so much bandwidth, and if they're going to give some to us, how are they going to make it up?" Instructors recommended being careful about timing and setting a reasonable pace for projects so as not to demand too much of a community partner's time at once. Overly demanding projects can strain partnerships. Students can, for example, misinterpret unresponsiveness from community partners (who have limited bandwidth) as a lack of interest in a project which can lead

to an erosive cycle of poor communication. Community partners might spread the responsibility of student communication across multiple community partner representatives. This can benefit students by providing access to multiple perspectives, but it can also hinder students, as a student described:

> Other [teams] typically have one person [...] that they're working with directly. We had a handful of people, and then got new and different people. [...] My dream scenario [would be] having a [community] partner with at least one person who is completely engaged and aware of everything that is happening and can talk to us.

Matters are further complicated by uncertainty in funding among partners. Campus partners wished for community partners who are forthright about their funding uncertainty, and community partners wished for campus partners who can help by offering creative funding solutions and cost-sharing. Interviewees suggested engaging community partners in collaborative grant writing and funding community partners to visit campus to work directly with students instead of exclusively sending students to communities.

> *Recommendation:* Assess whether partners have the capacity (available funding, time, and aligned timing) needed to implement potential projects. It may be helpful to document any expectations of timelines or resource sharing.

Is the project resilient to personnel turnover? Partners described how those involved with projects changed over time and that this caused significant project knowledge and momentum to be lost. Planning for and addressing turnover when vetting projects can help projects to continue and ultimately achieve their desired impacts. Student turnover is expected, but turnover also occurs among instructors and community partners, as an instructor illustrated:

> We had a meeting with the mayor, and the mayor was on board, and then there was a change in administration, and that priority fell down the list. [...] Then our main guy on the ground who was a [local] graduate student got an opportunity to study [abroad]. And our main guy in the administration at the local university was moving into higher positions in the government, so didn't really care about this that much anymore.

A consistent and dedicated community point-of-contact can be invaluable, as a community partner illustrated: "I took a leave of absence, and then everything stopped. [...] We never had a project again with [the university]."

> *Recommendation:* Assess the potential of a project to be affected by personnel turnover.

THEME 3: CLARIFYING COMMUNITY PARTNER EXPECTATIONS

Another major theme that emerged was mismatched expectations between partners. This is presented as two themes — clarifying expectations among community partners and among students. This section addresses the first of these themes and offers five questions addressed specifically to community partners.

At what level, in what settings, and by what means do you prefer to engage with students? While some community partners described acute time constraints, others wished to be quite engaged with students, i.e., invited to give a talk, lead in-class activities, or provide feedback on design reviews. Similarly, some community partners wished to be well informed about the course curriculum (e.g., topics covered, project deliverables, and deadlines for students) while others were not interested in such details. Informing and offering opportunities for community partners to be engaged in the classroom can work to "decolonize the curriculum" (Yep and Mitchell 2017). Such practices prioritize the voices of community partners and give the same attention to their knowledge and contributions as to, for example, textbook histories or engineering theory. Additionally, partners expressed the importance of feedback from community partners throughout the life of a project. To achieve this, some partners co-developed ways for community partners to participate and provide regular feedback through their existing communication channels.

> *Recommendation:* Engage community partners at the level, and using the communication channels, that they prefer.

For what duration and at what pace do you prefer to engage with students? The length and pacing of partnerships vary, and misalignment in these expectations can strain partner relations. For many courses, community partners and instructors expressed a preference for long-term partnerships, as an instructor shared, "I don't call it a class, I call it an initiative; I realized that you had to follow these things all year round." There is a concern about inequity in projects that are just one semester long. An instructor explained that such projects "have got to finish, and you start ending up in a situation where the students parachute in and evacuate out [...] and who knows if they really added any value." Instead of a typical academic rhythm (3–4 months of intense engagement, a break with little engagement, and another intense 3–4 months), community partners shared a preference for longer and slower engagements measured in years instead of semesters. Some instructors designed their courses to match their community partners' desired "intensity profile." This instructor shared that: "[Our] projects run for multiple years, [... and] these are slow projects. [...] We think the faster you go, the more the power imbalance comes into play, and the more potential there is for inequity in the relationship." As a student put it, projects that are "slowly baking at the right rate" can be

ideal because the pace works better for community partners, and students can realistically work on them alongside their other responsibilities. Of course, this is not to say that courses with short-term engagements cannot also achieve equitable outcomes among campus and community partners.

> *Recommendation:* Clarify each partner's expectations around the desired length and pacing of their engagement.

What resources do you expect to contribute, and what do you expect campus partners to contribute? Is there any uncertainty in these resources? Interviewees described funding as a major source of tension between partners. Community partners may be under-resourced and dealing with uncertainty in their funding streams, as a community partner explained:

> I was always a little bit nervous about the funding. That was really difficult because I never [...] knew right at the perfect time so that [the instructors] could plan the course. Sometimes, I was like, "I'm not sure I'm going to get funding." I don't know if there's going to be an opportunity to do another course because I'm still waiting.

One instructor expressed that, "we came to learn that the [community partner] we were working with wasn't that fiscally stable" and that this led to challenges in executing the project. Without a full understanding of a project's resources, it can be difficult for partners to plan, develop contingencies, and successfully execute their work.

> *Recommendation:* Clarify each partner's expected resource contributions to a project, including any uncertainty in these contributions.

Who do you expect will "own" the project in the long run? To achieve lasting impact, projects need people committed to the project's long-term implementation. Students described projects that were left orphaned and how this made them feel responsible for finding (or becoming) the project's long-term owners. A student shared that they organized a summer trip that "was completely about who was going to own the project, and ultimately we didn't find someone to take it." Different courses and programs encouraged different models of long-term project ownership, with projects primarily owned by a community partner, students, instructors, or members of multiple groups. This is illustrated in Figure 3, with each dot representing the authors' interpretation of how select interviewees described who was expected to own a community-engaged engineering project in the long run. This sample is not intended to be representative but to illustrate that expected long-term project ownership varied tremendously across this sample of engineering community-engaged courses and projects.

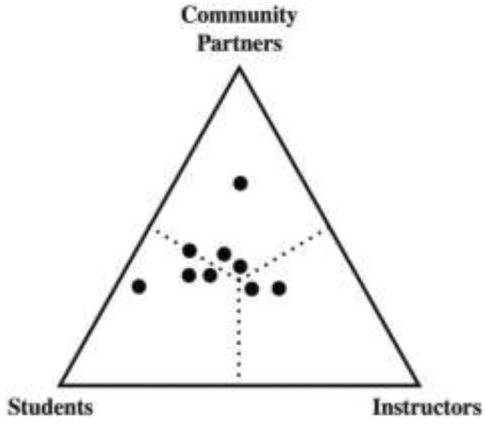

Figure 3. An interpretation of how select partners spoke to the question: Who will "own" the project in the long term?

Instructors offered several models of project ownership. The "client" model is when the community partner (client) fully owned the project and campus partners worked as consultants in service to them. The "bus" model is when the project (akin to a moving bus) had students and community partners who got on and off and instructors who stayed onboard to steer the project until it became mature enough to become its own entity. The "founder-less venture" model is when students provided many of the inputs that a traditional founder might (investing research, seed funding, time and "sweat equity") until a champion(s) from the partner community emerged to take over the effort. Finally, the "student-owned" model is when students were tasked to work with partners to develop a "continuity plan" that clarified how the project would live on after the course. Using this model, some students continued working and founded highly impactful social ventures, but in other cases, students moved on and "continuity plans" languished unfulfilled.

Recommendation: Clarify expectations across partners regarding who will own the project in the long term, including any expected hand-offs in ownership.

Who are other relevant community stakeholders, and what expectations might they have for this project? While expectations may be clear between immediate campus and community partners, other stakeholders in the community or on campus might not be fully informed. An instructor provided one explanation:

> We talked a lot about making sure that it's not just the CEO [...] who knows why [the students] are there and has all the expectations in mind but, also, whoever is going to be working with [... or] hosting students. They are all trying to understand why the students are there and what the expectations are for them.

Campus partners may assume that their community contacts will fully inform and clarify expectations among all other community stakeholders, but this may not occur (as illustrated by the story in the Introduction).

> *Recommendation:* Explore ways to clarify expectations with not just main points of contact but with all campus and community stakeholders.

THEME 4: CLARIFYING STUDENT EXPECTATIONS

Students enter community-engaged work with different expectations and degrees of preparedness. An instructor shared that "the most important thing is you should not deploy students who are not really ready." A student noted that "one of the first times I did a service project [...] I had no idea who I was, and a lot of my immaturity came out right away." Another student described a peer who was not really ready for immersion in a culture that was different from his own:

> There was one team member who [...] didn't understand why people would live the way that they did with very little [electric] power, with limited money, with limited food, when a city was within an hour's distance away. He looked down on all those people, in a way, for choosing that lifestyle when, in his idea, something better was there for them. He failed to see, I guess, how much the community and family mattered to the people in that village.

Some instructors recommended setting the expectation that engaging with community members is a privilege, and only those who have demonstrated that they are ready will be permitted to do so. Partners highlighted that a primary component of readying students is understanding and clarifying their beliefs and expectations. The five guiding questions that follow are intended to help students to constructively interrogate their beliefs and expectations related to engineering community-engaged courses. While students can reflect upon these guiding questions themselves, the recommendations in this section are intended primarily for instructors thinking about how to scaffold support for students.

Unlike other school projects, you will, in part, be responsible to real people. How can you engage responsibly and in ways that "do no harm"? Through community-engaged projects, students are responsible to others in ways that they may not be accustomed to. An instructor explained:

> Students are seldom in a situation where they're responsible to anyone, [...] where they are like, "Wow, if I screw this up, somebody's life is going to be impacted." [...] So we go slow,

> and going slow keeps people who don't feel like they know how to do this work from feeling like they're going to get hurt or hurt somebody.

Students reported enrolling in community-engaged engineering courses, in part, because of their potential to create real-world impacts in partner communities. This heightened potential for community and student impacts comes with heightened responsibilities, including the imperative to "do no harm" (Anderson, 1999). To address this, interviewees suggested that instructors provide students with preparation before, and support during, community engagements to grapple with concepts like responsibility, accountability, and safety.

> *Recommendation:* Provide students with opportunities to clarify their responsibilities to community partners and discuss ways of keeping themselves and their community partners safe.

How might you guard yourself against "expert" and "hero" mentality and instead work with curiosity and humility? Just as there can be power imbalances between campus and community partners at an institutional level, the social constructs embodied within identities also wield power at an interpersonal level. This dynamic can be palpable, as a student shared: "I walked into this community, and I was given an insane amount of power for no reason other than my name and my age and my separate label." An instructor further explained:

> Are you coming with the attitude that you have these amazing things to give to a community, and you're here to help them and solve problems? Or are you coming in thinking [...] I have a set of skills that I can use to contribute to this, but I am not the expert here, [and] this can only be something that works if we are partnering together?

This is not to say that students and instructors should not contribute what they do know. Another instructor clarified that, "[If you] know a ton about pumps, it's okay to go a community and say, 'I know a lot about pumps.' [...] but it doesn't mean I should be full of myself or think I'm better at something that I'm not good at." Assuming an "expert," "hero," or other deficit-based mentality (focused on the knowledge or resources that a community partner does not have) can preclude campus partners from seeing the expertise and assets that community partners do have. A community partner advocated for campus partners to ask questions like: "What's already here? How can we strengthen what the community partner already has instead of trying to bring in an alien idea?" Instructors may need to continually demonstrate "assets-based" thinking (e.g., Khadka, 2016;

Samuelson & Litzler, 2016) and work to counter culturally dominant narratives such as "expert" mentalities in engineering or "hero" mentalities in social entrepreneurship.

> *Recommendation:* Actively discourage "expert" and "hero" mentalities among students by promoting assets-based thinking, calling out deficits-based thinking, and discussing concepts like indigenous knowledge, respect, and humility.

How might you contribute to lasting positive impact when doing so often requires more than several semesters or more than engineering alone? Some students reported participating in community-engaged engineering courses to "make an impact," yet lasting community impacts did not occur on the timescale that they were involved in their project. As discussed in Theme 2, some projects were structured to last for multiple years in order to achieve desired impacts. An instructor stated: "I don't think it's fair to tell students, 'You're going to make real impact in the world because you're a smart engineer that's going to solve all these problems.'" Instructors described that facilitating change is a "multidisciplinary team sport" that requires people from many backgrounds (e.g., engineering, humanities, social sciences, or particular lived experience) who believe in the value of each other's potential contributions.

> *Recommendation:* Clarify with, and perhaps demonstrate for, students that, if their goal is to support lasting positive impact in partner communities, doing so may require years of effort and more than engineering know-how alone.

When projects and engagements do not go as expected, how might you adapt and adopt a learning orientation? Even when partnerships and projects are impeccably prepared, unexpected events still occur. A student noted that "we found out that [an aspect of the project] wasn't actually happening. [...] As students, we were kind of taken aback, and we were very confused [...] and frustrated." An instructor discussed a similar situation and how the teaching team responded to students by assuring them: "Don't even let this get you down, because this kind of adjustment stuff happens. [...] This is the nature of the business. You're learning how it goes, and the sooner you learn how it goes, the better you'll be at it." A student suggested: "Have an open mind and be really flexible with uncertainty; whatever you come in expecting or whatever your plan is, it is going to change." Such change and ambiguity can lead to negativity or pessimism among students, especially engineering students accustomed to being provided all the information needed to solve a problem. In one situation, a student expressed feeling "very disappointed, deflated, tired, and frustrated," and yet, after major project and partnership dysfunction, the student embodied a learning orientation toward their experience:

> I recognize I didn't have a great experience, and it could have been better, but there are also many, many great things about the experience. [...] The things that went bad taught us so

much about reliability, communication, and [...] group management. [...] There is so much you learn from being in such a challenging situation. I learned that [...] human relationships are tough, but you don't have to just bear with it. You can actually deal with it [...] and adjust.

Recommendation: Prepare students to be adaptive leaders by helping them to expect challenges and to see learning opportunities in each situation.

When challenging situations arise, how might you call upon your values and mentors to guide you? Given the complexity and ambiguity of community-engaged engineering work, and the likelihood of discomfort among students, instructors suggested expounding a set of course values as guides for students. An instructor explained:

[We] actually say to the students, "Here are our [course] values." [...] "Whenever you're in doubt or concerned, go back to the values, and they will tell you the right thing to do. If you get into conflict with your values, you're probably doing the wrong thing."

Students shared stories that illustrated how they needed to navigate ambiguity, uncertainty, and tension in attempts to understand and meet the expectations of both their instructors and community partners. One student described this as a "dual-syllabus" — an explicit syllabus with assignments for the course and an implicit syllabus with responsibilities to community partners.

For some students this was their first time leading an engineering project, as a student shared:

This was [...] my first time kind of heading an engineering team, if you will, so I was up in the forefront of almost every meeting, the communication, and the chain of emails. [If I could go back], I guess I would [...] tell myself to not be afraid to ask [...] questions.

Midway through this student's engineering capstone course they had to restart with a new project and community partner. The student explained how they wished they had spoken up and asked more questions to their instructors and project mentors when red flags with their community partner first started to appear.

Recommendation: Support students to proactively flag and address potential challenges by ensuring that a clear set of values and mentors are available.

THEME 5: UNDERSTANDING HISTORIES, POWER, AND SELF

Students and instructors come to community-engaged courses with different identities, understandings of self, life experiences, motivations, and readiness for engaging across lines of difference. A community partner noted: "I think [students] are often thrown into these positions that they aren't ready for. [...] They haven't done it before, but all of a sudden, they're working on a multicultural team, [...] and it can be a total disaster." Issues arise not just with engineering students but with engineering instructors, too. An instructor elaborated, "If it's the kind of thing that a faculty member doesn't know, [...] understand, [...] and have experience in, it can be destructive to those [partner] relationships and take a long time to rebuild." The following questions emerged as guides for students and instructors who wish to ready themselves for community-engaged work. They are particularly important because the self-work involved in building multi-perspective understandings of equity, power, ethics, and history is not always practiced as a "required" element of engineering teaching and learning, nor is it rewarded within academia for students (i.e., grades, recommendations) or instructors (i.e., publications, promotion).

How might there be power imbalances between students, instructors, and community partners, and how might these imbalances be attenuated? As discussed above, there are institutional power imbalances that can and should be thought through, especially related to the positionality of campus partners who "have money and can come and go as we want," as an instructor described. Students and instructors may question their own roles in perpetuating such structural differences. Power imbalances can be exacerbated by those who are "not being humble enough to ask questions... [and say], 'No, we're going to figure this out on our own; we don't really need help,'" in the words of one instructor. Just as there are power differentials between instructors and students that can be lessened through intentional steps by instructors (e.g., informal class gatherings, shared meals, inviting students to use given names instead of titles), there are opportunities to consider how campus and community partners can also operate on more level ground.

> *Recommendation:* Acknowledge and discuss the potential for power imbalances between campus and community partners and develop situational strategies to attenuate these.

What do you know about the assets of your community partners, their histories, and their prior engagement with people like yourself? Across the board, partners discussed the need for education in history, ethics, and critical theory as part of engineering community-engaged coursework. The purpose of such "non-engineering" curriculum is to help students and instructors to better understand the perspectives and assets (not just deficits) relevant to their partners and projects, to practice ways of engaging and amplifying the ideas and concerns of their partners, and to always respect

that they "are dealing with people's lives," as a community partner put it. Communities and community partners have specific events and experiences that have shaped who they are, the context they reside in, and how they relate to others. To better understand this, students and instructors may ask themselves, for example: "Have I asked my community partners about prior experiences they have had with working with people like me?" or "Have I researched the histories and structural impacts of things like colonialism, slavery, and genocide against indigenous people in relation to my community stakeholders?" Such histories can provide critical context for understanding how not to perpetuate injustice in a given community.

> *Recommendation:* Read histories, ask questions, and facilitate critical discussions that help students and instructors to better understand the assets, histories, and contexts of community partners and stakeholders.

How do you understand yourself and how you, as an outsider, relate to insiders in a community — especially across racial, cultural, socioeconomic and other lines of difference? What biases do you carry with you, and how might these affect your engagements with partners? These questions assume that all students and instructors are works-in-progress on a lifelong journey to better engage across cultural, racial, gender, national, socioeconomic and other lines of difference. An instructor explained the importance of such questions: "If students aren't adequately prepared to go into a community, I think it can do harm in reinforcing negative stereotypes around people in developing countries or people of a specific descent." Again, recall from the Introduction the incident in the South African clinic. This incident led that course instructor to conclude that "some kind of training [was needed] to make sure that partners are respected and that students are hearing them." While some interviewees suggested one-time cross-cultural trainings, others went further to suggest ongoing self-work and practice engaging across lines of difference more generally. They described this as involving ongoing critical self-reflection of the kind that many engineering students and instructors rarely experience. Another instructor offered:

> You can have co-design practices and inclusive processes. A layer down you can have mindsets that are more equity-minded. [...] And even below that is an understanding of yourself, and how you as an outsider relate to insiders. So we have students do a cultural gap analysis.

Such analyses encourage students and instructors to go beyond examining their (co-)design process (Mazzurco et al., 2018) and intended type of social change (Reynante et al., 2017) to reflect on who they are, the cultures and communities they come from, and the assumptions, epistemologies,

and worldviews they carry. Campus partners may explore their own multiple identities, biases and assumptions by pairing analyses with facilitated discussion and reflective practice. This can create "a lens of openness," as an instructor described it. Facilitating such exploration involves students and instructors stepping out of their personal comfort zones into zones of "constructive discomfort" or "brave spaces" (Arao & Clemens, 2013; Stanlick, 2015).

Recommendation: With the help of trained facilitators, students and instructors may engage in ongoing analysis, reflection, and critical discussion to better understand their own identities, beliefs, and biases, and how these affect their engagements with community partners.

THEME 6: FACILITATING COMMUNICATION AND TRUST

The four prior themes overlap to support a broader theme of facilitating communication and trust between campus and community partners. Interviewees described several partnerships with meager communication between partners which contributed to an absence or breach of trust. A wealth of literature offers definitions of trust, barriers to building trust, and the influence of trust on perceptions, attitudes, behaviors, and performance outcomes (e.g., Dirks & Ferrin, 2001; Kramer, 2017). This research suggests practices for establishing and maintaining trust, such as fairness and transparency with financial matters, delivering on expectations, and in-person interactions between distant global partners (Mortensen & Neeley, 2012). Emerging from our interviews, and in line with this literature, the following questions point toward improved communication and trust between partners.

Are students and community partners in direct, frequent communication? Instructors sometimes act as intermediaries between students and community partners to help establish trust through healthy communications, protect the time of community partners, and allow students to focus on the technical aspects of a project. A student recalled: "Initially, I would say 90–95% of our communications went directly to the [instructor], and they would relay our questions or concerns and give us information from the [community partner]." Students shared that this practice left them feeling somewhat uninformed, unsure how or if their efforts were having an impact and wishing to learn more about how real-world projects and partnerships work. Interviewees also shared that infrequent, indirect communications sometimes allowed partner expectations to become misaligned, especially when projects underwent unexpected changes. As an alternative, an instructor described the benefits of more direct communication:

> Giving the students the autonomy to communicate directly with community members, while it's difficult, has seemed to be one of the most important things that can happen. Not even

> like: "Hey, I'm working on this" [… but also] carving out some time to […] hang out digitally or otherwise to get to know each other and generally humanize the whole thing."

This quote emphasizes that direct and frequent communication between students and community partners is not just about the exchange of information but about developing a relationship. Meeting in-person early in a partnership can advance relationship building by establishing a foundation for future communications. Sometimes language barriers were described as an obstacle to direct communication between students and community partners. A student shared: "It was extremely difficult to speak directly to anybody because we were three languages away from them." Potential barriers to relationship building, like language, are important to understand and mitigate.

> *Recommendation:* Vet projects and structure engagements such that students and community partners can develop a relationship through direct, frequent communications.

Are partners aware of each other's communication norms and preferences? Interviewees cautioned that establishing communications directly between students and community partners requires attention and care. As touched on in Theme 3, students may not be aware that a community partner's communication norms might be very different from their own. An instructor offered, "[I hear students say]: 'We sent them six emails.' Well, does your partner typically communicate by email?" Students may be unaccustomed to protocols around when, how, and how much to communicate with partners. A student explained:

> [It's] simple things like establishing communication norms with the partner and adhering to them. Saying we're going to check-in every week at this time and then not canceling at the last minute or responding to emails from the partner in a timely fashion. Just a level of professionalism that you don't really learn in school is very helpful.

Another student described engaging community partners in urgent bursts of communications around the time of course deadlines, whereas a community partner expressed a desire for a relatively smooth cadence of interactions. To prevent such issues, several instructors made coaches available to guide student teams in their early communications with community partners.

> *Recommendation:* Establish a means and rhythm of communication based on each partner's norms and preferences and check-in on these over time.

Do campus partners attend to the ancillary needs of community partners? In reflecting on ways that trust was built, interviewees shared that campus partners sometimes went out of their way to

attend to community partner's ancillary needs, i.e., immediate needs beyond the scope of a project. An instructor explained: "It's a basic part of equity and partnerships and relationships, which is [...] you do things that weren't part of the actual project, per se, [...] but they are part of the relationship." A student shared an example:

> One thing that I'm very proud of, I think was the most useful thing that we did [and was not part of our project] was we [...] ran a first-aid class — how to deal with all sorts of injuries that you might deal with at home, or cardiac arrest, and things like that. That was open to the entire community, and I think there was something like 50 people who came.

An instructor shared another example:

> [Our community partner] was like, "We're going to this trade show." [...] Quickly, the team figured out, "Oh my God, you have really nothing to show," and we were like, "Would it help if we built this for you?" And they were like, "Oh, that would be so great!" So the team just kind of stopped what it was doing and hunkered down and built for them [...] a marketing brochure [...] with full graphic design layout, messaging, the works.

A community partner explained that such acts were appreciated because they provided them with tangible and immediate benefits in a partnership that "is always beneficial for them [campus partners]." Such acts worked to balance disparities in outcomes and build trust between partners, especially when there are power imbalances between campus and community partners, as discussed in prior sections. Attending to ancillary needs may also depend on how campus and community partners are oriented toward each other (as "partners" vs. "clients" as discussed in the Introduction).

Recommendation: Observe and attend to the ancillary needs of community partners in efforts to value the people and relationships in a partnership over a strict set of project objectives.

Do partners have patterns of sharing timely feedback and adjustments? Projects and partnerships changed with time, and partners adjusted along the way. There appeared to be a spectrum of how much communication, feedback, and adjustment was preferred by community partners. Some preferred close communication and frequent opportunities for checking-in while others preferred upfront communication with minimal additional interaction until deliverables were shared. A community partner explained that, in a project where engagement with students was frequent, "we were changing things as we went along. If it wasn't for that constant input [...]

correcting where we were, we could have really gone astray." On the other hand, an instructor shared an example of a group of students who had engaged a manufacturing partner in a "messy" drawn-out fashion. The manufacturer became frustrated and told the students: "You've got to decide what you're doing, or we need to pause this relationship." This was a case of a market-based partner who preferred minimal and more transactional engagement.

Recommendation: Develop a mutually agreed upon routine of timely feedback and adjustment based on the cadence that each partner prefers.

Do partners cultivate ownership in one another and allow the other to lead? In describing a successful project, a student acknowledged that "we got a lot done because [...] we let them lead. [...] We could trust the local [community] partner to lead us and to do it well." Interviewees discussed the importance of both students and community partners having opportunities to lead and that such opportunities were not always provided. An instructor shared an example illustrating how partners can inadvertently control the collaborative process and prevent others from leading:

> So, we wrote a proposal. I mean, I wrote the proposal. The [community partner] looked at it, and they let me put their name on it. [...] There was never much buy-in from our local partner. We didn't allow for it.

With tight timelines, differences in collaborative norms, and shifting constraints, campus partners may feel that they do not have the time to involve community partners in decisions as they unfold. Doing so was viewed by some instructors as inefficient and unnecessary. Again, how decisions are made (who decides) relates to power imbalances between campus and community partners. Partners who acknowledged power imbalances and held upfront conversations with their partners about them described being able to navigate the pressures of shifting projects while still creating space for students and community partners to take ownership and lead. Not all projects that interviewees described called for distributed ownership among multiple partners. Some market-based projects, for example, called for concentrated project ownership among a few students or community partners. Regardless of the project ownership model, situations in which partners trusted each other to lead major aspects of the joint work appeared to be partnerships in the truest sense of the word.

Recommendation: Based on the collectively agreed upon project ownership model, cede power to other partners in ways that grant them the time, space, resources, and authority to take ownership and lead.

THEME 7: CONCLUDING PARTNERSHIPS

We close with considerations for concluding partnerships, beginning with the first of three guiding questions: *How might the partnership be concluded in ways that preserve the dignity of all involved?* Framing this question around dignity acknowledges that concluding a partnership can affect a partner's status, access to resources, conceptions of self-worth, and more. Consider the following example recounted by an instructor who had been serving as a community partner liaison between a community partner and campus partners from another university:

> On the day that the call was arranged, there was nobody responding to the call. [...] I thought, "That's odd." So I sent an email and said, "So, obviously, we missed. Want to reschedule?" And an hour later I got a call from [the instructor] who very aggressively said that the project was over and that they were going alone with the [community partner] on a completely different project. [...] That had never happened before [...] in the dozen years that I've been doing this, to be blindsided completely. It was really unprofessional. [...] I mean, even on that call, I said, "Well, that's a shame. It would have been nice to know. We could have talked it through."

Recommendation: Conclude partnerships with professionalism and respect for the dignity of all involved, ideally through dialogue that leads to a mutually agreed upon conclusion.

Are there barriers for any partner to freely exit the partnership? Interviewees explained that not all partners can freely enter and exit partnerships to the same degree. In this sample, campus partners described freely entering and exiting partnerships, whereas community partners sometimes endured poorly performing partnerships because they desired benefits imbued by a campus partner (e.g., financial resources or social status) or otherwise could not end the relationship without repercussions. This is, in part, why multiple instructors suggested that campus partners acknowledge this possibility and regularly inquire with community partners about their desire to renew the partnership, as discussed in Theme 1.

Recommendation: Acknowledge that there may be more barriers for community partners than campus partners to exit a partnership. Work to lower these barriers so that all partners can freely exit a partnership, if desired.

What will happen to jointly developed ideas, artifacts, revenues, etc.? How might learnings and remaining resources be captured and appropriately shared? When concluding partnerships, the

ownership of collaboratively generated ideas, intellectual property, products, revenues, businesses, etc. can be called into question. As described in prior sections, such questions of ownership can arise if not effectively addressed when projects and partnerships are initiated and grown. Additionally, there is a risk of learnings being poorly documented and not shared across partners and stakeholders. The "lean research framework" (Armstrong, et al., 2015) attempts to address part of the later challenge by guiding partners to capture learnings that are relevant to, accessible for, and usable by community stakeholders.

Recommendation: Develop and grow partnerships in ways that continually clarify the ownership of jointly developed ideas, intellectual property, revenues, etc., and capture and disseminate relevant learnings so that these are not lost or contested upon a partnership's close.

CONCLUSIONS

This paper introduces the Partnerships Compass (Figure 1) as a set of guiding questions to help facilitate increasingly equitable and impactful engineering campus-community partnerships. We recognize that the word "guide" may convey a position of authority or certainty that we do not intend to presume. Given that engineering community-engaged courses vary tremendously, the guiding questions are not intended to be static or exhaustive but, rather, one possible starting point from which those involved in engineering community-engaged courses may build. The questions emerged through inductive analysis of 22 qualitative interviews with community partners, students, and instructors associated with a broad set of public and private, large and small U.S. engineering colleges. The Compass emphasizes preparatory work and ongoing support for projects to facilitate greater and more equitable impacts and partners to facilitate improved communication and trust. Preparation and ongoing self-work appear crucial for engineering students and instructors, particularly those with limited training or experience in examining power relations and engaging across lines of difference. While instructors may be untrained in or without institutional support for engaging community partners, they may be positioned to play a fundamental role in developing and stewarding campus-community partnerships. As illustrated in the Partnerships Compass, there are at least seven categories of questions that instructors and other partners may consider when attempting to facilitate more equitable and impactful partnerships in engineering community-engaged courses. Future work may examine the extent to which these or other guiding questions are associated with greater positive impacts and reduced risks of harm across partners. Our hope is that these among

other questions will help campus and community partners to improve how they engage with one another and collectively strive for a more just and sustainable world.

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