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Talking "Faculty Development" with Engineering Educators, Then Talking "Engineering Education" with Faculty Developers: A Collaborative Reflection on Working Across Communities

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Abstract

Over the last several years, the engineering education research community has aimed to disseminate and implement its work in engineering classrooms. Several investigations have explored reasons for and barriers to the adoption of evidence-based practices. Many of these investigations have been housed within STEM Education communities. External avenues, such as the Professional and Organizational Development (POD) network community of faculty developers, represent untapped resources that could enhance these dissemination efforts.

Over the past year, we have hosted parallel workshops for engineering education researchers at the Frontiers in Education (FIE) conference and faculty developers at the POD network's Annual Conference. Our parallel workshops were an effort to encourage conversation about engineering faculty development practices across both communities. At FIE, engineering education researchers explored ways POD could aid them in disseminating their research and wrote "messages-in-a-bottle" with things they wanted the POD community to know. At POD, faculty development experts stepped through a simplified version of the engineering design process in response to the messages from FIE participants. This paper brings together our experiences from both workshops to illustrate the challenges and benefits of furthering connections between the engineering education and faculty development communities. Increasing the fluidity of such collaborations may help disseminate educational best practices between them.

Background

Engineering Education Research (EER) and the Professional and Organizational Development (POD) network are both cross-disciplinary academic communities. Both are largely comprised of career-changers with a deep commitment to student learning; this commitment has led them into difficult and relatively uncharted waters. The EER community consists primarily of engineers who've journeyed into education research later in their careers, a transition that often comes with prestige and conceptual hurdles[1]. The POD community represents a young field with many new practitioners who have been -- or still are -- faculty in various disciplines and who have journeyed into faculty development later in their careers[2]. Both communities intersect in the realm of engineering faculty development. All three of us work within that intersection; we are engineers who journeyed into education research during our time in graduate school and who now focus aspects of our education research and outreach on engineering faculty development. The purpose of this paper is to share what we have learned about the challenges and opportunities that arose while working to bridge the two communities.

As we grew professionally within both communities, we started noticing strong parallels and affinities between the work being done in each. Issues in EER were considered solved problems in POD. Things POD found difficult were common practice in EER. We saw opportunities for both groups to take advantage of the other group's activities. It's like being singers who happen to sing across two choirs, and notice they're doing complementary interpretations of many of the same songs; such choirs could benefit from listening to each other's concerts and perhaps even

singing together. Part of the issue is awareness; since there are few people who sing in both choirs, many of the singers aren't aware that the other field exists. Living within both worlds, we could see how much each community could benefit the other and started working on ways to bring the two together.

Others have contributed to this bridging effort in the past. For instance, Ruth Streveler conducted foundational work in EER, collaborating with Karl Smith on what constitutes rigorous research in the field[3]. Streveler entered engineering education from a faculty development position, where she was an active member of POD and facilitated the crossover of a few POD members contributing to EER. For instance, POD's Nancy Chism served as an evaluator for the Rigorous Research in Engineering Education (RREE) workshops that introduced many now-prominent researchers to EER and later coauthored a guide on qualitative research basics for engineering educators[4,5]. There are discipline-specific centers for teaching and learning (CTLs), including several devoted to engineering, such as the University of Michigan's Center for Research on Learning and Teaching in Engineering[6], the Center for Engineering Teaching and Learning (CELT) at the University of Washington[7], and the Leonhard Center for the Enhancement of Engineering Education at Penn State[8], which focus on a combination of practicing and researching faculty development in engineering education. POD itself has a STEM interest group, which runs a mailing list and holds Birds of a Feather sessions at the POD network annual conference. Additionally, the NSF has recently approved a 5-year grant to the Association of Public and Land-Grant Universities to investigate "Creating and Studying a National Network of Centers of STEM Education: Developing Foundational Infrastructure for Educational Transformation"[9].

These efforts have largely focused on either being at this intersection by working with engineering faculty on their individual development or by introducing other individuals as guests to the "other side," as Streveler did in inviting Chism to do evaluation in an EER context. As new members to both fields, we wanted to explore the communities at large and approaches for increasing awareness of and promoting interactions with each other. In addition, we wanted to understand the factors that make it challenging for the two communities to come together. To investigate these areas further, we decided to try bridging both cultures -- as others had done in the past -- but this time, to keep an eye out for any collisions and challenges. Our idealistic vision was that when presented with the crossover opportunity, our colleagues in both communities would recognize what they had been looking for all along, and eagerly run into both worlds with us.

It didn't work that way.

Overview of Conference Sessions

As members of both organizations, we viewed their respective major conferences as a prime opportunity to build bridges across them. Frontiers in Education (FIE) is a conference in EER held once a year in conjunction with IEEE's Education Society[10]. A few weeks following FIE, the POD network runs their annual conference[11]. Both conferences were logical opportunities to work in faculty development across the intersection of the two disciplines. POD's focus is largely on faculty development itself; the "Professional and Organizational Development" in the organization name refers to the professional development of faculty and the organizational

development of academic institutions. FIE offers a forum for engineering education research discussions from the K12 level through faculty development. This includes opportunities for engineering faculty to attend workshops and special sessions where they can actively participate and improve their educational research and instructional practice.

Our hope was to strengthen the individual relationships across the two communities by running a workshop at each conference focused on engineering faculty development. At a national level, this outcome could include seeing faculty developers at the American Society for Engineering Education annual conference or running into engineering education researchers at POD. We also hoped to see increased connections between these groups within their publications, whether through multidisciplinary collaborations or the inclusion of citations from the other community's work.

At the local level, we hoped for increased utilization of CTLs by engineering faculty and the engineering education research community. Specifically, we saw value in utilizing engineering education research as resources for faculty development within that discipline and in related disciplines. Ultimately, this would allow faculty developers to disseminate engineering education research, which could increase implementation of evidence-based practices by engineering faculty.

These normative scenarios served as the foundation for the design of two workshops: one for FIE and one for POD. Our intention at FIE was for the workshop to facilitate engineering education researchers' exploration of ways POD could aid them in disseminating their research, and to scaffold them through communicating those thoughts to the POD community[12]. At POD, we intended to challenge the faculty development experts to "think like an engineer" and to have them brainstorm responses to the messages from the FIE participants[13].

In particular, at FIE, engineering education researchers were asked to consider their dissemination needs based on their individual research pursuits and those of their peers (see Table 1). Participants created affinity diagram of those identified needs. From this affinity diagram, we facilitated a discussion about POD resources, asking the participants to identify which POD resources could help with their needs. Finally, the "message-in-a-bottle" activity allowed participants to evaluate their individual needs and those of their peers by capturing their highest-priority thoughts on engineering education to share with POD practitioners. At the end of the day, if all worked out according to plan, from FIE we would have:

> "[enhanced] the connection between engineering education research and the day-to-day teaching practices of university instructors...Participants [would have left] with concrete methods and contacts for engaging the POD community in their own research-to-practice efforts"[12].

As occurs within the design process, initial designs do not always work to their desired specifications. The FIE workshop did not meet our expectations in regards to discussions among our participants and their overall takeaways from the session. In a brainstorming session following the FIE workshop, we determined that we needed to rethink our design of the POD workshop to avoid a similar result.

The POD workshop, which was conducted two weeks later, was originally designed to engage faculty development specialists in a collective exploration of engineering practices and values in an effort to enhance their interactions with engineering faculty and graduate students. The structure of the session was based on a series of "design rounds" that were abstracted from the engineering design process. Within the design, the POD participants would first be asked to identify their user by "drawing an engineering faculty member." These participants would then analyze the images to explore stereotypes and misconceptions of engineers by the participants. Next, the FIE "message-in-a-bottle" would be opened and read by participants, as an opportunity to acquaint themselves with their users. Finally, the participants would engage in a benchmarking task using research from the EER community that focused on engineering faculty. Our specific objectives for the workshop were for participants to (1) apply the engineering design process to design POD initiatives, (2) identify their own assumptions about STEM faculty, and (3) connect their POD initiatives with specific individuals within the field of engineering education.

Table 1: Session Agenda for FIE Workshop (adapted from Cutler, Strong, & Chua, 2015a)

Time	Activity
0-15 min	**Icebreaker/Community Building:** The session will open with an icebreaker activity to help identify the different levels of experience that are present at the session. Participants will then be divided into small groups so they can get to know each other better.
20-35 min	**Inspired Brainstorming with the "Write a Job Description" Scenario:** Guided by facilitator-provided discussion questions, each group will create a list of desired "features" for the hypothetical new hire(s). Each feature should be supported by a specific need of at least one person.
35-50 min	**Feature request synthesis:** Participants will synthesize their table's "features" and "needs" notecards into one large table of features/needs by merging/clustering their ideas with the ideas from other tables.
50-60 min	**Presentations and discussion:** Each large participant group will present/explain their synthesis to the room. These will be used to start a whole-room discussion.
60-65 min	**Presentation of POD resources:** Facilitators will briefly explain the POD network and some of the resources they offer, as well as examples of POD groups (Centers for Instructional Excellence, etc.) working specifically with engineering education.
65-80 min	**Development FIE "Message-in-a-bottle":** Participants will discuss the group feature map and think of potential overlaps between their group's 5 most important features and potential or existing POD resources. The groups will be asked to list the top 5 most important things about engineering education that they would like to be shared with POD practitioners.
80-90 min	**Unlocking the Black Box of Dissemination Debrief & Wrap Up:** Groups will share their lists, followed by a short wrap up by the facilitators.

Based on our experiences with the FIE workshop, we reviewed the initial design of the POD session and isolated a few key areas that needed revision (or even deletion). The first was the framing of the workshop. The initial framing focused around the high-level problem of improving engineering education. Yet, we knew from the challenges that arose during the FIE session that the dissemination framing didn't go over well. In particular, there was the "surprise!

POD is a great resource," that was described by some of our pilot participants as a "bait-and-switch."

Our solution was to be explicit about the purpose of the workshop. Instead of a more general problem focused on "improving engineering education," we decided to pose the following problem:

> How can we improve engineering education by bringing together the POD Network and the engineering education research community?

Within the FIE workshop, we also noticed our participants carried with them particular prior experiences with CTLs that impacted their perceptions and the discussions. Thus, we incorporated an opportunity at the start of the POD workshop for our participants to record their concerns prior to engaging with the activities. By acknowledging our participants' concerns and prior experiences, we hoped to "suspend disbelief" and create an environment for productive discussion around the problem defined above.

Finally, we wanted the focus to be on concrete ideas the participants could take back with them to their campuses. Thus, we first removed some components of the initial agenda to allow more time for the participants to engage with the prompts and brainstorm ideas. We then set up a physical space where participants could post ideas throughout the session. During the final portion of the workshop, participants regrouped ideas from this space onto a set of axes (X-axis: POD to EER, Y-axis: national audience to local audience). This diagram served as a mechanism for sharing ideas among the small groups as well as quickly identifying any gaps. The final agenda for the POD session can be found in Table 2.

Table 2: Revised POD Session Agenda

Time	Activity
0-5 min	**Introduction to the engineering design process**
5-20 min	**Design Round 1 – Looking Inward - (Individual)**: · *You as the designer*. What are your initial thoughts when you consider how to engage with the EER community? Record these thoughts and put aside. · *Identify your users*. "Draw an engineering faculty member" from your institution exercise. What assumptions do our drawings reveal? · *Benchmarking within POD*. What are you currently doing to reach out to engineering faculty? Once completed, share perceptions of users and current activities with group members.
20-40 min	**Design Round 2 - Getting to know users - (Small Group)**: · *Artifacts and interviews:* Unpack a "time capsule" from engineering education researchers that are also trying to influence the practices of faculty and institutions. What do these artifacts imply about engineering culture and their priorities? · *User group representation:* Create a representation of your user group based on Design Round 1 and what you found out from the artifacts in this round. · *Generate/revise outreach ideas:* Add any ideas to your group's ideas' list that come to you from working with the artifacts and creating your user group representation. If time, share experiences and ideas among the groups.
40-55 min	**Design Round 3 - Benchmarking in other fields – (Small Group)**: · *Overview of research on engineering faculty:* Participants will review one of 6 engineering education articles about faculty – highlighted and/or summarized. · *Generate/revise outreach ideas:* Add new ideas inspired by the research article or branching out from the discussions so far.
55-70	**As a large group, let's develop solutions to move forward:** · *Top 5 idea*s. As small group, select your favorite 5 ideas. Once chosen, place each idea on the overall session graph/axes. X-axis: POD to ENGE; Y-axis: National audience to Local audience. · *Large group share-back on ideas*. In particular, we will explore (1) What's missing on the graph?, (2) What can ENGE do for POD?, and (3) How can we (the facilitators) help?
70-75 min	**Review of the engineering design process and final notes**

Methods

To begin the analysis of our experience, we used the workshop artifacts (notes participants had written, photos of posters they'd created, and our own journals and email threads from the workshop creation and revision process) as prompts, and Terry Borton's (1970) 3 Stem Questions, Rolfe's, et al.'s (2001), and Driscoll's (2007) reflective model of "What? So What? Now What?" as scaffolding to prime our recollections. We completed a series of collective reflection sessions to write down, expand upon, and begin interrogating our memories and initial thoughts on our experiences[14–16]. These reflections became the "data" we drew upon to write this paper.

Our collaborative sensemaking took place on two levels simultaneously: as members of our study population and as researchers. Since we were also treating ourselves as members of the "studied" population, we kept our voices and perceptions separate while listing down impressions, but came together in a unified voice for analysis. We progressed through multiple iterations of thinking and writing, using a collaborative document to pose and respond to each other's prompts asynchronously and then coming together in real time to synthesize the paper and find its direction.

Rogers' Characteristics of an Innovation.

Upon reflecting on the two sessions as a whole, we realized that many of the elements we were highlighting aligned with the characteristics outlined by Rogers[17] as innovation characteristics that encourage adoption; defined in Table 3. By treating our sessions as innovations to help participants meet our goal of bringing together EER and POD, we were able to frame our discussion about the successes and shortcomings of the sessions using Rogers' characteristics.

Table 3: Definition of Rogers' Characteristics of an Innovation[17]

Characteristic	Definition
Relative advantage	the degree to which an innovation is perceived as better than the idea it supersedes
Compatibility	the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters
Complexity	the degree to which an innovation is perceived as difficult to understand and use
Trialability	the degree to which an innovation may be experimented with on a limited basis
Observability	the degree to which the results of an innovation are visible to others

Results and Lessons Learned

We will be discussing each of Rogers' characteristics individually; Table 4 provides an overview of our results. In the section that follows, each characteristic in the table will be outlined and supported by elements from the reflections by the facilitators.

Table 4: Summary of Rogers' Characteristics of an Innovation with respect to the two sessions

Characteristic	Summary
Observability	We could see the results right away that the POD session went better.
Trialability	The FIE session acted as a trial for running this type of session. After the session, the POD session was reworked and more explicitly laid out to help participants meet the goals of the session
	Also, from the participant perspective, POD participants came up with tangible and explicit ways to move forward and try out their ideas, where the FIE conversation was more nebulous or focus on the "could be" elements, so it did not result in tangible ways to move forward beyond the artifacts that would be taken to the POD session.
Relative advantage	The POD session had explicit steps to highlight the advantages of using EER for engineering educational development. This allowed for POD participants to discover strategies for integrating the two communities because they were able to see the advantage to the collaboration.
	The FIE session attempted to highlight the needs of the EER field, then highlight that POD could be a way to meet those needs. However, that is not the result of the session and once specific POD resources were brought up, there was a lot of existing baggage for the participants. The existing baggage made it more challenging for the FIE participants to see the advantage.
Compatibility	After the FIE session, the POD session was revised with a strong focus on ensuring that it consistently focused around the core objective of identifying resources to bring together EER and POD. This misalignment at the FIE session made it challenging for FIE participants to feel the session was compatible with their current thinking.
	Additionally, the POD session directly addressed the background and bias that the participants brought with them from past experiences working with engineers. This created an environment where the participants were able to suspending disbelief and really stretch during the session because they had acknowledged their current thoughts on the topic.
Complexity	The complexity of changing participants beliefs about connecting these two fields appeared to be greater for the FIE participants than the POD participants.
	The structuring of the sessions changed the complexity. The FIE session tried to have free, unbiased idea generation followed by a summary with POD resources being well positioned to help with the generated ideas. However, this was felt as a "bait and switch" that was emotionally charged and brought all of the EER baggage to the forefront. The POD session followed clear path focused on common EER/POD goal of improving EE framed in engineering design process and informed by experience with FIE session

Observability. Primarily, observability was discussed with respect to our ability as facilitators to see the results of the sessions. As facilitators, we saw a stronger positive results from the POD session even though both the POD and FIE sessions were attended by fewer than 10 people. We each noted how the more positive elements of the POD session were seen:

> Mel: The POD workshop felt good (in a way that the FIE workshop did not), and like we should run it again.

Stephanie: You could tell the POD participants engaged in the content and got really into the different rounds and allowed each round to help them develop new ideas.

Alexandra: There was good conversation in the room with the few attendees.

The positive atmosphere within the POD session and the causal feedback from participants following the session implied that even though there was a small number of attendees, they did benefit from the session and seemed to embrace or at least acknowledge the value of our goal.

In contrast, the overall observation of the facilitators was that the FIE workshop was less successful than desired. Stephanie felt like participants "didn't get it.",

"At FIE, the conversation seemed to stall around dissemination (which is how we framed it) and never seemed to branch over to how POD could help with these and when we explicitly moved to this, there was resistance based on previous experience with CTLs [Center(s) for Teaching and Learning]."

The FIE session ended with participants bringing up their CTL baggage, which resulted in ending on a negative note. The smaller number of participants didn't allow for as many diverse perspectives to emerge and create a more balanced and productive conversation. Many lessons were learned from the FIE conversation, but the overall goal of bringing together two communities was not as observably met as with the POD session.

Trialability. Trialability was framed across workshops, with the FIE session unintentionally becoming a trial of our special session approach that was then significantly revised before the POD session. This order was based on the conference schedule, where the FIE conference (October 21-24) came before the POD one (November 5-7). Despite hosting live tests with engineering faculty at our home institutions prior to the conference, we struggled to properly pilot the FIE session. The conversations and content were audience-specific making the exact individuals who showed up for the session able to change the direction and productivity of the overall discussions. The POD workshop did not necessarily go better because it was with the POD audience; a large part of it was that the POD workshop happened second.

In our debrief discussions, we acknowledged the ordering effect. Stephanie noted, "I think that FIE being first is a big reason I 'harped' on them so much." As Mel noted in an earlier comment,

"I think the re-thinking of the POD session was a critical incident. I think if we had done the POD session first we would have a number of other issues that probably would have made us re-thinking the FIE session, potentially then, having a better FIE session."

We hosted a trial run of the FIE session and received some really get feedback, but since it was with a different audience (Engineering Education Practitioners), it was hard to get an accurate picture of how the session would run at FIE with EER participants. However, with the complementary goals of the FIE and POD sessions, we were able to re-examine the POD session taking a critical inventory of what we wanted to happen and the specifics about how they would happen. Alexandra reflected on the discussion about the FIE workshop in our hotel room and the intensity of our rework session.

"I think I repeated…'I just don't get it' like 10 or 12 times. We did a LOT of reworking of our POD session during that challenging (challenging because I felt brain fried) work session. However, I think in the end that reworking was quite valuable."

As with many types of early prototypes, the FIE session allowed us to try out ideas and make adjustments as needed before the POD session.

One of our revisions across sessions involved the concreteness of ideas we were presenting. POD participants were offered more practical and tangible ways to try out the ideas we were supporting, whereas FIE participants were working more abstractly and did not have implementation-ready ideas for achieving the goals of the session when they left. Alexandra noted the differences between scaffolding for the POD and FIE sessions:

"I felt that we really only problem-solved with POD and we put the ball in POD's court to try and make something happen with the information we gave them. We didn't put the FIE people on the spot to try and get them to take charge in the change effort."

By challenging the POD participants to come up with some explicit strategies for how they could personally contribute to our goal, we gave them scaffolding to try out one of those strategies once they left the session. The more abstract ideas generated by the FIE participants did not leave them with an immediate way to try them out.

Relative advantage. The relative advantage of the sessions was approached from two perspectives. The first was how the participants seemed to perceive the relative advantage of our purpose statement and the second focused on how the session was structured to help the participants perceive the relative advantage of our purpose statement. At the FIE session, our purpose was that "Faculty development can help Engineering Education Research dissemination" and it was not as well accepted by participants. Alexandra commented that "People (just like in our practice) almost got too specific to their work and this idea of "someone else" doing it...may have been the departure point." Alexandra was reflecting on how the FIE participants focused on how other people could help with dissemination of their research, which was in part because of how we setup the session, but they did not seem to take ownership of the idea that the POD network could help with dissemination. This resulted in the participants not being able to develop any strategies for how the individual participants could help strengthen this connection.

On the other hand, the POD participants were able to see the advantage of connecting with Engineering Education Research, the purpose for the POD session, more directly. One participant commented something similar to "Well, I guess I could use this [Journal of Engineering Education] article to show engineering faculty how something was done in a similar context." This was reflected by Stephanie to be a clear way that the POD participant was able to see the advantages to bringing these two communities together.

The second element was based more on the structuring of the session, as mentioned above. At the FIE session, the session was structured to have participants develop characteristics, then have the facilitators point out that POD resources would help to fulfil many of the developed characteristics. This prescribed message was not accepted as advantageous by participants and resulted in prescribed results, which did not highlight large advantages and did not allow

participants to take ownership of the idea. Mel remembered one POD participant commenting, "Wow, all these answers are so... safe." Then she reflected that, "He was right. All the FIE answers were things nobody would ever get in trouble for criticizing, and things we would never get in trouble for not-changing... they are accepted as ways that academia is expected to be broken." The structuring of FIE session and the responses they developed were not pushing forward the overall goals of connecting these communities, but were prescribed and expected responses.

However, with the POD session, participants were encouraged to continually come up with ideas throughout the session. They were constantly revisiting ways that they, individually, could contribute to the overall goal, which allowed for an emergent discovery by participants. Alexandra commented on the active participation this fostered, and how it let her enter into active dialogue as a facilitator:

> "They [POD participants] looked through the [Engineering Education Research] article on definitions of engineering and told me right up front that they wanted another article and this one was not helpful. Then we got to talking and I got to poking about different ideas related to what we could learn from the fact that engineering faculty had different definitions of what engineering was...within a minute or two the group was rolling with a LOT of tangible ideas. Things they could really take back to their centers."

As the POD participants explored EER in different ways, the connections for how they could use the content emerged and the participants discovered and valued the connections more than the FIE participants who were given a set message at the end of the session.

Compatibility. Compatibility will be discussed as how compatible the message was with the participant mindset with respect to the related previous experiences of the participants as well as the compatibility of the message we used to engage the participants and how compatible that was with reaching our goals. At the POD session, we deliberately suspended disbelief by acknowledging participants' past experiences with engineers to help them more openly view the material and relate what we were presenting to their existing values and needs to create a compatible experience. Mel reflected that at the POD session, "People put down their baggage. They looked at it and put it down and were aware of it... I feel like FIE folks walked around with suitcases the whole time."

For example, POD had an explicit activity and discussion about stereotypes and suspending disbelief. This was designed into the POD workshop in response to FIE participants becoming stranded in their own work, philosophical topics, existing research and complaints about CTLs being non-helpful from their perspective. We saw this "baggage" as being an obstacle to FIE participants being able to move on in their discussions.

As Mel's reflection already alluded to, the misalignment of the FIE session goals and the overall goals allowed participants' past experiences to create a barrier between what we were saying and their values and needs. This barrier was caused in part by the lack of an initial conversation to address any preconceived notions the participants may have had with respect to faculty development professionals. Alexandra also noticed that the mention of CTLs served as a trigger for negative stereotypes:

> "It was only when we identified the possible resources and openly mentioned CTLs that the negative backlash regarding CTLs began. I explicitly remember [one participant] mentioning how only the same people attend CTL events and that CTLs aren't reaching the faculty he actually wants to reach with his work."

Once the FIE participants were introduced to the overall goal of connecting with the POD network, the participants' previous experiences working with local POD members caused the participant to rebuff connecting with them and using them as an effective resource. By structuring the POD session to begin with an explicit conversation about what the participants were bringing with them, we were able to move forward to a more compatible view of the overall message.

Additionally, the FIE session was presented as "we have research to practice issues and acknowledge them, how can we disseminate our research better?," which was not as directly compatible with the overall message of connecting the two fields. Alexandra reflected on her experience with one of the FIE groups, "They were particularly stuck on this idea of separating local and national needs, and the fact that different people had different dissemination needs." Those were important ideas, but they did not align with the overall message of connecting EER and POD. Stephanie noted that direct experience with dissemination work did not necessarily translate into positive results:

> "Having participants who do research and have been incredibly immersed in the dissemination conversation kind of hijacked the conversation or negated some of the brainstorming openness that I think we were hoping for because they would say things like 'Actually, the research says….' or 'we've actually found that'."

Again, the FIE focus on dissemination over connections inhibited the participant brainstorming from creating compatible solutions.

On the other hand, the POD session was presented as work the attendees were already aspiring to do. Faculty developers identify, quite logically, with wanting to develop and support faculty as well as they can. Within this identification, engineering faculty were presented as a group that they already wanted to reach but might have challenges connecting with on their campuses. This framing allowed for a much more compatible conversation leading to the overall message of collaboration. Mel recalled the following conversation with a POD attendee:

> **Attendee**: I don't feel like I have anything to contribute. I don't really work directly with engineering faculty. They are all the way over on the other side of campus, and I never talk with them. (Dejected, quiet tone)

> **Mel:** That is exactly why we're curious about your thoughts -- not to see if they are accurate or inaccurate, but because we want to know what the perception of engineering is like, from the outside -- what messages do you get from us, from a distance?

> **Attendee** (perking up): Oh, I hear X and Y and Z, and that they're ABC, etc. etc. (goes on for quite a while)

The attendee in Mel's story was able to connect with the session and create a compatible experience where he/she could relate to the message and find a way to connect with it personally. The building structure of the POD session allowed participants to have a more compatible experience and be more willing to adopt our message of collaboration.

Complexity. With the previous experiences of the FIE participants, it was a more complex challenge to accept our premise of "POD can help you with dissemination" than it was to have POD participants overcome their hesitation to work with engineering faculty, which resulted from POD members not understanding engineers. By raising awareness of engineering and engineering education, potential barriers were overcome as this increasing awareness was a less complex challenge than overcoming the bias of the FIE participants. As Stephanie reflected, with some prodding, a POD participant was able to make connections about how to use EER to help with her work after being given the opportunity to explore an EER article.

> **Stephanie**: How could this [an EER journal article] help you?

> **Participant**: Well, I guess I could use this article to show engineering faculty how something was done in a similar context, which could help them be more accepting of it.

On the flip side, Alexandra reflected that "There is a negative disposition towards CTLs by not only engineering faculty but also EER people, not just at my own institution, but at lots of other institutions. This is a problem, and, in my opinion it is a problem for everyone involved." The negative disposition towards CTLs and POD resources was an unexpected and complex challenge to overcome in a 90-minute special session.

Additionally, the structuring of the sessions represented different levels of the complexity. The FIE session tried to have free, unbiased idea generation followed by a summary of POD resources being well positioned to help with the generated ideas. However, this structure resembled a "bait and switch" that was emotionally charged and brought all of the EER baggage to the forefront. The POD session followed a clear path focused on a common EER/POD goal of improving engineering education, framed by engineering design process, and informed by our experience with FIE session.

Discussion and Future Work

The EER and faculty development communities share a common goal of improving the educational experiences of engineering students. Both communities engage in scholarship and practice activities that approach this goal in similar, yet sometimes different, ways[18]. If our focus had been solely to promote research collaborations between these communities, we would have explored the studies of interdisciplinary/ multidisciplinary/ cross-disciplinary collaborations[19,20]. Yet, at the start of this process, we hoped to raise awareness between the EER and educational development communities to ultimately promote not only these types of research collaborations, but also collaborations in their day-to-day practices. Looking forward, we hope others interested in creating a bridge between these two communities, or other communities, can learn from our experiences.

With the EER and POD communities specifically, future efforts should consider how to get more people in the room. One of the critical factors that impacted the diversity and quality of discussions in both sessions was the small number of attendees. Once in the room, it is necessary to recognize the diversity of experiences and viewpoints on CTLs and STEM topics. In particular, future bridge building activities should provide time to (1) acknowledge positive and negative dispositions by members of each community towards the other[21] and (2) highlight commonalities between the groups[22] in regards to their expectations, current practices, and assumptions. The negative disposition that emerged within the EER group towards CTLs and POD resources may have to be explored through other venues (i.e., outside of conference sessions) to understand its root cause. Additionally, solutions may also need to explicitly address the sense of separation and intimidation with respect to STEM departments and faculty that arose from discussion with some members of the POD and faculty development communities. As we discussed, the perceptions and previous experiences individuals carry with them can have a profound effect on the ability for an intervention to be successful[21]. By investigating these perceptions and previous experiences more closely, it may be possible to develop approaches for making both communities more hospitable to collaboration and relationship building.

For individuals pursuing bridge building work between two communities, it is important to be explicit with your participants about your goals and to acknowledge the perceptions and previous experiences of your participants as they relate to your goals. Finally, we recommend designing your intervention to give ownership and responsibility to the participants. What ideas or approaches could they explore in their local environment? What are tangible next steps for them to help achieve the overarching goal? Whether in the education space, or in other arenas, many individuals work on similar problems using a diverse set of approaches. Bringing these individuals and their respective communities together can promote information exchange and almost more importantly, more innovative solutions to common challenges.

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